VI. HEAT STRESS INSTRUMENTATION

The following sections contain a brief discussion of various types of instruments that may be used for heat and heat stress monitoring. Refer to the OSHA Technical Manual, Section III: Chapter 4 - Heat Stress for additional information on heat-related injuries and illnesses.

Application and Principle of Operation

There are two types of heat stress monitors available through the CTC. One type is a real-time area monitor that measures environmental conditions that contribute to heat stress, and the other is a real-time personal monitor that measures the wearer's body temperature and/or heart rate. The area monitors (QUEST Model QUESTemp™ 15 or 3M WIBGET™ Model RSS-214) measure indoor and outdoor wet bulb globe temperatures (WBGT). The temperature values can be data logged and the monitor can also be configured to sound an alarm when a predetermined WBGT is reached. The personal monitors provide real-time information on the wearer's physiological condition and work effort by either inserting a probe into the wearer's ear canal to monitor body temperature (QUEST Technologies QUESTemp II™), or wearing a sensor belt around the waist that monitors heart rate and temperature (Metrosonics® hs-383 Personal Heat Stress Monitor). Both personal devices can be programmed to alarm when a predetermined temperature or heart rate is exceeded.

The area monitors work by taking measurements of the ambient temperature, the wet bulb temperature, and the globe temperature, and then using a formula to determine the WBGT. The wet bulb temperature takes into account the effects of humidity on the body's cooling mechanism and the globe temperature accounts for radiant heat on the worker. Outdoors, a WBGT is calculated by multiplying the wet bulb temperature by 0.7, the globe temperature by 0.2, and the dry bulb temperature by 0.1. Because radiant heat from the sun is not a factor indoors (or outdoors without a radiant heat load), the WBGT is calculated differently for indoor environments: the wet bulb multiplier stays the same, the globe temperature is multiplied by 0.3, and the dry bulb temperature drops out of the formula.

Another personal heat stress monitoring system is available through the HRT. The CorTemp™ personal heat stress monitoring system uses an ingestible temperature sensor that is swallowed by the person being monitored. The capsule transmits the worker's core temperature to a receiver on his/her belt, which also receives a heart rate monitor's reading, and then transmits both signals to a receiver monitored by an observer up to 100 yards away. Because the sensor must be swallowed, the CorTemp™ system is considered a medical device and must be used under the supervision of a physician.

Calibration

Most calibration is done annually by the manufacturer. Certain instruments have simple user calibrations that must be performed before each use. The QUESTemp™ 15 is provided with a calibration module that plugs into the monitor. If the temperatures reported by the module and the monitor differ by more than 0.5°C (32.9ºF), the monitor needs to be returned to the manufacturer for calibration. The QUESTemp™ II personal heat stress monitor is calibrated to the user's body temperature every time it is used or if the ambient temperature changes by 10°C (50ºF).