Park management requested NIOSH to evaluate employees working in extreme heat (e.g., employees involved in maintenance of asphalt parking lots, housing repairs, grounds maintenance, or archaeological surveys), to review current and proposed heat stress management policies, and to recommend ways of preventing heat-related illnesses [NIOSH 2014b]. July temperatures in the park ranged from 31.1°C to 46.7°C (88°F to 116°F). Employees were asked to participate in work and medical history questionnaires, which also asked about health symptoms. Core body temperatures and heart rate were measured. Blood was analyzed daily for markers of muscle breakdown and dehydration during 4 workdays and the following 3 rest days. Estimates of how hard the workers were working were noted and daily temperatures and humidity were measured. The park’s heat stress policies and records of work-related injuries and illnesses were reviewed.

One worker was found to have a core body temperature above the ACGIH defined heat stress criteria (>38.5°C [101.3°F]); however, no workers were determined to be dehydrated or experiencing significant muscle breakdown. Several workers had sustained maximum heart rates. The heat stress policy was found to lack appropriate work/rest scheduling, and workers were not consistent in following the policy (i.e., failing to observe the buddy system rule).

The NIOSH HHE made the following recommendations for managers and workers:

**Managers**

- Avoid moderate to heavy outdoor tasks during summer months, or if necessary, work at night.
- Reduce the amount of time workers work in extremely hot weather.
- Revise the park’s heat stress policy to include work/rest schedules based on WBGT and workload.
- Require workers to conduct self-monitoring.
- Develop a workgroup (i.e., workers, responsible healthcare provider, and safety manager) to make decisions on self-monitoring options and standard operating procedures.

**Workers**

- Follow the heat stress policy.
- Carry a radio at all times.
- Avoid working alone (i.e., buddy system).
- Learn the signs and symptoms of heat-related illnesses.
- Self-monitor and document signs and symptoms of heat-related illnesses.
- Tell your supervisor if you have symptoms or if you note symptoms in a coworker.
- Drink plenty of fluids, and take rest breaks as needed.
- Volunteer to be on the work group to develop self-monitoring guidance for working in the heat.
An airline catering facility that included truck drivers was evaluated for ergonomic risk factors, heat and cold exposure, and job stress [NIOSH 2014a]. Although heat stress conditions in the food delivery trucks were not specifically evaluated, several employees and management representatives discussed temperatures in the trucks. Employees reported that the trucks were poorly maintained (e.g., some trucks had no air conditioning or had windows that did not open or close). Employees reported that the heating system in some of the trucks could not be turned off so it operated throughout the year.

Managers reported that a typical delivery job took about 2 hours and included loading the truck at the dock, driving approximately 25 minutes to the airport, going through airport security, driving to the plane parked on the tarmac, unloading carts from the truck to the plane, and then driving back to the dock. The delivery could take longer if the plane was not ready to receive the carts. Employees were expected to do three or four deliveries during their shift. Employees were expected to take breaks between deliveries in an air conditioned room at the airline catering facility. However, managers stated that on busy days employees sometimes skipped these breaks to keep up with job demands. Some employees also reported that they skipped breaks to shorten their shift so they could leave work early.

Drivers, loaders, and sanitation (i.e., autoclave operators, dishwashers) employees were potentially exposed to hot temperatures. Heat measurements in the autoclave area suggested a continuous work schedule is acceptable for acclimatized employees with moderate workloads when outdoor temperatures are in the mid-70s. For the temperatures measured in these work areas, acclimatization for most people occurred in 4 days by exposing them to progressively longer periods in a hot work environment. The company had heat-related training materials available. The training included sources of heat, symptoms of heat-related disorders, and recommendations for preventing heat stress, such as taking breaks in a cool area and drinking one glass of water every 20 minutes. However, breaks were limited to two per 8-hour shift, and beverages were prohibited in most work areas.

The NIOSH HHE made the following heat stress-related recommendations for managers and workers:

**Managers**

- Train workers on the health effects of exposure to hot temperatures and ways to be more comfortable at work. Inform employees and supervisors of OSHA heat safety tools found at [http://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html](http://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html). The website provides information on protective measures they can take on the basis of the heat index at the worksite.
- Develop and implement a heat stress prevention program. Establish mandatory breaks and access to fluids for workers exposed to heat.
- Ensure new trucks have air conditioning and repair systems in existing vehicles.

**Workers**

- Drink plenty of fluids when exposed to heat.
- Take regular breaks to recover from extreme temperatures.
- Take part in safety committees.
- Report symptoms to supervisors and medical staff as soon as they occur.
**Landscaping Case Study**

A 30-year-old male landscape mowing assistant collapsed and died of heat stroke after a day of caring for residential lawns [NIOSH 2002]. Two hours before his death he had complained of feeling light-headed and short of breath, but he refused assistance offered to him by his partner. The worker was on medication that had a warning about exposure to extreme heat, and this might have interfered with body temperature regulation. The landscape worker had been wearing two pairs of work pants on the day he died, but his partner did not notice any profuse sweating or flushed or extremely dry skin. Upon collapse, the victim was treated by emergency medical services (EMS) personnel at the site and then transported to the hospital. There he was pronounced dead, with an internal temperature of 42°C (107.6°F). On the day of the incident, the maximum air temperature was 17.2°C (81°F).

The following recommendations were made after the incident:

- Employers should ensure that supervisors/managers monitor workers during periods of high heat stress.
- Identify workers with risk factors that would predispose them to heat-related illnesses.
- Train workers about heat stress, heat strain, and heat-related illnesses.
- Ensure all workers are able to recognize the signs and symptoms of heat-related illnesses in themselves and in others.
- Stress the importance of drinking nonalcoholic beverages before, during, and after working in hot conditions.
- Periodically remind workers of the signs of heat-related illness and encourage them to drink copious amounts of water during hot conditions.

**Construction Case Study**

A 41-year-old male construction laborer was sawing boards to make concrete forms that were to be part of an addition to a factory [NIOSH 2004]. At 5 p.m. the worker collapsed in the parking lot on the way to his vehicle. He was found 30 minutes later by a factory worker, who then returned to the factory and reported the situation to a supervisor. The receptionist was instructed to call EMS while the supervisor administered emergency care to the collapsed worker. The worker’s body temperature was recorded as 41.7°C (107°F) by the EMS and as 42.2°C (108°F) when admitted to the hospital. The worker died the next day from heat stroke.

The following recommendations were made after the incident:

- Train supervisors and workers to recognize symptoms of heat exhaustion/stroke when working in high heat index and/or humid conditions.
- To avoid dehydration and heat exhaustion/stroke, workers should be given frequent breaks and be provided drinking water and other hydrating drinks when working in humid or hot conditions.
- Work hours should be adjusted to accommodate environmental work conditions such as a high heat index and/or high humidity.