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1.0 PURPOSE AND SCOPE

(7.1.1, 7.1.2)

This procedure provides requirements to identify, evaluate, and control worker heat stress in both indoor and outdoor work environments.

This procedure applies to all Washington River Protection Solutions LLC (WRPS) activities where heat stress conditions may be involved.

Certain medical services are outside the scope of this document, including:

- Medical intervention for treatment of heat stress illness by the first aid stations or the medical providers
- Fitness-for-duty protocol or medical certification to perform work in hot environments.

2.0 IMPLEMENTATION

This procedure is effective on the date shown in the header.

3.0 RESPONSIBILITIES

3.1 Heat Stress SME

- Coordinate with the External Affairs and Safety & Health managers to develop and print a Solutions article for heat stress mitigation during the month of May or as weather conditions dictate.
- Coordinate with the Safety & Health Manager to develop tailgate slides for company-wide presentation each week during the month of June or as weather conditions dictate.
- Provide support during the summer months for line organizations and Safety & Health to ensure heat stress mitigation activities are properly performed.

3.2 Area Maintenance Manager

Facilitates the annual kick off of summarization activities by **March 1**. This includes:

- a. Coordinate with Mission Support Alliance (MSA) Refrigerated Equipment Services to ensure that required electrical and mechanical preventative maintenance is performed.
- b. Coordinate with line organizations to ensure that sufficient long lead heat stress mitigation equipment is available to support the summer work schedule.
- c. At the end of the high heat season, coordinate with line organization managers to ensure heat stress mitigation equipment is properly stored for future use.

3.3 Industrial Hygienist

- Participate in job hazard analysis as requested to determine the potential for heat stress. Using Attachment A, assist in the determination of equipment, Personnel Protective Equipment (PPE), or techniques that should be used to mitigate the heat stress potential.
- Participate in pre-job briefings or other processes communicating the hazards associated with heat stress conditions at the work site and the control methods to be used.
- Assist line management in applying heat stress exposure guidelines using Attachment B to establish work/rest regimens.
- Identify other factors that may alter the interpretation and use of Attachment B and determine exposure limits accordingly.
- Investigate heat stress disorder cases.

3.4 Employees

- Participate in heat stress prevention activities (e.g., field condition review, pre-job briefings).
- Be aware of means to avoid heat stress.
- Select and wear personal clothing, as appropriate, to minimize body heat build-up (whether worn alone or in combination with work uniform).
- Wear appropriate PPE as required in the Heat Stress Mitigation Checklist, work package, or Radiological Work Permits (RWPs) to minimize body heat build-up.
- Understand lifestyle factors that increase the risk of heat injury or illness.
- Recognize the signs and symptoms of heat stress.
- If signs and symptoms of heat stress develop, inform supervisors and take appropriate action, such as immediately exiting the work area.

4.0 PROCEDURE

The illustration in Figure 1, should be started if: (1) a qualitative exposure assessment indicates the possibility of heat stress, (2) there are reports of discomfort due to heat stress, or (3) professional judgment indicates heat stress conditions.

4.1 Preparation for Potential Heat Stress Conditions (Medical Evaluation & Training)

Line Manager

1. Ensure that personnel assigned to work in heat stress conditions have been identified for this work activity through the employee job task analysis process ([TFC-ESHQ-S_IH-C-17](#)).
2. Ensure that employees who are working in or supervising work in hot environments have been briefed in heat stress recognition, prevention, and control (see Attachment C).

4.2 Identification of Potential Heat Stress Conditions/Plan Controls

- Line Manager
1. If, during the job hazard analysis process ([TFC-ESHQ-S_SAF-C-02](#) or field condition review, a potential for heat stress is identified, obtain support from the Industrial Hygienist to evaluate hazards and recommend controls.

NOTE: The potential for heat stress shall be considered whenever: (1) ambient temperatures are greater than 85°F; (2) or work load is heavy to very heavy; or (3) the utilized clothing ensemble will be greater than a traditional work uniform (see Attachment C).

- Industrial Hygiene/
Field Work
Supervisor
2. Consider environmental monitoring for wet bulb globe temperature (WBGT) whenever any of the above-mentioned conditions exist for heat stress.

NOTE: For the use of air conditioned controls in a controlled area or radiologically controlled area, see [TFC-ESHQ-RP_ADM-CD-21](#).

- Industrial Hygienist
3. As part of the job hazard analysis process or field condition review, provide required guidance and recommendations of the following:
 - Workload category (see Attachment D).
 - Acclimatization status (see Attachment D).
 - Use of clothing that severely restricts heat removal, such as water-vapor-impermeable, air-impermeable, and thermally-insulating clothing; encapsulating suits; or multiple-layered clothing, e.g., clothing types not specified in Attachment B, Table B-1.
 - Use of personal protective equipment to prevent heat stress, e.g., vortex coolers, ice vests, cool vests, breathable anti-contamination suits, and OREX or GORTEX water proof suits instead of impermeable suits when dealing with particulate radioactivity.
 - Anticipated work shifts of more than eight hours.
 - Use of physiological monitoring in accordance with Attachment E, or other heat stress management controls not listed.

4.3 Applying Heat Stress Control Strategies - Items Requiring Lead Time

- | | | |
|----------------------|----|---|
| Line Manager | 1. | Control strategies identified in Section 4.2, step 2, requiring long lead times for approval and purchase will be implemented in a timely manner so that the control strategy will be available, when needed. |
| | | NOTE: Special engineering controls, personal protective equipment, and some changes in work schedules are examples of longer lead-time controls. |
| Industrial Hygienist | 2. | Assist line management, as requested, in the purchase, issue, and use of cooling devices or other protective equipment. |

4.4 Applying Heat Stress Control Strategies - Daily Work Management

- | | | |
|---|----|---|
| Line Manager | 1. | Ensure cool water/fluids are provided to workers (see Attachment C). |
| | | NOTE: For providing water in a radiological contamination area, see TFC-ESHQ-RP_MON-C-22 . |
| Industrial Hygienist | 3. | Advise management of worker acclimatization status. |
| Line Manager | 4. | Implement acclimatization status established above for individuals working in potential heat stress environments. |
| | 5. | As appropriate, provide for a rest area that is properly shaded with additional cooling and misting equipment when appropriate. |
| | 6. | Communicate to affected employees in regular pre-job briefings expected temperature readings/environmental data, as well as first aid/emergency procedures for heat stress related illnesses, work uniform expectations, and additional heat stress information as necessary. |
| Line Manager/
Industrial Hygiene
Technician | 7. | Establish work/rest regimens for work groups using WBGT data, classification of the work activity level (work load), and the information in Attachment B. |

NOTE 1: Work activity level and acclimatization requirements are provided by the Industrial Hygienist. These requirements should be documented in the Supervisor's Field Log and/or the Industrial Hygiene WBGT Field Log.

NOTE 2: WBGT monitoring should be conducted when temperatures of 90°F (Dry bulb) or 84°F (Wet Bulb) are encountered for unacclimatized employees working in single layer clothing, performing moderate work.

NOTE 3: WBGT monitoring should be conducted when temperatures of 80°F (Dry bulb) or 75°F (Wet Bulb) are encountered for unacclimatized employees working in multiple clothing layers performing moderate work.

8. If directed by the Industrial Hygienist (or by work planning controls), ensure that work site WBGT readings are taken at the job site and are representative of work conditions (see Attachment D).

NOTE: Where work site WBGT monitoring is unspecified, general WBGT data from the U.S. Department Of Energy (DOE) Hanford Meteorological Station may be used to estimate the WBGT values for some outdoor activities. For data, see: www.hanford.gov/hms.

Line Manager/
Industrial Hygiene
Technician

9. If using DOE WBGT data (line manager) or if performing WBGT monitoring (Industrial Hygiene Technician), contact the Industrial Hygienist for guidance if:

- Work/rest regimen meets or exceeds 50% rest, or
- Work shift will exceed eight hours.

Line Manager

10. When work site WBGT readings are obtained, ensure that the direct reading instrument number is obtained and documented in the work package.

NOTE: It is NOT necessary to log WBGT readings obtained from the DOE weather station.

11. Communicate to the effected personnel during the pre-job briefings the planned use of heat stress mitigation techniques and then ensure that the additional heat stress monitoring or control strategy specified in the work planning process is implemented (personal monitoring, personal protective equipment controls for heat stress, etc.).

Industrial Hygienist

12. When physiological monitoring is required, collect, interpret, and document work site specific personal heat stress and environmental monitoring data.

5.0 DEFINITIONS

Core body temperature. The temperature of the internal core body. Both ACGIH and National Institute for Occupational Safety and Health (NIOSH) cite a core body temperature of 100.4°F as the limit for daily, prolonged work under heat stress conditions. Measured in the field either by tympanic, skin, or oral temperature readings.

Heat strain. Physiological response to heat stress recognized by: increased core body temperature, increased heart rate or sweating. If these responses are uncontrolled, these symptoms may progress and result in increased incidence of heat stress disorders and accident rates.

Heat stress. The total heat load on the body that results from exposure to external sources and from internal metabolic heat production due to physical work. It occurs when the body produces

or gains more heat than it is capable of giving off or losing. Contributing environmental factors affecting the potential for heat stress include air temperature, humidity, radiant heat exchange, and air movement.

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, use of protective clothing that impedes sweat evaporation or WBGT temperatures in excess of 75°F.

Heart (Pulse) Rate Monitoring. The monitoring of an individual's heart rate in beats per minute to determine the effect of heat on a person's core body temperature.

Rest. Includes sitting quietly in place or sitting with moderate arm movements in the same environment as the work activity. (See the industrial hygienist for further clarification.). NOTE: resting in air conditioning after work in hot environments can hinder work performance.

Threshold limit values (TLV) for heat stress. ACGIH values incorporate work exertion level, personal protective equipment in use, and WBGT temperatures to determine a work/rest regimen that permit nearly all workers to be repeatedly exposed to hot work environments without adverse health effects. Threshold limit values are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and dietary salt intake should be able to function effectively under the given working conditions without exceeding a core body temperature of 100.4°F.

Wet bulb globe temperature. 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 regimen. The proportion of time that an individual spends working and resting during an hour duration, and is established based on the WBGT index, work activity level (work loads) exertion level, personal protective equipment worn, and acclimatization status.

6.0 RECORDS

The following records are generated during the performance of this procedure:

- Industrial Hygiene Direct Reading Instrument Survey form (A-6003-860)
- Industrial Hygiene WBGT Field Log (A-6004-079)
- Industrial Hygiene Continuation Form (A-6004-020)
- Industrial Hygiene Technician's Monitoring Field Notes
- Industrial Hygiene Heart Rate Monitoring Form (Attachment F).

All readings from the survey shall be documented on the Sample Heart Rate Monitoring Form and, if needed, the Industrial Hygiene Continuation Form, or the Industrial Hygiene Technician's Monitoring Field Notes.

Any maintenance activities involving equipment identified in this procedure must be approved by the Industrial Hygiene Technician supervisor, and recorded on the Instrument and Equipment Maintenance Record.

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The record custodian identified in the Company Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with [TFC-BSM-IRM_DC-C-02](#) and [TFC-ESHQ-S_IH-C-46](#).

7.0 SOURCES

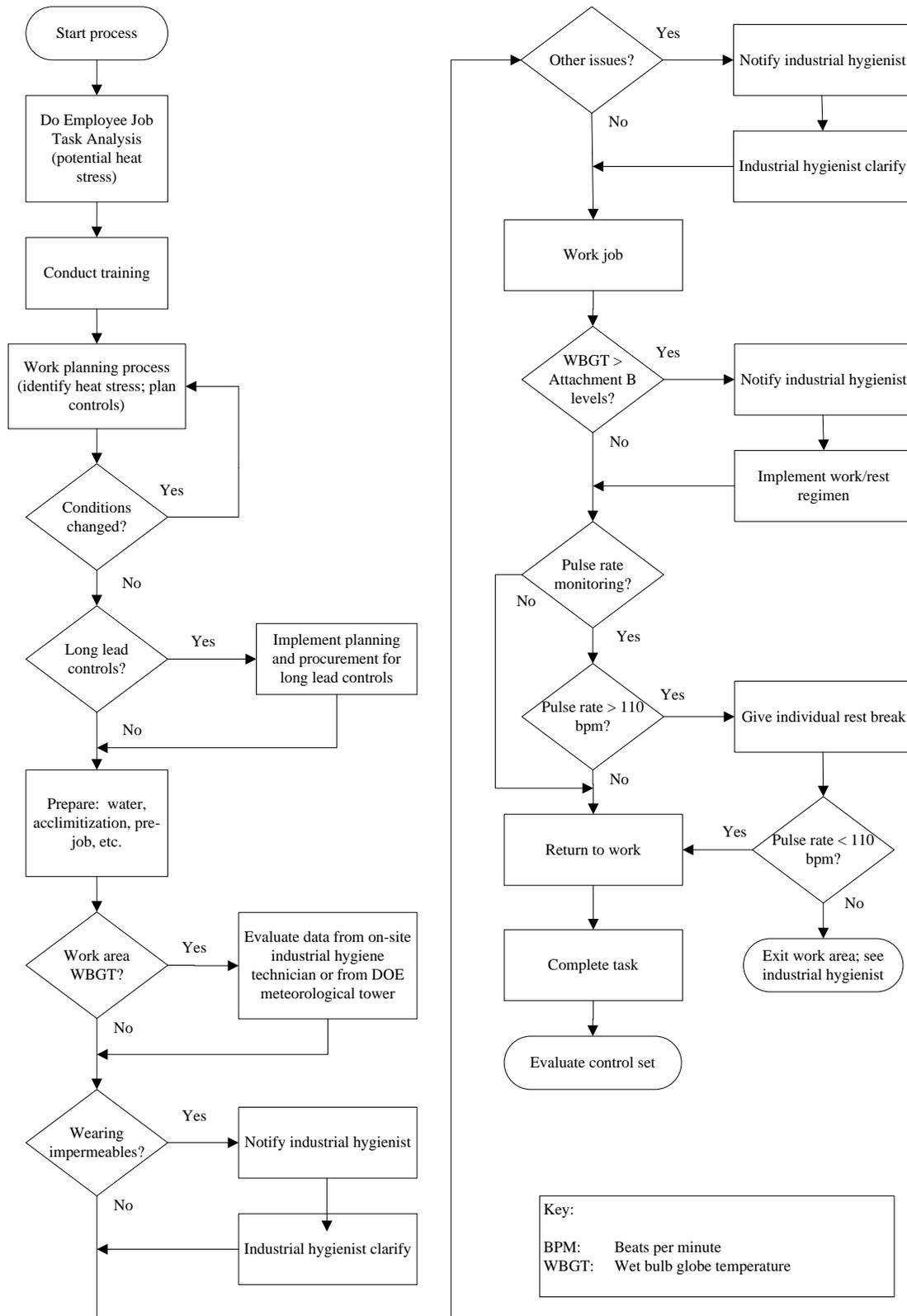
7.1 Requirements

1. 10 CFR 851, "Worker Safety and Health Program."
2. American Conference of Governmental Industrial Hygienists (ACGIH), "Threshold Limit Values for Chemical Substances, Physical Agents and Biological Exposure Indices."

7.2 References

1. 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."
2. 29 CFR 1926.10(a), "Scope of Subpart."
3. 29 CFR 1926.65, "Hazardous Waste Operations and Emergency Response."
4. Nonin Operator's Manual, 9500 Onyx Finger Pulse Oximeter, English, Nonin Medical, Inc. Plymouth, Minnesota, USA, December 1998.
5. TFC-BSM-IRM_DC-C-02, "Records Management."
6. TFC-ESHQ-RP_ADM-CD-21, "Radiological Controls for Heat and Cold Mitigation."
7. TFC-ESHQ-RP_MON-C-22, "Drinking in a Contamination Area or Radiological Buffer Area."
8. TFC-ESHQ-S_IH-C-17, "Employee Job Task Analysis."
9. TFC-ESHQ-S_IH-C-46, "Industrial Hygiene Reporting and Records Management."
10. TFC-ESHQ-S_IH-D-26, "Using Heat Stress Monitors."
11. TF-OPS-IHT-012, "Preparation and Field Use of the QUESTemp 15 and QUESTemp 32 Heat Stress Monitors."
12. TFC-OPS-MAINT-C-02, "Pre-Job Briefings and Post-Job Reviews."

Figure 1. Heat Stress Control.



ATTACHMENT A - HEAT STRESS MITIGATION CHECKLIST

This check list should be used as guidance when a job or job hazard analysis identifies the potential for workers to work in a heat stress environment where the WBGT indicates additional controls are required. This can also be triggered by the wearing of impermeable protective suites and applies to both an acclimated and unacclimated work force. Field work supervisors, safety professionals and the work force should evaluate the complete scope of the work, identify when a potential for heat stress is present and determine mitigation of the potential using ALARA concepts. The mitigation should be implemented using engineering controls, administrative controls, PPE, and/or physiological monitoring or combination of the above.

Engineered Controls:

___ Containment Tent with recirculating air conditioning

___ Containment Tent with once through air conditioning

___ Containment Tent with swamp cooling air conditioning

___ Misters, fan mounted

___ Misters, tubing runs without fans

___ Recirculating Air with fans/blowers if temperatures are < 95°F (dry bulb)

___ Shade (structural, tents, etc.) placed upwind/away from work area

___ Other _____

Administrative Controls:

___ WBGT jobsite monitoring by IH

___ Direct Industrial Hygienist control of the specific work scope

___ Perform work in a cooler time of the day (tropical shifts, night shifts, etc.)

___ Rotate Tasks between workers.

___ Other _____

ATTACHMENT A - HEAT STRESS MITIGATION CHECKLIST (cont.)

PPE:

- ___ Cooling vest
 - ___ Water-cooled vest/shirt
 - ___ OREX PVA coveralls, single or double set, depending on radiological conditions
 - ___ OREX PVA coveralls, water proof, when the potential for liquid exposure exists
 - ___ Camel back water hydration when wearing protective clothing including an air fed hood.
 - ___ Other _____
-

Physiological Monitoring:

- ___ Heart Rate Pulse monitoring for screened work force (Attachment F)
 - ___ Bodyweight Monitoring (pre-post body weight should not exceed 1.5%) in any work period
 - ___ Core Body Temperature (should not exceed 38°C / 100.4°F)
 - ___ Other (Approved by Management Directive) _____
-

ATTACHMENT B – GUIDANCE FOR ESTABLISHING WORK/REST REGIMENS

Table B-1 provides the ACGIH heat stress threshold limit values (work/rest regimens) for different clothing types and work activity levels. The presumption of ACGIH, and this procedure, is that activities under heat stress conditions are to be controlled in work/rest cycles of no greater than one hour increments. The application of work/rest regimens varies depending on the work activity level (work load), WBGT indices, clothing, worker's level of acclimatization, and water availability. See notes below for restrictions/conditions in applying this table.

INSTRUCTIONS:

1. Contact the Industrial Hygienist to obtain the estimated work activity level (workload) and acclimatization assessment - use the applicable section of the table. These requirements should be documented in the Supervisor's Field Log and/or the Industrial Hygiene WBGT Field Log.
2. Determine the type of clothing ensemble worn - use that section of the table. (See definitions section of this procedure for information on clothing types identified in Table B-1).
3. Measure (or estimate) work site specific WBGT values. (Estimated values can be based on data provided by the DOE weather station.) Per ACGIH, where WBGT values vary significantly within any work/rest cycle an average (e.g., representative) value should be used.
4. Within the table sections selected in steps 1 and 2 above, find the WBGT value in step 3 that corresponds to the WBGT range in the table.
5. Read to the left to find the work-rest regimen to be applied.
6. Consult Industrial Hygiene for guidance if:
 - Conditions are in the 50/50 and 25/75 percent column of the table
 - Work shifts of more than eight hours.

NOTES:

- Table values assume eight-hour work days in a five day work week with conventional breaks.
- Table values assume rest is in the same environment (WBGT level) as the work activity (see industrial hygienist for further guidance).
- Consult the industrial hygienist for any equivalencies of clothing ensembles worn not listed in the definitions.
- This table assumes employees do not wear protective equipment to reduce heat exposure.
- In accordance with interpretive guidance from the American Conference of Government Industrial Hygienists, no correction factors will be applied to workers wearing air purifying or air-line respirators. The correction factor for a self-contained breathing apparatus (SCBA) will be an increase by one Work Demand (work load) for the proposed work activity.
- All temperatures are degrees Fahrenheit (F°)

**ATTACHMENT B – GUIDANCE FOR ESTABLISHING WORK/REST REGIMENS
(cont.)**

- This table does not provide limits for wearing encapsulating suits (Level A)

Table B-1 Work-Rest Regimens.
(See instructions and notes on the previous page)

		ACCLIMATIZED				UNACCLIMATIZED			
	Work Demands	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
ONE CLOTHING LAYER	100% Work	<85.1	<81.5	<78.8	n/a	<81.0	<77.0	<72.5	n/a
	75% Work 25% Rest	85.1 - 86.9	81.5 - 83.3	78.8 - 81.5	n/a	81.0 - 84.2	77.0 - 79.7	72.5 - 76.1	n/a
	50% Work 50% Rest	87.0 - 88.6	83.4 - 85.1	81.6 - 83.5	<81.5	84.3 - 86.0	79.8 - 82.4	76.2 - 79.7	<77.0
	25% Work 75% Rest	88.7 - 90.5	85.2 - 87.8	83.6 - 86.0	81.5 - 85.1	86.1 - 87.8	82.5 - 84.2	79.8 - 82.4	77.0 - 79.7
TWO LAYERS	100% Work	<78.8	<75.2	<72.5	n/a	<75.2	<70.7	<66.2	n/a
	75% Work 25% Rest	78.8 - 80.6	75.2 - 77.0	72.5 - 75.2	n/a	75.3 - 77.9	70.8 - 73.4	66.3 - 69.8	n/a
	50% Work 50% Rest	80.7 - 82.4	77.1 - 78.8	75.3 - 77.0	<75.2	78.0 - 79.7	73.5 - 76.1	69.9 - 73.4	<70.7
	25% Work 75% Rest	82.5 - 84.2	78.9 - 81.5	77.1 - 79.7	75.3 - 78.8	79.8 - 81.5	76.2 - 77.9	73.5 - 76.1	70.8 - 73.4
THREE LAYERS	100% Work	<76.1	<72.5	<69.8	n/a	<72.5	<68.0	<63.5	n/a
	75% Work 25% Rest	76.2 - 77.0	72.6 - 74.3	69.9 - 72.5	n/a	72.6 - 75.2	68.1 - 70.7	63.6 - 67.1	n/a
	50% Work 50% Rest	77.1 - 79.7	74.4 - 76.1	72.6 - 74.3	<72.5	75.3 - 77.0	70.8 - 73.4	67.2 - 70.7	<68.0
	25% Work 75% Rest	79.8 - 81.5	76.2 - 78.8	74.4 - 77.0	72.6 - 76.1	77.1 - 78.8	73.5 - 75.2	70.8 - 73.4	68.1 - 70.7
LIMITED USE VAPOR BARRIER COVERALL	100% Work	<65.3	<61.7	<59.0	n/a	<61.7	<57.2	<52.7	n/a
	75% Work 25% Rest	65.4 - 67.1	61.8 - 63.5	59.1 - 61.7	n/a	61.8 - 64.4	57.3 - 59.9	52.8 - 56.3	n/a
	50% Work 50% Rest	67.2 - 68.9	63.6 - 65.3	61.8 - 63.5	<61.7	64.5 - 66.2	60.0 - 62.6	56.4 - 59.9	<57.2
	25% Work 75% Rest	69.0 - 70.7	65.4 - 68.0	63.6 - 66.2	61.8 - 65.3	66.3 - 68.0	62.7 - 64.4	60.0 - 62.6	57.3 - 59.9

**ATTACHMENT B – GUIDANCE FOR ESTABLISHING WORK/REST REGIMENS
(cont.)**

CLOTHING LAYER DESCRIPTIONS

Consult the Industrial Hygienist for further equivalencies.

One clothing layer: Traditional work uniform of a long-sleeved shirt and pants or one pair of Anti-Cs over modesty clothing.

Two layers: Clothing ensemble representing cloth overalls over the work uniform above. Equivalent to two pair of Anti-Cs over modesty clothing.

Three layers: Clothing ensemble representing two pair of cloth overalls (or two pair of Anti-Cs over the summer uniform. Equivalent to three pair of Anti-Cs over modesty clothing.

Modesty clothing: Personal choice clothing ensemble including shoes, socks, briefs, shorts, and T-shirt (scrubs, or equivalent loose/light garments may be substituted for shorts and/or T-shirt) to be worn under layers noted above.

NOTES:

- Work and rest areas are assumed to be in same environments
- Rest areas should allow for a decrease in core body temperature via shade, cooling mechanisms, removal of PPE, fans, etc. when possible, in addition to proper hydration
- The Work-Rest regimen starts with the work phase followed by the rest phase (i.e., progress from 100% work to 75% work, followed by 25% rest
- The Work-Rest regimen is evaluated hourly and adjusted as necessary (i.e., the work-rest phases should total no more than 1 hour in length)
- TWAs for work rates should be used when work demands vary significantly within the hour.

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ATTACHMENT C – HEAT STRESS SUPPLEMENTAL CRITERIA

1.0 CONTROLS FOR HEAT STRESS

Use Attachment A to develop the control set for Heat Stress Mitigation.

2.0 DRINKING WATER/FLUIDS

Maintaining adequate body hydration is an important protective measure against heat strain. General guidelines for fluid intake to maintain body hydration are as follows:

- Ensure water is accessible to employees in the work area
- Water should be cool
- Drink small volumes (approximately 1 cup) of cool water about every 20 minutes
- Salt tablets should not be used as part of fluid supplementation.

3.0 HEAT STRESS BRIEFING CONTENT

Heat stress briefings will address the following information:

- Identification of heat stress hazards and potential health effects
- Predisposing factors and relevant signs and symptoms of heat injury and illness
- Information on water intake replacement
- Heat stress control strategies such as work practices and engineering controls, proper acclimatization, and proper use of heat stress personal protective equipment
- Potential for therapeutic drugs, over-the-counter medications, or social drugs (including alcohol) to increase the risk of heat injury or illness by reducing heat tolerance
- Other factors such as: lifestyle, age, gender, or medical conditions.

4.0 HEAT STRESS RISK FACTORS

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

- a. High ambient temperatures.

NOTE: For the Hanford Site there is a risk of outdoor heat stress from May 1 until October 1.

- b. Work performed in greenhouses (containment tents) or other environments with minimal air movement during conditions that could result in heat buildup.
- c. Humidity.

ATTACHMENT C – HEAT STRESS SUPPLEMENTAL CRITERIA (cont.)

- d. Use of protective clothing (coveralls, Tyvek¹ 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 where heavy clothing is worn).
- f. Sources of radiant heat, such as steam pipes, boilers, heated vessels.
- g. Direct physical contact with hot objects.

¹ Tyvek is a registered trademark of E. I. du Pont de Nemours and Company.

ATTACHMENT D – HEAT STRESS TECHNICAL CRITERIA

1.0 WBGT INSTRUMENTATION FOR HEAT STRESS MONITORING

Thermal stress is a function of air temperature, solar and thermal radiation, relative humidity, air movement, and the physiologic condition of the worker. Where conditions of humidity, sunlight, or radiant heat exist, dry bulb measurements alone are inadequate as indicators of the proper work/rest regimen. Environmental monitoring instrumentation is obtainable through the Industrial Hygiene Group and the Site Industrial Hygiene Equipment Lab. Automated equipment is available that integrates the three temperature measurements and provides a digital readout. If equipment is used that provides individual wet bulb, globe, or dry bulb temperature measurements, use one of the two WBGT indices below:

(a) Equation 1 is applicable to outdoor conditions with solar load:

$$\text{WBGT} = 0.7 (\text{wet bulb temp.}) + 0.2 (\text{globe temp.}) + 0.1 (\text{dry bulb temp.})$$

(b) Equation 2 is applicable to indoor/outdoor conditions without solar load:

$$\text{WBGT} = 0.7 (\text{wet bulb temp.}) + 0.3 (\text{globe temp.})$$

2.0 WBGT MONITORING - GENERAL AREA

The DOE weather station provides WBGT readings during daylight hours, Monday through Friday, between May 1 and October 1, and until 12:00 p.m. on weekends and holidays. These readings are taken between the 200 East and 200 West Areas, and can be used as representative for most outdoor locations at Hanford. However, depending on specific work site conditions, the readings may not directly apply to any given work site.

As determined by Industrial Hygiene, supplementary WBGT readings may be necessary when work is performed inside containment tents, greenhouses, or other enclosures between the spring and fall months (approximately May 1 to October 1).

3.0 WBGT MONITORING - WORK SITE SPECIFIC

Conditions that may warrant work site WBGT readings include:

- Work performed in greenhouses, containment structures, or other enclosures, buildings or facilities during hot conditions with potential for heat stress.
- Use of protective clothing not covered by the descriptions in **Error! Reference source not found.**
- As prescribed by Industrial Hygiene.

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ATTACHMENT D – HEAT STRESS TECHNICAL CRITERIA (cont.)

4.0 HEAT STRESS ACCLIMATIZATION

Acclimatization requires physical activity under heat stress conditions similar to those anticipated for the work being performed. A person is considered acclimatized if they have a recent history of heat-stress exposures of at least 2 continuous hours for 5 of the last 7 days to 10 of the last 14 days. This is consistent with guidance from the Hanford Site Occupational Medical contractor that for individuals living in the Hanford area who regularly perform outdoor work activities, heat stress acclimatization is a natural process that accompanies the seasonal onset of warmer weather.

- Hanford Site workers are considered acclimated to heat stressful conditions after consistent exposures to temperatures of > 85°F (dry bulb).
- This assumes a single clothing layer as a traditional work uniform, no vapor impermeable clothing, and moderate work activities.

The acclimation status beyond the traditional work uniform, moderate work activities or use of vapor barrier clothing will require assistance from the organizational Industrial Hygiene representative and will be the responsibility of the Field Work Supervisor.

- Workers are assumed to be unacclimatized until the proper level of heat stress exposure occurs to classify them as acclimatized.
- An employees' acclimatization status may not apply to work in impermeable or excessively heavy clothing, sudden heat waves, or work near radiant heat sources – consult IH for unusual conditions.
- New hires, shift workers, and workers with extended time off due to illness, vacation, etc, may be considered unacclimatized, depending on the length of time away. New hires and shift workers performing similar tasks at other jobs/shifts should contact Industrial Hygiene for acclimatization status.
- When developing an acclimatization plan, consider the following during the initial heat stress exposure:
 - Assign light work loads
 - Allow longer rest periods
 - Assign work in heat stress conditions for at least 2 hours/day
 - Gradually increase the amount of time of work in the heat each day
 - Observe workers' responses to the change in conditions
 - The acclimatization process may be prolonged if work days are interspersed with days off or changes in shift; when levels of PPE vary on a daily basis; or, if exposure times vary considerably daily.

ATTACHMENT D – HEAT STRESS TECHNICAL CRITERIA (cont.)

Loss of acclimatization generally begins when the activity under those heat stress conditions is discontinued. A noticeable loss may occur after 4 days without exposure and may be completely lost in 3 to 4 weeks.

5.0 ESTIMATING WORK ACTIVITY LEVELS

Work activity levels (work load) are determined by the industrial hygienist and based on the following ACGIH categories.

- Rest includes sitting quietly in place or sitting with moderate arm movements and is in the same environment (WBGT level) as the work activity. Relocation to a shaded environment or cooled area and/or removal of personal protective equipment to allow for more effective cool-down between work periods may be considered where necessary.

NOTE: If work and rest environments are different, ACGIH recommends that hourly time-weighted averages should be calculated and used.

- Light work includes sitting with moderate arm and leg movements; standing with light work at a machine or bench while using mostly arms or with some walking about; using a table saw.
- Moderate work includes scrubbing in a standing position; walking about with moderate lifting or pushing; walking on level at 6 km/hr while carrying a 3 kg weight load.
- Heavy work includes hand sawing carpentry; shoveling dry sand; heavy assembly work on a non-continuous basis; intermittent heavy lifting pushing or pulling (e.g., pick-and-shovel work).
- Very heavy work includes strenuous work such as shoveling wet sand.

Per ACGIH guidance, work activity levels should be assessed based on essentially continuous activity levels within one-hour intervals. Time-weighted averages for work rates should be used when the work demands vary within the hour.

ATTACHMENT E – PHYSIOLOGICAL MONITORING FOR HEAT STRESS

This attachment provides guidance for conducting physiological monitoring of employee heart (pulse) rate in conjunction with evaluating potential heat stress. Physiological monitoring will be conducted at the direction of the Industrial Hygienist and utilized when work activities cannot be conducted within Work/Rest Regimens outlined in Attachment B. Physiological Monitoring should be used when the opportunity for other controls (e.g., work/rest regimens, cooling vests, performing work at cooler times of the day, etc.) have been exhausted.

Physiological monitoring will be conducted using an IH approved Heart Rate Monitor following manufacturer's instructions (e.g., Nonin Onyx heart rate monitor, or other approved monitor).

General Operation

Begin physiological monitoring when directed by the project Industrial Hygienist. Circumstances that may result in initiating physiological monitoring are the use of impervious clothing or other conditions detailed in Attachment A that requires consultation with the project industrial hygienist. Details of this attachment will be discussed in the pre-job meeting by the project industrial hygienist.

Pre-Survey

Industrial Hygiene
Technician

1. Prior to starting work, establish the means for notification of the Field Work Supervisor (FWS) and project industrial hygienist for reporting when a recovery heart rate cannot be attained by a worker after two rest periods, or any worker exhibits symptoms of heat stress.
2. Record all appropriate data, work location, task description, clothing requirements and the pre-work, resting heart rate for each employee (see Attachment E: INDUSTRIAL HYGIENE HEART RATE MONITORING FORM).

- a. Calculate and record each worker's target heart rate. The worker's permissible pulse rate or target rate is calculated as follows:

Target rate = 180 minus the person's age.

Example: for a 44 year old person, their target heart rate would be 136 beats per minute ($180 - 44 = 136$).

3. If the worker's pre-work resting heart rate is greater than 110 bpm, they cannot work in a heat stress environment. (Re-measurement of the resting heart rate can be made if there is some question about the representativeness of the initial measurement.)

ATTACHMENT E – PHYSIOLOGICAL MONITORING FOR HEAT STRESS (cont.)

Survey

- | | | |
|---|----|---|
| Industrial Hygiene Technician or Industrial Hygienist | 1. | Conduct and document work place heat stress related environmental and/or personal measurements (i.e., WBGT index or heart (pulse) rate monitoring). Document on forms A-6003-860, A-6004-079, or equivalent. |
| Line Manager | 2. | When the pre-job briefing indicates predicted extreme heat stress conditions periodically contact the Industrial Hygienist for current work/rest cycles. |
| Industrial Hygiene Technician | 3. | Take periodic heart rate measurements at a frequency of no greater than 30 minutes (monitoring intervals less than 30 minutes may be required by the Industrial Hygienist). Record data as indicated above, and make appropriate notifications as directed by the Industrial Hygienist. |

NOTE: The target rate is not a peak heart rate limit. It can be exceeded momentarily without adverse health effects in a population with medically assessed normal cardiac performance. However, it is the goal of the survey measurement process to prevent a sustained heart rate in workers which exceeds the target rate, and to identify workers who cannot sufficiently recover their heart rate after rest.

- | | | |
|--------------|---|---|
| Line Manager | 4 | Conduct survey measurements in accordance with the following: <ul style="list-style-type: none">• The requirements in this procedure• Documentation of the times that the workers are working/resting; the work tasks being performed; the PPE that is actually being worn; heart rate readings taken; and notifications made to the individual workers, FWS, and Project Industrial Hygienist• If monitoring determines that an individual(s) has reached or exceeded their target heart rate, the individual is required to be informed at that time and should begin a rest period for approximately 15 minutes. |
|--------------|---|---|

NOTE: Workers can request their heart rate reading at any time during the survey.

- | | | |
|--|----|---|
| | 5. | Implement rest periods using the workers' target heart rate measurements. |
|--|----|---|

ATTACHMENT E – PHYSIOLOGICAL MONITORING FOR HEAT STRESS (cont.)**Rest Periods**

The goal of the 15 minute rest period is to allow workers to reduce their heart rate to near their resting level prior to re-starting work.

Industrial Hygiene
Technician

1. After the 15 minute rest period, check and record the worker's pulse rate.
 - a. If not more than 10 bpm above their resting heart rate and less than 110 bpm, work can begin again.
 - b. If more than 10 bpm above their resting heart rate or more than 110 bpm, advise the person to rest for another 15 minutes.
 - c. If a person does not recover to below 10 bpm above their resting heart rate or less than 110 bpm after the second 15 minute rest period, get the person to a cooler environment and notify the FWS and project Industrial Hygienist. Additionally, depending on circumstances, the individual, FWS, and/or industrial hygienist may decide that medical attention is necessary.

NOTE 1: The rest periods can be conducted in the work area but are most effective if there is shade, ventilation, or cooling to further reduce heat accumulation.

NOTE 2: As long as the person's target heart rate is not exceeded and they take sufficient work breaks and remain hydrated, they can continue working with periodic pulse rate monitoring. Per the Heat Stress program, any person may request a rest/cool off period regardless of their heart rate.

Post-Survey

Industrial Hygiene
Technician

1. Complete all required forms and provide them to the Industrial Hygienist by the end of the next working day.

Definitions

Heart (pulse) rate. The rate of heart beats detected at the finger, wrist, or neck in units of beats per minute (bpm).

ATTACHMENT F – INDUSTRIAL HYGIENE HEART RATE MONITORING FORM

Date: _____

Worker Name: _____ Worker HID # _____

Worker Age: _____ Target Heart Rate 180- age = _____

Location: _____

Task Description: _____

Clothing Requirement (circle one): Permeable Impermeable # Layers: 1 2 3

Description of PPE worn: _____

Resting heart rate: _____ Time: _____

<u>Time</u>	<u>Heart Rate</u>	<u>Time</u>	<u>Heart Rate</u>

Monitoring Results:

Maximum sustained heart rate: _____

Recovery heart rate: _____ (goal < 10 bpm above resting heart rate and < 110 bpm)

Recommendations/Notifications: _____

Industrial Hygiene Review:

Prepared by (print/sign): _____ date: _____

Reviewed by (print/sign): _____ date: _____