U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Aviation Safety

ORDER
VS 3900.82

Effective date:
12/14/22

SUBJ: Aviation Safety (AVS) Thermal Stress Prevention Program (TSPP)

AVS employees work under a variety of thermal conditions, both indoors and outdoors, that can impair physical health. Certain job-related tasks may expose Flight Standards Service, Aircraft Certification Service, and Office of Accident Investigation and Prevention aviation safety inspectors, aerospace engineers, and accident investigators to thermal stress.

The AVS Thermal Stress Prevention Program is an element of the AVS Occupational Safety and Health Program and is designed to meet or exceed voluntary standards for the control of heat and cold stress that may be encountered in AVS work environments. Neither the Occupational Safety and Health Act nor Federal Aviation Administration Order 3900.19C, Occupational Safety and Health Policy requires specific thermal stress prevention controls (e.g., elimination, engineering, etc.), but AVS recognizes the general duty to protect its employees from hazards likely to cause serious harm. This document establishes the requirement for the protection of AVS employees working under these environmental conditions and serves to assure that they understand how to protect themselves against thermal stress and exposure.

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Chapter 1. General Information

1. Purpose of This Order. The purpose of this order is to establish a Thermal Stress Prevention Program (TSPP) to protect Aviation Safety (AVS) employees from exposure to heat and cold stress. The Occupational Safety and Health Administration (OSHA) does not have a specific standard for heat and cold stress but protects workers under Section 5(a)(1) of the Occupational Safety and Health (OSH) Act of 1970, referred to as the General Duty Clause. This clause requires employers to furnish employment and a place of employment which are "free from recognized hazards that are causing or are likely to cause death or serious physical harm to employees."

This order outlines key program elements and references exposure criteria for safeguarding employees. The information provided in this order is based on advisory documents by the American Conference of Governmental Industrial Hygienists (ACGIH) and standards published by the International Standards Organization.

2. Audience. This order applies to all AVS employees. AVS employees work under a variety of thermal conditions, both indoors and outdoors, that can impair health. Certain job-related tasks may expose Flight Standards Service (FS), Aircraft Certification Service (AIR), and Office of Accident Investigation and Prevention (AVP) aviation safety inspectors, aerospace engineers, and accident investigators to thermal stress. AVS employees may be exposed to thermal stress during inspections conducted on airport tarmacs, hangars, or manufacturing sites. All aircraft accident site investigators may be subject to thermal stress at aircraft accident sites.

3. Where to Find This Order. You can find this order on the MyFAA Employee website: https://employees.faa.gov/tools_resources/orders_notices/. This order is available to the public at http://www.faa.gov/regulations_policies/orders_notices/.

4. Action Date. Complete applicable organization-level requirements of this order within one year of the date on which this order is signed.

Chapter 2. Roles and Responsibilities

1. AVS Service and Office (S/O) Executive Directors

a. Ensure the resources (funding and personnel) are available to effectively implement the AVS TSPP throughout their organization for applicable employees.

b. Designate an S/O Program Administrator to oversee the TSPP and to provide the necessary technical support for their S/Os as needed.

2. AVS Middle Managers

a. Require affected employees who could be exposed to heat and cold stress to participate in the TSPP and associated training.

b. Manage and implement the TSPP requirements within the jurisdiction or organization(s) they manage.

3. AVS Frontline Managers

a. Promote thermal stress awareness during staff meetings and by posting awareness materials found on https://my.faa.gov/go/AVSOSH to local employee websites and/or bulletin boards.

b. Identify employees whose job functions or work environments may expose them to thermal stress, and include them in the TSPP.

(1) Know the procedures associated with this program order.

(2) Require applicable employees to participate in training and are informed of all heat and cold stress risk factors, in addition to recognizing signs and symptoms of thermal stress.

(3) Coordinate with the S/O TSPP Administrator to acquire required thermal-stress-related protective clothing.

(4) Assure employees do not exceed exposure limits for heat and cold while at work. Exposure limits for hot and cold environments are provided in Appendices B and C.

(5) Require that employees follow safe work practices and protective measures as referenced in this program and in Appendix D when working in hot or cold work environments.

(6) Support employee rest breaks, as necessary, to allow sufficient time to cool down and rehydrate in hot environments and rewarm in cold environments.

(7) Assure that employees who work in hot, outdoor environments know to drink adequate amounts of potable drinking water.

(8) Remind and assist, as applicable, employees with filing Injury and Illness Incident Reports (OSHA Form 301) electronically via the Department of Labor Employees' Compensation Operations and Management Portal (ECOMP).

4. S/O TSPP Administrators

a. Serve as the S/O TSPP subject matter expert and perform overall program management for the respective AVS S/O.

b. Develop, manage, and implement the AVS TSPP in accordance with this order and any additional S/O guidance.

c. Assist their respective S/O managers and employees with the implementation of the program.

d. Assist their respective S/O managers with the identification of employees at risk of thermal stress exposure, and determination of hazardous work areas and tasks that may result in exposures; and identify requirements for protective clothing.

e. Ensure TSPP awareness training is available to all affected employees.

f. In coordination with the Learning Management System (LMS) Training Coordinator, assure documentation and retention of training records.

g. Perform annual program evaluation of the AVS TSPP to evaluate effectiveness and make changes to program requirements, if needed, based on evaluation findings.

5. AVS Employees

a. Comply with the AVS TSPP, applicable OSHA standards, and FAA orders.

b. Complete assigned applicable training needed to acquire an understanding of and capability to implement the requirements of this program as well as the proper use of protective clothing.

c. Follow safe work practices, wear proper clothing, and keep hydrated during work in environments that may pose thermal stress hazards.

d. Understand signs and symptoms of heat and cold stress.

e. Proceed to a rest location if signs and symptoms of heat or cold stress appear.

f. Help co-workers get to rest locations when they show signs and symptoms of heat or cold stress.

g. Disengage from unsafe work activities or work environments and immediately notify the frontline manager, in accordance with the AVS OSH Policy.

h. Report workplace injury and illness incidents in accordance with FAA policies and procedures.

i. Using the Safety Management Information System, submit an Unsatisfactory Condition Report (UCR) where situations are observed that may cause or contribute to thermal stress exposure incidents or otherwise present a hazard to personnel and equipment, including any lack of training or awareness of hazards and appropriate worker protection measures. See the most current version of FAA Order 1800.6, Unsatisfactory Condition Report for specific guidance on submitting a UCR.

Chapter 3. AVS Thermal Stress Prevention Program Requirements

1. Designation of S/O TSPP Administrator. When an AVS S/O determines its employees may be exposed to thermal stress, an S/O TSPP Administrator must be designated. The S/O TSPP Administrator must be sufficiently knowledgeable, through education or training, to be able to anticipate, recognize, and evaluate employee exposure to thermal stress. The S/O TSPP Administrator is responsible for administering the program within their S/O.

2. Unsatisfactory Condition Report.

a. Do not enter unsafe or unhealthful work conditions. No employee is expected to perform work activities that subject the employee to an unsafe or unhealthful work condition. If potentially exposed to a hazard, an AVS employee must not perform the task until investigation and remediation of the hazard. If it cannot be corrected or there are no alternative measures that can be taken to address the hazard, the AVS employee must not complete the activity.

b. Report unsafe or unhealthful working conditions. Discuss the hazardous condition with the frontline manager. The frontline manager should coordinate with the S/O TSPP Administrator to abate the unsafe condition. Any employee or employee representative who believes that an unsafe or unhealthful working condition exists has the right to make a report of the unsafe or unhealthful working condition to an appropriate agency safety and health official and request an inspection of the workplace.

c. File a UCR. Using the Safety Management Information System, submit an Unsatisfactory Condition Report. Although the unsatisfactory condition may be conveyed verbally with an employee's frontline manager, it is recommended that a UCR be filed. See the current edition of FAA Order 1800.6, Unsatisfactory Condition Report for further instructions.

3. Hot Weather Working Environments.

a. Signs, Symptoms, Acclimatization, and Risk Factors.

(1) Employees exposed to hot environments must be able to recognize the signs and symptoms of heat stress. Recognizing the signs and symptoms of the onset of these heat stress injuries can alert employees that they must leave the hot environment, be allowed to cool down, re-hydrate, and seek medical treatment as necessary.

(2) Employees exposed to hot environments must understand the effects of heat acclimatization. Personnel will begin to experience heat tolerance the longer they are subjected to a hot environment. Full heat acclimatization requires up to three weeks of continued physical activity under hot conditions similar to those anticipated for normal work. High or low humidity levels may impact acclimatization times. Acclimatization to hot environments is quickly lost when the person stops working in a hot environment.

(3) Employees must also know the major risk factors for heat-related stresses. Examples of risk factors include:

(a) Consumption of alcohol, which can increase dehydration, decrease tolerance to the heat, and increase the risk of heat strain.

(b) Taking over-the-counter, prescribed, or illegal drugs, which can increase the risk of heat strain.

(c) Excess water and electrolyte loss due to increased perspiration or use of diuresis-inducing substances, which can result in heat cramps and heat exhaustion.

(d) Being overweight or in poor physical condition, which can cause problems working in and becoming acclimatized to hot environments, and can increase the risk of heatstroke during initial exposure to hot environments.

(e) Being elderly, which can increase vulnerability to the effects of hot weather.

(f) Having degenerative diseases of the heart or blood vessels, which can increase the risk of heat stress.

b. Heat Stress Preventative Measures. Hot-working environments that cannot be controlled through engineering methods should be controlled through the use of administrative controls and work practices. Appendix D, Operational Control Guidance, contains additional details on hierarchy of controls and protective measures. Frontline managers must remind employees to utilize the following administrative controls and work practices to reduce the risk of heat stress in hot environments:

(1) Check available resources (such as news, smart phone applications, OSHA-NIOSH Heat Safety Tool, etc.) to determine the weather before performing work outdoors. Weather conditions including the environmental temperature, humidity level, precipitation, and wind conditions can aid in selecting appropriate protective clothing and control measures.

(2) Take scheduled rest breaks during work in hot environments to cool down and re-hydrate. Identify and utilize recovery areas (e.g., air-conditioned enclosures). Alternate the work and rest periods with longer rest periods in a cool area.

Note: Rest periods or breaks referred to in this Order refer to a stoppage of work in the thermal condition, which includes doing paperwork, equipment maintenance, or other low-exertion work activity away from the hot/cold environment.

(3) Maintain fluid and electrolyte intake. Have cool (50°- 60°F) water available and drink small amounts frequently; e.g., 1 cup (8 ounces) every 15-20 minutes, based on the level of exertion. Place ample supplies of liquids close to the work area. However, do not overhydrate and maintain electrolyte balance. Hyponatremia is a condition where too much water intake causes your kidneys to be unable to get rid of excess water.

(4) Schedule outdoor work activities to allow employees time to acclimatize to hot work conditions.

(5) Schedule outdoor work activities on hot days during the morning or evening when temperatures are cooler.

(6) Avoid overexertion while working in hot environments. Reduce the physical demands of work (e.g., excessive lifting or digging with heavy objects).

(7) Work in tandem using the buddy system, when feasible. Employees should monitor each other's behavior to recognize the signs and symptoms of the onset of heat stress. If it appears that an employee is exhibiting signs or symptoms of heat stress, the employee should be removed from the hot environment, helped to the rest location to cool down, and seek medical treatment as necessary.

Note: An effective way to prevent heat-related illness is to understand and use the Heat Index System. The heat index chart is in Appendix B.

c. Hot Weather-Related Protective Clothing.

(1) When workers wear protective clothing, they are at risk of heat stress when the temperature exceeds 70°F, since some protective clothing includes semi-permeable or impermeable material. Employee protection while working in a hot environment should follow all of the requirements shown in Appendix E, Table E-1 Protective Clothing Hazard Assessments for General Thermal Stress – Hot Weather. See Appendix B, Heat Stress Exposure Limits and Risk Levels and Appendix C, Cold Stress Exposure Limits and Risk Levels for exposure limits that account for work demands, humidity, and wind.

(2) Employees should wear clothing in hot work environments that allows them to remain comfortable in the heat while still providing skin protection from ultraviolet radiation. Clothing should be loose-fitting to allow for proper cooling by evaporation of perspiration. Wear hats with a brim to provide face and eye protection from the sun. Use sunscreen to provide protection and prevent damage from prolonged sun exposure.

d. Hot Weather-Related Engineering Controls. A variety of engineering controls can be used to modify the rate of heat exchange between workers and their surrounding environment. Examples of engineering control methods that AVS employees may utilize include:

(1) *General ventilation* is used to dilute hot air with cooler air. This technique works better in cooler climates than in hot climates. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas. (Example: ventilation in a hangar, industrial ceiling fans)

(2) *Air conditioning* is a method of air-cooling. (Example: building HVAC systems in administrative areas or vehicle air conditioning systems)

(3) *Local air cooling* is used to cool air in a specific location, usually set near a hot area or in a break room. Cool rooms are used to enclose a specific workplace or offer a recovery area near hot tasks. (Example: floor, pedestal, or box fan in a hangar.)

(4) *Changes in airspeed* can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Since this method does not actually cool the air, any increases in airspeed must impact the worker directly to be effective. (Example: moving vehicle with windows down, golf cart)

(5) *Evaporative cooling* involves reduction in temperature resulting from the evaporation of a liquid, which removes latent heat from the surface from which evaporation takes place. It may be improved by air movement; however, airspeed increases have no effect on the body temperature of workers wearing vapor-barrier clothing. (Example, natural cooling effect of human body when air passes over perspiration)

4. Cold Weather Working Environments.

a. Signs, Symptoms, and Risk Factors.

(1) Employees exposed to cold work environments must be able to recognize the signs and symptoms of cold-related injuries. Recognizing the signs and symptoms of the onset of these injuries can alert employees that they must leave the cold environment, be allowed to get warm, and seek medical treatment as necessary.

(2) Employees must understand the major risk factors that can contribute to cold-related stresses. Examples of risk factors include:

(a) Wetness/dampness (including sweating).

(b) Dressing improperly, having exposed skin or tight clothing and shoes that restrict blood flow.

(c) Predisposing health conditions such as hypertension, hypothyroidism, diabetes, or blood circulation issues.

(d) Improper acclimation.

(e) Poor physical conditioning or overexertion.

b. Cold Stress Preventative Measures. Frontline managers must remind employees to utilize the following administrative controls and work practices to reduce the risk of cold stress in cold environments:

Note: Appendix D, Operational Control Guidance, contains additional details on hierarchy of controls and protective measures.

(1) Check available resources (such as news, smart phone applications, etc.) to determine the weather before performing work outdoors. Weather conditions including the environmental temperature, humidity level, precipitation, and wind conditions can aid in selecting appropriate protective clothing and control measures.

(2) Assure employees understand the added effect of exposure to wind and moisture while working in cold conditions. Exposure to wind will result in wind chill, causing the perceived temperature to feel significantly colder than the actual temperature.

(3) Wear the proper clothing, which is a very effective method of protection from exposure to the cold.

(4) Prepare for the worst weather conditions and have additional clothing available.

(5) Replace wet clothing immediately. Clothing can become wet due to wet weather, working with water, or through perspiration.

(6) Take rest breaks, as necessary, to get warm and take breaks from heavy exertion that may cause perspiration. Identify and utilize shelter (e.g., heated break rooms and wind protection).

Note: Rest periods or breaks referenced in this Order refer to a stoppage of work in the thermal condition, which includes doing paperwork, equipment maintenance, or other low-exertion work activity away from the hot/cold environment.

(7) Arrange work so that sitting or standing still for long periods is minimized. Adjust work schedules (e.g., rotate workers, provide rest periods out of the cold, and perform work at the warmest part of the day) as needed.

(8) Work in tandem using the buddy system, when feasible. When multiple individuals are working in the same area, they should monitor each other's behavior to recognize the signs and symptoms of the onset of cold stress. If it appears that an employee is exhibiting signs or symptoms of cold stress, the employee should be removed from the cold environment and helped to the rest location to get warm.

(9) Understand the procedures for rewarming and immediately seek medical attention if any signs and symptoms of cold stress appear.

c. Cold Weather-Related Protective Clothing.

(1) Protective clothing is the most important means to avoid cold stress. The type of fabric also makes a difference. Cotton fabric loses its insulation value when it becomes wet. Wool fabric retains its insulation even when wet. Wear dry insulated clothing when working in cold outdoor environments. Wear wind-resistant and water-repellent clothing during wet or windy conditions.

(2) Wear cold-weather clothing in layers to stay warm and dry during changing weather conditions. During heavy physical exertion, clothing layers can be removed to allow the release of the heat resulting from the body's metabolic heat production. When physical exertion is low, warm clothing can be added to trap and conserve body heat.

(a) Outer layer: Breaks the wind and repel water.

(b) Middle layer: Wool or synthetic fabric to insulate the body.

(c) Inner layer: Material capable of wicking water away from the skin.

(d) Hats that cover the ears should also be worn to prevent heat escape from the top of the head.

(3) Employee protection while working in cold weather may include all recommendations shown in Appendix E, Table E-2 Protective Clothing Hazard Assessment for General Thermal Stress – Cold Weather. See Appendix C, Cold Stress Exposure Limits and Risk Levels for exposure limits that account for work demands, humidity, and wind.

Note: Per 29 CFR 1910.132, the FAA is not required to pay for everyday, ordinary clothing or other items used for protection from weather, such as, long-sleeve shirts, long pants, winter coats, jackets, gloves, parkas, etc. However, AVS does purchase specific protective clothing and equipment to be used by AVS employees for protection from thermal stress and other occupational hazards encountered at aircraft accident investigation sites as indicated by safety hazard analysis.

d. Cold Weather-Related Engineering Control Methods. A variety of engineering controls can be used to reduce the risk of cold stress between workers and their surrounding environment. Potential engineering control methods include:

(1) Using radiant heaters.

(2) Shielding work areas from drafts or wind to reduce wind chill.

(3) Covering metal handles of tools and control bars with thermal insulating material when temperatures drop below 30°F.

(4) Designing tools and machine controls for operation by gloved hands in cold conditions.

5. Employee Training. Training identified by the S/O TSPP Administrator must be completed by AVS employees who work outdoors. Training will be web-based and must cover the symptoms, severity, treatment, and prevention of heat and cold stress illnesses included in this chapter as well as the risk factors that could increase the likelihood of developing heat and cold stress illnesses.

6. Program Evaluation. The S/O Program Administrators must conduct a program evaluation annually to determine the efficacy of the TSPP. The S/O Program Administrators should observe employees as they work in hot or cold environments and conduct interviews with them to understand their concerns when working in environments that pose a risk of thermal stress.

7. Threshold Limit Values (TLV) and Action Limits.

a. Heat Stress. Understanding the degree of heat stress exposure for an employee involves determining the level of physical exertion. As the level of activity increases, the body's

metabolic heat production increases as well. It must be determined whether the activity is light, moderate, or heavy work. Appendix B presents procedures for calculation of the WBGT index and comparison to the Action Limit and TLV for heat stress and strain in accordance with the methodology in ACGIH Heat Stress and Strain – 2017.

b. Cold Stress. Threshold limit values recommended for properly clothed workers in a cold environment with temperatures below freezing are included in Appendix C.

Chapter 4. Administrative Information

1. Distribution. This order is distributed to all AVS personnel.

2. Authority to Change This Order. The issuance, revision, or cancellation of the material in this order is the responsibility of the Associate Administrator for Aviation Safety (AVS-1).

3. Suggestions for Improvements. Please forward all comments on deficiencies, clarifications, or improvements regarding the contents of this order to the FAA Directive Feedback System at https://ksn2.faa.gov/avs/dfs/Pages/Home.aspx. FAA Form 1320-19, Directive Feedback Information, is located in Appendix F of this order for your convenience.

4. Records Management. Refer to FAA Order 0000.1, FAA Standard Subject Classification System; FAA Order 1350.14, Records Management; or your office Records Management Officer or Directives Management Officer for guidance regarding retention or disposition of records.

Appendix A. Definitions

1. Acclimatization. The physiologic changes that occur in response to a succession of days of exposure to environmental heat stress that reduces the strain caused by the heat stress of the environment.

2. Chilblain. A nonfreezing, painful cold injury that causes little or no permanent impairment. It appears as red, swollen skin that is tender, hot to the touch, and may itch. It can develop in only a few hours of exposure to moist cold.

3. Cold stress. The loss of body heat in cold weather conditions, when the deep body temperature falls below 96.8°F. For the purposes of this document, cold stress conditions can be assumed to exist whenever the weather parameters dictate that the regular break schedule be modified, as indicated by the American Conference of Governmental Industrial Hygienists guidelines.

4. Deep body temperature. The internal temperature of the human body. For normal functioning of organs, the body must regulate this temperature between 96.8°F and 100.4°F.

5. Diuresis. Increased or excessive production of urine.

6. Electrolyte. Substance that can convey an electrical impulse when in solution. Body electrolytes include such elements as sodium, potassium, and chlorides.

7. Environmental temperature. The temperature of the air surrounding a body. Also called *air temperature*, *ambient temperature*, or *dry bulb temperature*.

8. Frontline Managers. Provide first-level supervision to subordinate employees and manage the activities of one operating unit, project, or program area. Frontline Managers report to Middle or Senior Managers.

9. Frostbite. A condition that involves local tissue destruction resulting from freezing. The skin becomes numb and turns to a gray or waxy-white color. The area will be cold to the touch and may feel stiff or wooden. Ice crystal formation and lack of blood flow to the frozen area damage the tissues.

10. Frostnip. A condition that involves freezing of water on the surface of the skin. The skin becomes reddened and swollen. Usually, there is no further damage after re-warming.

11. Heat cramp. A heat-related illness characterized by spastic contractions of the voluntary muscles (mainly arms, hands, legs, and feet), usually associated with a restricted salt intake and profuse sweating without dehydration.

12. Heat exhaustion. A heat-related illness characterized by muscular weakness, distress, nausea, vomiting, dizziness, pale clammy skin, and fainting; usually associated with lack of heat acclimatization and physical fitness, low health status, and an inadequate water intake.

13. Heat rash. A condition, also known as prickly heat, that occurs when sweat glands are plugged and inflamed from exposure to heat, humidity, and sweat. Tiny blister-like red spots appear on the skin.

14. Heat strain. Adjustments made by an individual in response to heat stress. These adjustments include biochemical, physiological, and psychological processes. For example, an increase in sweat rate is the first sign of heat strain. The steady rise of sweat rate causes an excessive wetting of the skin. Extended exposure to heat will cause a decline in sweat rate. The sweat gland fatigue and consequent reduction in sweat production indicate a very high level of heat strain.

15. Heat stress. The buildup in the body of heat generated by the muscles performing work combined with the heat coming from hot environments, when the deep body temperature rises above 100.4°F. Mental performance can be affected with an increase of 2ºF above normal (98.6°F), and death can result if the body temperature rises as much as 5ºF. For the purposes of this document, heat stress conditions can be assumed to exist whenever the weather parameters dictate that the regular work regimen be modified, as indicated by the American Conference of Governmental Industrial Hygienists guidelines.

16. Heat syncope. The collapse and/or loss of consciousness during heat exposure without an increase in body temperature or cessation of sweating, similar to vasovagal fainting except heat induced.

17. Heatstroke. An acute medical emergency arising during exposure to heat from an excessive rise in body temperature and failure of the temperature-regulating mechanism. It is characterized by a sudden and sustained loss of consciousness preceded by vertigo, nausea, headache, cerebral dysfunction, bizarre behavior, and body temperatures usually in excess of 105.8ºF. Normally, there is a lack of sweating, and the skin feels hot and dry.

18. Hyponatremia. When you drink too much water, your kidneys can't get rid of the excess water. The sodium content of your blood becomes diluted. This is called hyponatremia and it can be life-threatening**.**

19. Hypothermia. A life-threatening condition in which the body cannot generate heat as fast as it is being lost and the deep body temperature falls below 95ºF. Symptoms of possible hypothermia include confusion, slurred speech, uncoordinated movements, altered vision, and withdrawn or bizarre behavior.

20. Middle Managers. Provide second-level supervision to subordinate employees and manage the activities of several operating units, projects, or program areas. Middle Managers report to Senior Managers, or, in highly vertical organizations, other Middle Managers.

21. Metabolic heat. The heat generated within a person’s body due to normal body functions as well as muscle contractions from increased activity or exercise.

22. Thermal stress. Heat stress or cold stress.

23. Trench foot. A very serious nonfreezing cold injury develops when the skin of the feet is

exposed to moisture and cold for periods of 12 hours or more. The combination of moisture and cold softens skin, causing tissue loss and, often, infection. Untreated, trench foot may eventually require amputation. Often, the first sign of trench foot is itching, numbness, or tingling pain. Also known as "immersion foot."

24. Wet Bulb Globe Temperature (WBGT). This is an environmental temperature arrived at by measuring dry air temperature, humidity, and radiant energy (i.e., usually direct sunlight being absorbed by clothing), used to calculate a thermal load on the person.

25. Wind chill. Wind removes warm air surrounding the surface of the body created by body heat, resulting in an increased perception of cold stress known as wind chill. As the wind velocity increases, cold stress increases, even though the environmental temperature remains the same.

Appendix B. Heat Stress Exposure Limits and Risk Levels

Environmental factors (e.g., humidity, wind, temperature, and radiant heat), clothing, and workload (i.e., metabolic rate) are considered when determining if there is a heat hazard present in an indoor or outdoor workplace. To assess heat hazards to workers, follow the steps below. (Source: https://www.osha.gov/heat-exposure/hazards)

Step 1: Estimate the workload.
When workers engage in intense work, their bodies create heat. This "metabolic" heat combines with environmental heat (from temperature, sunlight, humidity, etc.) so workers' core temperature can rise to dangerous levels.

To prevent a hazardous combination of environmental and metabolic heat, employers should be aware of workers' activity level. Workload can be classified as follows:

- Light: Sitting or standing with minimal arm and leg work, and occasional walking.
- Moderate: Continuous modest intensity, such as light pushing/pulling or normal walking.
- Heavy: Intense upper body work such as carrying loads or sawing, walking at a fast pace.
- Very heavy: Intense activity at an almost maximum pace.

Step 2: Determine Wet Bulb Globe Temperature (WBGT).
Refer to this set of tools that OSHA has compiled from historical weather data to facilitate estimation of WBGT.

Step 3: Add Clothing Adjustment Factors.
Some workers wear clothing that prevents heat dissipation. Examples include coveralls or protective gear. These workers experience an "effective WBGT" that feels warmer than the measured ambient WBGT. To determine the effective WBGT for these workers, use the following table.

Table B-1. Clothing Adjustment Factor

Type of Clothing	**Clothing Adjustment Factor** *This amount must be added to the measured WBGT when determining heat stress.*
Normal work clothes (e.g., long sleeve shirts and pants)	0
Cloth (woven) coveralls*	0
Spunbond/melt blown/spunbond (SMS) polypropylene coveralls*	0.9°F
Polyolefin coveralls*	1.8°F
Double layer of clothing	5.4°F
Limited-use vapor-barrier coveralls*	19.8°F

**Coveralls assume that only undergarments, not a second layer of clothing, are worn underneath.*

Table B-1 was adapted from TLVs® and BEIs®. Thermal stress: heat stress and heat strain (American Conference of Governmental Industrial Hygienists (ACGIH), 2017).

Step 4. Determine whether the worker is acclimatized to heat.
In general, assume that workers are unacclimatized if they have been doing the job for less than one to two weeks.

Step 5. Determine the Threshold Limit Value (TLV) or Action Limit
Use the following tables to determine whether the total heat stress is hazardous. First consult Table B-2, which is a simplified version of recommendations from the National Institute for Occupational Safety and Health (NIOSH) and ACGIH.

Table B-2. Simplified Heat Exposure Recommendations

Effective WBGT*	Unacclimatized Workers	Acclimatized Workers
Below 70°F	Low risk of heat-related illness	Low risk of heat-related illness
70 to 77°F	Strenuous work possibly unsafe	Low risk of heat-related illness
Above 77°F	High risk of heat-related illness with strenuous work	Strenuous work possibly unsafe

**Effective WBGT equals measured WBGT plus any clothing adjustment factors.*

If Table B-2 indicates that the heat stress is potentially unsafe, a more detailed hazard assessment is warranted. Use Table B-3 or OSHA's Heat Stress Calculator to determine whether the total heat stress is too high.

Table B-3. Heat Stress Recommendations

Workload	Limit for Unacclimatized Workers (Action Limit)	Limit for Acclimatized Workers (Threshold Limit Value)
	Effective WBGT	
Light	82.4°F	86°F
Moderate	77°F	82.4°F
Heavy	73.4°F	78.8°F
Very heavy	69.8°F	77°F

Table B-3 was adapted from NIOSH and ACGIH guidelines, Source: https://www.osha.gov/heat-exposure/hazards.

Employers and workers should become familiar with the symptoms of heat disorders. When any of these symptoms is present, promptly provide first aid. Do not try to diagnose which illness is occurring. Diagnosis is often difficult because symptoms of multiple heat-related illnesses can occur together. Time is of the essence. These conditions can worsen quickly and result in fatalities.

When in doubt, cool the worker and call 911.

Table B-4 identifies common heat disorders, symptoms, and medical response.

Table B-4. Common Heat Disorders

Heat Disorder	Symptoms	First Aid
Sunburn	• Redness and pain • In severe cases, swelling of skin, blisters, fever, and headaches	Ointments for mild cases if blisters appear and do not break. If breaking occurs, apply dry sterile dressings. Serious, extensive cases should be seen by a physician.
Heat Cramps	• Painful spasms are usually in the muscles of the legs and abdomen possible • Heavy sweating	Firm pressure on the cramping muscles, or gentle massaging to relieve the spasm. Give sips of water. If nausea occurs, discontinue use.
Heat Exhaustion	• Heavy sweating • Weakness • Skin is cold, pale, and clammy • Weak pulse • Normal temperature possible • Fainting and vomiting	Get victim out of the sun. Lay down and loosen clothing. Apply cool, wet cloths. Fan or move victim to an air-conditioned room. Sips of water. If nausea occurs, discontinue use. If vomiting continues, seek immediate medical attention.
Heatstroke (*sunstroke*)	• High body temperature (106°F or higher) • Hot dry skin • Rapid and strong pulse • Possible unconsciousness	*Heatstroke is a severe medical emergency. Summon emergency medical assistance or get the victim to a hospital immediately. Delay can be fatal.* Move the victim to a cooler environment. Reduce body temperature with cold bath or sponging. Use extreme caution. Remove clothing, use fans and air conditioners. If the temperature rises again, repeat the process. Do **not** give fluids.

Appendix C. Cold Stress Exposure Limits and Risk Levels

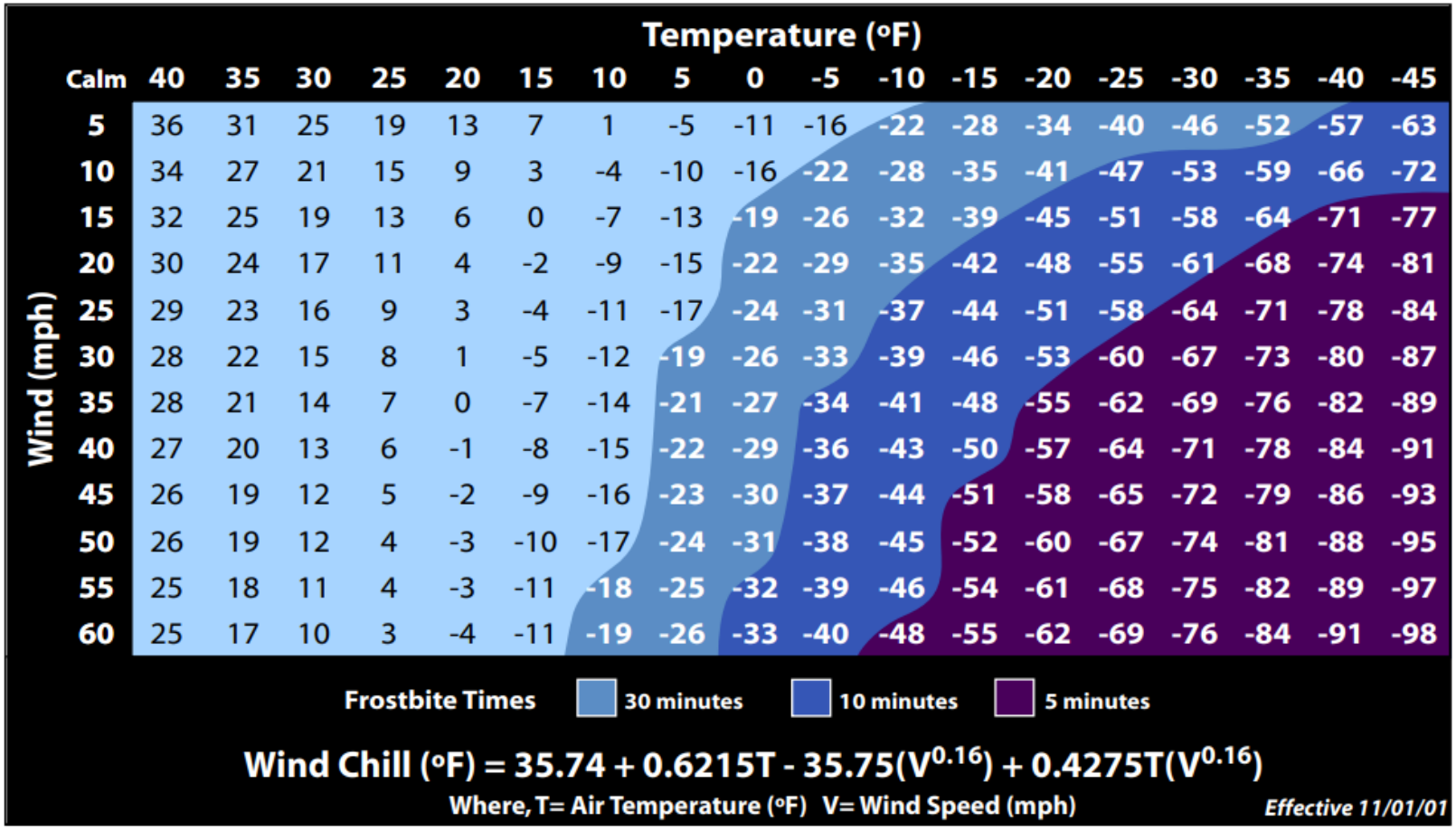
Table C-1: Work/Warm-up Schedule for a Four-Hour Shift

Air Temperature -- Sunny Sky	No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°F (approx-imate)	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks
-15 to -19	(Normal Breaks) 1		(Normal Breaks) 1		75 min	2	55 min	3	40 min	4
-20 to -24	(Normal Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5
-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-30 to -34	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-35 to -39	40 min	4	30 min	5	Non-emergency work should cease					
-40 to -44	30 min	5	Non-emergency work should cease							
-45 & below	Non-emergency work should cease									

Schedule applies to any four-hour work period with moderate to heavy work activity; with warm-up periods of 10 minutes in a warm location and with an extended break (e.g., lunch) at the end of the four-hour work period in a warm location.

Table C-1 was adapted from the American Conference of Governmental Industrial Hygienists 2012 Threshold Limit Values.

Table C-2: Wind Chill Table



Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Table C-2 was extracted from the National Oceanic Atmospheric Administration.

Appendix D. Operational Control Guidelines

A hierarchy of controls is applied when determining effective risk controls. The guiding principle is that elimination and engineering are more effective than administrative and protective clothing. The actual controls vary with each workplace condition on any given day and the demands of the mission. Table D-1 may be applied as a guide.

Table D-1: Hierarchy of Controls

Hierarchy of Controls	Action
Elimination	• Airport ground stops, facility closures, and rescheduling for hazardous weather conditions
Engineering	• Standard design, construction, operation, and maintenance of HVAC systems • Misting • Warm air jets, radiant heaters, contact warm plates, thermal-insulated hand tools • Windshields • Fans • Mechanical lifts
Administrative	• Employee rotation • Work/rest regiment • Shift scheduling and rescheduling • Drinking water resources • Sunscreen • Monitoring and reporting National Oceanic Atmospheric Administration heat advisories, ultraviolet (UV) indices, and wind chill factors • Acclimatizing workers • Physiological monitoring
Protective Clothing	• Cold weather gear (e.g., hat, hood, gloves, scarf or neck tube, facemask, and several layers of flexible clothing) • UV protection including sunglasses and hats • Light-wick clothing

Table D-2 contains the most critical actions **frontline managers must take** in the prevention of heat-related illness among their employees.

Table D-2: Protective Measures by Heat Index and Risk Level

Heat Index	Risk Level	Protective Measures
<91°F	Lower (Caution)	Remind workers to: • Bring plenty of drinking water • Assure that adequate medical services are available • Plan ahead for times when the heat index is higher, including taking a worker heat-safety training • Wear sunscreen • Allow time to acclimatize If workers must wear heavy protective clothing, perform a strenuous activity, or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.
91°F to 103°F	Moderate	In addition to the steps listed above, remind workers to: • Drink water often (about four cups/hour) • Review heat-related illness topics: how to recognize heat-related illness, how to prevent it, and what to do if someone gets sick • Schedule frequent breaks in a cool, shaded area • Acclimate to the local climate • Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness If workers must wear heavy protective clothing, perform a strenuous activity, or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness: • Schedule activities at a time when the heat index is lower • Develop work/rest schedules • Monitor workers closely
103°F to 115°F	High	In addition to the steps listed above, remind workers to: • Be cognizant of high-risk conditions • Drink plenty of water (about four cups/hour) • Limit physical exertion (e.g., use mechanical lifts) • Establish and implement work/rest schedules • Adjust work activities (e.g., reschedule work, pace/rotate jobs) • Use cooling techniques When possible, reschedule activities to a time when the heat index is lower.
>115°F	Very High to Extreme	In addition to the steps listed above, remind workers to: • Reschedule non-essential activities for days with a reduced heat index or to a time when the heat index is lower. • Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts.

Heat Index	Risk Level	Protective Measures
		• Not conduct strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing when the heat index is above 115°F. If essential work must be done, in addition to the steps listed above, remind workers to: • Be cognizant of extreme heat hazards • Establish a water drinking schedule (about four cups/hour) • Establish and implement protective work/rest schedules • Conduct physiological monitoring (e.g., pulse, temperature, etc.) • Stop work if essential control methods are inadequate or unavailable

Appendix E. Protective Clothing Hazard Assessments

Table E-1: General Thermal Stress – Hot Weather

Affected Area	Assessment of Hazard	Corrective Action/Protective Clothing Required
Head	N/A	Hat with a brim to provide face and eye protection from the sun
Eyes or Face	N/A	Sunglasses
Skin	Sunburn	Liberally apply sunscreen to exposed skin areas
Hand	N/A	N/A
Foot	N/A	N/A
Hearing	N/A	N/A
Electrical Shock	N/A	N/A
Whole Body	Heat cramps, heat exhaustion, and/or heatstroke	Corrective Action • Rotate work shifts to avoid prolonged exposure to heat; • Take frequent breaks; • Drink plenty of cool water; and/or • Use an umbrella to avoid direct sunlight. Protective clothing • Reflective clothing with good ventilation (cotton) • Ice and/or water-cooled garments
Respiratory	N/A	N/A

Note: Per 29 CFR 1910.132, the Federal Aviation Administration (FAA) is not required to pay for every day, ordinary clothing or other items used for protection from weather, such as, long-sleeve shirts, long pants, winter coats, jackets, gloves, parkas, etc. However, Aviation Safety (AVS) does purchase specific protective clothing and equipment to be used by AVS employees for protection from thermal stress and other occupational hazards encountered at aircraft accident investigation sites as indicated by safety hazard analysis.

Table E-2: General Thermal Stress – Cold Weather

Affected Area	Assessment of Hazard	Corrective Action/ Protective Clothing Required
Head	N/A	Hat that covers ears is recommended
Eyes or Face	Frostbite	Wool face mask is recommended
Skin		Thermal underwear and/or three layers of clothing is recommended
Hand		Thermal insulated gloves are recommended
Foot	Trench foot/Frostbite	Two layers of wool socks or insulated boots is recommended.
Hearing	N/A	N/A
Electrical Shock	N/A	N/A
Whole Body	Hypothermia	Wear three layers of clothing: • Outer layer to break the wind and allow some ventilation (like Gore-Tex or nylon) • Middle layer of down or wool to absorb sweat and provide insulation even when wet • Inner layer of cotton or synthetic weave to allow ventilation Keep a change of clothing in case work clothes become wet.
Respiratory	N/A	N/A

Note: Per 29 CFR 1910.132, the FAA is not required to pay for every day, ordinary clothing or other items used for protection from weather, such as, long-sleeve shirts, long pants, winter coats, jackets, gloves, parkas, etc. However, AVS does purchase specific protective clothing and equipment to be used by AVS employees for protection from thermal stress and other occupational hazards encountered at aircraft accident investigation sites as indicated by safety hazard analysis.

Appendix F. Directive Feedback Information

Please submit any written comments or recommendations for improving this directive, or suggest new items or subjects to be added to it. Also, if you find an error, please tell us about it.

Subject: Order VS 3900.82, Aviation Safety (AVS) Thermal Stress Prevention Program (TSPP)

To: AVS Directives Management Officer

Please mark all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:
(attached separate sheet if necessary)

☐ In a future change to this order, please include coverage on the following subject
(briefly describe what you want added):

☐ Other comments:

☐ I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____

Telephone Number: _____ Routing Symbol: _____

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