



OSHA REGIONAL INSTRUCTION

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

DIRECTIVE NUMBER: SFO-CPL-04-00-16

SUBJECT: Regional Emphasis Program for Heat Illness Prevention

REGION: San Francisco

SIGNATURE DATE: September 30, 2022 **EFFECTIVE DATE:** November 4, 2022

ABSTRACT

Purpose: This instruction establishes a Regional Emphasis Program (REP) for heat related health hazards.

Scope: This instruction applies to areas of federal enforcement in the San Francisco Region.

References: See Paragraph III

Cancellations: This instruction cancels all previous San Francisco Regional Instructions and memorandum on this subject.

State Impact: No Impact

Action Offices: All San Francisco Regional and Area Offices

Originating Office: San Francisco Region Enforcement Programs

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I. Purpose

This Instruction establishes a regional emphasis program (REP) for conducting heat illness inspections of indoor and outdoor hazardous work activities. It expands on the agency's ongoing heat-related illness prevention campaign by setting forth the enforcement component regardless of the temperature at the time of the enforcement activity and reiterating its compliance assistance and outreach efforts. Employers will be encouraged to implement proactive interventions, such as water, rest, and shade, and other important prevention measures such as acclimatization of new or returning workers.

II. Scope

This Instruction applies to Federal enforcement activities in the San Francisco Region.

III. References

- A. OSHA Instruction CPL 04-00-002, Procedures for Approval of Local Emphasis Programs (“LEPs”), November 13, 2018, or current update.
- B. OSHA Instruction CPL 02-00-164, Field Operations Manual (FOM), April 14, 2020, or current update.
- C. OSHA Instruction CPL 02-00-025, Scheduling System for Programmed Inspections, January 4, 1995, or current update.
- D. OSHA Instruction CPL 02-00-051, Enforcement Exemptions and Limitations under the Appropriations Act, May 28, 2005, or current update.
- E. Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments, DHHS (NIOSH) Publication Number 2016-106, February 2016.
- F. OSHA Directive TED 01-00-015, OSHA Technical Manual – Section III, Chapter 4 – Heat Stress, (September 15, 2017).
- G. OSHA Safety and Health Topic Page [Occupational Heat Exposure](#)
- H. OSHA's [Heat Illness Prevention Campaign](#)
- I. OSHA-NIOSH Heat Safety Tool – Smartphone Application
- J. OSHA Technical Manual (OTM), Section III: Chapter 4

- K. Fact Sheet: Biden Administration Mobilizes to Protect Workers and Communities from Extreme Heat
- L. Executive Order (EO) 14008, January 27, 2021, Tackling the Climate Crisis at Home and Abroad
- M. U.S. Department of Labor Climate Action Plan, September 2021, pgs. 6-7
- N. OSHA Instruction CPL 03-00-024, National Emphasis Program – Outdoor and Indoor Heat-Related Hazards Information, April 8, 2022, or current update

IV. Cancellations

This instruction cancels all previous San Francisco Regional Instructions and memoranda on this subject.

V. Expiration

This Instruction will expire on September 30, 2027, but may be renewed as necessary.

VI. State Plan Impact

None.

VII. Background

The U.S. Department of Labor's Bureau of Labor Statistics (BLS) reports that from 2011 to 2019, environmental heat cases resulted in an average of 38 fatalities per year and an average of 2,700 cases with days away from work. Heat related illnesses range from heat cramps to heat stroke, which can lead to death. Between 2015 and 2020, federal OSHA conducted approximately 200 heat-related inspections each year, with about 15 heat-related fatality inspections annually. Many of these inspections resulted in OSHA citations under the general duty clause, Section 5(a)(1) of the OSH Act, for exposing workers to heat-related hazards. However, the total number of heat-related fatalities may be underreported. The cause of death is often listed as a heart attack when the actual cause may have been exposure to a heat-related hazard. Since 2013, former Region IX (now known as part of the San Francisco Region) has conducted four heat-related fatality investigations. Between October 1, 2015, and May 1, 2022, approximately 5% of the complaints received by the former Region IX and X Area Offices within the San Francisco Region included alleged heat related hazards. Considering that outdoor heat is not a year-round concern, this number is significant.

This REP is part of a broader Department of Labor response to President Biden's Executive Order (EO) 14008, "Tackling the Climate Crisis at Home and Abroad." EO 14008 established an interagency effort and commitment to workplace safety, climate resilience, and environmental justice. In response, the US Department of Labor has developed the Climate Action Plan, where the Secretary of Labor has established a goal of reducing heat-related illnesses. OSHA's initial enforcement response to the President's order was to issue a heat initiative memorandum on September 1, 2021, instructing the Regional Offices to increase their efforts to prioritize heat complaints and referrals and to intervene when they become aware of heat hazard conditions. On April 8, 2022, OSHA initiated a National Emphasis Program to ensure that employees in high-hazard industries are protected from heat-related hazards, both indoors and outdoors, that may lead to serious illnesses, injuries, or death. This REP expands on the NEP to include additional industries outside the NEP with a documented history of heat stress hazard exposures within the San Francisco Region, regardless of the temperature. This REP further specifies additional industries in the San Francisco Region where heat hazards exist and provides a mechanism for identifying hazards and compelling abatement in those industries using targeted outreach and compliance assistance.

Serious heat-related illnesses can occur when an unacclimated person has a body temperature that exceeds 100.4 degrees Fahrenheit (100.4°F). Fatal heat-related incidences are usually the result of exertional heat stroke, where physical activity in hot environments causes the body temperature to reach 104°F or higher (normal body temperature is around 98.6°F). Appendix A provides a list of serious heat-related illnesses, along with common signs and symptoms, and appropriate first aid procedures. Heat-related illnesses occur when body heat generated by physical work is performed in conditions of high ambient heat, especially when combined with humidity and inadequate cooling. Combinations of heat and humidity are used to determine the commonly used "feels like" (i.e., or heat index, or HI) temperature. The National Weather Service (NWS) uses heat index to classify environmental heat into four categories: Caution (80°F - 90°F HI), Extreme Caution (91°F - 103°F HI), Danger (103°F - 124°F HI), and Extreme Danger (126°F or higher HI). (Heat Index and other relevant terms are defined in paragraph X. Definitions.)

The National Institute for Occupational Safety and Health (NIOSH) has published recommended occupational exposure limits and controls for heat stress. A NIOSH publication, **Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments**, outlines recommended environmental limits for physical work at which point engineering controls, preventative work, hygienic practices, and administrative or other control procedures should be implemented to reduce the risk of heat-related illnesses. NIOSH has a Recommended Alert Limit (RAL) and a Recommended Exposure Limit (REL) based on the Wet Bulb Globe Temperature (WBGT).

While all alerts and advisories can serve to signify 'heat priority days' (i.e., days in which a maximum heat temperature can result in increased risks of heat-related illnesses), these criteria vary across the country. In areas of the United States that are not usually subject to elevated dangerous heat conditions, unacclimatized workers may suffer serious heat-related illnesses even when the heat index is not high enough to trigger NWS heat advisories or warnings.

When the heat index exceeds 80°F, serious occupational heat-related illnesses and injuries become more frequent, especially when unacclimatized workers are performing heavy strenuous work (e.g., intense arm and back/lifting work, carrying, shoveling, manual sawing, pushing and pulling heavy loads and walking at a fast pace), without easy access to water or shade, or working in direct sunlight. Heat-related fatalities have occurred with a heat index below 80°F, particularly when these aggravating factors are present.

This initiative identifies heat priority days as those days when the National Weather Service forecasts that the heat index will be 80° F or above on its website. A heat index at this level indicates a need to increase enforcement efforts to identify potential heat-related hazards present in working conditions before the occurrence of an illness or death.

Section 5(a)(1) of the OSH Act states that employers shall provide to their employees "employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm". This includes a duty to prevent heat-related illnesses, injuries, and deaths in workplaces. Hot temperatures create excessive heat working conditions that are especially dangerous to workers who have not been acclimatized. Acclimatization is a process by which a person gradually increases their exposure time in hot environmental conditions, causing beneficial physiological changes to prevent heat-related illnesses by properly regulating body temperature. It is essential for employers of new or returning workers to gradually increase their workloads and ensure more frequent breaks as they acclimatize to ambient conditions. However, the most successful efforts to prevent heat-related illnesses and deaths include more than just worker acclimatization programs. A resource for best practices on worker acclimatization is the American Conference of Governmental Industrial Hygienists (ACGIH®) Action Limit (AL) for unacclimatized workers and a Threshold Limit Value (TLV®) for acclimatized workers, see Heat Stress and Strain: TLV® Physical Agents 2021 or current edition. Employers should use a combination of intervention methods, including encouraging or mandating that employees regularly take breaks for rest, shade, and supply water. Employers should train employees on heat-related illnesses, how to spot common symptoms, and what to do when a worker suspects a heat-related illness is occurring. Employers should also take periodic temperature measurements to determine employees' heat exposure and provide protection to employees from heat, as necessary.

VIII. Objective

The purpose of this REP is to prevent occupational exposure to conditions creating heat stress. This REP is targeted at keeping employees from developing heat cramps, heat exhaustion, and heat stroke. Evidence from the Department of Labor, Centers for Disease Control, and NIOSH, shows that elevated environmental temperatures cause hundreds of employees working both indoors and outdoors to experience heat-related illnesses and deaths annually.

Excessive heat occurs from a combination of elevated temperatures, moderate or higher workloads, and high humidity. At certain levels of work, heat, and humidity, the human body cannot maintain a normal internal temperature and may experience a heat illness, including a fatal heat stroke.

To prevent these illnesses and injuries, OSHA will utilize weather forecasts to determine days with hazardous heat conditions. OSHA will endeavor to ensure employers take appropriate precautions to address heat hazards. These heat illness precautions include: (1) training employees on the hazards of hot environmental temperatures, and procedures for responding to and reporting heat illness or injury (2) making appropriate first aid available, (3) having drinking water available, (4) having shade or a climate-controlled (i.e. air conditioning) area for rest breaks, (5) having a protocol to protect and acclimatize new workers and those who have just returned from an extended absence, because these workers are particularly vulnerable, and (6) having made provisions for prompt medical attention if a heat-related illness occurs.

This instruction is provided to address the unsafe working conditions created by heat hazards and inappropriate safety procedures.

IX. Scope of REP

This instruction applies to indoor and outdoor worksites in the San Francisco Region where potential heat-related hazards exist. Working conditions that have resulted in serious heat-related illnesses occur in all major industry sectors of employers, including general industry, construction, agriculture, and maritime. Typical indoor worksites where heat-related illnesses may occur include electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, warehouses without adequate climate control, chemical plants, and smelters.

The outdoor work activities impacted by heat under the jurisdiction of federal OSHA in the San Francisco Region include National Security; Water Supply and Irrigation Systems; Landscape Architectural Services; Nonferrous Metal (except Aluminum) Smelting and Refining; Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum); Administration of Conservation Programs; National Parks and Other Similar Institutions; Support Activities for Forestry; the Postal Service; Couriers and Express Delivery Services; and any

other activities that require moderate to high physical exertions or the wearing of heavy and/or bulky clothing or equipment on a hot day. See Appendix B for all covered industries.

X. Definitions

- A. Heat Index - A measure indicating the level of discomfort the average person is thought to experience because of the combined effects of the temperature and humidity of the air.
- B. Wet Bulb Globe Temperatures - a measure of heat stress which considers temperature, humidity, wind speed, sun angle and cloud cover (solar radiation). This differs from the heat index, which takes into consideration temperature and humidity and is calculated for shady areas. For work or exercise in direct sunlight, this is a good element to monitor. Military agencies, OSHA, and many nations use the WBGT as a guide to manage workload in direct sunlight.
- C. OSHA-NIOSH Heat Safety Tool - a useful resource for planning outdoor work activities based on how hot it feels throughout the day. Features include real-time heat index and hourly forecasts, by specific locations, and occupational safety and health recommendations from OSHA and NIOSH.
- D. Heat Advisory - A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Advisory is that the maximum heat index temperature is expected to be 100°F or higher for at least 2 days, and nighttime air temperatures will not drop below 75°F.
- E. Heat Wave - A heat wave is forecast by NWS or a local news station. A heat wave is when the daily maximum temperature exceeds 95°F or when the daily maximum temperature exceeds 90°F and is 9°F or more above the maximum reached on the preceding days.
- F. Excessive Heat Warning - An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is that the maximum heat index temperature is expected to be 105°F or higher for at least 2 days and nighttime air temperatures will not drop below 75°F.
- G. Excessive Heat Watches - Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Heat Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.

- H. Excessive Heat Outlooks - Outlooks are issued when the potential exists for an excessive heat event in the next 3-7 days. Outlook provides information for those who need considerable lead-time to prepare for the event.
- I. Heat Priority Days - Days when the National Weather Service forecasts that the Heat Index will be 80° F or above on its website.

XI. Roles and Responsibilities

A. Area Office

1. Role of the Compliance Safety and Health Officers (CSHOs): On heat priority days, the CSHO should be aware of the potential for heat-related illnesses during inspection activities and will investigate heat-related hazards where appropriate. The CSHO must take time to develop the best strategy to gather and document each prima facie element and determine whether additional resources or assistance may be necessary. The CSHO shall utilize the information provided in the appendices of this instruction to develop heat stress cases. The CSHO shall ensure that each violation is cited in accordance with this Instruction and Chapter 4 of the FOM.

Area Offices should work with the Regional Office to contact the Office of Occupational Medicine and Nursing early in the inspection (especially in fatality or hospitalization cases) to obtain Medical Access Orders, if needed, and for technical assistance from the Health Response Team on the use of WBGT instrumentation. The Regional Office may also contact the Directorate of Enforcement Programs, Office of Health Enforcement, for assistance with enforcement policy.

2. Role of the Area Director (AD): Upon notification of a potential heat related case, the AD should confer with the CSHO and provide guidance and assistance if necessary. The AD will also ensure the CSHO is prepared to be in elevated temperature conditions themselves and have the necessary personal protective equipment available. The AD should conduct “go/no-go” checks throughout the inspection process to validate or appropriately guide the CSHO in developing violation(s). Following the completion of fieldwork, the AD shall review the violation(s) prior to submission to the OEP. The AD shall ensure that each violation is cited in accordance with this Instruction and Chapter 4 of the FOM.

B. Regional Office

1. Role of the Regional Administrator (RA): The RA has the approval authority for all heat related cases and will resolve any disagreements that may develop between OEP and the AD regarding the evaluation of the violation(s). The RA refers heat cases to the Directorate of Enforcement Programs (DEP) for any novel case processing, review and approval where required.
2. Role of the Office of Enforcement Programs (OEP): It is the role of OEP to conduct a critical review of all violations to ensure that any proposed violations are supported by the documentation in the casefile. OEP will work with the AD to strengthen the violation(s) and obtain needed technical information. OEP will reach out to OOMN, as necessary. OEP will coordinate with RSOL to resolve any legal and factual issues that surface during the review. OEP works directly with DEP to resolve concerns where National Office approval is required.
3. Role of the Regional Heat Coordinator (Regional Industrial Hygienist): The Regional Heat Coordinator is responsible for assisting CSHOs and Area Offices to develop heat-related enforcement actions, monitoring the status of all heat inspections within the region, and coordinating the field staff training program.
4. Office of Solicitor (RSOL): RSOL will provide guidance throughout the development of the violation. RSOL will work with OEP to resolve any legal and factual issues that surface.

XII. Policy

- A. At any time of the year the scope of other programmed inspections can be expanded to address heat-related hazards where worksite conditions or other evidence, such as heat priority days, suggest there could be heat hazards.
- B. OSHA 300 logs shall be analyzed for heat related illnesses where heat-related hazards may be present.
- C. Prior to submittal to the Assistant Regional Administrator of Enforcement Programs (hereinafter referred to as ARA-EP), the AD shall thoroughly review all proposed violations. All considerations in this instruction will be evaluated prior to regional review.

- D. A Hazard Alert Letter (hereinafter HAL) may be proposed where all the elements of a general duty clause violations are not present. See Chapter 4, Section III.F.2.b of the FOM.
- E. All proposed violations and HALs under this REP shall be submitted to the ARA-EP for review and concurrence prior to issuance.
- F. If the CSHO learns of previous or potential exposures to elevated environmental heat, the CSHO shall evaluate to determine the existence of a hazard warranting a violation or HAL. If the CSHO believes that a violation or HAL cannot be supported, the CSHO should alert the employer to areas of concern and provide the employer with information on how to develop an effective heat-illness prevention program. This could be done in the form of an intervention package and entered into OIS as an intervention. This approach allows the agency to initiate heat-related assessments throughout the year despite the temperature and to influence employers' implementation of early interventions to prevent illnesses and deaths among workers who are most at-risk.
- G. OSHA interventions, i.e., having discussions with employers about important steps they can take and providing heat posters and other outreach materials, are critical to mitigating potential hazards and preventing heat-illnesses before they occur. Inspections should be completed and citations, if any, should be issued expeditiously to facilitate prompt abatement.

XIII. Inspection Process

A. Procedures

1. Area Office Responsibilities

- a. The Area Office will develop a program to monitor weather data within its jurisdiction, paying close attention to publicized heat advisories, watches, warnings, and/or heat waves to proactively address heat hazards in targeted areas.
- b. Heat-related inspections should be reported to the regional heat coordinator as soon as possible.
- c. Area Offices should work with the Regional Office to contact the Office of Occupational Medicine and Nursing early in the inspection (especially in fatality or hospitalization cases) to obtain Medical Access Orders, if needed, and for technical assistance from the Health Response Team on the use of WBGT instrumentation. The Regional Office may contact the Directorate

of Enforcement Programs, Office of Health Enforcement, for assistance with enforcement policy.

2. Area Director Responsibilities

- a. Instruct CSHOs traveling in the field on heat priority days to be alert to circumstances where employees may be performing moderate or strenuous work in hot conditions and to conduct an onsite referral inspection.
- b. Instruct CSHOs to assess the potential for heat-related illnesses during all inspections and review the employer's heat illness prevention plan where appropriate.

3. CSHO Responsibilities

- a. CSHOs should use the OSHA-NIOSH Heat Safety App as a resource. This app provides current and projected heat indices for that day at the current location. The display indicates the hazard levels as caution, warning or danger in heat index ranges and offers recommended actions to protect workers. NWS provides certified historic weather data to document conditions at the time of an incident and prior days.
- b. Review OSHA 300 logs for any entries indicating heat-related illness(es).
- c. Review injury and illness reports and obtain any records of any hospitalizations and corresponding reporting requirements. Also review any reports indicating emergency room visits and/or ambulance transport, even if hospitalizations did not occur.
- d. Interview workers for reports of headache, dizziness, fainting, dehydration, or other symptoms that may indicate heat-related illnesses.
- e. Review employer's plan to address heat exposure, including acclimatization procedures (especially for new and returning workers), work-rest schedules, access to shade and water (with electrolytes when needed), and any training records associated with implementing a heat illness prevention program.
- f. Document, where possible, the heat index on the OSHA-NIOSH Heat App, using the screen save feature on a mobile phone or tablet.

- g. On heat priority days, CSHOs should be prepared to conduct WBGT sampling during programmed planned inspections when they observe work activities.
- h. Explore emergency response planning:
 - Is someone trained to recognize dizziness, confusion, or other symptoms suggestive of heat stroke?
 - Is there access or planning for access to shade (air conditioning, vehicle cabs, tents, etc.?)
 - Is someone authorized to call 911 in situations where confusion and or confused speech occurs? Is there a plan to deal with heat stroke?

Note: WBGT readings will be in accordance with procedures on conducting WBGT sampling and performing workplace assessments, OSHA Technical Manual, Section III, Chapter 4. WBGT sampling is considered a more accurate indicator of the effects of heat on individuals than dry bulb thermometer readings. Dry bulb readings measure air temperature only. When appropriate, CSHOs should also conduct workload assessments through direct observation of work practices/operations and employee interviews. They should particularly note if heavy or bulky clothing or equipment is used. The information obtained from employer and employee interviews should be verified during the walkaround inspection.

- i. Identify conditions and activities relevant to heat-related hazards. These can include, but are not limited to:
 - Potential sources of heat-related illnesses (e.g., working in direct sunlight, a hot vehicle, areas with hot air, near a gas engine, furnace, boiler, or steam lines).
 - WBGT calculations and/or other temperature measurements.
 - Heat advisories, warnings, or alerts.
 - The use of heavy or bulky clothing or equipment.
 - The types of activities performed by the employees and whether those activities can be categorized as moderate, heavy, or very heavy work.

- The length of time in which a worker is continuously or repeatedly performing moderate to strenuous activities.
- Heat-related illnesses among new workers. The presence of any recent vacation time or breaks in employment prior to complaints of heat-related symptoms.
- The availability of rest breaks, water, and shade on site.

B. Exemptions and Limitations

Before initiating enforcement activities, the CSHO will determine if an inspection is limited through OSHA Instruction CPL 02-00-051, "Enforcement Exemptions and Limitations under the Appropriations Act." Health inspections are not affected by exemptions under this directive.

C. Interface with Other Inspection Activities

Several OSHA standards may also be applicable to address certain aspects of worker protection in hot environments including, but not limited to, use of personal protective equipment, sanitation, medical services and first aid, and recordkeeping.

The Recordkeeping regulation at 29 CFR §1904.7(b)(5) requires that employers record certain work-related injuries and illnesses. If a worker requires medical treatment beyond first aid, the worker's illness or injury must be recorded. However, if a worker merely requires first aid treatment for the worker's condition, the employer is not required to record the condition. For example, if a worker becomes unconscious, the worker's condition must be recorded. However, if a worker is only instructed to drink fluids for relief of heat stress, the worker's condition is not recordable. Refer to 29 CFR §1904.7(b)(5) for an explanation of the difference between medical treatment and first aid. Recordkeeping issues must be managed in accordance with OSHA Instruction, CPL 02-00-135.

The Sanitation standards at 29 CFR §1910.141, 29 CFR §1915.88, 29 CFR §1917.127, 29 CFR §1918.95, 29 CFR §1926.51, and 29 CFR §1928.110 require employers to provide potable water.

The general construction safety training and education standards for construction at 29 CFR §1926.21 and 29 CFR §1926.20 require a Safety and Health Program as well as frequent and regular safety and health inspections.

Follow-up inspections, referrals, complaints, fatalities, and catastrophes will still be inspected under procedures outline in the FOM.

D. Basis of Inspection

Whenever an inspection is begun under this REP, the CSHO will include in the casefile narrative a description of the circumstances which initiated the inspection.

E. Size of Employer

Establishments with ten or fewer employees will be included in this program because of the hazardous nature of high environmental temperatures. Safety violations discovered under this program will be addressed in accordance with CPL 02-00-051 (CPL 2-0.51J) "Enforcement Exemptions and Limitations under the Appropriations Act."

F. VPP and Partnership Sites

If an employer and/or contractor are a Voluntary Protection Program (VPP) employer or have passed an annual OSHA Partnership verification inspection, the terms of the VPP and/or partnership agreement will be followed. A list of current VPP sites and partnerships within the Area Office jurisdiction will be maintained and made available for CSHO review.

G. Citations

Citations for violations will be issued in accordance with the FOM, Chapters IV, V, VI and VII. A citation for failure to provide an adequate heat illness prevention program will be addressed under the General Duty Clause or 29 CFR 1960.8 for federal agencies.

Any proposed citation for heat-related hazards, where the employer's procedures to protect workers are inadequate, will be issued under the General Duty Clause ("GDC"), Section 5(a)(1) of the OSH Act or 29 CFR 1960.8 for federal agencies. Citations for heat related hazards will be issued for both indoor and outdoor work activities when all elements of a GDC violation are established. CSHOs should document the relationship between the workplace exposure(s) and the potential for heat-related illness(es), specifically including all conditions and activities that present heat-related hazards.

Ensure that the hazard is clearly described in the citation and avoid solely describing an employer's failure to implement specific heat stress abatement measures. The Regional Solicitor's office will be consulted prior to issuing any heat-related 5(a)(1) citations. A sample Alleged Violation Description (AVD) for a heat-related illness 5(a)(1) violation is in Appendix C.

A Hazard Alert Letter (HAL) may be sent when all the elements of a GDC violation are not present. A sample Hazard Alert Letter (HAL) is in Appendix D and in OIS respectfully. Issuance of citations or HALs should be expedited so abatements can be implemented and achieved earlier to protect other employees exposed to the hazard.

H. Inspection Resources

All OSHA personnel participating in this REP must be familiar with the policies and procedures described in this instruction.

I. CSHO Personal Protective Equipment (PPE)

CSHOs shall use personal protective equipment suitable for general industry or construction inspections.

XIV. Recording in OIS

A. Enforcement Inspections

Enforcement inspections completed under this initiative will be coded in OIS in the inspection Type sub-tab as follows:

1. Initiating Type will be coded “Programmed Planned” except when the inspection is conducted because of a complaint, referral, or fatality/catastrophe. These will be coded as the appropriate “unprogrammed” activity.
2. Local Emphasis Program will be coded with **SFOHEAT** for all programmed and unprogrammed inspections.
3. Where an establishment is within a targeted NAICS under the Outdoor and Indoor Heat-Related Hazards National Emphasis Program it will also be coded **HEATNEP**.
4. Additional Codes will be coded to indicate the industry type as follows:

Types	ID	Value	Industry
N	02	HEATCON	Construction
N	02	HEATGI	General Industry
N	02	HEATMT	Maritime
N	02	HEATAG	Agriculture
N	02	HEATLNGSHR	Longshoring

B. Compliance Assistance Interventions

Interventions completed under this initiative will be coded as compliance assistance as follows:

1. Regional Emphasis Program will be coded as SFOHEAT.
2. Where an establishment is within a targeted NAICS under the Outdoor and Indoor Heat-Related Hazards National Emphasis Program it will also be coded HEATNEP.
3. Other Emphasis Areas will include any applicable additional codes and the codes specific to the construction, general industry, maritime or agriculture activity covered by the inspection per XIV.A.4.

C. Data Accuracy

Area Offices and the Regional Office shall periodically check their OIS databases to verify accuracy of the data for the initiative.

XV. Outreach

All REPs must contain an outreach component that must be ongoing throughout the effective period of the program. These outreach efforts should be coordinated with or include the consultation program for the area. However, OSHA has continually conducted outreach at the National, Regional, and Area Office levels through the heat campaign that was first initiated in 2011, so this requirement has been met.

A. Outreach Methods

Methods at the Area Director's discretion can consist of one or more of the following:

1. Broadcast mail-outs for program information
2. Stakeholder meetings
3. Targeted training sessions
4. Presentations to the affected group(s)
5. OSHA heat exposure website

B. Outreach During Inspections

During heat inspections, CSHOs should provide employers and employees with information about available education and training resources and publications, as appropriate. CSHOs should provide employers and employees with materials highlighting heat illness prevention in English and Spanish, or other languages, as applicable and available. They should also recommend employers and employees visit the OSHA Heat Illness exposure webpage for additional resources.

C. All outreach activities shall be entered into OIS and coded appropriately.

XVI. Partnership and Alliances

In the event outreach efforts result in interested groups developing an alliance or partnership, the Area Director will ensure that these efforts conform to current National and Regional Policy.

XVII. Evaluations

The Regional Office will evaluate the impact of the REP at the midpoint of the program as well as at the expiration. Information and data from OIS along with input from the Area Director will be used in the program report. Elements to be considered in the evaluation are contained in OSHA Instruction CPL 04-00-002.

XVIII. Whistleblower Protections

Workers requesting inspections, complaining of heat-related exposure, or reporting illnesses or retaliation, may be covered under one or more whistleblower protection statutes. Inform the workers of their protections from retaliation and refer them to www.whistleblowers.gov for more information, including how to file a retaliation complaint. If the worker is alleging some form of retaliation, the AO must submit a referral to the Regional Whistleblower Protection Program.

Appendix A: First Aid for Heat Stress

The NIOSH website provided the reference information below:

Heat Rash: skin irritation caused by excessive sweating during hot, humid weather.

Symptoms of heat rash include:

- Red clusters of pimples or small blisters.
- More likely to occur on the neck and upper chest, in the groin, under the breasts and in elbow creases.

Workers experiencing heat rash should:

- Try to work in a cooler, less humid environment when possible.
- Keep the affected area dry.
- Dusting powder may be used to increase comfort.

Heat Cramps: affect workers who sweat a lot during strenuous activities. This sweating depletes the body's salt and moisture levels. Low salt levels in muscles causes painful cramps. Heat cramps may also be a symptom of heat exhaustion.

Symptoms of heat cramps include:

- Muscle pain or spasms are usually in the abdomen, arms, or legs

Workers with heat cramps should:

- Stop all activity and sit in a cool place.
- Drink clear juice or a sport drink.
- Do not return to strenuous work for a few hours after the cramps subside because further exertion may lead to heat exhaustion or heat stroke.
- Seek medical attention if any of the following apply:
 - The worker has heart problems.
 - The worker is on a low sodium diet.
- The cramps do not subside within one hour.

Heat Syncope: fainting (syncope) episode or dizziness that usually occurs with prolonged standing or sudden rising from a sitting or lying position. Factors that may contribute to heat syncope include dehydration and lack of acclimatization.

Symptoms of heat syncope include:

- Light-headedness
- Dizziness
- Fainting
- Heavy sweating
- Extreme weakness or fatigue
- Dizziness or light-headedness
- Nausea

- Clammy, moist skin
- Pale or flushed complexion
- Muscle cramps
- Slightly elevated body temperature
- Fast and shallow breathing

Workers with heat syncope should:

- Sit or lie in a cool place when they begin to feel symptoms.
- Slowly drink water, clear juice, or a sports beverage.

Heat Exhaustion: the body's response to an excessive loss of water and salt, usually through excessive sweating. Workers most prone to heat exhaustion are those that are elderly, have high blood pressure, and those working in a hot environment.

Symptoms of heat exhaustion include:

- Heavy sweating
- Extreme weakness or fatigue
- Dizziness or lightheadedness
- Nausea
- Clammy, moist skin
- Pale or flushed complexion
- Muscle cramps
- Slightly elevated body temperature
- Fast and shallow breathing

Treat a worker suffering from heat exhaustion with the following:

- Have them rest in a cool, shaded, or air-conditioned area.
- Have them drink plenty of water or other cool, nonalcoholic beverages.
- Have them take a cool shower, bath, or sponge bath.

Heat Stroke: the most serious heat-related disorder. It occurs when the body becomes unable to control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body temperature rises to 104°F or higher. Heat stroke victims have brain dysfunction that causes mental changes. Heat stroke can cause death or permanent disability if emergency treatment is not given.

Symptoms of heat stroke include:

- Confusion
- Slurred speech
- Unconsciousness
- Hallucinations

- Seizures
- Hot, dry skin (no sweating) or heavy sweating
- Chills
- Throbbing headache
- High body temperature

Take the following steps to treat a worker with heat stroke:

- Call 911 and notify their supervisor.
- Move the sick worker to a cool shaded area.
- Cool the worker aggressively using methods such as:
 - i. Immersing them in water.
 - ii. Removing their clothes and covering them with towels soaked with water.
 - iii. Spraying, sponging, or showering them with water.
 - iv. Fanning their body.

Appendix B: Targeted Industries

Heat-related hazards can be found in every industrial sector, including general industry, construction, maritime, and agriculture. To increase the likelihood of preventing heat-related illnesses and make efficient use of OSHA resources, OSHA compliance officers should inquire about heat illness prevention programs during any inspection, regardless of the actual temperature.

Appendix B includes three tables of industries (NAICS codes at the 4-digit level) with the following: 1) High numbers or high incidence rates of heat related illnesses from Bureau of Labor Statistics (BLS) data; 2) Elevated number of days away from work (BLS) or high numbers of severe cases of heat related illnesses as indicated by death or hospitalization (from OSHA severe injury reports made by employers), or an OSHA heat inspection since 2018. Table 1 are non-construction industries in ListGen, Table 2 are construction industries and Table 3 are non-construction industries not found in ListGen.

NOTE: It should not be assumed that employee exposure to heat occurs in all establishments within the industries listed in the tables below. The AO may delete from their target list any establishment that does not have an exposure to heat-related hazards or an establishment that has had a comprehensive or partial health inspection that addressed heat hazards with an Opening Conference date occurring within the twelve (12) previous months.

Table 1. Non-construction industries that are in ListGen are likely to have heat-related hazards.

2017 NAICS Code (4-digit level)	2017 NAICS Title
1121	Cattle Ranching and Farming
1151	Support Activities for Crop Production
2131	Support Activities for Mining
3211	Sawmills and Wood Preservation
3241	Petroleum and Coal Products Manufacturing
3251	Basic Chemical Manufacturing
3272	Glass and Glass Product Manufacturing
3311	Iron and Steel Mills and Ferroalloy Manufacturing
3314	Nonferrous Metal (except Aluminum) Production and Processing
3323	Architectural and Structural Metals Manufacturing

3329	Other Fabricated Metal Product Manufacturing
3361	Motor Vehicle Manufacturing
3362	Motor Vehicle Body and Trailer Manufacturing
3363	Motor Vehicle Parts Manufacturing
3364	Aerospace Product and Parts Manufacturing
3365	Railroad Rolling Stock Manufacturing
3366	Ship and Boat Building
3369	Other Transportation Equipment Manufacturing
3371	Household and Institutional Furniture and Kitchen Cabinet Manufacturing
4239	Miscellaneous Durable Goods Merchant Wholesalers
4241	Paper and Paper Product Merchant Wholesalers
4242	Drugs and Druggists' Sundries Merchant Wholesalers
4243	Apparel, Piece Goods, and Notions Merchant Wholesalers
4244	Grocery and Related Product Merchant Wholesalers
4245	Farm Product Raw Material Merchant Wholesalers
4246	Chemical and Allied Products Merchant Wholesalers
4247	Petroleum and Petroleum Products Merchant Wholesalers
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers
4249	Miscellaneous Nondurable Goods Merchant Wholesalers
4413	Automotive Parts, Accessories, and Tire Stores
4442	Lawn and Garden Equipment and Supplies Stores
4881	Support Activities for Air Transportation
4882	Support Activities for Rail Transportation
4883	Support Activities for Water Transportation
4884	Support Activities for Road Transportation
4889	Other Support Activities for Transportation
4921	Couriers and Express Delivery Services
4922	Local Messengers and Local Delivery
5311	Lessors of Real Estate

5617	Services to Buildings and Dwellings
5621	Waste Collection
5622	Waste Treatment and Disposal
5629	Remediation and Other Waste Management Services
6231	Nursing Care Facilities (Skilled Nursing Facilities)
7211	Traveler Accommodation
8111	Automotive Repair and Maintenance
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
8114	Personal and Household Goods Repair and Maintenance

The AO should use C-Target to find active construction sites to add to their list of heat inspections from April 1 to October 31 or on a heat priority day (when the National Weather Service forecasts that the Wet Bulb Globe Temperature will be 81° F or above). (Note that if a project from the C-Target list is inspected, the Area Office must account for all projects from that list by either inspection or deletion in accordance with CPL 02-00-155). Where OSHA is conducting an inspection for other purposes, a heat-related inspection shall be opened for all hazardous conditions observed in plain view (such as, for example, employees or temporary workers in high exposure areas without adequate acclimatization or access to water, rest, and shade).

Table 2. Construction industries that are likely to have heat-related hazards¹.

2017 NAICS Code (4-digit level)	2017 NAICS Title
2371	Utility System Construction
2372	Land Subdivision
2373	Highway, Street, and Bridge Construction
2379	Other Heavy and Civil Engineering Construction
2381	Foundation, Structure, and Building Exterior Contractors
2382	Building Equipment Contractors
2383	Building Finishing Contractors

¹ Construction inspections (C-Target) or local list should be scheduled from a list of **construction worksites** rather than construction employers, due to the mobility of the construction industry, the transitory nature of construction worksites, and work that frequently involves more than one construction employer on the site.

2389	Other Specialty Trade Contractors
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For certain industries not included in ListGen alternative sources may be utilized (e.g., ReferenceUSA). The AO should use local knowledge to add these industries in Table 3 to the inspections list.

Table 3. Industries not included in ListGen or Construction that are likely to have heat-related hazards.

2017 NAICS Code (4-digit level)	2017 NAICS Title
1112	Vegetable and Melon Farming
1113	Fruit and Tree Nut Farming
2213	Water, Sewage and Other Systems (maybe State or local jurisdiction)
4411	Automobile Dealers
4412	Other Motor Vehicle Dealers
4821	Rail Transportation (maybe Federal jurisdiction)
4885	Freight Transportation Arrangement
4911	Postal Service
5611	Office Administrative Services
5612	Facilities Support Services
5613 *	Employment Services
5614	Business Support Services
5615	Travel Arrangement and Reservation Services
5616	Investigation and Security Services
5619	Other Support Services
6117	Educational Support Services
8112	Electronic and Precision Equipment Repair and Maintenance
9281	National Security and International Affairs (includes Customs and Border Patrol, and Transportation Security Administration)

Table 4. Industries where heat related inspections have been conducted in former Region IX Area Offices since 2012 and not included in ListGen or Construction that are likely to have heat-related hazards.

2017 NAICS Code (6-digit level)	2017 NAICS Title
236115	New Single-Family Housing Construction (except For-Sale Builders)
236220	Commercial and Institutional Building Construction
311812	Commercial Bakeries
322211	Corrugated and Solid Fiber Box Manufacturing
493110	General Warehousing and Storage
541320	Landscape Architectural Services
541620	Environmental Consulting Services
561612	Security Guards and Patrol Services
722511	Full-Service Restaurants
722513	Limited-Service Restaurants
922140	Correctional Institutions
928110	U.S. Customs and Border Patrol

* **Note:** Establishments within the Temporary Help Services (NAICS 5613) industry should not be automatically included in the targeting list for programmed inspections. Although this industry has been among the top industries with OSHA enforcement activities related to heat, this has primarily occurred where services occurred at a high-hazard host. Therefore, to effectively address heat-illness hazards for Temporary Help Services, where OSHA is conducting an inspection for other purposes, a heat-related inspection shall be opened for all hazardous conditions observed in plain view (such as, for example, temporary employees working in high exposure areas without adequate acclimatization or access to water, rest, and shade).

Sources for injury and illness data:

- I. Bureau of Labor Statistics (BLS) Fatality cases 2015-2019 due to exposure to heat
- II. BLS days away from work cases, incidence rates, and median days away from work 2015-2019 due to exposure to heat
- III. OSHA severe injury reports of fatalities and hospitalizations 2018-2020. Hospitalization reports include all employer-reported referrals with Event Title "Exposure to Environmental Heat". Fatality reports include all fatality investigations with victim type "Fatality-OSHA Covered" and any of the following

public page keywords: Heat Stroke, Heat Exhaustion, Heat-Related Illness, High Temperature, Overheated, Heat.

- IV.** OSHA inspections 2018-Aug 2021, inspections with additional codes, HEATGI, HEATCON, HEATMI, or HEATAG.
- V.** OSHA Inspections 2016-Sept 2021, inspections with a general duty keyword of HEAT.
- VI.** OSHA Hazard Alert Letters and 5a1 citations, 2018-Aug 2021, violations with the "Heat" General Duty Clause keyword.

Appendix C: Sample AVD for Heat-Related 5(a)(1) Violation

The 5(a)(1) AVD language for heat related hazard violations of Section 5(a)(1) must specify the heat related hazard, such as the source of heat (e.g. environmental temperature measurements and information on heat-generated equipment), including any specific workplace conditions or practices making employees vulnerable to a likelihood of heat-related illness (e.g., performing moderate to very hard roofing work, dumping heavy refuse bins while running behind a sanitation truck, wearing impermeable protective clothing, and lack of acclimatization of new or returning workers), as applicable. The alleged heat-related hazard descriptions should not include the employer's failure to implement any specific abatement measures such as acclimatizing workers for the heat, failure to provide drinking water, shade or air conditioning, or training workers on heat stress.

Sample AVD:

On or about and at times prior to [the date of the incident], employees were exposed to the recognized hazard of high ambient heat from [list sources of and conditions of ambient heat, such as direct sun, boiler, steam, furnace, combustion engine] during the performance of their job duties, including [describe specific task(s)]. [Describe temperature, relative humidity, WBGT measurements and calculations, and any aggravating factors such as heavy or bulky clothing, duration of exposure, direct sunlight, and level of workload. Include any NOAA heat advisory or alert that supports a high ambient hazardous heat condition and WBGT if known]. Such exposures are likely to lead to the development of serious heat-related illnesses such as, but not limited to, heat cramps, heat stress, heat exhaustion and heat stroke. [Describe any heat-related incidents/ illness that occurred].

Where the information is available and applicable to the inspection, the case file should document factors such as the employer's knowledge of the hazard, the reading on the OSHA-NIOSH App (use the camera screen shot function to save the image of the reading, when possible), WBGT temperature, if possible, wind speed and /direction, radiant heat, cloud cover, length of time the work was performed, and other sources of heat in the workplace.

Additionally, document whether any exposed employees were temporary workers, new hires, or employees returning from prolonged leave periods who were not acclimatized. When listing availability of feasible abatement methods in the citation, document all potential measures the employer failed to implement that would have materially reduced or eliminated the hazard of heat-related illness, such as providing cool, drinking water, frequent breaks, cooling or shaded areas, and access to first aid/prompt medical attention. NOTE: Do not set forth recommended measures as alternative options. Use language such as "Among other methods, feasible and acceptable measures to abate this hazard may include:" At the end of listing the proposed measures, insert the

following: "The listing of these available abatement methods does not necessarily mean that any one measure is sufficient to abate the hazard".

Any water or other fluids provided by the employer should be cool and provided in a location that is familiar to the employees, near the work, easy to access, and in sufficient quantity for the duration of the work.

Appendix D: Sample Hazard Alert Letter (HAL)

SAMPLE HAZARD ALERT LETTER

Note: This letter must be adapted to the specific circumstances noted in each inspection. The letter below is an example of the type of letter that may be appropriate in some circumstances. If the employer has implemented or is in the process of implementing efforts to address hazardous heat conditions, those efforts should be recognized and encouraged, where appropriate. CSHOs should tailor the recommended controls outlined below to the specific needs of the employer. Italicized and bracketed text are for OSHA compliance use only and should not be included in the letter.

Dear Employer:

An inspection of your workplace and evaluation of your OSHA recordkeeping logs at [location] on [date] disclosed the following workplace condition(s) which have been associated with the development of heat-related illnesses in workers:

[Describe the work performed for each task or job, including the type of PPE worn, the source of heat, WBGT and duration of the heat exposure, reading on the OSHA-NIOSH heat app during the inspection, any heat notifications from the National Weather Service, and any other information relevant to workers' exposure to the risk of heat-related illness].

In the interest of workplace safety and health, I recommend that you voluntarily take the necessary steps to materially reduce or eliminate your workers' exposure to the conditions listed above, including, but not limited to, the following:

General Controls:

General controls include training, personal protective equipment (PPE), administrative controls, health screening, and heat alert programs.

1. **Training:** inform workers of the following (Modify this list as appropriate for the specific situation):
 - a. Hazards of heat-related illnesses.
 - b. How to avoid heat-related illnesses by recognizing and avoiding situations that can lead to heat-related illnesses.
 - c. Recognition of signs and symptoms of heat-related illnesses.
 - d. First-aid procedures.
 - e. Employer's program to address heat-related illnesses.
2. **Personal Protective Clothing and Equipment:** (CSHOs should recommend the appropriate PPE).
 - a. Hats for work outdoors in the sun.
 - b. For indoor work, loosely worn reflective clothing to deflect radiant heat, such as vests, aprons, or jackets.

- c. Cooling vests and water-cooled/dampened garments may be effective under elevated temperature and low humidity conditions. However, be aware that cooling vests can become an insulator when they reach the body's temperature.
 - d. In environments where respirator usage is necessary, consult with an industrial hygienist to determine the appropriate clothing to prevent heat stress while still protecting the workers.
 - e. Consider the use of dermal patches for monitoring core temperature to better identify when workers need to be removed from the work area.
 - f. Consider the use of heart rate monitoring to better identify when workers need to be removed from the work area. Both sustained (180 minus age) and recovery (120 bpm after a peak work effort) heart rates are recommended guidelines for limiting heat strain.
3. **Administrative Controls:** (CSHOs should consult the OSHA Technical Manual, Section III Chapter 4 for additional information).
- a. Schedule hot jobs for cooler parts of the workday, and routine maintenance and repair work should be scheduled for the cooler seasons of the year when possible.
 - b. Provide adequate cool drinking water on the worksite that is easily accessible and permit employees to take frequent rest and water breaks.
 - c. Use relief workers and reduce physical demands of the job.
 - d. Have air-conditioned or shaded areas available for water breaks and rest periods.
4. **Health Screening and Acclimatization:**
- a. New workers should be allowed to get used to hot working environments by using a staggered approach over 7-14 days. For example, begin work with 50% of the normal workload and time spent in the hot environment, and then gradually increase the time over a 7–14-day period. The same should be done for workers returning from an absence of three or more days, staging acclimatization over three consecutive days.
 - b. Workers should be made aware of the following:
 - i. Medications such as the following can increase risk of heat stress:
 - Amphetamines -sometimes prescribed for narcolepsy or attention deficit hyperactivity disorder (ADHD),
 - Diuretics -water pills,
 - Antihypertensives -blood pressure medication,
 - Anticholinergics -for treatment of chronic obstructive pulmonary disease (COPD), and
 - Antihistamines -allergy medications.
 - ii. Dangers of using illegal drugs and alcohol in hot work environments. Illegal amphetamines such as methamphetamine are particularly hazardous when heat stress is present.

- iii. Some conditions, such as pregnancy, fever, gastrointestinal illness, heart disease, and obesity, may increase the risk of heat-related illness. Workers should be advised to check with their doctors if they have any questions. (Please note: the employer is NOT entitled to know whether workers have these conditions, but only whether workers have any health conditions that limit their ability to perform their job duties. In some instances, workers with chronic conditions may need extra time to become acclimatized or may need other accommodations, such as more frequent breaks or restricted work.)
- iv. Workers should consult a doctor or pharmacists if they have questions about whether they are at increased risk for heat-related illness because of health conditions they have and/or medications they take.

You may voluntarily provide this Area Office with progress reports on your efforts to address these heat-related conditions in your workplace. OSHA may return to your worksite to further examine the conditions noted above.

Sincerely,

Area Director

Enclosures

Appendix E: CSHO Pre-Inspection Checklist

Here are some things to consider before proceeding with any inspection:

- a. Ensure the availability and use of all necessary and appropriate personal protective equipment (PPE).
- b. Ensure all PPE, inspection equipment, and media are retrievable and ready for use.
- c. Review any relevant cleaning procedures for equipment and the vehicle, government (GOV) or personal (POV).
- d. For all heat inspections, the manager/supervisor/CSHO, in consultation with designated regional office staff, will develop and document a risk assessment that includes an exposure control plan, Job-Hazard Analysis, and PPE hazard assessment prior to entry and update it as necessary for each inspection, to include individual inspection risks that may not otherwise be captured in a general or overall worksite assessment. Individual inspection risks may be based on factors such as industry type, or on-site hazard location.
- e. Ensure GOV or POV is road-ready to include gas/fuel, first aid kit, hand sanitizer, disinfecting wipes, or other cleaning and/or disinfecting agents (as required), and bags to dispose of contaminated PPE and used disinfecting wipes.
- f. Ensure there is enough water available to drink a cup of water every 15 minutes while performing an inspection on a heat priority day. Ensure the air conditioning in the GOV or POV is adequate to provide a cool place to rest during inspections on heat priority days.
- g. Develop a document request letter in advance of the opening conference (e.g., programs, OSHA Form 300/300A, and summaries) to be provided to the employer during the opening conference if needed.

Appendix F: Additional Resources

For Additional Information – OSHA and NIOSH

For more information on heat stress and educational products for safety and health professionals, employers, and workers, visit

- OSHA-NIOSH Heat Safety Tool Smartphone App: Heat Safety Tool Application
- OSHA Educational Resources: Fact Sheets/ Posters (en Español)
- OSHA Webpages: Heat Illness Prevention, Occupational Heat Exposure
- OSHA-NIOSH Info Sheet: Protecting Workers from Heat Illness
- NIOSH Topic Page on Heat Stress
- OSHA Technical Manual (OTM), Section III: Chapter 4
- Fact Sheet: Biden Administration Mobilizes to Protect Workers and Communities from Extreme Heat