Hot Weather Health and Safety Tips

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I have been leading archaeology crews in all types of weather conditions and environments for almost 10 years. Sometimes my work has taken me into deserts where the temperature peaked 100 degrees by 10AM and over 110 degrees by 2PM. These conditions require vigilance on part of the supervisor and the crew. Heat-related injuries do not go away when you leave the field and leave you more susceptible to future injury. Ultimately, you are responsible for taking care of yourself because it is your own health that is at risk.

Here are a few of my own personal tips for staying safe in extreme temperatures:

DISCLAIMER: I am not a doctor or an occupational hygienist. You may still get hurt even if you follow my tips. I am not responsible for any injuries incurred by following this information. These tips are for "entertainment purposes," but it will help you greatly if followed.

Acclimatization is key-- Be prepared to work in extreme heat. That is the best way you can keep from getting injured. According to the book *NOLS Wilderness Medicine* by Tod Schimelpfenig (2008:114),

> *"Acclimatizing to heat entails increasing the rate of sweating, decreasing the sweating threshold, improving vasodilation, and decreasing electrolyte loss in the sweat. When acclimatized, we sweat faster and sooner and lose the fewer electrolytes in the sweat.*
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> *To become acclimatized to a hot environment, the body requires 1 to 2 hours of exercise in the heat daily for approximately 10 days to 2 weeks. To remain acclimatized requires 1 to 2 hours of exercise per week."*

This means, it will take you about 10 days to get used to working in extreme heat. In my experience, you can speed this up if you do some workouts in the heat (i.e. taking short jogs in hot temperatures [10--20 minutes]). But, this can be very dangerous because you are very susceptible to overheating if you haven't acclimated. Take it easy until you get used to working out in the sun.

Also, you can prevent heat illness by maintaining good cardiovascular fitness through regular exercise. You will last longer if you're in shape.

Know your body, know your co-workers--As soon as possible, learn what your body can and cannot take. Figure out how long you can be exposed to direct sun and heat, what time of day you feel weakest, and how much water and electrolyte drinks you need to stay healthy. Learn what you can eat if you have to work in the heat all day. Once you know your limits, you can work on increasing them and slowly improving your resilience to the heat. You also need to know what your limits are so you can take it easy and get out of the heat once you get the slightest feeling that you are succumbing to heat illness.

You also need to pay attention to the people you're working with. Help your crew members help themselves BEFORE anyone gets hurt. Know and watch for any signs of heat illness in any of the people you're working with. Notice if you seem to be telling someone the same numbers or instructions more than once. Pay attention to how they look (skin color, body movement, the look in their eyes). Is someone walking or digging slower than the rest of the crew? Do they look disoriented or pale? There is a wide range of behaviors and actions that give clues that co-workers are getting hurt by the heat. Remember, you can be held liable if you see signs of heat illness in a co-worker and do not bring that to anyone else's attention.

Here are my personal heat limitations. They are similar to other archaeology desert rats (*FYI: I'm 34-years-old, weigh 225, and have worked outside about 2-3 months a year in 100+-degree temperatures for the last 4 years*): When it is over 100 degrees, I can dig consistently for about 30-45 minutes before I need a 10-15 minute break. I can usually keep this up for a whole 10-hour day, but am a little weak during the first few days. I can survey between 10 and 20 miles a day (20 miles if I don't find anything). As long as I'm hydrated, I feel okay until 105--110 degrees, then I start getting forgetful and making simple mistakes in my writing. After 115, I start getting lethargic. I also pay attention to my water supply. On survey, I carry a 3-liter camelbak bladder, a separate 1-liter reserve bladder, and a small 8-oz. bottle of pedialyte for emergencies (usually the pedialyte is frozen. It can be used as a drink or a cold compress in an emergency).

As a supervisor, I never want to be more than 1 mile away from the jeep/truck because I only carry a small first aid kit with me (basically bandaids, antihistamine, and pedialyte) and it takes me about 10--12 minutes to jog a mile in 100+-degrees and (I presume) 15--20 minutes to help carry someone to the vehicle depending upon terrain. So, it would take too long to get a crew member to the vehicle in the event someone got extreme heat illness. A human being can die from heatstroke or heat exhaustion in less than 20 minutes.

Hydrate and stay hydrated--This should go without saying, but there are a lot of folks that don't hydrate properly. Everyone is different, but most of us should drink constantly while out in the field. You should take a lot of little sips throughout the day rather than chugging a liter all at once. You should still be urinating and it shouldn't be too dark (unless you just took vitamins). Drink lots of water and try not to have too much coffee or soda. Electrolyte drinks are good (Gatorade and PowerAde), but pedialyte is the king of electrolyte drinks. I drink about 8-oz. of pedialyte each day when the temperature is over 90 degrees. I also bring some in the field with me in case somebody gets hyponatremic (drinks too much water).

It's also essential to drink AFTER you get out of the sun. Again, everyone is different but you should keep drinking water after you get back to your house/hotel. It can take more than a day to rehydrate, so it's best not to get dehydrated.

Once again, I'll use myself as an example. I drink about 2--3 liters AFTER I get off work (4-9PM) and about 1 liter in the morning BEFORE I get out in the field. I usually drink about 16--32 oz. of coffee in the morning and 3 liters of water from 5AM to Noon and another 2--3 liters from noon to 3PM. I also drink about 8 oz. of pedialyte when I get back to the hotel/home.

Take Immediate Action--Do not hesitate to take a break or get out of the heat if you feel yourself getting sick. It is your responsibility to take care of yourself. If you see someone starting to get sick, you should also confront that individual about their condition and ask if they need a rest. If they resist, be sure to tell your supervisor immediately. Things progress can very quickly from heat strain to heat exhaustion and heatstroke. By the time you feel heat strain, your body is starting to fail and you are on a bad trajectory. Do not hesitate to do the right thing. Heat illness can strike very quickly and the effects can destroy or end somebody's life.

There is no job or archaeological site worth risking your life over. Don't try to be a tough guy/girl. You could die.

I have learned from experience that even the most acclimated field archaeologist can still succumb to the heat. I've seen people that have been doing this for years get light-headed and have to spend the afternoon doing paperwork in the truck. I've also seen people that didn't listen to their body and ended up getting heat exhaustion that landed them in the hospital. I've heard even worse stories.

There are a number of resources out there that can help you stay safe in the field. I have included a segment of a health and safety plan that I followed for a project years ago that has one of the most comprehensive hot weather safety recommendations I have ever seen for an archaeology project. You can also take a wilderness first-aid course through the NOLS (http://www.nols.edu/wmi/courses/wildfirstaid.shtml). For general tips that will greatly help you while working in the field you can also read:

Schimelpfenig, Tod

2008 *Wilderness Medicine*. Stackpole Books, Mechanicsburg, PA.

If you're leading crews, I suggest you read:

Graham, John

1997 *Outdoor Leadership: Technique, Common Sense, and Self-Confidence*. The Mountaineers, Seattle.

The following is from a health and safety manual created by AECOM for a multi-state project that covered a wide variety of environmental zones. The following section is not property of Succinct Research. Many of the following recommendations are almost impossible to follow for most CRM projects.

AECOM

2011 *Health and Safety Plan: Arizona: BLM National Historic Trails Cultural and Visual Inventories*. Prepared by AECOM, San Diego, California.

1.1.1 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress. For additional requirements, refer to H&S SOP No. 10.4, *Hot Environments* and H&S SOP No. 10.3, *Cold Environments.*

1.1.1.1 Responding to Heat-Related Illness

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel working in the Southwestern desert. Site personnel must be instructed in the identification of a heat stress symptoms, the first-aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Workers must be encouraged to immediately report any heat stress that they may experience or observe in fellow workers. Site Technical Leads must use such information to adjust the work-rest schedule to accommodate such problems.

Wherever possible, a designated break area should be established in a shaded area. The break area should be equipped to allow workers to loosen or remove protective clothing, and sufficient seating should be available for all personnel. During breaks, workers must be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

Personnel who exhibit ANY signs of heat related illness should be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water. Anyone exhibiting symptoms of heat exhaustion or stroke must be taken immediately to the nearest medical facility.

The guidance below will be used in identifying and treating heat-related illness.

Table1 Identification and Treatment of Heat-Related Illness		
Type of Heat-Related Illness	**Description**	**First Aid**
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	• Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	• Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*). • If the victim is conscious, it may be helpful to give him/her sips of water. • Transport victim to a medical facility ASAP.
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	• Immediately evacuate the victim to a cool/shady area. • Remove all protective outerwear and as much personal clothing as decency permits. • Lay the victim on his/her back w/the feet slightly elevated. • Apply cold wet towels or ice bags to the head, armpits, and thighs. • Sponge off the bare skin with cool water. • The main objective is to cool without chilling the victim. • Give no stimulants or hot drinks. • Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility.

1.1.1.1.1 Work Rest Schedule

The prevention of heat stress is best performed through observation of employees and routine heat stress awareness training activities. However, it is also necessary to implement a work routine that incorporates adequate rest periods to allow workers to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest and recover. The frequency and length of work breaks must be determined by the Site Technical Lead based upon the ambient temperature, amount of sunshine, humidity, the amount of physical labor being performed, the physical condition of the workers, and protective clothing being used.

4.2.4.1.2 Establishing the Work-Rest Schedule

Two techniques can be used to initially determine an appropriate daily workrest schedule. These methods are:

- Wet Bulb Globe Thermometer (WBGT) Method – this method is preferred, if a WBGT meter is available.
- Adjusted Temperature Method – this method should be used only if WBGT data is not available.

Either procedure will provide the Site Technical Lead with a recommended routine, however adjustments to this routine may be required to accommodate the specific daily conditions at the work site.

4.2.4.1.3 Guidelines

Table 4-2, the *Non-Chemical Protective Clothing (CPC) Activities WBGT Chart*, is intended for use where personnel are not utilizing CPC.

WBGT readings (in degrees Fahrenheit - ^{O}F) are compared directly with the values the applicable WBGT Chart for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching, very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 2 Non-Chemical Protective Clothing Activities

Work-Rest Frequency	^{0}F – WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	85	81	78	
75% Work – 25% Rest	86	83	81	
50% Work – 50% Rest	88	85	83	81
25% Work – 75% Rest	90	87	86	85

4.2.4.1.4 Adjusted Temperature Method

This method can be utilized where WBGT data is not available, and requires only that the ambient temperature (in degrees Fahrenheit - ^{O}F) be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate, humidity and a fully acclimated work force). The adjustments should be made by addition or subtraction to the ambient temperature reading, or changes in table position, as indicated in Table 4-3. Adjustments are independent and cumulative, all applicable adjustments should be applied. The result is the *Adjusted Temperature*, which can be compared with the values in Table 4-4 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching, very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 3 Temperature Adjustment Factors	
Time of Day	
Before daily temperature peak[1]	+2°F
10 am – 2 pm (peak sunshine)	+2°F

Sunshine	
No clouds	+1°F
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F
Cloudy (>7/8 cloud cover)	-7°F
Indoor or nighttime work	-7°F

Wind	
Gusts greater than 5 miles per hour at least once per minute	-1°F
Gusts greater than 10 miles per hour at least once per minute	-2°F
Sustained greater than 5 miles per hour	-3°F
Sustained greater than 10 miles per hour	-5°F

Humidity	
Relative Humidity greater than 90%	+5°F
Relative humidity greater than 80%	+2°F
Relative Humidity less than 50%	-4°F

Chemical Protective Clothing (CPC)	
Modified Level D (coveralls, no respirator)	+5°F

Miscellaneous	
Un-acclimated work force	+5°F
Partially acclimated work force	+2°F
Working in shade	-3°F
Breaks taken in air conditioned space	-3°F

[1] This adjustment accounts for temperature rise during the day. If the temperature has already reached its daytime peak it can be ignored.
[2] Locate the proper column based on work rate, then move one column to the right (next higher work rate) before locating the corresponding adjusted temperature.

Table 4 Work-Rest Schedule Based on Adjusted Temperature				
Work-Rest Frequency	^{0}F – WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
No Specified requirements	< 80	< 75	< 70	< 65
15 minute break every 90 minutes of work	80-90	75-85	70-80	65-75
15 minute break every 60 minutes of work	> 90-100	> 85-95	> 80-85	> 75-80
15 minute break every 45 minutes of work	> 100-110	> 95-100	> 85-90	> 80-85
15 minute break every 30 minutes of work	> 110-115	> 100-105	> 90-95	> 85-90
15 minute break every 15 minutes of work	> 115-120	> 105-110	> 95-100	> 90-95

STOP WORK	**> 120**	**> 110**	**> 100**	**> 95**

4.2.4.1.5 Evaluating the Work-Rest Schedule's Effectiveness

Once a work-rest schedule is established, the Site Technical Lead must continually evaluate its effectiveness through observation of workers for signs/symptoms of heart stress. Measurement of each employee's pulse can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

At the start of the workday each employee's baseline pulse rate (in beats per minute – bpm) is determined by taking a pulse count for 15 seconds and multiplying the result by four. Employee pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- Each employee's maximum heart rate at the start of any break should be less than [180 minus workers age] bpm. If this value is exceeded for any employee, the duration of the following work period will be decreased by at least 10 minutes.

- At the end of each work period all employees' heart rates must have returned to within +10% of the baseline pulse rate. If any employee's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be re-measured and the end-of-break criteria again applied.

Measurements for each employee can be recorded and tracked throughout the work day using the Heat Stress Monitoring Log (Attachment F)

Recommended Guidelines

The guidelines discussed in this section are intended to be used only as a means for initial establishment of a work/rest regimen.

- The Site Technical Lead, in consultation with the Safety Professional, will evaluate the conditions at a specific operation and make final determinations of the work/rest regimen.
- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz per hour during the work shift; fluid replacement at frequent intervals is most effective.
- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration, and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool and/or shaded location.
- Dry clothing or towels should be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
    - Erecting a cover or partition to shade the work area;

- Use of cooling garments (e.g., cooling vest).

- The Site Technical Lead, in consultation with the Safety Professional, will determine the potential for heat stress based on planned activities and weather forecasts.
- If the potential for heat stress exists:
    - All site employees will be informed of the potential for heat stress during the daily safety meeting.
    - The Site Technical Lead will determine if any workers are at particular risk for heat stress due to illness, etc.
    - The Site Technical Lead must ensure that sufficient quantities of potable water and electrolyte drinks are available.
    - All employees are advised to drink 16 ounces of water prior to beginning work and at least 16 ounces during each rest period.
    - The initial work period and monitoring frequency is set according to the level of risk for heat stress.
    - Within the first minute of each rest period, each employee's heart rate (pulse) will be measured, and compared to the following:
        - Initial heart rate: 110 beats/minute (28 beats/15 sec).

Each employee's heat rate must be measured again three minutes later, and compared to the following:

- Recovery heart rate: 80 beats/minute (20 beats/15 sec).

- If both heart rate criteria are met, the subsequent work period may be increased by one third, provided the temperature remains constant.
- If the initial heart rate is > 110 beats per minute, or the recovery rate is not less than 80 beats per minute, the subsequent work shift is decreased by one third.
- Additional means of prevention include:
    - If cooling devices are worn, only physiological monitoring will be used to determine work activity.
    - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
    - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress