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Aerospace Medicine

PREVENTION OF HEAT STRESS INJURIES

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This instruction implements Air Force Policy Directive (AFPD) 48-1, *Aerospace Medical Program*, and describes procedures designed to protect personnel, who are exposed to severe weather while performing duties at Yokota Air Base (AB), from the adverse health effects from heat stress. This instruction applies to all personnel assigned, attached, or associated with the 374th Airlift Wing (374 AW).

SUMMARY OF REVISIONS

There have been significant changes to this instruction therefore the entire instruction requires review. A bar (|) indicates revision from the previous edition.

1. References and Terms Explained: See [Attachment 1](#).

2. Concept:

2.1. This instruction provides unit commanders and supervisors with information and guidance to operate continuously in a severe hot environment. This instruction is to be applied in peacetime, contingency, and exercise operations.

2.2. This instruction provides guidance beyond that supplied in Air Force Pamphlet (AFPAM) 48-151, *Thermal Injury*, and Air Force Manual (AFMAN) 32-4005, *Personnel Protection and Attack Actions*. AFMAN 32-4005 outlines work cycle guidance which can lead commanders and supervisors to place personnel in a situation where they must remove Chemical Warfare Defense Equipment (CWDE) to reduce body heat to a safe level.

3. Responsibilities:

3.1. 374th Aerospace Medicine Squadron Bioenvironmental Engineering (BE) (374 AMDS/SGPB) will:

3.1.1. Establish recommended heat stress prevention guidelines for personnel occupationally exposed to extreme temperature environments and document the evaluations in the work area's periodic Industrial Hygiene Survey. Personnel at Yokota AB are occupationally exposed to hot environments such as aircraft maintenance, grounds maintenance, and repair work on the flight line. Yokota AB does not have ground trainee activities or conduct troop movements for training purposes; therefore, flag color reporting is not required. However, to minimize confusion between wartime and peacetime operations BE has correlated historical Wet Bulb Globe Temperature (WBGT) data with historical dry bulb temperature readings in [Attachment 2](#). A significant safety factor has been incorporated into the correlation.

3.1.2. Provide commanders and supervisors with risk assessments, upon request, for conducting tasks outside guidelines established in this instruction.

3.2. 374 AMDS Public Health (374 AMDS/SGPM) will:

3.2.1. Provide training information on the effects and risks of heat stress for workers routinely exposed to extreme temperature environments.

3.2.2. Provide training to supervisors, upon request, for workplaces without routine, occupational exposure to extreme temperature environments.

3.3. 374th Operations Support Squadron Weather flight (374 OSS/OSW) will:

3.3.1. Report heat categories starting in May when the projected daily high temperature will exceed 84 degrees Fahrenheit and end in October when the projected daily high temperature is below 84 degrees Fahrenheit. Outdoor WBGT measurements are only applicable during daylight hours due to the presence of solar load. Heat categories will be monitored hourly, Monday through Friday from 0730 until 1630. The last heat category at 1630 will be in effect until sunset then start over the next duty day. Heat categories/WBGT are non-applicable on rainy days and after sunset.

3.3.2. Use the most current dry bulb temperature from weather and the correlated heat category from [Attachment 2](#) for peacetime conditions. Use [Attachment 3](#) for base readiness exercises. An increase in heat category requires one measurement to be within the new elevated heat category. A decrease in heat category requires two consecutive measurements within the new lower heat category. The two measurements need to be at least 30 minutes apart. Heat categories will be reported only when there is a change in the heat category. The information will be disseminated to all units connected to the Automated Weather Distribution System (AWDS), and display a heat category slide on the Yokota weather channel.

3.4. The 374 AW Command Post (374 AW/CP) will: Only when there is a change in heat categories, notify 374 AW Maintenance Operations Center (MOC) (374 AW/CPM), group commanders, base operations, main gymnasium, 730th Air Mobility Squadron Air Mobility Command Center (730 AMS/AMCC).

3.4.1. Only when there is a change in heat categories, the 374 AW/CPM will broadcast all appropriate heat stress conditions to flight line production supervisors via the Land Mobile Radios (LMR).

3.5. Supervisors will:

3.5.1. Provide drinking water convenient to the work area during times where the heat condition is Yellow or above.

- 3.5.2. Monitor workers for signs of heat stress and intervene when appropriate.
- 3.5.3. Ensure workers are trained on heat stress symptoms and prevention, and document the training in AF Form 55, **Employee Safety and Health Record**.
- 3.5.4. Supervisors of workers in outdoor or non-airconditioned areas should implement work/rest cycles in accordance with **Attachment 2** of this instruction. *Should* indicate the highly recommended method for accomplishing work and does not indicate a mandatory requirement. Supervisors, however, are directly responsible for the health and safety of workers under the intent of this supplement.
- 3.5.5. Ensure proper facilities are available for rest periods.

4. Heat Stress:

- 4.1. Controlling heat stress.
 - 4.1.1. Follow the rest and work regime as specified in **Attachment 2** of this instruction.
 - 4.1.2. During the hot season or when the worker is exposed to artificially generated heat, drinking water should be made available to the workers. Water should be kept reasonably cool, but not cold. Reference **Attachment 2** for recommended water intake. Urine should be clear and free of odor if proper hydration is occurring.
 - 4.1.3. Personnel working in hot environments should be encouraged to drink non-caffeinated drinks that may contain electrolyte replacement. Sports drinks should be diluted prior to consumption as salt intake at that point may be excessive. Do not take salt tablets unless directed by a physician.
 - 4.1.4. Light, loose clothing made of breathable material should be worn during outdoor activities in hot conditions. If special clothing is required for performing a particular job and it impedes sweat evaporation or has a high insulation value (firefighters, chemical warfare), the workers heat tolerance is reduced.
 - 4.1.5. Acclimatization and fitness:
 - 4.1.5.1. Acclimatization to heat involves both physiological and psychological adjustments which occur in an individual during the first week of exposure to a hot environment. Workers arriving from colder climates during the hot weather should be given light duty for the first week.
 - 4.1.5.2. Workers who are not fit or have a medical condition may be more susceptible to the effects of extreme heat. If the member or the supervisor has any questions about fitness for duty in extreme heat, contact the member's physician.
 - 4.1.5.3. Encourage a healthy life-style and ideal body weight.
- 4.2. Symptoms of heat related conditions:
 - 4.2.1. Heat cramps: Symptoms include painful cramps of the voluntary muscles following exposure to heat. Heat cramps result primarily from excessive sweating which results in the loss of essential salts and water in the body. Body temperature is normal unless heat cramps are accompanied by heat exhaustion.

4.2.2. Heat exhaustion: Symptoms of heat exhaustion include cool, clammy, moist skin, and profuse sweating. Breathing will usually become shallow and quiet, and the pulse rate will be weak. The pupils will remain normal.

4.2.3. Heat stroke: Symptoms include extreme rise in body temperature, shivering, and lack of sweating. If continued for a period of time, it can result in kidney failure, pulmonary edema, and liver damage. A heat stroke is a severe medical emergency.

4.2.4. If any of the symptoms listed above persist after normal re-hydration procedures, seek medical advice and/or support immediately.

MARK O. SCHISLER, Colonel, USAF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFMAN 32-4005, *Personnel Protection and Attack Actions*

AFPAM 48-151, *Thermal Injury*

Threshold Limit Values for Chemical Substances and Physical Agents, American Conference of Governmental Industrial Hygienists, 2003.

TB MED 577/NAVMED P-5010-9/AFOSH Standard 48-7, *Sanitary Control and Surveillance of Field Water Supplies*.

Terms

Dry Bulb Temperature—The temperature of the air without regard to the effects of humidity, radiant heat of the sun, or wind.

Heat Stress Condition—A four level advisory based on the risk of injury or illness due to the effects of working in extreme temperatures.

Condition Green—The risk of heat-related injury or illness is real, but typical workloads can continue with proper hydration, clothing, and surveillance. All outdoor workers should have current training on the symptoms of overexposure and first aid measures. Implement work and rest cycles as appropriate.

Condition Yellow—The risk of heat-related injury or illness is significant. Work practices should be modified to properly manage the risks. Worker surveillance and education should be increased. Force hydration. Consider reassigning workers not acclimatized who are performing moderate and heavy tasks in hot environments to duties protected from extreme temperatures. Implement work and rest cycles as appropriate.

Condition Red—The risk of heat-related injury or illness is high. Work practices must be modified to properly manage the risks. Workers should be monitored constantly and education should be conducted at least weekly. Reassign workers not acclimatized, who are performing moderate and heavy tasks in hot environments, to duties protected from extreme temperatures. Implement work and rest cycles as appropriate.

Condition Black—The risk of heat-related injury or illness is severe. For heavy work in hot environments, only emergency and mission critical tasks should be conducted outdoors. Implement work and rest cycles as appropriate.

Wet Bulb Globe Temperature (WBGT)—A method of measuring temperature to more accurately describe how the human body perceives the relative heat of an environment. It adjusts the dry bulb temperature for the effect of humidity, the cooling effect of evaporation, and the warming effect of the radiant heat from the sun.

Attachment 2

PEACETIME HEAT STRESS RECOMMENDED WORK/REST CYCLES & WATER INTAKE

Table A2.1. Peacetime Heat Stress Recommended Work/Rest Cycles & Water Intake.

Dry Bulb (F) (Weather)	Heat Category	WBGT Index (° F)	LIGHT WORK		MODERATE WORK		HEAVY WORK	
			Work/Rest (min/min)	*Water Intake (Qt/hr)	Work/Rest (min/min)	*Water Intake (Qt/hr)	Work/Rest (min/min)	*Water Intake (Qt/hr)
< 84	1 (None)	78 – 81.9	No Limit	½	No Limit	¾	40/20	¾
84 – 87	2 (Green)	82 – 84.9	No Limit	½	50/10	¾	30/30	1
88 – 90	3 (Yellow)	85 – 87.9	No Limit	¾	40/20	¾	30/30	1
91 – 94	4 (Red)	88 – 89.9	No Limit	¾	30/30	¾	20/40	1
≥ 95	5 (Black)	≥ 90	50/10	1	20/40	1	10/50	1
NOTES			EXAMPLES OF WORK LOAD CATEGORIES			CLOTHING ADJUSTMENTS		
<p>1. Work/rest cycle recommendations are based on personnel who are fully acclimatized, optimally conditioned, hydrated, and rested.</p> <p>2. Rest means minimal physical activity (sitting or standing) and should be accomplished in the shade if possible.</p> <p>3. Drink small amounts of water throughout the work period, not all at once. Individual water need will vary +/- 1/4</p> <p>4. These values will sustain performance and hydration for at least 4 hours of work in the specified heat category. (Values are based on US Army Research Institute for Environmental Medicine recommendations; US Army policy.)</p>			<p>Light: Standing or sitting to control machines, performing light hand or arm work.</p> <p>Moderate: Cleaning floor, hammering nails, moderate lifting, most flightline work.</p> <p>Heavy: Digging ditches by hand, sandbags filling and moving.</p>			<p>Cotton Coveralls: Add 2°F to the WBGT index.</p> <p>Level A, B, Equivalent Coverall Suits: Add 10°F to the WBGT index</p> <p>MOPP gear: Add 10°F to the WBGT index.</p> <p>Only Body Armor: Add 5°F to measured WBGT.</p> <p>MOPP gear w/Body Armor: Add 15°F to the WBGT index.</p>		
<p>When performing activities with ground crew ensemble, fire-fighting gear, or other restrictive or impermeable clothing, add 10° F to the measurement (add 15° F if also wearing body armor). These adjustments account for the clothing and equipment effects on evaporative cooling (increased barrier) and any increase in work due to the additional load.</p> <p>*CAUTION</p> <p>Hourly fluid intake should not exceed 1 1/2 quarts; daily fluid intake should not exceed 12 quarts.</p> <p>Rapid ingestion of large amounts of water (greater than 1 1/2 quarts per hour) may lead to hyponatremia (acute water intoxication), which is a life-threatening condition that may lead to weakness, convulsions, loss of consciousness, and death if not recognized and treated promptly.</p>								

Attachment 3

EXERCISE HEAT STRESS RECOMMENDED WORK/REST CYCLES & WATER INTAKE

Table A3.1. Exercise Heat Stress Recommended Work/Rest Cycles & Water Intake (with MOPP Gear & Body Armor).

Dry Bulb (F) (Weather)	Heat Category	WBGT Index (°F)	LIGHT WORK		MODERATE WORK		HEAVY WORK	
WITH MOPP GEAR & BODY ARMOR			Work/Rest (min/min)	*Water Intake (Qt/ hr)	Work/Rest (min/min)	*Water Intake (Qt/hr)	Work/Rest (min/min)	*Water Intake (Qt/hr)
< 69	1 (None)	78 – 81.9	No Limit	½	No Limit	¾	40/20	¾
69 – 72	2 (Green)	82 – 84.9	No Limit	½	50/10	¾	30/30	1
73 – 75	3 (Yellow)	85 – 87.9	No Limit	¾	40/20	¾	30/30	1
76 – 79	4 (Red)	88 – 89.9	No Limit	¾	30/30	¾	20/40	1
≥ 80	5 (Black)	≥ 90	50/10	1	20/40	1	10/50	1

***CAUTION**

Hourly fluid intake should not exceed 1 1/2 quarts; daily fluid intake should not exceed 12 quarts.

Rapid ingestion of large amounts of water (greater than 1 1/2 quarts per hour) may lead to hyponatremia (acute water intoxication), which is a life-threatening condition that may lead to weakness, convulsions, loss of consciousness, and death if not recognized and treated promptly.

Table A3.2. Exercise Heat Stress Recommended Work/Rest Cycles & Water Intake (with MOPP Gear).

Dry Bulb (F) (Weather)	Heat Category	WBGT Index (°F)	LIGHT WORK		MODERATE WORK		HEAVY WORK	
WITH MOPP GEAR			Work/Rest (min/min)	*Water Intake (Qt/ hr)	Work/Rest (min/min)	*Water Intake (Qt/hr)	Work/Rest (min/min)	*Water Intake (Qt/hr)
< 74	1 (None)	78 – 81.9	No Limit	½	No Limit	¾	40/20	¾
74 – 77	2 (Green)	82 – 84.9	No Limit	½	50/10	¾	30/30	1
78 – 80	3 (Yellow)	85 – 87.9	No Limit	¾	40/20	¾	30/30	1
81 – 84	4 (Red)	88 – 89.9	No Limit	¾	30/30	¾	20/40	1
≥ 85	5 (Black)	≥ 90	50/10	1	20/40	1	10/50	1

***CAUTION**

Hourly fluid intake should not exceed 1 1/2 quarts; daily fluid intake should not exceed 12 quarts.

Rapid ingestion of large amounts of water (greater than 1 1/2 quarts per hour) may lead to hyponatremia (acute water intoxication), which is a life-threatening condition that may lead to weakness, convulsions, loss of consciousness, and death if not recognized and treated promptly.