#### BY ORDER OF THE COMMANDER, 18TH WING (PACAF)

18TH WING INSTRUCTION 48-103

17 JUNE 2003



Aerospace Medicine

HEAT STRESS MANAGEMENT PROGRAM (PA)

# COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

# **NOTICE:** This publication is available digitally on the AFDPO WWW site at: http://www.e-publishing.af.mil.

OPR: 18 AMDS/SGPB (Maj Daniel J. Golen) Supersedes 18 WGI 48-103, 15 October 2001 Certified by: 18 MDG/CC (Col Mark A. Presson) Pages: 11 Distribution: F

This instruction implements requirements of AFPD 48-1, *Aerospace Medical Program* and provides guidance on heat stress management. The goal of the Heat Stress Management Program is to prevent heat related injuries through education and monitoring. This instruction applies to all units assigned or tenant to Kadena Air Base, Japan. This publication does not apply to the Air National Guard or US Air Force Reserve.

This publication requires the collection and or maintenance of information protected by the Privacy Act (PA) of 1974. The authorities to collect and or maintain the records prescribed in this publication are 10 U.S.C. 55, *Medical and Dental Care*; 10 U.S.C. 8013, *Secretary of the Air Force;* powers and duties; delegation by, and Executive Order 9397. Forms affected by the PA have an appropriate PA statement. Systems of records notice F044 AF SG D, *Automated Medical/Dental Record System* (June 11, 1997, 62 FR 31793) applies.

# SUMMARY OF REVISIONS

The changes made include the addition of AFPAM 48-151 as a reference source, updated water intake requirements, inclusion of heat category for each flag color, modified of workload categories, prescribed training frequency, and how to document training. Changes made also included adjustments of wet bulb globe temperature based on mission-oriented protective posture variations. New or revised material is indicated with a bar (|).

## 1. References.

1.1. U.S. Army Research Institute of Environmental Medicine Technical Note 91-3, *Heat Illness: A Handbook for Medical Officers*.

1.2. American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values (TLV) booklet.

- 1.3. AFPD 48-1, Aerospace Medical Program.
- 1.4. AFMAN 32-4005, Personnel Protection and Attack Action.
- 1.5. AFI 32-4001, Disaster Preparedness Planning and Operations.
- 1.6. AFPAM 48-151, Thermal Injury.

#### 2. Responsibilities and Procedures.

2.1. Bioenvironmental Engineering (18 AMDS/SGPB) will:

2.1.1. Measure temperatures and calculate the Wet Bulb Globe Temperature (WBGT) index as established in this instruction.

2.1.2. Report the WBGT index to the 18th Command Post and 18th Public Affairs for dissemination to base personnel and community.

2.1.3. Provide heat stress prevention and activity level recommendations to the SRC and 18th Wing Commander during contingency operations and readiness exercises.

2.1.4. Perform baseline heat stress evaluations to establish the normal, expected, and average WBGT index temperatures for indoor hot environments where personnel are occupationally exposed to heat sources. The baseline data will be validated during annual surveys.

2.1.5. Conduct WBGT evaluations upon special request or as part of routine industrial hygiene surveillance, if warranted.

2.2. Public Health (18 AMDS/SGPM) will:

2.2.1. Coordinate heat stress education classes when requested.

2.3. Command Post (18th CPO) will:

2.3.1. Establish and implement notification procedures to inform affected base and tenant units of the WBGT index and heat condition information.

2.4. Public Affairs (18th PA) will:

2.4.1. Announce heat stress conditions on the Commander's Channel for both peacetime and contingency operations.

2.5. Commanders will:

2.5.1. Ensure all individuals under their command are aware of heat stress hazards and prevention methods.

2.5.2. Enforce activity level recommendations.

2.5.3. Where applicable, ensure flying personnel are annually informed on how heat stress affects aircrew performance and appropriate preventive measures.

2.5.4. During training exercises when personnel wear the ground crew chemical defense ensemble, ensure supervisors and workers are counseled concerning the early signs of heat stress and the methods to be used to minimize associated effects.

2.6. Supervisors will:

2.6.1. Train workers annually on the health hazards of heat stress, the WBGT index, notification procedures, flag colors, and appropriate preventive measures. This training will be documented on AF Form 55, **Employee Safety and Health Record (PA)**.

2.6.2. Acclimate workers to heat exposures. Allow 2 weeks of progressively increasing exposure and workload for new arrivals to allow for acclimatization to a heat stress environment.

2.6.3. Disseminate the WBGT index to workers when informed through the notification procedures.

2.6.4. Enforce strict water discipline during heat stress conditions by using Table A5.1, *Training Guidelines for Average Acclimated Airmen Wearing BDU, Hot Weather*, and Table A5.2, *Training Guidelines for Average Unacclimatized Airmen Wearing BDU, Hot Weather* contained in Attachment 5 of AFPAM 48-151. General guidance is provided in Table 1., *Heat Stress Countermeasures*, of this instruction. Contact Bioenvironmental Engineering Flight (634-4752) for clarification, if needed.

2.6.5. Request advice from Public Health Flight (630-4520) on methods for preventing heat stress.

2.6.6. Limit wear of chemical protective overgarments/battle dress overgarments as much as possible during training until personnel are fully acclimatized (approximately 2 weeks).

2.6.7. Schedule work requiring strenuous physical effort during the cool part of the day/shift, as duty requirements allow.

2.6.8. Discourage the use of salt tablets and caffeinated drinks such as sodas during heat stress conditions. A balanced diet must be consumed in addition to water intake to prevent water intoxication.

2.6.9. Plan work and rest cycles for personnel occupationally exposed to hot environments. Provide shaded or air conditioned rest areas, as available.

2.6.10. Permit individuals to remove unnecessary clothing whenever practical during heat stress conditions.

2.6.11. Permit use of Electrolyte Solutions for Re-Hydration ("Sports Drinks").

Heat Category/Flag Color	WBGT (F)	Easy Work Water Intake (Qt/hr)	Moderate Work Water Intake (Qt/ hr)	Hard Work Water Intake (Qt/hr)
1 White (Minimal)	78 – 81.9	1/2	3⁄4	3⁄4
2 Green (Low)	82 - 84.9	1/2	3⁄4	1
3 Yellow (Moderate)	85 - 87.9	3⁄4	3⁄4	1
4 Red (High)	88 - 89.9	3⁄4	3⁄4	1
5 Black (Extreme)	> 90	1	1	1

## **Table 1. Heat Stress Countermeasures.**

**NOTES:** 

- 1. Water intake depends on workload. See Table A5.1. and Table A5.2. of AFPAM 48-151.
- 2. Hourly fluid intake for both acclimatized and un-acclimatized personnel should not exceed 1<sup>1</sup>/<sub>2</sub> quarts and daily fluid intake should not exceed 12 quarts.

2.7. Individuals will:

- 2.7.1. Always be aware of existing or potential heat stress situations within their workplace.
- 2.7.2. Be aware of heat stress symptoms and necessary first aid measures.
- 2.7.3. Follow the prevention directives of commanders and supervisors.

#### 3. 18th Wing Exercises.

3.1. The Wing Commander or Vice Wing Commander can cancel Mission-Oriented Protective Posture (MOPP) exercises or suspend work based on existing heat stress conditions. The 18 MDG/CC will be available for consultation in that decision making process.

3.2. The 18th Wing Battle Staff will use **Table 2.**, Heat Stress Work/Rest Cycles, to calculate and announce work-rest periods while in MOPP conditions.

3.2.1. Water intake should be 0.5 to 1 quart per hour depending on workload (**Table 1.**). In addition, a balanced diet must be consumed to provide essential electrolytes and prevent water intoxication.

3.2.2. Commanders will establish scheduled water breaks.

3.2.3. Easy work is defined as walking, sitting, or lifting 30 pounds or less. Examples include office work, marshalling an aircraft, weapon maintenance, marksmanship training, and drill and ceremony (see AFPAM 48-151, Attachment 6).

3.2.4. Moderate work is defined as lifting less than 40 pounds, patrolling, low craw-high crawl, defensive position construction, and field assaults (see AFPAM 48-151, Attachment 6).

3.2.5. Hard work is defined as lifting 40 pounds or greater, digging, jogging (fast walking, rushing), or any significant physical exertion (see AFPAM 48-151, Attachment 6). Examples include loading missiles on aircraft or hot pit refueling.

3.2.6. Rest is defined as minimal physical activity (e.g., sitting or standing), preferably in an air-conditioned area or shaded area.

3.2.7. These guidelines are not a substitute for common sense. Supervisors/commanders will closely monitor their personnel.

## 4. Procedures for Ground Personnel.

4.1. Acclimatization:

4.1.1. Acclimatization is a series of physiological adjustments that occur when an individual is exposed to a hot climate. A period of acclimatization is required for all personnel regardless of each individual physical condition. The better the individual physical condition, the quicker the acclimatization is reached. Acclimatization is achieved through progressive degrees of heat expo-

sure and physical exertion. Acclimatization to heat begins with the first exposure and is usually developed to about 50 percent by the end of the first week. Substantial acclimatization (about 78 percent) should occur by the end of the second week. Full acclimatization is attained most quickly by gradually increasing periods of work in the heat.

4.1.2. For workers needing acclimatization, supervisors should adjust work schedules. The most strenuous tasks should be performed early in the morning or late in the evening with lighter duty tasks performed during the remainder of the duty day. As workers become acclimatized, work schedules can be shifted back to normal routines. When unacclimatized workers are exposed to heat, they may experience some discomfort and signs of heat strain, such as high body temperature, increased heart rate, and fatigue on the first day. On each succeeding day, the worker's ability to perform at the same level of heat stress improves as signs of discomfort and strain diminish. During the two weeks a worker takes to acclimatize, he or she should be especially aware of the signs and symptoms of heat stress disorders and drink plenty of water. When discomfort and heat stress symptoms occur, workers should self-pace their activities to perform below maximum physical capacity by adjusting their work speed and interspersing brief, unscheduled, and in-place breaks. After a period of 1 to 2 weeks, a worker should be able to perform all tasks without difficulty.

4.1.3. The following applies to people who need acclimatization:

4.1.3.1. Individuals who are routinely and occupationally exposed to strenuous duties or heavy work need acclimatization each year. This may occur during regular duty or work as outside temperatures increase during the spring and summer.

4.1.3.2. Newly assigned personnel arriving from cooler climates should follow the acclimatization guidelines given above.

4.1.3.3. Personnel returning to work after 4 days of illness should undergo a 4-day reacclimatization.

4.1.3.4. Personnel returning to work after 9 or more days away from work should undergo a 4-day reacclimatization.

#### 5. Measurement of WBGT Index.

5.1. BEF will use the WBGT formulas from the latest edition of the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) and Biological Exposure Indices. These formulas are:

5.1.1. Outdoors with Solar Load: WBGT = 0.7 NWB + 0.2 BG + 0.1 DB.

5.1.2. Indoors or Outdoors with No Solar Load: WBGT = 0.7 NWB + 0.3 BG.

5.1.3. Where: DB Dry Bulb; BG Black Globe; NWB Natural Wet Bulb.

5.2. The WBGT index will be measured using either the field apparatus described in the ACGIH TLV booklet, the portable hand-held WBGT kit (NSN 6665-00-159-2218), or a suitable commercially available instrument.

5.3. When the predicted or forecasted outside temperatures reach 85 degrees Fahrenheit (°F) as a daily high, BEF will perform WBGT measurements hourly during normal duty hours. Monitoring will

be performed hourly during readiness exercises during daylight hours, as long as attack and post-attack situations will permit such monitoring.

5.4. Monitoring will be performed by the on-call or designated BEF technician.

5.5. Notification of WBGT Stages:

5.5.1. BEF will initiate the notification procedure by calling the 18th Command Post and 18th Public Affairs.

5.5.2. Subsequent notification of base units will be accomplished by the posting of applicable slides on the 18th Commander's Channel.

#### 6. Guidelines for Occupational Heat Exposures.

6.1. Supervisors of occupationally exposed personnel should use **Table 2.** to plan work and rest cycles for individuals under their control. When the WBGT index reaches the temperatures shown below for the category of workload, supervisors should initiate the work and rest regimen.

Heat Category/Flag Color	WBGT ( <sup>0</sup> F)	Easy Work (Work/Rest)	Moderate Work (Work/Rest)	Hard Work (Work/Rest)
1 White (Minimal)	78 - 81.9	No limit	No limit	40/20 (min)
2 Green (Low)	82 - 84.9	No limit	50/10 (min)	30/30 (min)
3 Yellow (Moderate)	85 - 87.9	No limit	40/20 (min)	30/30 (min)
4 Red (High)	88 - 89.9	No limit	30/30 (min)	20/40 (min)
5 Black (Extreme)	> 90	50/10 (min)	20/40 (min)	10/50 (min)

Table 2. Permissible Heat Exposure Limits. (WBGT in degrees F)

NOTE: Examples of easy, moderate, and hard work are described in AFPAM 48-151, Attachment 6.

6.2. Exposures above 90 degrees Fahrenheit WBGT should be allowed only when performing mission essential duties and only then with caution.

6.3. When necessary to accomplish a task, two or more details should be arranged to work in sequence to ensure each crew receives the proper work and rest cycle.

## 7. Guidelines for Personnel Wearing the Ground Crew Chemical Defense Ensemble.

7.1. Personnel performing ground crew operations and training while wearing the charcoal-impregnated over garment and associated protective equipment of the chemical defense ensemble are at increased risk of injury from heat stress. Maximum work times tolerated by personnel while they are wearing the protective ensemble are affected by factors such as an individuals physical condition, state of thermal acclimatization, and degree of hydration; the work load associated with a given task; and environmental factors, including air velocity, radiant heat (sunlight), air temperature, and humidity. WBGT criteria incorporate many of these variables.

7.2. Make the following adjustments to the WBGT index based on mission oriented protective posture (MOPP) conditions and individual protective equipment (IPE) worn: 7.2.1. IPE (flak jacket and helmet) only \_ add 5 degrees to the WBGT.

7.2.2. MOPP 2 only \_ add 5 degrees to the WBGT.

7.2.3. MOPP 2 and IPE worn \_ add 10 degrees to the WBGT.

7.2.4. MOPP 3 or 4 only \_ add 10 degrees to the WBGT.

7.2.5. MOPP 3 or 4 and IPE worn \_ add 15 degrees to the WBGT.

7.3. Make the following adjustments to the WBGT index based on MOPP variations (figures are based on estimates and professional judgement):

7.3.1. MOPP 2 ventilated \_ subtract 2 degree from the adjusted WBGT.

7.3.2. No BDU option \_ subtract 3 degrees from the adjusted WBGT.

7.3.3. No BDU and ventilated \_ subtract 4 degrees from the adjusted WBGT.

7.4. Make the appropriate work/rest cycle recommendations using **Table 2.** Hydration recommendations are contained in Tables A5.1 and A5.2 of AFPAM 48-151. General guidance is provided in **Table 1.** of this instruction.

**8. Prevention of Heat Stress Disorders.** The following subjects discuss actions to help prevent heat stress disorders.

8.1. Education. Personnel working and (or) training in hot environments must be educated on the causes, symptoms, first-aid treatment, and prevention of heat disorders. Personnel must also be educated on the following factors that may contribute to heat injury:

8.1.1. An acute or chronic infection.

8.1.2. A fever.

8.1.3. Reaction to an immunization.

8.1.4. A vascular disease.

8.1.5. A condition affecting the ability to sweat.

8.1.6. The presence of a heat rash or acute sunburn.

8.1.7. A previous heatstroke.

8.1.8. Recent use of alcohol.

8.1.9. Dehydration.

8.1.10. The lack of sleep or fatigue.

8.1.11. Being overweight.

8.1.12. Medications and drugs.

*NOTE:* The sample heat stress training aid shown in **Attachment 1** may be used as part of the education program to remind personnel of the signs and symptoms of heat stress disorders and appropriate first-aid procedures.

Injury	Symptoms	First Aid
Heat Syncope	Fainting when standing erect and immobile in the heat.	Remove to cool area. Allow to recline and provide cool water. Recovery will be prompt and complete.
Heat Cramps	Active sweating, muscle cramps.	Remove to cool area. Massage extremities. Contact medical facility.
Heat Exhaustion	Profuse sweating, headache, weakness, and nausea; skin cool and moist.	Remove to cool area. Elevate feet. Loosen clothing and apply wet cloths. Evacuate to medical facility.
Heatstroke - MEDICAL EMERGENCY	High body temperature; skin dry and hot; unconsciousness, convulsions, or delirium.	THIS IS A MEDICAL EMERGENCY. Call medical facility first. Lower body temperature immediately. Remove clothing, immerse in water, if available. Otherwise, sprinkle with water and fan to increase evaporation, massage extremities and trunk. Move to medical facility, continue cooling measures during transportation.

Table 3. Symptoms and First-Aid Treatment for Heat Injuries.

8.2. **Water.** Drink large quantities of cool water to make up for water lost through sweating. It is better to drink small amounts of water frequently (a pint every 20 minutes) to replace water than to drink large amounts less frequently. Milk and coffee do not make up for water loss. Carbonated beverages, while containing water, are not as good as water in keeping the body hydrated because of the tendency to delay gastric emptying.

8.3. **Salt.** Some salt is lost in the sweat. Because the typical North American diet contains so much salt, an individual should season food to taste but should not make any additional attempts to add excessive salt to the diet. Salt tablets must not be used except under special operating environments when ordered by competent medial authority.

8.4. **Clothing.** Wear loose fitting clothing, especially at the neck and wrist, to allow air circulation. Wear appropriate headgear. When exposed to the Suns rays, cover yourself and apply a sun-blocking lotion to prevent sunburn. When not exposed to the sun, consideration should be given to wearing the least allowable amount of clothing.

8.5. Acclimatization. Personnel must be acclimated to heat exposures.

8.6. Work Schedules. Modify work schedules to perform the heaviest work in the coolest parts of the day. When working in hot environments, establish work and rest cycles.

8.7. Food. Avoid eating greasy, fatty, or heavy foods.

8.8. Medical Treatment. Seek medical treatment for illnesses and skin problems, including rashes.

8.9. **Heat Syncope.** Heat syncope may be prevented by selecting acclimated personnel, drinking copious amounts of water, intermittently moving the arms and legs to assist the return of blood to the heart.

8.10. **Recognition and First-Aid Treatment for Heat Stress Disorders.** Use **Table 3.** as a guide in recognizing the common heat disorders and as a quick reference for first aid.

JEFFERY A. REMINGTON, Brigadier General, USAF Commander, 18th Wing

## Attachment 1

## SAMPLE HEAT STRESS TRAINING AID

The following is a sample heat stress training aid. This sample may be used locally or if this information is not applicable, other information can be substituted. The WBGT flag conditions only list activity restrictions for the Basic Military Training School (BMTS) and technical training students.

# FRONT SIDE

SAVE A LIFE	DIRECTIONS WHAT TO DO FOR
IT MAY BE YOUR OWN	HEAT EXHAUSTION/HEATSTROKE
THIS IS A MEDICAL EMERGENCY	- Trainees in 11th DOT and above, curtail outside
	activities, under close supervision, 10 minutes rest
	each 30 minutes. Drink additional water.
HEATSTROKE SYMPTOMS	- Flights in 10th DOT and below, move at At Ease
	March.
	HEAT EXHAUSTION SYMPTOMS
EARLY	
- Headache	EARLY
- Nausea	- Nausea
- Dizziness	- Weakness
- Dryness of Mouth	- Headache
	- Dizziness
LATER	- Unsteady Walk
- Little or No Sweating	
- Overheated (Hot) Body	LATER
- High Temperature	- Profuse Sweating
- Flushed and Dry Face	- Cold Body
- Normal or Weak and Rapid Pulse	- Low Temperature
- Convulsions and Unconsciousness	- Pale and Moist Face
- Mental Confusion	<ul><li>Weak and Rapid Pulse</li><li>Vomiting and Involuntary Bowel Action</li></ul>
WASTE NO TIME!	- volinting and involuntary bower Action
WASTE NO TIME:	WASTE NO TIME!
FIRST-AID PROCEDURES	WASTE NO TIME.
- Call ambulance or obtain other emergency	FIRST-AID PROCEDURES
transportation.	
- Take person to hospital or clinic emergency room.	- Call ambulance.
- Cool persons body as much as possible while	- Lay person down with feet elevated in he closest,
transporting to hospital.	coolest place.
	- Fan person and massage arms and legs.
THIS IS A MEDICAL EMERGENCY	- Caution against hyperventilation.
	- Give water in sips.
BMTS AND OTS	
- Trainees in 10th DOT and below, suspend drill,	<b>GREEN FLAG CONDITION (82 WBGT)</b>
work details, and physical conditioning (PC)	
(except swimming).	

DO	- Trainees in day 11th DOT and above, curtail outside activities, under close supervision, 10 minutes rest each			
- Drink two glasses of water at each meal.	30 minutes. Drink additional water.			
- Drink water at frequent intervals during day.	- Flights 10th DOT and below, move At Ease March.			
- Get as much rest as possible.	<b>RED FLAG CONDITION (88 WBGT)</b>			
- Avoid overexposure to suns rays during the hot summer.				
- Take medications as prescribed by physician so as not to interfere with strenuous activity.	BMTS AND OTS			
TAKE EXTRA PRECAUSTION IF YOU	<ul> <li>Suspend drill/PC (except swimming).</li> <li>Suspend outside work details during 15th DOT and below.</li> </ul>			
- Come from a colder climate.	- Continue light work details during 16th DOT and			
<ul><li>Are in a weakened condition.</li><li>Have had prior heat injury.</li></ul>	above. - Ten minutes rest each 30 minutes in shade. Drink			
- Are overweight.	additional water.			
- Have recently had a fever.	- Flights move at at Ease March. <b>TECHNICAL TRAINING</b>			
- Are on prescribed medications.	- Curtail training.			
	- Give 15 minutes rest each hour.			
	- Suspend strenuous exercise, such as running.			
KEEP YOUR HEAD COVERED WHEN	- Brief on adequate daily water intake and heat illness			
EXPOSED TO THE SUN	symptoms. - Reduce outside work and supervise closely. Ten			
DON'T	minutes rest each 30 minutes in shade with water.			
- Overexpose yourself to the sun, especially your head.	<b>BLACK FLAG CONDITION (90 WBGT)</b>			
- Over exercise in hot weather.	DMTC AND OTC			
- Drink iced beverages (including ice water) immediately following exercise.	<ul> <li>BMTS AND OTS</li> <li>Suspend all drill, outside work details, and PC (except swimming).</li> <li>Flights move at At Ease March.</li> </ul>			
BMTS AND OTS	TECHNICAL TRAINING			
- Trainees in 10th DOT and below, use discretion for intense physical activities. Provide constant	- Suspend training requiring physical exertion.			
supervision.	- Suspend all outside work details.			
- Flights in 10th DOT and below, move at standard				
cadence.				
YELLOW FLAG CONDITION (85 WBGT)				
BMTS AND OTS				
- Trainees in 10th DOT and below, suspend drill, work details, and physical conditioning (PC) (except swimming).				

## **REVERSE SIDE**