THE NATION'S URANIUM PROCESSING FACILITY

UPF PROJECT PROCEDURE

Title:	**HEAT AND COLD STRESS PREVENTION**
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Revision History

Revision	Reason/Description of Change
6	This revision is a complete re-write, therefore no revision bars are shown. This revision further establishes guidance and instructions for the protection of workers from heat and cold stress.
5	Adopted initial issue from Bechtel Core Process 314 at its current revision 5.

Table of Contents

1.0 PURPOSE

This procedure provides the guidance and instructions for the protection of workers from heat and cold stress and the potential injury/illness that can result.

2.0 GENERAL

2.1 Applicability

This procedure applies to all direct hire employees, and subcontractors/sub-tier subcontractors whose job assignments expose them to ambient temperatures above 85 °F and below 20 °F on the UPF construction site and support areas.

2.2 Acronyms

CM	Construction Manager
FSM	Field Safety Manager
FSR	Field Safety Representative
DS	Discipline Superintendent
STR	Subcontract Technical Representative
ACGIH	American Conference of Governmental Industrial Hygienist
TLV	Threshold Limit Value

2.3 Definitions

Ambient Temperature	The temperature of air measured by a thermometer freely exposed to the air, but shielded from radiation and moisture.
Acclimatize	A physiological adaptation that improves an individual's ability to tolerate heat stress resulting in the person being acclimatized. A person is considered acclimatized if he/she has worked in a non-air-conditioned environment with outdoor temperature at or above 85 °F for a period that allows them to become accustomed to the temperature.
Acrocyanosis (Cyanosis)	A bluish, purple, or grayish discoloration of the skin (for instance, the hands and feet) and mucous membranes due to deficient levels of oxygen in the blood, often caused by exposure to cold.
Cold Stress	Stress resulting from net heat loss of the body or of a portion of the body, such as feet, hands, limbs, or head.
Core Body Temperature	The internal temperature of the central part of the body.
Frostbite	Damage to skin and subcutaneous tissues resulting from exposure to extreme cold. Symptoms include numbness, itching, tingling, or a burning sensation upon cooling of the skin.
Hot Environment	A work area where one or more of the following factors may exist, creating the potential for heat stress: high temperature/humidity,

	sources of significant radiant heat, or use of protective clothing that impedes sweat evaporation.
Hypothermia	A condition in which the body loses heat faster than it can be produced and the core temperature drops dangerously low (95 °F or lower).
Rest Period	A period for which the worker moves or is moved from a hot or cold work environment to a more benign environment to allow recovery from the effects of hot or cold temperatures being experienced in the workplace.
Self-Determination	The method by which an individual may begin to recognize the early warning signs of heat/cold-related disorder and seek relief from the heat/cold stress exposure. Self-determination may shorten assigned work times.
Safety Task Analysis Risk Reduction (STARRT)	A process that uses supervisors and employees to identify and resolve environmental, safety, and health hazards associated with a task prior to it being performed.
Wet Bulb Globe Temperature (WBGT)	The environmental temperature index used to assess the potential for heat stress. WBGT values may be measured with integrated equipment or calculated using readings from a globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer.
Work Rest Cycle	The amount of time within a period of work and rest that allows the body to recover from the heat or cold stress. This can be any amount of time up to 2 hrs.
Wind Chill	The apparent temperature felt on exposed skin due to the combination of air temperature and wind speed.
Work-Cooling, Warming Regimen	A work/rest schedule determined by the WBGT level or ambient temperature, allowing the body core temperature to remain below a heat or cold stress condition.

3.0 RESPONSIBILITIES

3.1 **Construction Manager –** has the overall responsibility for ensuring the implementation of this procedure, in conjunction with the FSM; ensuring that all project personnel actively participate; and provides worker support, facilities, and other resources necessary to effectively carry out this procedure.

3.2 **Field Safety Manager –** has the overall authority for interpretation of the regulations associated with the procedure and the interpretation of the procedure as to intent and application.

3.3 **Field Safety Representative –** has the responsibility of compliance oversight with the procedure through periodic field inspections, heat and cold stress monitoring and is responsible for supplying technical advice and interpretation of this procedure.

3.4 **Discipline Superintendent –** is responsible for being thoroughly familiar with this procedure and their individual responsibilities regarding compliance with and implementation of this procedure, pre-planning work activities to identify the appropriate heat and cold stress stays times for workers to use, and ensuring workers understand the requirements of the procedure.

3.5 **Supervisor –** is responsible for ensuring the applicable safety controls and processes are incorporated into planning and execution of the work, observing workers' performance and physical condition relative to the temperatures and/or environmental conditions in which they are working, and understanding and following the work/rest cycle for their appropriate heat/cold exposure work area.

3.6 **Subcontract Technical Representative –** is responsible for being familiar with this procedure and with their specific responsibilities regarding implementation and enforcement with subcontractors.

3.7 **Worker-** is responsible for understanding and complying with the requirements of this procedures and how it applies to the work they perform, identifying emerging heat and cold stress related illness's during work activities being performed.

4.0 THERMAL STRESS PREVENTION, EVALUATION & CONTROL

Compliance to the American Conference of Governmental Industrial Hygienist (ACGIH) Thermal stress standard/Threshold Limit Values (TLV) is accomplished at the UPF by the implementation of a comprehensive management program that utilizes a number of engineering and administrative controls. Application of the TLV is achieved by following a work/rest cycle when applicable, utilization of cooling and heating systems when appropriate and providing means for hydration.

Weather information specific to the Y-12 National Security Complex (and UPF) can be obtained by contacting the Y-12 Plant Shift Superintendent (PSS) at 574-7172.

4.1 Heat Stress Environments

The following subsections provide information on preparation for hot weather, hot weather controls and work/rest cycles.

4.1.1 Heat Stress Evaluation and Determination

Heat stress evaluation and determination is accomplished through this procedure identifying the actions for supervision and workers. Heat stress evaluation includes a combination of the following elements:

- WBGT level
- Level of clothing or PPE worn
- Metabolic rate of the work activity

4.1.2 Hot Weather Preparation

Starting in the month of May, supervision with the assistance from FSR begins planning for hot weather through the following:

- Establishing cooling stations (e.g. vehicles, shade structures or cool rooms) for areas that may implement a work/rest cycle, setting up air moving equipment, and preparing other materials, equipment, etc.

NOTE: It is preferable that cooling stations are air conditioned.

- Brief workers on the heat related hazards, symptoms, and preventions (refer to Appendix A).
- Begin evaluation of potential heat related conditions and identify preventative measures into daily and weekly planning meeting agendas.

4.1.3 Hot Weather Onset

When the ambient temperatures are expected to reach and be sustained at or above 85 °F during the work shift, supervisors are to implement the following appropriate engineered and administrative control methods:

- Establish and identify the location(s) of cooling stations.
- Set-up air moving equipment in appropriate locations
- Workers to initiate discussion of heat related environmental conditions during the STARRT card briefing specific to the area where work is performed.
- Initiate heat stress prevention measures:
    - Direct workers to drink plenty of water before, during, and after performing work activities in heat stress environments.

NOTE: The quantity of water taken in is to be sufficient to replace lost fluids and electrolytes during the work activities. To maintain adequate hydration, it is recommended that workers drink 1 quart of water 1 hour before a job task begins, and consume an average of approximately 1 cup of water for every 20 minutes worked in a heat stress environment.

    - Instruct workers that if they begin to have heat stress symptoms they are able to self-determine the need for a break to prevent a serious heat stress incident or condition.
    - Whenever possible, perform work activities in shaded areas or during cooler times of the day (evening or early morning).
    - Give special consideration to shielding or minimizing exposure from radiant heat sources in a work area (e.g., welding/cutting, heat generated by compressors and engines).
    - Provide cool areas for rest breaks with an approximate temperature of 73 °F WBGT or lower. Use misters and fans in the work area, as appropriate.
    - Monitor workers for signs of sudden and severe fatigue, nausea, dizziness, light-headedness, or profuse, sustained sweating.
    - Workers shall not be allowed to work alone in heat stress environments that would require 40% rest or higher.

4.1.4 Work/Rest Cycle Determination

- Work/rest cycles are designed to keep exposure below the TLV by prescribing what portion of the work cycle should be spent in recovery. The cycle time is a period of work/rest up to 120 minutes.
- Once the work zone has been identified the supervisor will use WBGT readings for that zone, the clothing layers, and metabolic rate specific to the work being performed to determine the work/rest cycle for each work area. Table 1 provides the work/rest cycle determination based off these factors.

Table 1 WBGT TLV Work/Rest Cycle

	Work/Rest Percentages	Metabolic Rate 1	Metabolic Rate 2
		WBGT Levels	
SINGLE CLOTHING LAYER	100% Work /0% Rest	87.4 to 88.3 °F	82.8 to 83.6 °F
	90% Work /10% Rest	88.4 to 90.5 °F	83.7 to 86.5 °F
	80% Work /20% Rest	90.6 to 93.3 °F	86.6 to 88.1 °F
	70% Work /30% Rest	93.4 to 97.0 °F	88.2 to 91.4 °F
	60% Work /40% Rest	97.1 to 102.0 °F	91.5 to 96.1 °F
	50% Work /50% Rest	102.1 to 109.2 °F	96.2 to 103.0 °F
DOUBLE CLOTHING LAYERS	100% Work /0% Rest	84.4 to 85.3 °F	79.8 to 80.6 °F
	90% Work /10% Rest	85.4 to 87.5 °F	81.7 to 82.5 °F
	80% Work /20% Rest	87.6 to 90.3 °F	82.6 to 85.1 °F
	70% Work /30% Rest	90.4 to 94.0 °F	85.2 to 88.4 °F
	60% Work /40% Rest	94.1 to 99.0 °F	88.5 to 93.1 °F
	50% Work /50% Rest	99.1 to 106.4 °F	93.2 to 100.0 °F

- Table 2 gives the number of required minutes of rest at various percentages for 20 minutes, 1 hour, 1.5 hour and 2 hour work cycles. (This is the amount of rest time that would be incorporated into a 20 minutes, 1 hour, 1.5 hour and 2 hour work cycle.)

Table 2 Rest Time per Work Cycle

% Rest	20 Minute Work Cycle (Minutes Rest)	1 Hour Work Cycle (Minutes Rest)	1.5 Hour Work Cycle (Minutes Rest)	2 Hour Work Cycle (Minutes Rest)
10%	2	6	9	12
20%	4	12	18	24
30%	6	18	27	36
40%	8	24	36	48
50%	10	30	45	60

4.1.4.1. Work Zone Determination

The supervisor will compare the work area with the established criteria for zones 1-4. Due to the progression of construction and/or movement of the sun, physical conditions in the work area may change requiring a reevaluation of the work area to determine the appropriate work/rest cycle for that change.

- **Zone 1:** Inside a building without an operating HVAC system, with no radiant heat load (no direct sun). This is the least restrictive work location for applying the TLVs.
- **Zone 2:** Outside with no radiant heat load (no direct sun).
- **Zone 3:** Outside with a radiant heat load (with direct sun).
- **Zone 4:** Outside with a radiant heat load (with direct sun) and no air movement (cell).

NOTE: Additional zones may be added by FSM as new heat sources are created (e.g., boiler room).

4.1.4.2. Metabolic Rate Determination

Refer to the descriptions in Table 3 below to determine the metabolic rates. To establish the metabolic rate for the work evaluate the physical demand of the work activity and if the activity is continuous i.e., conducted for 40 minutes or more in a 60 minute period. **The DS determines the metabolic rate of the jobs being performed with technical input from FSR.**

Table 3 Metabolic Rates

ACGIH Examples of Work Load Level for Typical Tasks Basis for TLV Exposure Limit	
Metabolic Rate 1 **180 watts/hr** (This work level applies approximately 75 % of the time)	• Sitting with moderate arm and leg movements • Standing with light work at machine or bench using mostly arms • Pulling cable through conduit or general electrical wiring • Painting • General carpentry • Housekeeping • Plumbing and electrical work • Standing with light to moderate work at machine or bench and some walking • Cutting rebar, welding, grinding (Continuous - minimum 40 minutes per hour)
Metabolic Rate 2 **300 watts/hr** (This work level applies approximately 20 % of the time)	• Walking about with moderate lifting and pushing 20-30 lbs • Putting up dry wall, framing carpentry, carrying and tying rebar. • Finishing concrete; masonry and block work • Scrubbing in a standing position (Continuous - minimum 40 minutes per hour)

4.1.4.3. Clothing Determination

Determine clothing based on the following criteria:

- **Single layer of clothing:** Traditional work uniform of a long-sleeved shirt and pants or one pair of full body coveralls over/under clothing.
- **Double layer of clothing:** Clothing ensemble representing cloth overalls over the work uniform described above. Equivalent to two pair of full body coveralls over under clothing or welding PPE or semi-permeable full body suit over work clothes.

NOTE: If three or more layers of clothing are worn or impermeable PPE is worn over work clothing, contact FSR for effect to work/rest cycle determination.

4.2 Cold Stress Environments

The following subsections provide information on preparation of cold weather, cold weather controls, and work/rest cycles.

4.2.1 Cold Weather Preparation

Starting in October, supervision with the assistance from FSR begins planning for the upcoming cold weather.

Workers are to receive the following:

- A review of the pertinent elements of Appendix B in this procedure; specifically, the importance of layered clothing and of keeping dry.
- A caution to avoid working in the cold conditions when clothing is wet, and encouragement to:

- Have a change of clothing and insulated shoes available during cold weather conditions.
- Wear synthetic fabrics such as polypropylene next to the skin to ensure dryness.
- Wear clothing that does not restrict flexibility
- Consider the additional weight and bulkiness of clothing when planning work.

NOTE: The use of rain wear in cold environments, when doing moderate to heavy work, increases the wetting of the inner layers of clothing from sweat.

4.2.2 Cold Weather Controls

When the ambient temperature falls to 20 °F or below considering wind chill, safety controls are to be implemented. In selecting cold weather actions, the following are provided:

- Encourage all workers to apply pertinent elements of Appendix B in applying self-determination to limit exposure, recognize changes to their physical conditions and to promote awareness of cold stress signs to limit exposure.
- Workers to initiate discussion of cold related environmental conditions during the STARRT card briefing specific to the area where work is performed.
- Use a buddy system for co-workers to regularly check on one another to observe signs or symptoms of cold stress. If signs or symptoms are observed, co-workers take immediate action to seek heated shelters.
- Cover exposed skin as much as possible.
- Plan work so it is performed away from windy, drafty, or unprotected areas, as much as possible.
- Schedule new workers so they rotate into cold stress weather work and not require full shifts during the first days of employment, so as to become accustomed to the working conditions and required protective clothing.

4.2.3 Work/Warming Cycle

When the air temperature drops to −15 °F (also providing consideration for wind chill factor) then consider the implementation of work/warming cycles as outlined by ACGIH Cold Stress TLVs.

NOTE: Depending on the medical condition of the individual worker, the work-warming regimen can be modified to ensure an individual's safety.

NOTE: The record low temperature for Oak Ridge, TN is -17 °F (*USTravelWeather.com*).

5.0 RECORDS

All records generated as a result of this procedure are maintained in accordance with Y15-101, *Records and Controlled Documents*, and Y15-95-800, *UPF Document Management.*

- None

6.0 REFERENCES

6.1 Source References

- TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists.
- Bechtel ES&H Core Process 314, *Heat and Cold Stress Prevention*

7.0 EXHIBITS / APPENDICES / FIGURES

Appendix A, *Heat Stress Information*

Appendix B, *Symptoms of Cold Exposure and Cold Stress Factors*

Appendix A
Heat Stress Information
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A.1 Heat Stress Risk Factors [Bechtel Core Process, CP-314, Heat and Cold Stress Prevention, page 1]

Consider the following risk factors when evaluating a work environment for heat stress potential:

a. High ambient temperatures.
b. Work performed in containment tents (greenhouses) or other environments with minimal air movement during conditions that could result in heat buildup.
c. Humidity.
d. Use of protective clothing (coveralls, Tyvek coveralls, semi-permeable, or impermeable chemical protective clothing) that can impair the body's ability to regulate heat.
e. Work requiring moderate to heavy physical labor (especially when heavy clothing is worn).
f. Sources of radiant heat, such as steam pipes, boilers, and heated vessels.
g. Direct physical contact with hot objects.

A.1.1 Causes and Symptoms

Heat stress may occur any time that work is being performed at elevated temperatures or when protective clothing is worn. Heat stress symptoms include fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild to fatal. Because heat stress is one of the most common and potentially serious problems that workers encounter, regular monitoring and preventive measures are vital. Employees must learn to recognize and treat the various forms of heat stress.

A.1.2 Preventive Measures

At all project/facilities, the listed steps are to be followed:

- Suggest that employees drink 500 ml of water before beginning work in the morning and after lunch.
- Provide disposable cups and water.
- Urge employees to drink water during the day.
- Provide a cool (preferably air-conditioned) area for rest breaks.
- Discourage the use of alcohol during non-working hours, and discourage the intake of coffee during working hours.
- Monitor employees for signs of heat stress.
- An employee with high blood pressure must be monitored often, and extra precautions should be taken (e.g., drink more water).

- Acclimate employees to work conditions by slowly increasing their workloads (i.e., do not begin work activities with extremely demanding tasks).
- Where appropriate, provide cooling devices to aid natural body ventilation. Because these devices add weight, their use should be carefully considered and properly balanced against worker efficiency.
- Ensure that adequate shelter is available to protect personnel from heat which can decrease physical efficiency and increase the probability of heat stress. If possible, set up the command post in the shade.
- Maintain good hygienic standards by frequent changes of clothing and showering.
- Clothing should be permitted to dry during rest periods.
- Employees should immediately report any skin problems to their supervisor.
- Provide initial and on-going information regarding heat stress recognition and prevention.

A.1.3 Heat Stress Disorders

A number of disorders associated with excessive exposure to hot working conditions can pose serious, even life threatening effects on individuals. These are described as follows:

A.1.3.1 Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by chafing clothes. The condition decreases a person's ability to tolerate heat.
Symptoms: The symptoms of heat rash include mild, red rash, especially on areas of the body in contact with protective gear.
Treatment: Heat rash is treated by decreasing the amount of time workers wear protective gear and by applying powder to affected areas to help absorb moisture and decrease chafing.

A.1.3.2 Heat Cramps

Heat cramps are caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a heat exposure situation that can lead to the more serious condition of heat stroke.
Symptoms: Heat cramps are characterized by acute painful spasms of the voluntary muscles (e.g., abdomen and extremities).
Treatment: Move the victim to a cool area and loosen clothing. Have the victim drink 250 - 500 ml of water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be 5 – 8 quarts per day. Consult a physician.

A.1.3.3 Heat Exhaustion

Heat exhaustion is a state of weakness or exhaustion caused by the loss of fluids from the body. This condition, although less dangerous than heat stroke, must be treated.
Symptoms: The symptoms of heat exhaustion include pale, clammy, moist skin; profuse perspiration; and extreme weakness. The body temperature is normal, the pulse is weak and rapid, and breathing is shallow. The victim may have a headache, may vomit, and/or may be dizzy.
Treatment: Move the victim to a cool place, loosen clothing, place the victim in a head-low position, and provide bed rest. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have the victim drink a cup of water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be about 5 – 8 quarts per day. Consult a physician, especially in severe cases.

A.1.3.4 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body (i.e., the temperature control system that causes sweating stops working properly). During an episode of heat stroke, the body temperature can rise so high that brain damage and death may result if the person is not cooled quickly.
Symptoms: The symptoms of heat stroke include red, hot, dry skin (although the person may have been sweating earlier); nausea; dizziness; confusion; extremely high body temperature; rapid respiratory and pulse rate; and unconsciousness or coma.
Treatment: The victim of heat stroke should be cooled quickly to prevent permanent brain damage or death. Soak the victim in cool but not cold water, sponge the body with cool water, or pour water on the body to reduce the temperature to a safe level, 102 °F (39 C). Do not give the victim coffee, tea, or alcoholic beverages. Observe the victim and obtain medical help.

A.2 Controls

Engineered Controls:
Shaded areas with ventilation
Misters (fans)
Recirculation fans
Shading materials
Others (e.g., umbrellas)

Administrative Controls:

WBGT level jobsite monitoring
Direct industrial hygienist control of the specific work scope
Perform work in a cooler time of the day
Crew briefing on hydration (water)

Rotate tasks between workers

PPE:

Cotton coveralls
Cooling vest
Elimination or substitution of protective clothing
Hard hat cooling pads and/or neck cooling wraps

Appendix B
Symptoms of Cold Exposure and Cold Stress Factors
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B.1 Symptoms of Cold Exposure

Exposure to low temperatures may be a factor if work is done in the evening hours, if winds are high, if unpredictable weather moves in, or during the winter months. The body works best at, and tries to maintain a set internal temperature of, approximately 99 to 100 °F. When the body temperature decreases much below this set point, the body's temperature regulation system acts to conserve heat and generate new heat. The first physiologic response is constriction of blood vessels, inhibiting sweat gland function and/or shivering, and releasing extra glucose for heat production.

B.2 Hypothermia

When the body can no longer maintain core temperature by constricting blood vessels, it shivers to increase heat production. Maximum severe shivering develops when the core body temperature has fallen to 35 °C (95 °F). The most critical aspect of hypothermia is the body's failure to maintain its deep core temperature. Lower body temperatures present the following signs and symptoms:

- Persistent shivering – usually starts when core temperature reaches 35 °C (95 °F)
- Irrational or confused behavior
- Reduced mental alertness
- Poor coordination, with obvious effects on safety
- Reduction in rational decision-making

In addition, acute exertion in cold temperatures can constrict blood vessels in the heart. This is particularly important for older workers or workers with coronary disease, who may have an increased risk of heart attack.

B.2.1 Hypothermia Stages

Mild – Early signs of hypothermia include:

- Shivering
- Blue lips and fingers
- Pain in the extremities
- Numbness, itching, or burning
- Poor coordination

Moderate – The next stage includes:

- Slurred speech
- Exhaustion
- Mental impairment
- Confusion
- Poor decision-making
- Drowsiness
- Disorientation
- Inability to take precautions from the cold
- Heart slowdown/weak pulse
- Slow breathing

Severe – In severe cases, hypothermia resembles death. Patients must be treated as though they are alive. Symptoms include:

- Unconsciousness
- Heart slowdown to the point where pulse is irregular or difficult to find
- No shivering
- No detectable breathing

B.2.2 First Aid for Hypothermia

Stop further cooling of the body and provide heat to begin re-warming.

- Carefully move injured to shelter. Sudden movement or rough handling can upset heart rhythm.
- Keep injured awake.
- Contact the Medical Provider for treatment.

B.3 Frostbite

B.3.1 Signs and Symptoms

Frostbite symptoms vary, are not always painful, but often include a sharp, prickling sensation. The first indication of frostbite is skin that looks waxy and feels numb. Once tissues become hard, the case then becomes a severe medical emergency. Severe frostbite results in blistering that usually takes about 10 days to subside. Once

damaged, tissues are always more susceptible to frostbite in the future. Workers should observe each other's facial extremities (ears and nose) and exposed skin for signs of frostbite (whitening of the skin surface) or acrocyanosis (a blue, purple, or grayish hue).

B.3.2 Frostbite First Aid

Once frostbite occurs, treatment should be performed by the UPF Occupational Medical Provider.

B.4 Cold Stress Factors

Both environmental and personal health factors contribute to cold injury. Environmental factors include: exposure to cold temperatures, high humidity, high winds, contact with wetness, metal, or inadequate clothing. Personal factors include: allergies, vascular disease, excessive smoking and drinking, some medications, age, and general health condition. Cold stress is best prevented by proper hydration and diet, and by applying engineering, administrative, and personal protective controls.

Hydration – Significant water loss from the lungs and skin occurs upon exposure to the dry quality of cold air. Increased fluid intake is essential to ensure proper hydration, which allows adequate blood flow to the extremities. Coffee intake should be limited because of the diuretic and circulatory effects.

Diet – A well-balanced diet is important for individuals working in cold environments to ensure adequate stores of energy. Employee are recommended to bring warm, sweet drinks and soups to work to provide caloric intake and fluid volume.

B.5 Controls

B.5.1 Preparing the Worker

The best protection against cold-related health risks is to be aware and prepared.

- Well in advance of approaching cold weather (September/October), during the Plan of the Day and group meetings, discuss potential cold stress issues.
- As weather conditions cool, supervisors are to review the symptoms of cold stress, its potential effects, and appropriate control measures. Workers are to be able recognize the signs and symptoms of overexposure in themselves and others.
- Workers with health conditions adversely affected by cold weather, should see the UPF Occupational Medical Provider to verify their ability to work in cold weather.
- Supervision should be aware of conditions during the work shift, such as the weather forecast, and the physical condition of potentially affected workers.
- Workers should be informed about the importance of a proper diet in cold weather conditions. Include information about foods and drinks that could adversely affect their health.

B.5.2 Engineering Controls

When possible, engineering controls should be used to prevent the stress of a cold environment. Some engineering controls include:

- General or spot heating
- Wind shielding
- Insulated metal tool handles
- Use of power tools, lift assists, etc., to balance and prevent high metabolic workloads
- Provide warm rest areas when the ambient or wind chill temperature is 20 °F, or less

B.5.3 Administrative Controls

When engineering controls do not completely mitigate the hazards or are not feasible, area management and direct supervision can use administrative controls instituted including:

- Implementing work/warm-up schedules
- Encouraging workers to bring warm drinks other than coffee
- Scheduling work during the warmest part of the day
- Assigning extra workers
- Allowing workers to pace themselves
- Scheduling/planning work to avoid standing in the cold for extended periods
- Using the buddy system for personnel working in isolated cold environments, whether indoors or outdoors.
- Allowing new employees to become accustomed to the working conditions and required protective clothing
- Ensuring that workers are medically fit to work in excessive cold; the following medical conditions can increase the risk of a cold injury:
    - Heart disease, asthma/bronchitis, diabetes, vibration/white finger disease

B.5.4 Personal Protective Controls

When engineering and administrative controls are not adequate, personal protective controls should be implemented. Workers are to do the following:

- **Clothing**
    - Select protective clothing to suit the cold, the job, and the level of physical activity.
    - Wear several layers of clothing rather than one thick layer. Air captured between layers acts as an insulator.
    - Wear synthetic fabrics such as polypropylene next to the skin to wick away sweat. Clothing should not restrict flexibility.

- Have workers who get hot while working open their jackets but keep hats and gloves on.
- Recognize that if conditions are wet as well as cold, the outer clothing worn is waterproof or at least water-repellent. Wind-resistant fabrics may also be required under some conditions.
- Understand that at air temperatures of 35 °F or less, workers immersed in water or whose clothing gets wet for any reason must change clothes. A change of clothes and shoes should be available for such situations.
- Use protective clothing for the head, feet, and hands (the most important areas).

- **Head**
  - Use hard hats with approved liners to prevent heat loss from the head and to protect ears.
  - Use approved hard hat liners.
- **Feet**
  - Understand that tight-fitting footwear restricts blood flow. Use footwear large enough to allow wearing either one thick or two thin pairs of socks. Avoid wearing too many socks, which can tighten fit and harm rather than help.
  - Use socks with a high wool content (best). Change socks when wet.
- **Hands**
  - Hand warmers provide an additional heat source.
  - Avoid using tight fitting gloves that could restrict circulation to the hands and fingers.
  - Use gloves when manual dexterity is not required. When the air temperature is less than 0 °F; use glove liners with gloves.