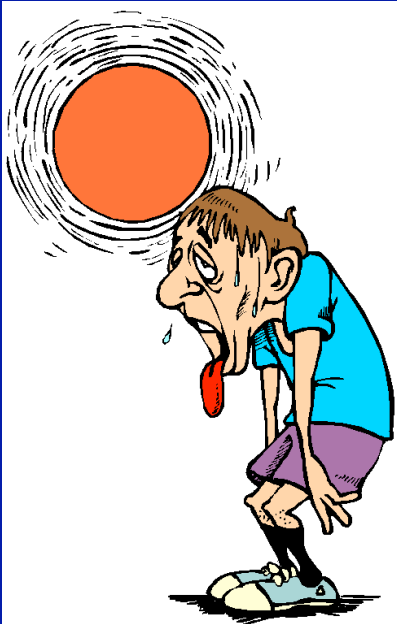


# Heat warnings for personnel management at ATEC ranges



or

when is it *hotter than hell?*

# Wet Bulb Globe Temperature:

High WBGT is correlated with heat injury

- A University of Wisconsin study found that > 90% of heat injuries in the Singapore military occurred when WBGT was greater than 26 °C (79 °F)
- The US Military uses WBGT to determine recommended work/rest ratio and fluid intake per hour

# Wet-Bulb Globe Temperature Equations

Measurement

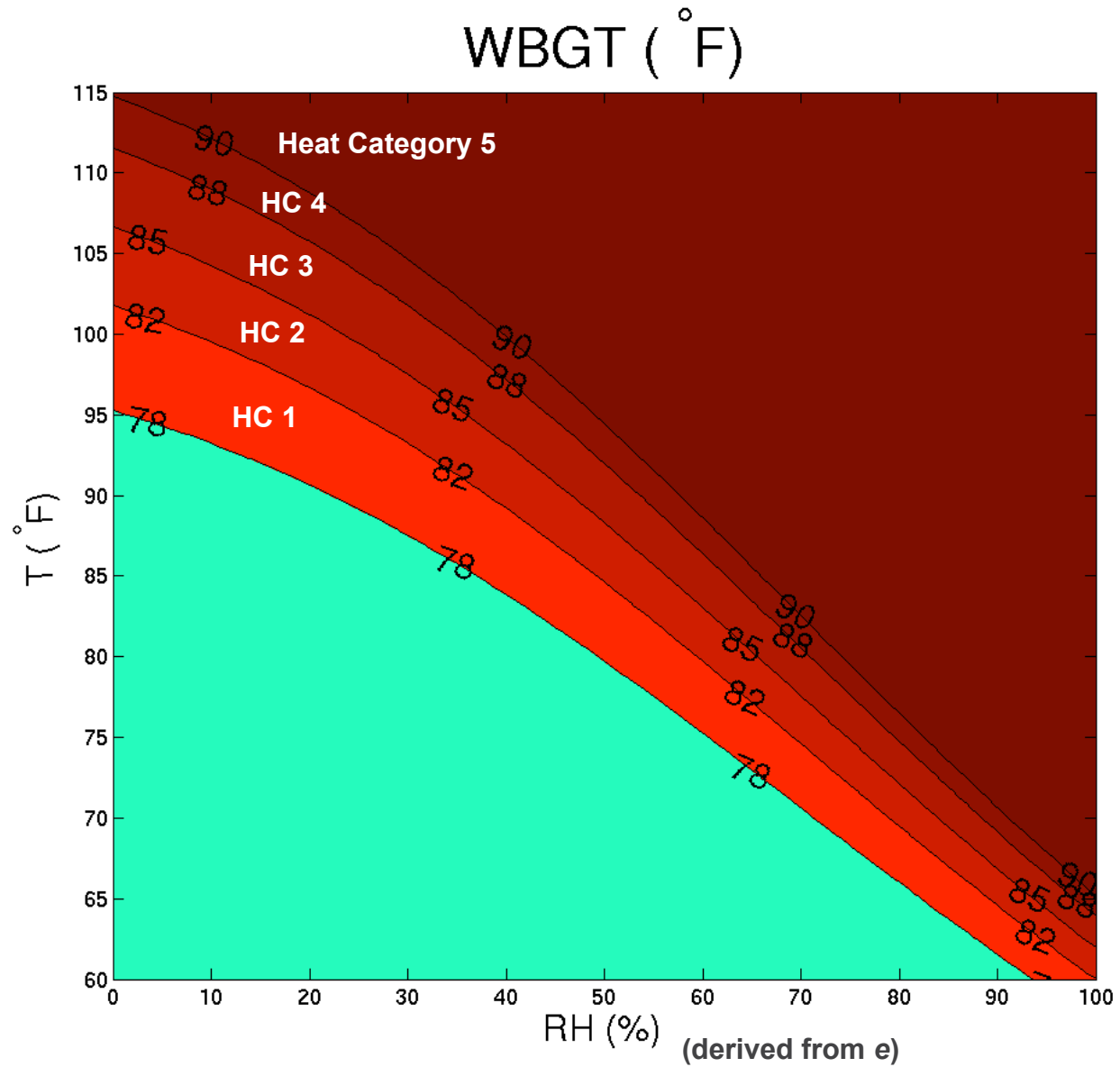
Approximation  
and RTFDDA

- $T_w$  = wet-bulb temperature (\_C)
- $T_g$  = globe temperature (\_C)
- $T$  = Temperature (\_C)
- $e$  = water vapor pressure (mb)  
(associated with RH)



# Approximation of WBGT


$$0.567T + 0.393e + 3.94$$



# WBGT on the Web

http://140.196.88.2/4dwx/index.jsp

4DWX



**WDTC Meteorology Division**  
Dugway Proving Ground, Utah

Login
Home
Model
Local Data
National

**Current Conditions Ditto**

Latest Query Time: 2005-07-14 11:35:00

Temperature: 90.5 F  
 Dew Point: 48.2 F  
 Relative Humidity: 23.3 %  
 Pressure: 25.67 in Hg  
 Wind Direction: 303.7 Deg  
 Wind Speed: 6.48 MPH  
 Wind Peak: 10.5 MPH  
 15 Min Precip: 0.0 Ins  
 24 Hr Precip: 0.0 Ins  
 WBGT (Latest at 2005-07-14 11:40:00): 75.5 F

**Current DCP Readings (all sites)**

**Almanac Mouse-over**

Date: 2005-07-14  
 Sunrise/Sunset: 06:15 / 21:01 MDT  
 Moonrise/Moonset: 14:06 / 00:44 MDT  
 Moon Illumination (%): 51%  
 Civil Twilight Dawn/Dusk: 05:43 / 21:33 MDT

Next day / Prev day

**Fluid Replacement Guidelines for Warm Weather Training:**  
(Applies to average acclimated soldier wearing BDU, Hot Weather).

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	78-81.9	NL	1/2	NL	3/4	40/20 min	3/4
2	82-84.9	NL	1/2	50/10 min	3/4	30/30 min	1
3	85-87.9	NL	3/4	40/20 min	3/4	30/30 min	1
4	88-89.9	NL	3/4	30/30 min	3/4	20/40 min	1
5	>90	50/10 min	1	20/40 min	1	10/50 min	1

- ◆ The work:rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified heat category. Individual water needs will vary +/- 1/4 qt/hr.
- ◆ NL = no limit to work time per hour.
- ◆ Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
- ◆ **CAUTION:** Hourly fluid intake should not exceed 1 1/2 quarts.
- ◆ Daily fluid intake **should not exceed 12 quarts.**
- ◆ Wearing body armor - add 5 °F to WBGT index.
- ◆ Wearing MOPP overgarment add 10 °F to WBGT index.

Easy Work	Moderate Work	Hard Work
<ul style="list-style-type: none"> <li>◆ Weapon Maintenance</li> <li>◆ Walking Hard Surface at 2.5 mph, &lt;= 30 Lb. Load</li> <li>◆ Manual of Arms</li> <li>◆ Marksmanship Training</li> <li>◆ Drill and Ceremony</li> </ul>	<ul style="list-style-type: none"> <li>◆ Walking Loose Sand at 2.5 mph, no Load</li> <li>◆ Walking Hard Surface at 3.5 mph, &lt;= 40 Lb. Load</li> <li>◆ Calisthenics</li> <li>◆ Patrolling</li> <li>◆ Individual Movement Techniques, i.e. low crawl, high crawl</li> <li>◆ Defensive Position Construction</li> <li>◆ Field Assaults</li> </ul>	<ul style="list-style-type: none"> <li>◆ Walking Hard Surface at 3.5 mph, &gt;= 40 Lb. Load</li> <li>◆ Walking Loose Sand at 2.5 mph with Load</li> </ul>

4DWX Home
Operational Ranges
DPG Home

# How to forecast today's WBGT

- Get current WBGT reading. *Is heat category > 0?*
- Get current RTFDDA run status. *Which run is active?*
- Get RTFDDA status monitor. *Are observations included? Is the model running?*
- Compare SAMS observations to tabular site model data  
*How accurate is the model today?*
- Using FDDA Image Viewer, get short-term forecast of meteorological conditions – on small and large scale.
- Get tabular sites data. *Is it getting warmer, more humid, cloudy; is it raining?*
- View local conditions via MRRD *Is it going to rain and thus cause cooling?*

# How to forecast tomorrow's WBGT

- Go to NCAR/RAP weather data site (global and regional NCEP models).
- Go to RTFDDA image viewer. *Is tomorrow warmer/more humid than today?*
- Get tabular sites data, bias corrected. *Is tomorrow warmer, more humid than today?*