OREGON State FACE Program
Fatality Assessment & Control Evaluation
Oregon Institute of Occupational Health Sciences • Oregon Health & Science University
3222 SW Research Dr. L606 • Portland, OR 97239 • 503-494-2281

REPORT#: 2021OR02 **REPORT DATE:** September 27, 2023

Farm worker heat-related fatality—Oregon

INCIDENT HIGHLIGHTS

DATE:
June 26, 2021

TIME:
3:38 pm

VICTIM:
38-year-old Hispanic farm worker

INDUSTRY/NAICS CODE:
Agriculture/115115, 111421

EMPLOYER:
Farm Labor Contractor

SAFETY & TRAINING:
No training related to the hazards of heat

SCENE:
Nursery/Agriculture

LOCATION:
Oregon

EVENT TYPE:
Heat-related fatality

SUMMARY

On June 26, 2021, a 38-year-old Hispanic farm worker was found unresponsive in the field where he had been working to install irrigation lines. The cause of death was determined to be hyperthermia due to environmental heat exposure and dehydration. The temperature on the day of the incident reached a high of 105°F.
READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in the investigation include:

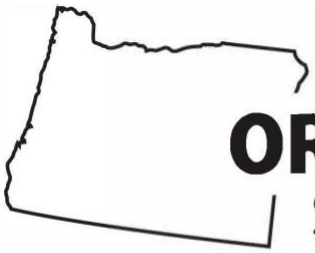
- Environmental heat exposure and lack of acclimatization
- Failure to implement a work/rest schedule based on heat exposure
- Lack of adequate shaded areas and consumption of water
- Inadequate communication with a supervisor or electronic tracking of heat stress symptoms
- Lack of training on the hazards of heat exposure

LEARN MORE> (p.8)

RECOMMENDATIONS

Oregon FACE investigators concluded that, to help prevent similar occurrences, employers should:

- Provide an acclimatization schedule for new employees and appropriate work/rest schedule based on type of work and clothing worn when employees are exposed to environmental heat.
- Provide adequate access to shade and water when exposed to outdoor environmental heat.
- Implement communication methods, buddy system, or electronic tracking of heat stress.
- Train supervisors and employees on the dangers of heat stress and how to recognize symptoms. LEARN MORE> (p.8)



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Oregon Fatality Assessment and Control Evaluation Program

The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Program is a project of the Oregon Institute of Occupational Health Sciences at Oregon Health & Science University (OHSU). OR-FACE is supported by a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH) (grant #U60OH012411) through the Occupational Public Health Program (OPHP) of the Public Health Division of the Oregon Health Authority. OR–FACE reports are for information, research, or occupational injury control only. Safety and health practices may have changed since the investigation was conducted and the report was completed. Persons needing regulatory compliance information should consult the appropriate regulatory agency.

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OR-FACE supports the prioritization of safety interventions using a hierarchy of safety controls, where top priorities are hazard elimination or substitution, followed by engineering controls, administrative controls (including training and work practices), and personal protective equipment.

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INTRODUCTION

At approximately 3:38 pm on June 26, 2021, a 38-year-old Hispanic farm labor worker was found unresponsive in the field where he was working. He was part of a five-person work crew installing irrigation lines at an Oregon nursery. The crew had been working on the site since 5 am that morning. They took a morning break at 10 am and a lunch break at noon. When it was time for the afternoon break at 3 pm, the employee did not report back to the van with the other employees. They tried calling his phone, but he had left it in the work passenger van. The crew notified the supervisor about the missing employee. Other work crew employees went into the field to look for the missing farm worker and found him unconscious and face down where he had been working. The other work crew members moved him to a shaded area nearby. Emergency response was called and arrived at the scene in approximately 10 minutes.

EMPLOYERS

The decedent was employed by a farm labor contractor located in Oregon. The labor contractor provided work crews to different agricultural locations in the area. According to the company's OSHA 300 logs, they employ an average of 150 employees annually.

The host employer was a nursery and farm in Oregon. They operate 1400 acres of land to produce trees, shrubs, and other plants for the nursery. The host employer provided work instructions for the contracted employees on the day of the incident. This nursery directly employed approximately 50 workers.

WRITTEN SAFETY PROGRAMS and TRAINING

The decedent and the rest of the work crew had not been trained on heat-related hazards, including how to recognize heat stress and best practices to prevent heat stress. The work crew reported that they were able to take additional breaks if needed, but this policy was not enforced.

The farm labor employer was the primary employer and had a written emergency action plan and provided initial training for employees on general safety guidelines, but lacked training specific to heat-related hazards. Employees signed a safety pledge that included an agreement stating that they were expected to tell a supervisor if they could not do a job safely. They were also expected to report unsafe conditions and make safe choices. Each of the training documents signed by employees were provided in English, and it is not known if they also provided this information in Spanish.

The farm labor contractor (primary employer) held monthly safety meetings. The topics of these meetings included COVID-related precautions, safe lifting techniques, and not using phones while working. There were two meetings where drinking water was listed as a discussed topic, but no other precautions related to the hazards of heat exposure were documented. This occurred at the safety meeting in April 2021 and June 2021. The June safety meeting also included a note that wearing appropriate clothing was discussed. The documentation from these work meetings was written in Spanish.

A supervisor from the primary employer was not present on the day of the incident. The work crew received instructions from the host employer, the nursery farm location where work was being performed that day.

WORKER INFORMATION

The farm labor contractor had employed the decedent since May 1, 2021. He recently moved to the United States from Guatemala and lived with his nephew. His wife was still living in Guatemala. The decedent's native language was Spanish.

Training materials from the employer signed by the decedent were written in English. However, the level of written English proficiency of the decedent is unknown. Other work meeting notes were documented in Spanish, and the Oregon OSHA investigation interviews with work crew members required an interpreter.

The decedent turned 38 years old the day prior to the incident.

EQUIPMENT

Employees were installing an irrigation system at the nursery location. The work involved moving irrigation piping into a field to water young trees. The sections of piping weighed approximately 30 pounds. The process of moving one line of irrigation piping would take employees approximately 30 minutes. The employee was wearing a hat, a long sleeve cotton shirt, long pants, and boots. This type of work is considered moderate physical work. According to OSHA's Technical Manual, moderate physical work includes a normal walking pace, moderate lifting, and light pushing or pulling. This categorization of physical activity is based on the metabolic rate generated by the body, which is an important factor in heat stress prevention (OSHA, 2017). A photo of the irrigation system in use at this location is shown in **Image 1** below.

Image 1. Example of irrigation system in use near incident location (photo courtesy of Oregon OSHA).

WEATHER

The weather on the day of the incident was a major contributing factor. According to Weather Underground and the National Weather Service, the high temperature recorded at the closest weather station reached 105°F on June 26, 2021. During this time, temperatures were much higher than is typical in this region, where the average temperatures in

June range between 60°F and 70°F. Referred to as the 2021 Northwest Heat Dome, this heat wave resulted in record-breaking temperatures across Oregon, with the highest daily temperature averaging over 30°F hotter than seen over the past decade. (US Department of Agriculture, 2021).

During this weather event, a high-pressure system created conditions with clear skies and high temperatures that remained trapped in the area for several days. This high-pressure system also prevented cooler air from the Pacific Ocean from moving inland and moderating temperatures in the area (Loikith, 2023). **Image 2** illustrates the extreme temperatures that occurred during the 2021 Northwest Heat Dome (US Department of Agriculture, 2021).

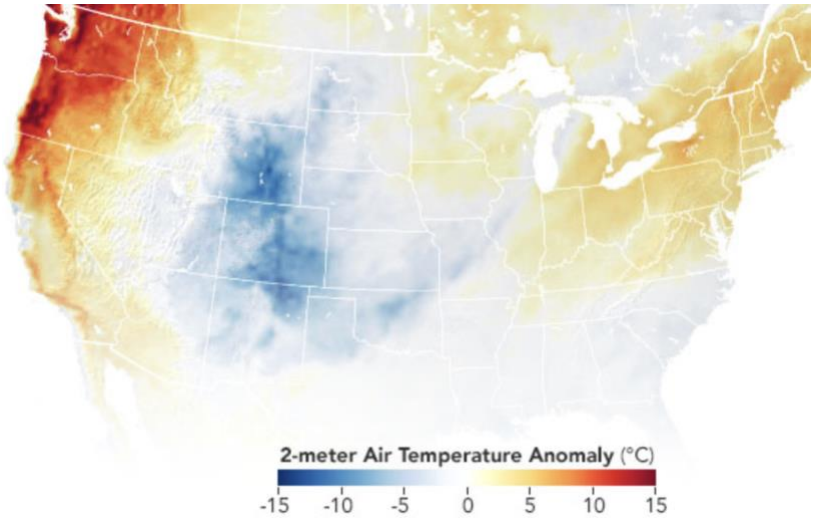

Image 2. 2021 Northwest Heat Dome--illustration of extreme temperatures in region (from United States Department of Agriculture Northwest Climate Hub, 2021).

INCIDENT SCENE

The incident occurred at a nursery field in rural Oregon. The work location included fields of young trees and shrubs, with most of the work area in direct sunlight. The tree line at the edges of the fields provided some areas of shade. **Image 3** below is a satellite image with the shaded areas indicated. It also includes the approximate location where the decedent was found and where other work crew members were working at the time.

Image 3. Satellite Image of Field with Shaded Areas and Worker Locations Noted (Google Maps and Oregon OSHA investigation notes).

INVESTIGATION

The day of the incident was the decedent's first day working for this particular host employer. He had moved to Oregon from Guatemala a few months prior and had been employed by the primary employer (farm labor contractor) since early May 2021. The day before the incident, June 25, the decedent had been working at a different farm location. However, that particular employer sent him home early along with all the other workers at the site because of the unusually high temperatures. Temperatures in the area on June 25 reached a high of 94°F. Just a week before the incident, high temperatures in the area were in the low 80's.

According to the medical examiner's report, there was no evidence of alcohol consumption. The toxicology report also confirmed the absence of medications or substances that could have increased susceptibility to heat stress.

The incident occurred on Saturday, June 26, an extra work shift for the decedent that week. On the day of the incident, the decedent and four other employees arrived at the work location (nursery/farm in Oregon) at approximately 5 am. They received work instructions from the nursery irrigation manager of the host employer and drove to the specific

work field in a passenger van. Each crew member worked in separate field locations, moving irritation pipes into place. The work crew members had purchased their own containers of water that day. The host employer also provided a source of water for workers, as shown in **Image 4.**

Image 4. Example of water provided by the employer (photo courtesy of Oregon OSHA).

The work crew took their first rest break at 10 am when temperatures would have already reached 85°F. By their lunch break at noon, the temperature was 92°F. The afternoon break was scheduled for 3 pm, and the work crew had together decided to end the workday at 4 pm. The employees returned to the work passenger van to take their breaks. Although employee interviews indicated that employees could take extra breaks if needed, this was not widely utilized, and no extra rest breaks other than the normally scheduled breaks were taken on this day. The decedent did not return to the van at the afternoon break (3 pm). The other work crew employees first called his cell phone, which had been left in the van, and then began searching for him. The employee was found face down in the field where he had been working and was unresponsive but still breathing. Emergency medical services were called, and the other employees moved him to a shaded area. At this time, the outside temperature had reached 103°F.

CAUSE OF DEATH

According to the Medical Examiner's Report, the cause of death was exogenous hyperthermia and dehydration. These conditions were caused directly by heat exposure, physical exertion, and inadequate hydration.

CONTRIBUTING FACTORS

Occupational injuries and fatalities often result from one or more contributing factors or key events in a more extensive sequence of events that ultimately result in the injury or fatality. Oregon FACE investigators identified the following unrecognized hazards by the employers as key contributing factors in this incident:

- *Environmental heat exposure and lack of acclimatization*
- *Failure to implement a work/rest schedule based on heat exposure*
- *Lack of adequate shaded areas and consumption of water*
- *Inadequate communication with a supervisor or electronic tracking of heat stress symptoms*
- *Lack of training on the hazards of heat exposure*

Heat-related illnesses and fatalities occur when the heat load on the employee surpasses the body's ability to regulate internal temperature. However, heat-related fatalities are also preventable. The following recommendations consider the practices supported by the National Institute for Occupational Safety and Health (NIOSH) and Oregon OSHA.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: When employees are exposed to environmental heat, employers should implement acclimatization schedules for new employees, and appropriate work/rest schedules based on the type of work being performed and clothing worn.

Discussion: Work/rest cycles and acclimatization schedules are essential prevention strategies for heat-related illness. Work rest cycles to allow the body to recover from heat exposure, while acclimatization is the process of allowing the body to build a tolerance to heat gradually over time.

Several approved methods exist to determine an adequate **work/rest schedule** for employees exposed to environmental heat. One of these methods has been published by NIOSH and includes recommended rest schedules based on the temperature, humidity, and level of physical work. The type of clothing employees wear must also be considered when determining an appropriate work/rest schedule. Because some fabrics or types of clothing, especially personal protective equipment, can trap heat near the body and reduce sweat evaporation, this can make the body's natural cooling systems less effective.

The NIOSH chart below**, Chart 1**, shows work/rest schedules for employees wearing everyday clothing. This chart was taken from their publication *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments* (NIOSH, 2016). The footnotes of this chart include assumptions and temperature adjustments based on environmental conditions. The temperatures should be adjusted for humidity and sunlight, and these adjusted temperatures can be referenced in the chart. For full sun conditions, 13°F should be added to the outdoor temperature. Humidity conditions above 40% also include additional adjustments.

At the time of the incident, the outdoor temperature would have been 103°F, with full sun conditions and humidity of 32%. According to this chart, the following adjustments to the temperature should have been used.

103°F + 13°F (full sun conditions) + 0°F (30% humidity, no adjustment) = 116°F

The adjusted temperature of 116°F surpasses the temperatures listed on the chart. All temperatures above those listed on the chart would be categorized as a caution or high heat stress level. The footnote for these conditions indicates that employers should consider rescheduling work. Based on this chart, even earlier in the day, with full sun and moderate work, the work crew should have started a work/rest schedule of 15-minute breaks each hour (45 minutes of work/15 minutes of rest) when the temperature reached 87°F (100°F adjusted temperature) at approximately 10:30 am that day. These two adjusted temperatures, the adjustment explanations, and other footnotes are highlighted in **Chart 1.**

When looking at work schedules, **heat acclimatization** is another factor that should be considered. Acclimatization is the process of allowing the body to adapt to higher temperatures or build a tolerance to the heat by gradually increasing the employee's work schedule. If a worker is not used to working in hot environmental conditions, working a full shift in certain conditions can make them more susceptible to heat stress. According to Federal OSHA, 50% to 70% of heat related fatalities occur in the first few days of working in environmental heat and the lack of acclimatization represents a major risk factor for these fatalities (OSHA, n.d.).

Acclimatization is necessary for new employees and is typically implemented over the course of seven to fourteen days. On the first day of work, heat exposure should be limited to 20% and then increased by approximately 20% on each additional day. Acclimitization schedules should also be implemented for employees that have have been away from environmental conditions for a week or longer. When outdoor environmental conditions shift suddenly, or extreme weather is unpredictable, this can make acclimitization schedules more difficult to plan ahead. However, they should still be utilized to limit heat exposure and allow employees to gradually adapt to environmental conditions.

Adjusted temperature (°F)†	Light work (minutes work/rest)	Moderate work (minutes work/rest)	Heavy work (minutes work/rest)
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	40/20
98	Normal	Normal	35/25
99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	25/35
103	Normal	30/30	20/40
104	Normal	30/30	20/40
105	Normal	25/35	15/45
106	45/15	20/40	Caution‡
107	40/20	15/45	Caution‡
108	35/25	Caution‡	Caution‡
109	30/30	Caution‡	Caution‡
110	15/45	Caution‡	Caution‡
111	Caution‡	Caution‡	Caution‡
112	Caution‡	Caution‡	Caution‡

*With the assumption that workers are physically fit, well-rested, fully hydrated, under age 40, and have adequate water intake and that there is 30% RH and natural ventilation with perceptible air movement.

†Note: Adjust the temperature reading as follows before going to the temperature column in the table:
Full sun (no clouds): Add 13°
Partly cloudy/overcast: Add 7°
No shadows visible/work is in the shade or at night: no adjustment
Per relative humidity:
10%: Subtract 8°
20%: Subtract 4°
30%: No adjustment
40%: Add 3°
50%: Add 6°
60%: Add 9°

‡High levels of heat stress; consider rescheduling activities.

Chart 1. Work/Rest Schedules for workers wearing normal work clothing (from *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments, NIOSH, 2016*).

Recommendation #2: When employees are exposed to environmental heat, employers should provide adequate access to water and shade.

Discussion: According to OSHA and NIOSH, water, rest, and shade are the best ways to prevent heat-related illness for employees that are exposed to outdoor environmental conditions. It is the employer's responsibility to ensure that employees have access to these resources. Staying hydrated can be one of the most important elements of preventing heat-related illness. This includes not only drinking water when employees feel thirsty, but drinking enough water throughout the day to prevent dehydration.

At the time of the incident, Oregon OSHA did not have a heat illness prevention rule in place. However, after this incident a temporary rule was adopted followed by a permanent rule in the summer of 2022. Oregon OSHA's resources for heat illness prevention include information on the appropriate quantities of water for employers to provide for employees. The water should be cool or cold, and enough should be provided so each employee can drink 32 ounces per hour. Electrolyte drinks could also be provided as an acceptable source of hydration, but they should be in addition to plain water. The work crew present on the day of the incident reported that they stopped at the store before work to purchase water bottles. The employer also provided sources of water for employees to refill their containers.

When exposed to outdoor environmental heat, employees need to be able to access shade, which is defined as the blockage of direct sunlight. This can be provided by natural or artificial means. According to interviews with other employees, it was estimated that shade provided by trees was within approximately 100 feet of where the decedent was working. The shaded areas should be open to outside air or have mechanical ventilation, should be large enough to accommodate employees, and close to employees' work areas. It was reported that employees met at the van to have their lunch; however, it is not specified if the employees used the van's air conditioning to cool off or if they merely used it as a meeting location.

Recommendation #3: Employers should implement communication methods, buddy system, or electronic tracking of employees that are exposed to conditions that could contribute to heat stress.

Discussion: Employers should implement a method of communitating with employees and monitoring them for signs and symptoms of heat stress or illness. This can include checking in with employees periodically through supervisor communication, a buddy system, or electronically monitoring physical symptoms, including heart rate and temperature. This communication is essential because susceptibility to heat-related illness can vary depending on personal factors. Some of the factors that can increase the risk of heat stress include age, health conditions such as diabetes and heart disease or prior heat illness, physical fitness, certain medications, and alcohol use within 24 hours of heat exposure.

When supervisor check-ins are used to for communication and monitoring of heat stress, they should occur periodically throughout the workday and are recommended for supervisors of 20 employees or less. During this communication, supervisors should assess employees' alertness and any signs or symptoms of heat stress or illness. They can also use the check-ins to remind employees to drink water and to take rest breaks. The buddy system is a similar method of ensuring communication and observation of employees to identify early signs of heat stress. This involves assigning pairs of employees to communicate with each other during the work day to monitor for signs of heat stress.

Personal monitoring using electronic devices is another monitoring and communication method that is becoming more widely available to detect early symptoms of heat stress. Many personal fitness trackers and watches are now available with features that can measure heart rate, body temperature, oxygen saturation, and other biometrics. As this technology becomes more accessible and less costly, it may be an optimal strategy for monitoring employees working at

various locations outdoors. For example, a Georgia-based company provides a biomonitoring system to monitor heat stress symptoms (Slatesafety, 2023). This system includes armbands that are worn by workers against the skin and provides real-time monitoring of heart rate and core temperature. It also allows employees to double-tap the device to call for help. The arm bands send information to the supervisor and alert the employee if they show early warning signs of heat stress.

Recommendation #4: Employers should educate and train employees on the dangers of heat exposure and how to recognize symptoms of heat stress.

Discussion: Education and training is necessary for all employees and supervisors of employees exposed to heat and hot environmental conditions. Like other hazards in the work environment, training on heat stress should include information on the hazards of heat exposure and the controls or protections to prevent heat stress. The training should be provided in the language that employees understand. Oregon OSHA provides free interactive training available online. This training covers risk factors for heat stress, the importance of drinking adequate water, identifying and reporting heat-related illnesses and symptoms, and other risk factors.

Another training resource intended for supervisors and managers on Heat-Related Illness Prevention in Agriculture is provided through the University of Washington's Pacific Northwest Agricultural Safety and Health Center. This low-cost training provides information on how heat affects workers, risk factors, appropriate clothing, hydration, and other best practices during high temperatures.

In addition to these external training resources and essential information on heat stress, employers should educate and train employees and supervisors on their specific work plans to prevent heat stress and the site-specific response procedures should an employee experience symptoms of heat stress. The site-specific prevention strategies should include the provision of adequate water, shade, and rest schedules.

Recommendation #5: When employees are exposed to outdoor environmental conditions, employers should monitor weather conditions related to heat exposure and plan precautions accordingly.

Discussion: When monitoring weather conditions and heat exposures, employers need to consider the heat and humidity, or heat index, not only the outside temperature. Humidity impacts the body's ability to cool itself effectively. In addition to the heat index, another measure of heat stress incorporates wind or air movement and exposure to direct sunlight or radiant heat. This type of measurement is referred to as the Wet Bulb Globe Temperature, or WBGT, and is recommended for work in direct sunlight. The National Weather Service has published three tools to assist with forecasts based on the heat index, WBGT, or heat-related impacts. A reference sheet on these tools and their application is available online at NWS Heat Tools.

Federal OSHA and NIOSH have also developed a Heat Safety Tool app to provide real-time heat index information, risk levels, and recommended precautions (NIOSH, 2022). Employers can use this tool to monitor conditions and forecasts and appropriately adjust work schedules and tasks. **Image 5** is an example of how this application can be viewed on a mobile device and Oregon OSHA has created a video on how to use the application, Safety App Tutorial.

Image 5. Example of OSHA-NIOSH Heat Safety Tool App (NIOSH, 2022).

Extreme weather conditions, such as the heat dome that impacted the Pacific Northwest in 2021, are becoming more common. An indicator from the US Environmental Protection Agency (EPA) has shown a steady increase in the number of heat waves in the United States over the past seven decades (EPA, 2022). As the incidence of extreme weather conditions continues to increase, it is necessary for employers to monitor temperatures and to be prepared for weather events such as extreme temperatures that may not be typical of the region.

ADDITIONAL RESOURCES

Oregon OSHA [2023]. Heat Stress Resources. https://osha.oregon.gov/pages/topics/heat-stress.aspx

NIOSH [2022]. OSHA-NIOSH Heat Safety Tool App. https://www.cdc.gov/niosh/topics/heatstress/heatapp.html

NIOSH [2016]. Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments. https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf

Pacific Northwest Agricultural Safety and Health Center [2022]. Health and Safety Solutions in Agriculture: Heat Related Illness Prevention Online Course. https://deohs.washington.edu/pnash/online-learning

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INVESTIGATOR INFORMATION

This investigation was conducted by Rachel Madjlesi, OR-FACE Fatality Investigator. The report was reviewed and received input from Dr. David Hurtado, Director of the OR-FACE Program, Jackie Boyd, OR-FACE Project Coordinator, and the OR-FACE Publications Review Panel, including Dr. Ryan Olson and Gideon Potgieter.

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