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Aerospace Medicine

HEAT STRESS MANAGEMENT PROGRAM



COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction implements requirements of AFD 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.

SUMMARY OF REVISIONS

Revised to remove unnecessary information and add procedures to disseminate heat stress information, acclimatization of personnel to heat stress and address work-rest cycles during 18th Wing exercises on Kadena Air Base, Japan. A bar (|) indicates revision from the previous edition.

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. AFD 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*.

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. Brief 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**, for military members, and AF Form 971, **Supervisors Employee Brief** (computer generated) for civilians.
 - 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, using Table I, Heat Stress Countermeasures, as guide for determining water intake.
- 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”).

Table 1. Heat Stress Countermeasures.

WBGT (F)	Water Intake (Quarts) Per Hour
Below 82	½ - ¾
82-84	½ - 1
85-87	¾ - 1
> 88	1

- 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 ½ to 1 quart per hour depending on workload. (**Table 3.**) 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. Light work is defined as walking, sitting, or lifting less than 20 pounds. Examples include office work or marshalling an aircraft.

3.2.4. Heavy work is defined as lifting 20 pounds or greater, digging, jogging (fast walking, rushing), or any significant physical exertion. Examples include loading missiles on aircraft or hot pit refueling.

3.2.5. Rest is defined as no activity, preferably in an air-conditioned area or shaded area.

3.2.6. Continuous work is defined as 50 minutes work and 10 minutes rest per hour.

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 exposure 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 2 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: $WBGT = 0.7\text{ NWB} + 0.2\text{ BG} + 0.1\text{ DB}$.

5.1.2. Indoors or Outdoors with no solar load: $WBGT = 0.7\text{ NWB} + 0.3\text{ BG}$

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 in the attachment for the category of workload, supervisors should initiate the work and rest regimen.

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

Heat Stress Condition	Work and Rest Regimen	Light	Moderate	Heavy
Green	Continuous Work	86	80	77
Yellow	75% Work/25% Rest	87	82	78
Red	50% Work/50% Rest	89	85	82
Black	25% Work/75% Rest	90	88	86

NOTE: Examples of light, moderate, and heavy work are described in the ACGIH TLV booklet.

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 individual's 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:

7.3.1. MOPP 2 ventilated - subtract 1 degree from the adjusted WBGT.

7.3.2. No BDU option - subtract 2 degrees from the adjusted WBGT.

7.3.3. No BDU and ventilated - subtract 3 degrees from the adjusted WBGT.

7.4. Make the appropriate work/rest cycle and hydration recommendations using [Table 2](#).

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.

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

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.

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.

GARY L. NORTH, 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
IT MAY BE YOUR OWN**

THIS IS A MEDICAL EMERGENCY

HEATSTROKE SYMPTOMS

EARLY

- Headache
- Nausea
- Dizziness
- Dryness of Mouth

LATER

- Little or No Sweating
- Overheated (Hot) Body
- High Temperature
- Flushed and Dry Face
- Normal or Weak and Rapid Pulse
- Convulsions and Unconsciousness
- Mental Confusion.

WASTE NO TIME!

FIRST-AID PROCEDURES

- Call ambulance or obtain other emergency transportation
- Take person to hospital or clinic emergency room
- Cool persons body as much as possible while transporting to hospital

THIS IS A MEDICAL EMERGENCY

**DIRECTIONS WHAT TO DO FOR
HEAT EXHAUSTION/HEATSTROKE**

HEAT EXHAUSTION SYMPTOMS

EARLY

- Nausea
- Weakness
- Headache
- Dizziness
- Steady walk

LATER

- Profuse Sweating
- Cold body
- Low temperature
- Pale and moist face
- Weak and rapid pulse
- Vomiting and involuntary bowel action

WASTE NO TIME!

FIRST AID PROCEDURES

- Call ambulance
- Lay person down with feet elevated in the closest, coolest place
- Fan person and massage arms and legs
- Caution against hyperventilation
- Give water in sips

GREEN FLAG CONDITION (82 WBGT)

REVERSE SIDE**DO**

- Drink two glasses of water at each meal
- Drink water at frequent intervals during day
- Get as much rest as possible supervision
- Avoid overexposure to sun's rays during the hot summer standard cadence
- Take medications as prescribed by physician so as not to interfere with strenuous activity

TAKE EXTRA PRECAUTION IF YOU

- Come from a colder climate
- Are in a weakened condition
- Have had prior heat injury
- Are overweight
- Have recently had a fever
- Are on prescribed medications

KEEP YOUR HEAD COVERED WHEN EXPOSED TO THE SUN**DON'T**

- Overexpose yourself to the sun, especially your head
- Over exercise in hot weather
- Drink iced beverages (including ice water) immediately following exercise

BMTS and OTS

- Trainees in 10th DOT and below, use discretion for intense physical activities. Provide constant
- Flights in 10th DOT and below, move at YELLOW FLAG CONDITION (85 WBGT)

BMTS and OTS

- Trainees in 10th DOT and below, suspend drill work details, and physical conditioning (PC) (except swimming)
- Trainees in 11th DOT and above, curtail outside activities, under close supervision, 10 minutes rest each 30 minutes. Drink additional water.
- Flights in 10th DOT and below, move At Ease March

RED FLAG CONDITION (88 WBGT)**BMTS and OTS**

- Suspend drill/PC (except swimming)
- Suspend outside work details during 15th DOT and below
- Continue light work details during 16th DOT and above. Ten minutes rest each 30 minutes in shade. Drink additional water.
- Flights move At Ease March.

TECHNICAL TRAINING

- Curtail training
- Give 15 minutes rest each hour
- Suspend strenuous exercise, such as running
- Brief on adequate daily water intake and heat illness symptoms
- Reduce outside work and supervise closely. Ten minutes rest each 30 minutes in shade with water.

BLACK FLAG CONDITION (90 WBGT)

BMTS and OTS

- Suspend all drill, outside work details, and PC (except swimming)
- Flights move At Ease March

TECHNICAL TRAINING

- Suspend training requiring physical exertion
- Suspend all outside work details