# IT'S A DRY HEAT

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Avoiding heat related injuries is a primary concern during CAP activities during the hot summer months. The primary tool used to evaluate the risk of heat related injuries is the heat index. The heat index is designed to represent the total heat in the air and is calculated using the dry-bulb temperature of the air which is the air temperature measured by a thermometer, and the relative humidity. The appropriate amount of activity/rest, the correct clothing, and the amount of water to drink can be determined from CAPR 60-1. Unfortunately the use of the heat index can actually increase the risk of heat related injuries in many parts of the country.

Table 1: Work/rest and water intake requirements from CAP 60-1 based on heat index.

| | Easy Work | | Moderate Work | | Hard Work | |
|---|---|---|---|---|---|---|
| Heat Index | Work/Rest | Water Intake (Cup/hr) | Work/Rest | Water Intake (Qt/hr) | Work/Rest | Water Intake (Qt/hr) |
| 85-91 (Low) | 50/10 min | 3 | 50/10 min | 3 | 30/30 min | 3 |
| 91-103 (Moderate) | 50/10 min | 4 | 50/10 min | 4 | 30/30 min | 4 |
| 103-115 (High) | 30/30 min | 4 | 20/40 min | 4 | Prohibited | - |
| >115 (Extreme) | 20/40 min | 4 | Prohibited | - | Prohibited | - |

## Humidity

Since the heat index is calculated using the dry bulb and the relative humidity, in areas with low humidity the heat index is frequently lower than the actual temperature. Generally speaking, if the relative humidity is less than 40%, the heat index will be lower than the actual air temperature. In most of the western United States, the typical relative humidity is much lower than that found in the central, eastern, or southern portions of the US. This low humidity creates clear, cloudless skies with high amounts of solar radiant heat and high ultra-violet light indexes. Compounding the low cloud cover is the fact that many of the western states are also at high elevations where the thinner atmosphere does not filter out as much of the sun's radiant heat as the atmosphere at lower elevations. None of these factors are included in the heat index and as a result, the use of the heat index is not appropriate for use in the semi-arid to arid western US.

## Wet-Bulb Globe Temperature

A better tool to evaluate the risk of heat related injuries in dry, hot climates is the Wet-Bulb Globe Temperature, abbreviated as WBGT. Like the heat index this method includes the dry bulb and the relative humidity, albeit indirectly through the use of the wet-bulb temperature. But it also adds a third factor: the heat created by solar radiation. This factor is found using a thermometer mounted inside a black sphere or with a thermometer with a black coating on the lower portion of the thermometer body or thermometer bulb. These devices typically have some type of calculator that allows the user to determine the WBGT index from the three indicated temperatures. Electronic WBGT meters will output the calculated WBGT index on an integral digital display.

No matter what type of apparatus is used to determine the WBGT, it will include the effects of radiation from both the sun and from the surrounding areas. If activities are taking place on a grass field the WBGT will be less than if the activities are taking place on a paved parking lot.


Figure 1: Thermometer-based WBGT apparatus.

Figure 2: Electronic WBGT apparatus.

Table 2: Work/rest and water intake requirements based on WBGT index.

| Heat Category | WBGT Index (°F) | Easy Work | | Moderate Work | | Hard Work | |
|---|---|---|---|---|---|---|---|
| | | Work/Rest | Water Intake (Qt/hr) | Work/Rest | Water Intake (Qt/hr) | Work/Rest | Water Intake (Qt/hr) |
| 1 (White) | <81.9 | NL* | 1/2 | NL | 3/4 | 40/20 min | 3/4 |
| 2 (Green) | 82-84.9 | NL | 1/2 | 50/10 | 3/4 | 30/30 | 1 |
| 3 (Yellow) | 85-87.9 | NL | 3/4 | 40/20 | 3/4 | 30/30 | 1 |
| 4 (Red) | 88-89.0 | NL | 3/4 | 30/30 | 3/4 | 20/40 | 1 |
| 5 (Black) | >90 | 50/10 | 1 | 20/40 | 1 | 10/50 | 1 |

*NL = No Limitations

## Risk

CAPR 60-1 uses the heat index to prescribe different procedures to reduce the likelihood of heat related injuries. Safety Officers should keep in mind that the heat index will underestimate the risk of heat related injuries in the arid or semi-arid climates found throughout the western half of the US. In these areas with low humidity and clear skies, the WBGT gives a better indication of the risk of heat injuries. When the heat index is used in these areas, it will underestimate the risk of heat injuries and be less effective.