

Migrant Farm Worker Dies From Heat Stroke While Working on a Tobacco Farm - North Carolina

SUMMARY

On August 1, 2006, a 44-year-old Hispanic migrant farm worker (the victim) died after succumbing to heat stroke while working in a tobacco field on a farm in North Carolina. The victim arrived on the farm from Mexico on July 21, 2006. On July 24 he was assigned to work in the tobacco fields, where he worked for the next week. On August 1, 2006, he started work at 7 a.m., had a short break between 9 and 10 a.m. that included soda and crackers, and ate lunch between noon and 1 p.m. The weather was hot and humid with a heat index (a measure of the combined effects of high temperatures and high humidity on the body) between 100 and 110. He had been working in a tobacco field when around 3 p.m. he complained to the crew leader that he was not feeling well. The victim drank some water and was driven back to the workers' housing and left alone to rest. At approximately 3:45 p.m. the victim was found unconscious on the steps of the house. Emergency medical service (EMS) personnel were immediately called and responded within five minutes. The victim was transported to the hospital where his core body temperature was recorded at 108° F and he was pronounced dead. NIOSH investigators determined that to help prevent similar occurrences agricultural employers should:

- *develop, implement, and enforce a comprehensive safety and health program which includes standard operating procedures for prevention of heat-related illnesses*
- *train supervisors and employees on how to prevent, recognize, and treat heat illness, using a language and literacy level that workers can understand*
- *establish a hydration program which provides adequate potable water (or other appropriate hydrating fluid) for each employee and which encourages workers to drink at regular intervals*

Fatality Assessment and Control Evaluation (FACE) Program

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatality Assessment and Control Evaluation (FACE) investigations when notified by participating states (Maryland, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia); by the Wage and Hour Division, Department of Labor; or when a request for technical assistance is received from NIOSH-funded state-level FACE programs in California, Iowa, Kentucky, Massachusetts, Michigan, New Jersey, New York, Oregon and Washington. The goal of FACE is to prevent fatal work injuries by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact. FACE investigators evaluate information from multiple sources that may include interviews of employers, workers and other investigators; examination and measurement of the fatality site, and related equipment; and review of records such as OSHA, police, medical examiner reports, and employer safety procedures and training records. The FACE program does not seek to determine fault or place blame on companies or individual workers. Findings are summarized in narrative reports that include recommendations for preventing similar events in the future. For further information visit the FACE website www.cdc.gov/niosh/face or call toll free 1-800-35-NIOSH.

- *monitor environmental conditions and develop work/rest schedules to accommodate high heat and humidity*
- *provide an appropriate acclimatization program for new workers to a hot environment, workers who have not been on the job for over a week, and experienced workers during a rapid change to excessively hot weather*
- *provide prompt medical attention to workers who show signs or symptoms of heat illness*

INTRODUCTION

On August 1, 2006, a 44-year-old Hispanic H-2A worker died after succumbing to heat stroke. H-2A workers are temporary, nonimmigrant foreign workers hired under contract to perform farm work in the US when American workers are unavailable.¹ On August 4, 2006, the North Carolina Department of Labor (NCDOL), Agricultural Safety and Health Bureau, notified the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), of the incident. On August 22, 2006, a DSR senior investigator and an Epidemic Intelligence Service (EIS) officer conducted an investigation of the incident. The incident was reviewed with the bureau chief and agricultural safety officer of the NCDOL Agricultural Safety and Health Bureau. The farm owner was interviewed and photographs of the workers' house and tobacco farming process were obtained. The official cause of death was obtained from the death certificate. Temperature and humidity at the farm were not recorded the day of the incident. Local climatologic data were obtained for this report from the National Climatic Data Center weather station at Goldsboro-Wayne Municipal Airport, approximately 8 miles from the farm.

Employer: The employer was a farmer that grew tobacco, corn, wheat, and soybeans on 2,000 acres of land, of which 425 acres were used for tobacco. The farm had been in the family since 1916 and the current farmer took ownership in 1973. The farmer employed 5 full-time workers, 3 part-time workers, and 12 H-2A workers. The employer was using H-2A workers for the first time and had contracted for 12 workers from July 24 to October 20, 2006. He was a Gold Star grower, meaning the housing he provided the migrant workers met all of the housing requirements of the Migrant Housing Act of North Carolina.² The farmer had no written safety and health program or documented training for employees, but the NCDOL's *Guide to Safety and Health* which included information on heat illness and heat stroke (in English and Spanish) was provided to the workers. The farmer spoke English. A crew leader spoke English and Spanish.

Victim: The victim was Mexican and had traveled to the U.S. as an H-2A worker. He had no tobacco farming experience, and the farmer had been told that in Mexico the victim made a living by selling pastries produced in his family's bakery. The victim was 44 years old and spoke Spanish. His literacy level was not known. He had been in the United States for 11 days.

Environment: The work week was Monday through Saturday, 7 a.m. to approximately 10 p.m. in the evening. There was a short mid-morning break between 9 and 10 a.m. when soda and crackers were provided and an hour lunch break around noon. Breaks were taken in a shaded area with a

portable toilet containing a hand-wash station. No formal breaks were scheduled for the afternoon or evening. Soda, sports drink, and water were always available. The workers were responsible for supplying their own meals. On Sundays, the farmer drove them to a local store to shop for groceries and to use the telephone. The typical clothing worn by workers included sneakers or leather boots, long pants, a cotton t-shirt, colored long-sleeve cotton shirt, and hat. The victim lived with the other H-2A workers in a worker house on the farm. There were no fans or air conditioning in the house. The weather conditions on the farm the day of the incident are summarized in Table 1.

Weather at Goldsboro-Wayne Municipal Airport on August 1, 2006			
Time	Temperature (° F)	Relative Humidity (%)	Heat Index (° F)
6:40 a.m.	79	88	83
7:40 a.m.	90	75	109
8:40 a.m.	90	61	100
9:40 a.m.	95	56	110
10:40 a.m.	97	46	107
11:40 a.m.	99	42	109
12:40 p.m.	99	39	106
1:40 p.m.	99	37	105
2:40 p.m.	100	38	108
3:40 p.m.	99	37	105
4:40 p.m.	97	45	106

Table 1. Temperature, relative humidity, and heat index between 6:40 a.m. and 4:40 p.m. at the Goldsboro-Wayne Municipal Airport (8 miles from the farm) on August 1, 2006.³

INVESTIGATION

The victim and eleven other male H-2A workers arrived from Mexico at the farm in North Carolina around 2 p.m. on Friday, July 21. No work was performed the weekend of July 22-23 as that time was used for the workers to settle in at their new location. The new crew started work in the tobacco fields on Monday, July 24. During the victim's first week of work, July 24-29, the average maximum temperature was 92° F, the average daytime temperature was 83° F, the average daytime humidity was 70%, and there were periods of rain on Tuesday, Thursday, Friday, and Saturday.

As tobacco matures, the flower that grows on top is removed which helps the leaves to grow larger. Removal of the flower causes lateral shoots or suckers to develop that are also removed since the suckers compete with the leaves for nourishment. Removal of the flower and suckers is called topping and suckering, and it is done by hand on the farm.

On Tuesday, August 1, the crew (a crew leader, the victim, and 11 H-2A workers) started topping and suckering the tobacco at 7 a.m. They took a short mid-morning break between 9 and 10 a.m. for soda and crackers. The workers had an hour at noon for lunch. At approximately 3 p.m., the victim complained of not feeling well to the crew leader, who notified the farmer. The farmer drove the

victim to the migrant workers' house where the farmer watched him get out his key and go up the stairs on the right into the house (photo 1). Approximately 45 minutes later, the farmer's brother found the victim unconscious on the steps on the left side of the house. No first aid was administered but emergency medical services (911) were called, and they arrived within five minutes. The victim was unresponsive and was transported by ambulance to the hospital. His core body temperature was recorded at 108° F. Cooling measures were attempted but to no avail, and he was pronounced dead.



Photo 1. The front of the migrant worker's house

CAUSE OF DEATH

Heat stroke was listed as the cause of death on the death certificate. There were no identified contributing causes.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Agricultural employers should develop, implement, and enforce a comprehensive safety and health program which includes standard operating procedures for prevention of heat-related illnesses.

Discussion: Agricultural employers should evaluate tasks performed by workers, identify all potential hazards, and then develop, implement, and enforce a written safety program, which includes preventing heat stroke and other heat-related illnesses.

Although there is no OSHA standard for heat stress in the workplace, there are resources available to the agricultural employer to help develop standard operating procedures for the prevention of heat illness. The Environmental Protection Agency (EPA), in conjunction with OSHA, has published *A Guide to Heat Stress in Agriculture*⁴ which is available through the EPA website at <http://www.epa.gov/oecaagct/awor.html>. This guide offers a step-by-step basic program for agricultural employers to control heat stress. Also available on the EPA website are pocket cards and

posters (in English and Spanish) on heat stress. NIOSH has a topic page on its website dedicated to heat stress resources at <http://www.cdc.gov/niosh/topics/heatstress/>.⁵ NIOSH publications available on this site are *Criteria for a Recommended Standard . . . Occupational Exposure to Hot Environments. Revised Criteria 1986*⁶ and *Working In Hot Environments* (available in English and Spanish)⁷, both also available by calling 1-800-356-4674. OSHA has additional resources, such as fact sheets and a technical manual, on heat stress available at <http://www.osha.gov/SLTC/heatstress/recognition.html>.⁸ The Army and Air Force have published a technical bulletin *Heat Stress Control and Heat Casualty Management*⁹ that provides applicable strategies for the agricultural employer to control heat stress. It is available at <http://chppm-www.apgea.army.mil/documents/TBMEDS/tbmed507.pdf>. NCDOL makes available to all employers safety posters and pamphlets,¹⁰ which includes heat safety, in English and Spanish; and, as part of their safety outreach program, a DVD on heat illness prevention is being produced in Spanish for farmers to show their workers.

In August 2005, California initiated emergency legislation in response to occupational heat-related illnesses and deaths. The legislation, which has since become permanent, provides heat-illness prevention requirements for employers. Extensive support materials and a model heat-illness prevention program¹¹ are available on their website at <http://www.dir.ca.gov/DOSH/HeatIllnessInfo.html>. In May 2007, Washington state issued a temporary emergency rule addressing heat-related illness in the outdoor environment, which requires all employers who have one or more employees working outside to develop and implement written procedures to prevent the occurrence of heat-related illness. Resource materials regarding outdoor heat-related illness are available on their website at <http://www.lni.wa.gov/safety/topics/atoz/heatstress/default.asp>.¹²

Recommendation #2: Train supervisors and employees on how to prevent, recognize, and treat heat illness, using a language and literacy level that workers can understand.

Discussion: Both agricultural employers and workers should be trained in preventing, recognizing, and treating heat illness. The farmer had distributed to the farm workers a safety and health booklet written in Spanish that included information on heat illness and heat stroke. However, the farmer did not require the workers to read the booklet nor did he discuss the contents of the booklet with them.

Heat stroke is preventable. During the warmer months, employees should be made aware of the dangers of working in the heat and made aware of the risk factors for heat illness, such as inadequate sleep, poor nutrition, and alcohol and drug use.⁴ Supervisors and employees should be vigilant for signs of heat illness, not only in themselves but in their coworkers (a buddy system may be prudent during periods of heat extremes), and be prepared to provide and seek medical assistance.

Heat stress is the combined stress a worker experiences from the effects of the body's work load (how hard the body is working), environmental load (i.e., air temperature, humidity), and the amount and type of clothing being worn.¹³ The body undergoes physiological changes to eliminate the excess heat, such as sweating which evaporates and cools the body. In hot and humid temperatures, the evaporation process is diminished and the body has to work harder to maintain a normal body

temperature. Severe heat stress can overwhelm the body’s ability to cool itself which can lead to permanent organ damage and death.

The different degrees of heat illness and their signs and symptoms and associated treatments are outlined in Table 2.

Heat Illness	Signs and Symptoms	Treatment
Heat rash (prickly heat)	Small, red blisters on the skin; most likely to occur on neck/upper chest, groin, under the breasts, and in elbow creases.	Provide a cooler, less humid environment. Remove wet clothing and wash affected area. Keep affected area dry.
Heat cramps	Painful spasms of muscles in legs, arm, and abdomen; often occurs in association with strenuous activity	Stop all activity and rest in a cool place. Drink water or sports beverage. Do NOT take salt tablets. Seek medical attention if cramps continue for more than 1 hour.
Early heat illness	Mild dizziness, fatigue, or irritability; decreased concentration; impaired judgment.	Loosen or remove clothing. Rest in shade 30 minutes or more. Sip cool water.
Heat exhaustion	Heavy sweating, paleness, fatigue, weakness, dizziness, headache, nausea/vomiting, fainting, excessive thirst, dry mouth, dark yellow urine. May lead to heat stroke.	Move to cooler, shaded area as soon as possible. Loosen or remove clothing. Splash cool water on body. Rest lying down. If conscious, give sips of water. Have victim evaluated by health professional.
Heat stroke	Can occur suddenly and without warning. Red, hot, and dry skin (no sweating—though this may not be easy to determine if clothes are sweat-soaked), rapid and strong pulse, throbbing headache, dizziness, nausea, confusion, incoherent speech, aggressive behavior, convulsions, unconsciousness.	Medical Emergency—Provide immediate medical assistance. Move to a shaded area. Cool victim rapidly using whatever means available—wrap victim in sheet then pour water over sheet and fan vigorously or immerse victim in tub of cool water or spray victim with hose. If conscious, drink sips of water. Transport to nearest medical facility.

Table 2. Heat illnesses, their signs and symptoms, and associated first aid measures. (Adapted from CDC’s *Extreme Heat: A Prevention Guide to Promote Your Personal Health and Safety*.¹⁴⁾

It is important to note that though the signs and symptoms of heat illness, green tobacco poisoning, and pesticide poisoning are different, there are enough similarities among them, such as nausea, sweating, and weakness, that the illnesses may be misidentified by workers.¹⁵ This can be a fatal mistake in the case of heat illness.

Over 80% of hired crop workers report Spanish as their native language; 70% speak little or no English.¹⁶ OSHA has developed *The Hispanic Outreach Module* to assist employers with a Spanish-speaking workforce to identify Spanish-language outreach and training resources and to learn how to work cooperatively with OSHA.¹⁷ In addition, the module provides a list of OSHA's Hispanic/English-as-a-second-language coordinators. These materials are available at http://www.osha.gov/dcsp/compliance_assistance/index_hispanic.html or can be obtained by contacting an OSHA area office. OSHA contact information can be found at <http://www.osha.gov>. Information provided can be used by employers who are developing or improving safety and training programs for their Spanish-speaking employees.

Recommendation #3: Establish a hydration program which provides adequate potable water (or other appropriate hydrating fluid) for each employee and which encourages workers to drink at regular intervals.

Discussion: Proper hydration is extremely important in the prevention of heat illness. The farmer had soda, sports drink, and water readily available for the workers, who were allowed to drink as much as they wanted. Soda was usually the drink of choice for the workers. However, soda may contain caffeine and sugar, both of which may increase the loss of fluid from the body. Water is the preferred beverage to combat dehydration during work in hot environments. It is not enough for employers to just have water available in the fields and barns. Employers should monitor their employees' intake of fluids and actively encourage employees to drink water at scheduled intervals.

In hot or humid environments, farm workers need to replace the fluid they are losing through perspiration. A body can lose up to a quart of water per hour through sweat.⁶ Because lack of thirst does not indicate that a person is hydrated (in fact, just the opposite can occur; a worker can be very dehydrated and not feel thirsty),^{4,9} agricultural employers should ensure that farm workers are drinking sufficient amounts of water by providing frequent water breaks and access to water. The rule of thumb is the amount of body fluid lost to perspiration should be replaced by drinking the same amount of water.⁴ The agricultural employer should provide a minimum of two to three gallons of clean, cool, potable water per worker per day. It is best to drink a little water more often than a large amount of water at once; for example, six to eight ounces of water every 20 minutes. Workers may be more willing to drink larger quantities of flavored drinks than water, so a flavored drink containing electrolytes, such as sports drinks, is acceptable. Caffeinated and sugared sodas should be avoided. Because of the gas content, carbonated drinks are not recommended; they make a person feel full. Alcohol of any kind should be discouraged as it can affect the body's ability to regulate temperature. Salt tablets or drinks containing large amounts of salt should also be avoided.^{4,6}

Fluid replacement can also occur during mealtimes. Workers can drink water, tea, juice, sport drinks, or other fluids with their meals that will help replace lost fluids. In addition, water is better absorbed when taken with food and food can provide salt which is necessary to retain water.⁹ After this incident, the agricultural employer began providing a hot noon meal consisting of meat, vegetables, bread, and sweet tea for each of the farm workers.

Recommendation #4: Monitor environmental conditions and develop work/rest schedules to accommodate high heat and humidity.

Discussion: During the hotter months, agricultural employers should obtain local climate data to identify periods of high heat and humidity in order to adjust the work duties for the conditions of the day, schedule adequate water and rest breaks, and maintain watchfulness for signs of heat illness in the workers. Tools such as the heat index in Figure 1 are available to assist the employer in assessing environmental conditions. To protect employees from heat illness, it may be necessary to schedule heavy work activities during cooler periods, such as morning or evening, or to shorten working periods and increase rest periods to ensure workers have an appropriate recovery period from the heat. Rest breaks provide time to drink water and allow the body to cool down. Breaks should be taken in cool, shady areas, possibly even air conditioning. For specific guidelines on setting work and rest schedules, see the EPA publication *A Guide to Heat Stress in Agriculture*, EPA-750-b-92-001, available through the EPA website at <http://www.epa.gov/oecaagct/awor.html> or by calling 1-800-490-9198.⁴ Note that the EPA guidelines for work/rest schedules are for those workers already acclimatized.

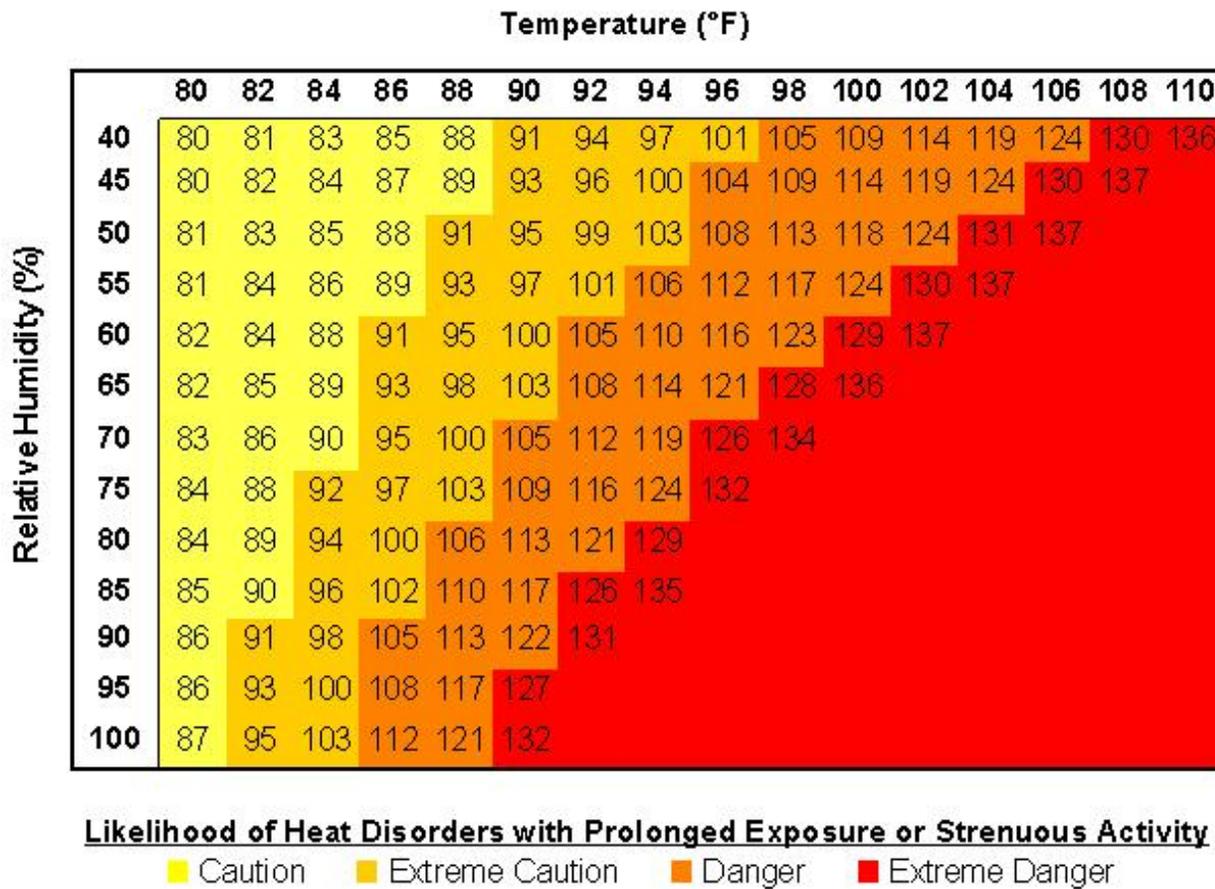


Figure 1: Heat Index Chart. The heat index combines the effects of heat and humidity to determine how hot it feels. Direct sunshine increases the heat index by 15° F. Reprinted from the U.S. National Weather Service.¹⁸

Recommendation #5: Provide an appropriate acclimatization program for new workers to a hot environment, workers who have not been on the job for over a week, and experienced workers during a rapid change in excessively hot weather.

Discussion: Acclimatization is the body's improved response to heat stress after exposure to environmental heat and strenuous physical exertion. It allows the body time to adjust to working in hotter temperatures by improving the sweating mechanism and allowing the body to better maintain appropriate body temperature and heart rates.^{4,6,9,13} According to NIOSH, it takes approximately five to seven days for an individual to acclimatize to a hot environment and an acclimatized person begins losing acclimatization within four days.⁶ Acclimatization does not reduce the need for water or rest breaks. Acclimatized workers still require adjusted work/rest schedules during periods of high heat and humidity. Work/rest schedules set for acclimatized workers should not be used as an acclimatization schedule for the non-acclimatized worker. The acclimatization period should be tailored to local conditions, type of clothing worn, type of work, and the worker.^{4,6,13}

An acclimatization program should be implemented for the following:

- new workers to a hot environment
- workers who have not been on the job for over a week
- experienced workers during a rapid change to excessively hot weather⁴

The acclimatization process should take about five to seven days and include assigning lighter duties, providing longer rest periods, gradually increasing the level of work each day, and monitoring how the workers respond to working in the heat. It is important that workers complete the full acclimatization period. Even after acclimatization, workers still may not work as effectively in high heat and humidity.⁴

For specific guidelines on setting work and rest schedules, see the EPA publication *A Guide to Heat Stress in Agriculture*, EPA-750-b-92-001, available through the EPA website at <http://www.epa.gov/oecaagct/awor.html> or by calling 1-800-490-9198.⁴

Recommendation #6: Provide prompt medical attention to workers who show signs of heat illness.

Discussion: In this incident, the worker complained of not feeling well, but instead of receiving medical attention, he was left alone to rest. He was found unconscious 45 minutes later. Heat stroke is a life-threatening illness, and medical care must be administered immediately to prevent permanent disability or death.¹⁴ Even a minor heat illness can develop into a life-threatening heat illness without the worker or others around them even knowing it. Employees showing signs of a heat illness should NOT be left alone and should be given water and allowed to rest and recover. Outer layers of clothing and any personal protective equipment should be removed and air movement (such as use of a fan) increased as appropriate to aid in evaporative cooling.^{6,9} Prompt medical attention can alleviate minor heat illness symptoms and prevent a minor heat illness from escalating into a life-threatening heat illness.

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INVESTIGATOR INFORMATION

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