Administrative Procedure, Level 1 - Company Wide

CPCC-PRO-SH-121

Heat Stress Control

Revision 2, Change 1

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Program: Occupational Safety and Industrial Hygiene
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Technical Authority: Linklater, Carson K
Functional Manager: Steelhammer, Jacob G

Use Type: Administrative

USQ Facility	USQ Review	Screener
105 KW Facility	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
324 Building	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
Below HazCat 3	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
Canister Storage Building/Interim Storage Area	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
Capsule Storage Area	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
D4ES-Central Plateau	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
Solid Waste Operations Complex	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
Transportation	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	
Waste Encapsulation Storage Facility	**Exclusion Reason:** *N/A per CPCC-PRO-NS-53097*	

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Change Summary

Description of Change

Removal of Section 3.7.1, Step 3. Addition of reference to CPCC-PRO-SH-409 in Section 3.3.

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1.0 INTRODUCTION

1.1 Purpose

This procedure establishes requirements for working in Central Plateau Cleanup Company (CPCCo) areas where there is a potential for heat stress and provides a process to mitigate heat strain and prevent heat stroke. This procedure implements the requirements put forth by the 2016 American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values (TLV) for Chemical Substances, Physical Agents and Biological Exposure Indices, as specified by 10 CFR 851, “Worker Safety and Health Program,” which are specified in CPCC-MP-SH-32219, *10 CFR 851 CPCCo Worker Safety and Health Program Description*.

1.2 Scope

This procedure is applicable to all CPCCo employees, CPCCo subcontractors and any visitors who may work in environments with a potential for heat stress. This procedure also provides direction for preparing for seasonal heat stress, identification of heat stress conditions, heat stress evaluations, implementing heat stress controls and physiological monitoring, and providing heat stress information and training to employees.

1.3 Implementation

This procedure is effective upon publication.

2.0 RESPONSIBILITIES

All responsibilities associated with this procedure are identified in the process steps.

3.0 PROCESS

CPCCo's heat stress control program follows the process identified in Figure 1, "CPCCo Decision Logic for Heat Stress Control," and uses information from planning tables that factor in the Wet Bulb Globe Temperature (WBGT) value, clothing ensemble, metabolic work rate, and worker acclimatization status. Figure 1 and planning tables are used by Occupational Safety and Industrial Hygiene (OS&IH) to assess heat stress and strain, evaluate risk to workers, collect physiological screening data, and establish work-rest cycles.

3.1 Preparation for Seasonal Heat Stress

Actionee	*Step*	*Action*
OS&IH Manager	1.	ENSURE an assessment is completed annually prior to the onset of warm weather to ensure projects are prepared to effectively manage heat stress hazards by verifying the following: • Adequate inventory of cool down area items such as tents, fans, misters, coolers, chairs, benches, etc. Items should be verified they are in good condition and functioning properly. • Adequate inventory of items to maintain hydration such as coolers, water bottles, electrolytes, etc. • Adequate inventory of WBGTs and physiological monitoring equipment that is in good condition and fully functioning. • Work schedules have been evaluated to identify potential opportunities where work schedules can be adjusted to start shifts earlier to avoid hotter parts of the day. • SlateSafety devices and iPads are updated and tested prior to field use.
	2.	DOCUMENT the results of the assessment within the Integrated Contractor Assessment System (iCAS).

3.2 Identification of Heat Stress Conditions

The following conditions require consideration for heat stress and may require completion of Site Form A-6007-263, *Heat Stress Evaluation,* (HSE) or Site Form A-6007-296, *Industrial Hygiene Exposure Assessment (IHEA*), by OS&IH:

a. Predicted air temperatures greater than 85°F outdoors, or 90°F indoors

When working in single-layer cotton clothing (Clothing Adjustment Factor [CAF] equal to zero), either outdoors and/or in direct sun, in air temperatures greater than or equal to 85°F, or indoors in air temperatures greater than or equal to 90°F.

b. Humidity greater than 60%

When relative humidity reaches 60% in the work environment in combination with warm air temperatures, and/or when wearing protective clothing that significantly restricts air movement, such as impermeable clothing.

c. Sources of radiant heat are present, or work involves contact with hot objects

When working around and/or in direct contact with radiant heat sources such as heated vessels, welding operations, and heat reflected from or retained in asphalt surfaces or concrete buildings.

d. Protective clothing is required

When wearing protective clothing with a CAF greater than zero, at air temperatures greater than or equal to 70°F; or wearing impermeable clothing (e.g., water- or vapor-barrier clothing, encapsulating suits, 40 cal/cm^2 Arc-Rated suit) at any temperature.

e. High work intensity

Work at heavy and very heavy metabolic levels.

f. Work performed inside an enclosure or greenhouse

When working in a greenhouse or other enclosure with minimal air movement that could result in heat build-up.

Actionee	***Step***	***Action***
Line Management	1.	IF the heat stress conditions listed above are expected and controls are required to mitigate hazards, THEN REQUEST OS&IH to prepare a HSE or IHEA for the activity.

3.3 Heat Stress Evaluation

An IHEA that addresses the required elements listed in the process below is an equivalent hazard evaluation and may be used in lieu of the HSE.

Actionee	***Step***	***Action***
OS&IH	1.	DEVELOP a HSE or IHEA AND DOCUMENT the following: a. Location of Heat Stress Conditions. b. Metabolic Demands of the Work Activity/Task. 1) USE Table 1, “Metabolic Rate Categories and Work Level.” c. Clothing Ensemble and CAF for personal protective equipment (PPE) worn, using Table 2, “Additions to Measured WBGT Values based on Clothing Adjustment Factors.”

Actionee	Step	Action
OS&IH		2) IF a CAF for an ensemble is not shown, THEN PERFORM one of the following: a) REFER to IHTE-2017-001, *Heat Stress Clothing Adjustment Factor Table*, for additional information, including adjustments to account for head coverings and impermeable gloves. b) WORK with the Heat Stress Control Technical Authority (TA) to extrapolate a CAF. c) USE a CAF estimate AND PLAN work activity using physiological monitoring.

NOTE: *According to the ACGIH: worker acclimatization is gained incrementally over 1 to 2 weeks in similar heat stress conditions. A rule of thumb for acclimatized status is that the worker has at least 2 continuous hours of similar heat exposure in 5 of the last 7 days, or 10 of the last 14 days.*

1) *Loss of acclimatization is noticeable after 4 days of not being in similar heat stress conditions. For most healthy adult workers, loss of acclimatization is transitory and quickly made up.*
2) *Unacclimatized status is reserved for:*
   - *No recent heat stress exposure*
   - *Those that are not fully acclimatized*
   - *Recent heat stress exposures that resulted in excessive heat strain*

d. Worker acclimatization status to be planned for the activity, using “Unacclimatized” as the default status.

1) Acclimatization status based on a 4-day work week may be used with concurrence from Project OS&IH Manager, and the Heat Stress Control TA.

Actionee	*Step*	*Action*

NOTES:

- *When indoor worksite temperatures are greater than 95°F, air should be cooled before using fans or forced air ventilation.*
- *Use of cooling suits in a radiological controlled area needs to be planned with RadCon to address the potential for the spread of contamination. A CAF reduction is not applied to cooling vests/suits. Instead, physiological monitoring must be utilized to validate the effectiveness of the control.*

OS&IH

e. Heat Stress Control Set taking into consideration the hierarchy of controls, see Table 5, Job-Specific Heat Stress Controls

1) IDENTIFY the effective WBGT for implementation of work/rest, and/or Physiological Monitoring utilizing Table 3, “WBGT Screening Criteria for Heat Stress Exposure.

f. Monitoring plan/equipment, specifically describing methods and periodicity of monitoring, lines of communication, and notification processes.

1) WHEN physiological monitoring is identified as necessary, THEN DESCRIBE requirements for pre-work resting heart rate, sustained target heart rate (STHR), and recovery heart rate (RHR).

g. Emergency egress and response to be used in the event of excessive heat strain, if not already identified in project/work control documents.

2. RETAIN a working copy
AND SUBMIT HSE or IHEA to the Site Wide Industrial Hygiene Database (SWIHD) Administrator.

SWIHD Administrator

3. ENTER the HSE or IHEA into SWIHD
AND PROCESS the record into the Integrated Document Management System (IDMS) per CPCC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*.

Table 1. Metabolic Rate [Watts] Categories and Work Activity Level

Work Level Category	***Metabolic Rate* [W], 154 lb of weight***	***Metabolic Rate [W], 200 lb of weight***	***Metabolic Rate [W], 250 lb of weight***	***Example Activities***
Rest	Up to 115	149	187	• Sitting, attending meetings, observing work, taking notes.
Light	180 (115-235)	234	292	• Sitting, light manual work with hands and/or arms. • Driving cars, trucks. • Standing and occasional walking with some light arm work, such as: ○ Walk-through inspections, rounds and surveillances ○ Reading instruments ○ Using non-powered hand tools ○ Using table saw, bench top machinery ○ Performing routine RCT/IH sampling, data-logging.
Moderate	300 (235-360)	390	487	• Sustained moderate hand and arm work, moderate arm, leg work, and trunk work, such as: ○ Moderate pushing and pulling, ○ Environmental sampling, ○ Crane and rigging work, ○ Heavy equipment operation, ○ Using portable power tools, 7-15 pounds of force. • Materials handling: installing barricades, moving waste drums/containers with mechanical means. • RO/RO container opening/closing/liner installation. • Normal walking while carrying < 7 pounds, such as walking stick surveys, HPT surveys with reaching.
Heavy	415 (360-470)	539	674	• Intense arm and trunk work, such as: ○ Carrying/shoveling dry sand/soil, ○ Manual sawing, ○ Pushing and pulling heavy loads, ○ Moving waste or laundry bags, ○ Intermittent heavy assembly work or ○ Heavy lifting/pulling/pushing/carrying <25 pounds. • Walking at a fast pace. • Hand tool use with >15 pounds of force.
Very Heavy	520	675	844	• Very intense activity at fast pace, such as: ○ Shoveling wet sand/soil, ○ Heavy assembly work, ○ Heavy lifting/pulling/carrying >25 pounds. ○ Running, ○ Installing T-posts.

- *The effect of body weight on the estimated metabolic rate may be accounted for by multiplying the estimated rate by the ratio of actual body weight, divided by 154 lb.*
- *The default Metabolic Rate value* is based on a 154-lb person. The IH should determine the average weight of workers in the crew, to include equipment and gear they carry or wear, to more accurately predict the metabolic load.*
- *The estimated metabolic rate may be considered on a time-weighted average basis. Intermittent, short duration tasks do not necessarily result in a higher work level category determination.*

Table 2. Additions to Measured WBGT Values based on Clothing Adjustment Factors for Some Clothing Ensembles (ACGIH, 2016)

Clothing Type	***Addition to WBGT, ºF***
Work Clothes (Long Sleeve Shirt and Pants)	0
Cloth (woven) Coveralls	0
Double-layer woven Clothing	5.4
SMS Polypropylene Coveralls	0.9
Polyolefin Coveralls	1.8
Limited-use Vapor-barrier Coveralls	19.8

Additions may also need to be made to account for head covers and gloves. For a more complete listing of CAFs, see IHTE-2017-001.

Table 3. WBGT Screening Criteria for Heat Stress Exposure

Allocation of Work in a Cycle of Work and Recovery	***TLV® WBGT Values in °F (Acclimatized)***				***Action Limit WBGT Values in °F (Unacclimatized)***			
	Light	***Moderate***	***Heavy***	***Very Heavy***	***Light***	***Moderate***	***Heavy***	***Very Heavy***
100% Work	<87.8	≤82.4	**PM**	**PM**	≤82.4	≤77.0	**PM**	**PM**
75% Work/ 25% Rest	87.8	82.5 – 84.2	≤81.5	**PM**	82.5 - 83.3	77.1 – 78.8	≤75.2	**PM**
50% Work/ 50% Rest	87.9 - 89.6	84.3 – 86.0	81.6 - 84.2	≤82.4	83.4 - 85.1	78.9 – 80.6	75.3 – 77.9	≤76.1
25% Work/ 75% Rest	89.7 - 90.5	86.1 – 88.7	84.3 - 86.9	82.5-86.0	85.2 - 86.0	80.7 – 84.2	78.0 - 82.4	76.2 - 80.6
PM	>90.5	>88.7	>86.9	>86.0	>86.0	>84.2	>82.4	>80.6

- *Table 3 is intended as an **initial screening tool** to evaluate if a heat stress situation may exist.*
- *See Table 1, Metabolic Rate Categories and Work Level and/or consult the 2009 Documentation.*
- *Thresholds are computed as a TWA-Metabolic Rate, where the metabolic rate for rest is taken as 115W and work is the representative (mid-range) value of Table 1.*
- *In the table, rest is assumed to occur in the same or similar environment as the work (e.g., WBGT is the same). The metabolic rate for rest is already factored into the screening limit.*
- ***If work and rest environments are different** (e.g., rest environment has different WBGT), **calculate <u>hourly</u> time-weighted average (TWA)-WBGTs, or utilize the most conservative location as representative.** TWAs for Work Rates should also be used when the work demands vary within the hour. (See 2009 Documentation, p 22).*
  - ***TWA-WBGT** = $[(WBGT_W \times t_W) + (WBGT_R \times t_R)] / t_{W+}t_R$*
  - ***TWA-Metabolic Rate** = $[(MR_W \times t_W) + (MR_R \times t_R) / t_{W+}t_{RE}$*
- *Values in the table are applied by reference to the "Work-Rest Regimen" section of the Documentation and assume 8-hour workdays in a 5-day workweek with conventional breaks***** as discussed in the Documentation.*
  - *******The Hanford 10 hour/day work schedule, for purposes of heat stress TLVs, may be considered as comparable to the standard 8-hour day, <u>when</u> 2 hours/day are spent on administrative tasks such as pre-job briefings, checking out respirators, obtaining work equipment, and dress/undress/shower activities. .When workdays are extended, consult the "Application of the TLV" in the 2009 Documentation.*
- *Because of the physiological strain associated with Heavy and Very Heavy work regardless of WBGT, criteria values are not provided for continuous work, and for up to 25% rest in an hour for Very Heavy. Instead of using the screening criteria, a detailed analysis and/or **Physiological Monitoring (PM)** should be used.*

3.4 Identification and Response to Signs and Symptoms of Heat Strain

Monitoring for signs and symptoms of heat strain and heat-related illness should be continuously conducted by all workers when conducting work in heat stress conditions. Additional attention should be given when rapid changes in outdoor temperature occur (i.e., sudden heat wave), when workers are new to heat stress environments, or after a worker experiences symptoms of heat-related illness.

Actionee	*Step*	*Action*
All employees	1.	OBSERVE yourself and co-workers for signs and symptoms of excessive heat strain AND immediately REPORT those who show signs and symptoms to the Field Work Supervisor (FWS). a. IF worker exhibits any of the following signs and symptoms: • Sudden and severe fatigue • Nausea • Dizziness or lightheadedness THEN: 1) REMOVE the worker from the source of heat (e.g., PPE, hot environment). 2) MOVE them to a cool location (shade, air-conditioned, or fans blowing on employee) for a minimum of 15 minutes. 3) PROVIDE water. 4) OBSERVE employee until the signs and symptoms have abated and return to step 1. b. IF worker exhibits any of the following signs and symptoms: • Disoriented or confused • Inexplicable irritability • Malaise • Loss of consciousness • Chills THEN RESPOND as a medical emergency. 1) CALL 911 (509-373-0911 from a cell phone). 2) COOL, MONITOR, AND ASSIST worker until emergency responders arrive.
	2.	PERFORM notification and follow up actions identified in CPCC-PRO-SH-077, *Reporting, Investigating, and Managing Health and Safety Events*.

3.5 Implement Heat Stress Controls

Heat stress conditions that are adequately addressed using general and job specific heat stress controls, as identified in the tables below.

Table 4. General Heat Stress Controls

- Review and discuss signs and symptoms of heat strain.
- Monitor heat stress conditions and reported symptoms of Heat-Related Illness.
- Provide oral and written work instructions.
- Provide additional heat stress information in safety bulletins and seasonal initiatives.
- Include information about the role medications may pose in maintenance of kidney function, cardiovascular health, blood pressure, and body temperature regulation.
- Take regularly scheduled breaks.
- Identify cool down areas.
- Provide water and encourage drinking small volumes of cool water regularly throughout the shift.
- Encourage workers to self-limit exposures and/or report heat-related symptoms.
- Encourage the buddy system/coworker observations.
- Encourage healthy lifestyles, maintenance of electrolyte balance and ideal body weight.
- Adjust expectations of worker performance and take individual factors into consideration:
    - Those returning to work after absence from hot exposure conditions.
    - Those not acclimatized to wearing specialized PPE.

Table 5. Job-Specific Heat Stress Controls

Implement Job-Specific Controls where heat strain may be *<u>excessive:</u>*
• **Engineered Controls** that reduce the metabolic work rate, provide general air movement, reduce process heat and water vapor release, and shield radiant heat sources o Mechanical assistance with tasks o Containment tents/enclosures with recirculating or once-though air conditioning, or evaporative cooling o Misters (fan-mounted, tubing runs) o Fans o Designated shaded rest area o Portable swamp coolers o Heat shielding insulation
• **Administrative Controls** that set acceptable exposure times, allow sufficient recovery, and limit physiological strain o Pre-job briefing on heat stress associated with the work scope, and signs and symptoms of heat strain o Work/rest cycle in accordance with Table 3 or the HSE/IHEA o Physiological Monitoring in accordance with Table 3, and/or the HSE/IHEA o Adjusted shift or start time (work in cooler part of day) o Rotate tasks between workers, and/or divide tasks between workers in a manner to reduce metabolic rate
• **Cooling PPE** demonstrated as effective, with RadCon, concurrence (as applicable); e.g., o Cooling suit/vest and accessories (e.g., cool tie/scarf, vortex)

Table 6. Guidelines for Limiting Excessive Heat Strain

One or more of the following measures <u>may</u> identify <u>excessive</u> heat strain. An individual's exposure to heat stress should be discontinued when any of the following occur:
• Sustained (several minutes) target heart rate in excess of 180 beats per minute (bpm) minus the individual's age in years (180-age), for individuals with assessed normal cardiac performance
• Recovery heart rate at <u>one minute</u> after a peak work effort exceeds 120 bpm

Actionee	***Step***	***Action***
Line Management	1.	WHEN potential heat stress conditions exist for a work activity performed in clothing with a CAF of zero, THEN IMPLEMENT **general heat stress controls** as applicable.
	2.	WHEN potential heat stress conditions exist for a work activity performed in clothing with a CAF greater than zero, THEN IMPLEMENT the **feasible job-specific heat stress controls** in addition to general heat stress controls, and the control set identified on the HSE or IHEA.
	3.	CONSULT with OS&IH to determine the metabolic work rate, CAF and if **heat stress monitoring** should be requested for the project (e.g., work is indoors, or around heat reflective surfaces, heat sinks like concrete buildings or asphalt, etc.), or if Hanford Meteorological Station (HMS) WBGT data may be used.
	4.	REVIEW the **heat stress controls** and applicable **heat stress monitoring** for the work activity at the pre-job briefing.

NOTE:

- *It is anticipated that workers may become warm and/or thirsty while working under job-specific heat stress controls. Rest periods may be taken in the work area, or outside of the work area, as needed to maintain adequate hydration and cooling.*
- *When radiological, chemical, and/or particulate contamination is present, or potentially present, decontamination practices may be required prior to entering the drinking station.*

	5.	IF heat stress conditions exist in a radiological controlled area, THEN PROVIDE water at drinking stations in accordance with CPCC-PRO-RP-40196, *Drinking Liquids in Contamination Areas*.

3.6 Wet Bulb Globe Temperature Monitoring

Implementation of work-rest regimens, as identified in Table 3, “WBGT Screening Criteria for Heat Stress Exposure” is a general heat stress control.

Actionee	***Step***	***Action***
Line Management/ OS&IH	1.	IMPLEMENT heat stress monitoring in accordance with the HSE or IHEA using the following steps:

Actionee	Step	Action

NOTE: *HMS WBGT readings must be representative of the employee's work area, or be more conservative, to be used to determine work/rest. Reference IHTE-2017-002, Use of Hanford Meteorological Station for WBGT Measurements, for more information.*

Actionee	Step	Action
OS&IH/ Designee	2.	EVALUATE WBGT data on an hourly interval to determine applicable work-rest cycle AND COMMUNICATE work-rest cycles as appropriate. a. COLLECT, RECORD, AND EVALUATE **local** WBGT data. OR EVALUATE WBGT data from the **nearest HMS**.
OS&IH	3.	DOCUMENT WBGT monitoring in accordance with CPCC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*. Site Form A-6004-691, *WBGT Monitoring Data,* may be used. • WBGT data is entered under the Heat tab in SWIHD. • WBGT data when collected by the subcontractor, is entered in the Generic tab in SWIHD. • Work record entries of a work package, or logbook entries may also be used.
Line Management	4.	IMPLEMENT work-rest cycles as applicable.

NOTE: *When temperatures are expected to reach levels which require physiological monitoring, a pre-work resting heartrate for physiological monitoring may be collected after the morning pre-job.*

Actionee	Step	Action
	5.	ENSURE physiological monitoring is implemented as required by Table 3 or as directed by OS&IH.

3.7 Implement Physiological Monitoring

Two pathways are identified for physiological monitoring:

1. Continuous monitoring wearing devices that monitor heart rate by use of computer software.

2. Intermittent monitoring using a finger pulse oximeter.

General requirements from physiological monitoring include:

NOTE:	*ACGIH defines recovery heart rate at 120 beats per minute (bpm) after exertion, therefore an individual's pre-work resting heart rate shall be less than or equal to 120 bpm to demonstrate adequate cardiovascular recovery.*

- Pre-work resting heart rates must be at or below 120 beats per minute to be monitored using a heart rate monitor. The pre-work resting heart rate may be reassessed as many times as necessary, and later in the day if applicable. Workers who cannot meet pre-work resting heart rate requirements should be reassigned work outside of heat stress environments.
- Sustained target heart rates (STHR) are based on a sustained duration of elevated heart rate (180 bpm – age of person). The default duration to be considered sustained is 5 minutes. Alternate STHR durations may be defined on an HSE/IHEA in situations with remote work locations, extended egress requirements, extended durations to reach a cool down area, extreme heat stress hazards, or as identified as necessary by a project.
- Physiological monitoring data is designated "Official Use Only" (OUO), shared only by OS&IH, Line Management, and the employee during the work evolution, to prevent excessive heat strain.
- Physiological monitoring data is used for real-time decision-making regarding the timing and length of work-rest cycles needed for adequate heart rate recovery.
- Alternative physiological monitoring implementation strategies, including but not limited to changes to sustained target heart rate durations and rest breaks may be used with concurrence from an OS&IH Manager, and the Heat Stress Control TA. Deviations that are more conservative do not require special approvals.

3.7.1 Continuous Physiological Monitoring

Actionee	*Step*	*Action*
OS&IH/Line Management	1.	DISCUSS HSE/industrial hygiene sample plan (IHSP) instructions in the pre-job briefing including the flow of communications between the IH surveyor/technician, workers, Line Management, and the IH Professional in the event of excessive heat strain.
OS&IH	2.	COLLECT pre-work resting heart rates prior to conducting work in potential heat stress conditions.
	3.	CONTINUOUSLY MONITOR AND EVALUATE the heart rate monitor.
	4.	IF elevated heart rates are detected, THEN RESPOND as follows: a. IF an individual's STHR is exceeded, THEN DIRECT worker to: 1) EXIT the work area AND REMOVE PPE to reduce CAF as feasible. 2) For a minimum of 15 minutes, REST in a cool down area AND DRINK water. b. CHECK the individual's RHR after 1 minute of rest, during the 15-minute rest period, to ensure it is decreasing and ≤ 120 bpm. 1) IF the RHR continues to rise, or is >120 bpm, THEN NOTIFY the FWS and IH (as applicable). c. CHECK the individual's heart rate at the end of 15-minute rest period. • IF the heart rate is **≤** 120 bpm after one rest period, THEN NOTIFY the individual that they may return to activities that are a potential source of heat stress. • IF the heart rate is > 120 bpm after one rest period, THEN DIRECT individual to continue to rest in a cool down area and drink water for an additional 15 minutes (minimum).

Actionee	Step	Action
OS&IH		d. CHECK the individual's heart rate at the end of the second 15-minute rest period. • IF the heart rate is **>** 120 bpm, after a second rest period, THEN NOTIFY the FWS and IH (as applicable) AND CEASE the affected worker's activities that are a potential source of heat stress for the remainder for the day. • IF individual's heart rate is **≤** 120 bpm after the second rest period, THEN NOTIFY the individual that they may return to activities that are a potential source of heat stress and return to step 4.
	5.	ATTACH physiological monitoring data to a SWIHD survey, created in the PM survey tab, AND ADD each individual name in the OUO sub-tab.
	6.	Process the record in SWIHD per CPCC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*.

3.7.2 Intermittent Monitoring

Actionee	Step	Action
OS&IH/Line Management	1.	DISCUSS HSE/IHSP instructions in the pre-job briefing including the flow of communications between the IH surveyor/technician, workers, FWS, and the IH Professional in the event of excessive heat strain.
OS&IH	2.	COLLECT pre-work resting heart rates prior to conducting work in potential heat stress conditions,.
	3.	RECORD PM data on Site Form A-6007-287, *Physiological Monitoring Form,* or equivalent.
	4.	COLLECT heart rate measurements at an interval of about 30 minutes after work begins. For instances with extended egress times, workers should initiate the necessary steps to have their heart rates checked no later than 30 minutes from the previous check, and checks shall not exceed 45 minutes between measurements.
	5.	COMPARE individual heart rates to the STHR criteria. a. IF the initial heart rate measurement is greater than STHR, THEN DIRECT the individual to cease work activity. 1) COLLECT a minimum of two additional heart rate measurement as necessary over a 5-minute period to determine if the STHR duration has been met.

Actionee	*Step*	*Action*
OS&IH	6.	IF the individual's STHR is not exceeded, THEN INFORM them they may resume work activities.
	7.	IF an individual's STHR is exceeded, THEN RESPOND as follows: a. DIRECT the individual to: 1) EXIT the work area AND REMOVE PPE to reduce CAF as feasible. 2) For a minimum of 15 minutes, REST in a cool down area AND DRINK water. b. CHECK the individual's RHR after 1 minute of rest to ensure it is decreasing and is ≤ 120 bpm. • IF the RHR continues to rise, or is >120 bpm, THEN NOTIFY the FWS and OS&IH. c. CHECK the individual's heart rate at the end of 15-minute rest period. • IF the heart rate is **>** 120 bpm after one rest period, THEN DIRECT individual to continue to rest in a cool down area and drink water for an additional 15 minutes (minimum). • IF the heart rate is **≤** 120 bpm after one rest period, THEN NOTIFY the individual that they may return to activities that are a potential source of heat stress. d. CHECK the individual's heart rate at the end of the second 15-minute rest period. • IF the heart rate is **>** 120 bpm after a second rest period, THEN NOTIFY the FWS and OS&IH AND CEASE the affected worker's activities that are a potential source of heat stress for the remainder for the day. • IF the heart rate is **≤** 120 bpm after the second rest period, THEN NOTIFY the individual that they may return to activities that are a potential source of heat stress. e. CONTINUE monitoring after an individual has completed cool down/recovery, and they have returned to work.

Actionee	Step	Action
OS&IH	8.	ATTACH physiological monitoring data to a SWIHD survey, under the “PM” survey tab once monitoring is complete, AND ADD each individual name in the OUO sub-tab.
	9.	Process the record in SWIHD per CPCC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*.

3.8 Employee Information and Training

Actionee	Step	Action
Line Management	1.	VERIFY that employees working in, or supervising work in hot environments, receive the computer-based training course 620193, *CPCCo Temperature Extremes,* every 2 years.
Line Management/ OS&IH	2.	CONDUCT AND DOCUMENT discussions and presentations pertaining to work-specific heat stress in safety meetings and pre-job briefings.
		a. DISCUSS heat strain prevention and emergency response in pre-job briefings.
		b. DISCUSS the use of WBGT readings, work-rest cycles, physiological monitoring, and the flow of communication.
		c. PARTICIPATE in seasonal heat stress campaigns and special safety meetings.
	3.	VERIFY the Employee Job Task Analysis (EJTA) is marked for “Work in Hot Environments” and/or “Greenhouse Work,” as applicable, in accordance with CPCC-PRO-SH-52755, *Employee Job Task Analysis.*
OS&IH	4.	As requested, PARTICIPATE in pre-job briefings and safety meetings to discuss heat stress hazards and control methods.
All Employees	5.	PARTICIPATE in seasonal heat stress campaigns, safety meetings pre-job briefings, and with physiological monitoring efforts.
	6.	RECOGNIZE factors that may contribute to heat-related illness (e.g., medications, inadequate hydration) and those that mitigate it (e.g., adequate water consumption, rest, good physical conditioning).
	7.	UNDERSTAND the signs and symptoms of excessive heat strain AND IDENTIFY when an emergency situation is occurring.
	8.	RESPOND appropriately to a heat stress situation in accordance with Section 3.4.

Actionee	***Step***	***Action***
OS&IH	9.	INVESTIGATE cases of heat strain in accordance with CPCC-PRO-SH-077, *Reporting, Investigating, and Managing Health and Safety Events*.

4.0 FORMS

A-6004-691, *WBGT Monitoring Data*
A-6007-263, *Heat Stress Evaluation*
A-6007-287, *Physiological Monitoring Form*
A-6007-296, *Industrial Hygiene Exposure Assessment (IHEA)*

5.0 RECORD IDENTIFICATION

All records are required to be managed in accordance with CPCC-PRO-IRM-10588, *Records Management Processes*.

Records Capture Table

Name of Record	Submittal Responsibility	Retention Responsibility
Heat Stress Evaluation, A-6007-263	SWIHD Administrator	IRM Service Provider
Industrial Hygiene Exposure Assessment (IHEA), A-6007-296	SWIHD Administrator	IRM Service Provider

6.0 SOURCES

6.1 Requirements

None.

6.2 References

10 CFR 851, *Worker Safety and Health Program*

ACGIH, *Threshold Limit Values for Chemical Substances, Physical Agents and Biological Exposure Indices*, 2016

CPCC-MP-SH-32219, *10 CFR 851 CPCCo Worker Safety and Health Program Description*

CPCC-PRO-IRM-10588, *Records Management Processes*

CPCC-PRO-RP-40196, *Drinking Liquids in Contamination Areas*

CPCC-PRO-SH-077, *Reporting, Investigating, and Managing Health and Safety Events*

CPCC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*

CPCC-PRO-SH-52755, *Employee Job Task Analysis*

6.3 Bases

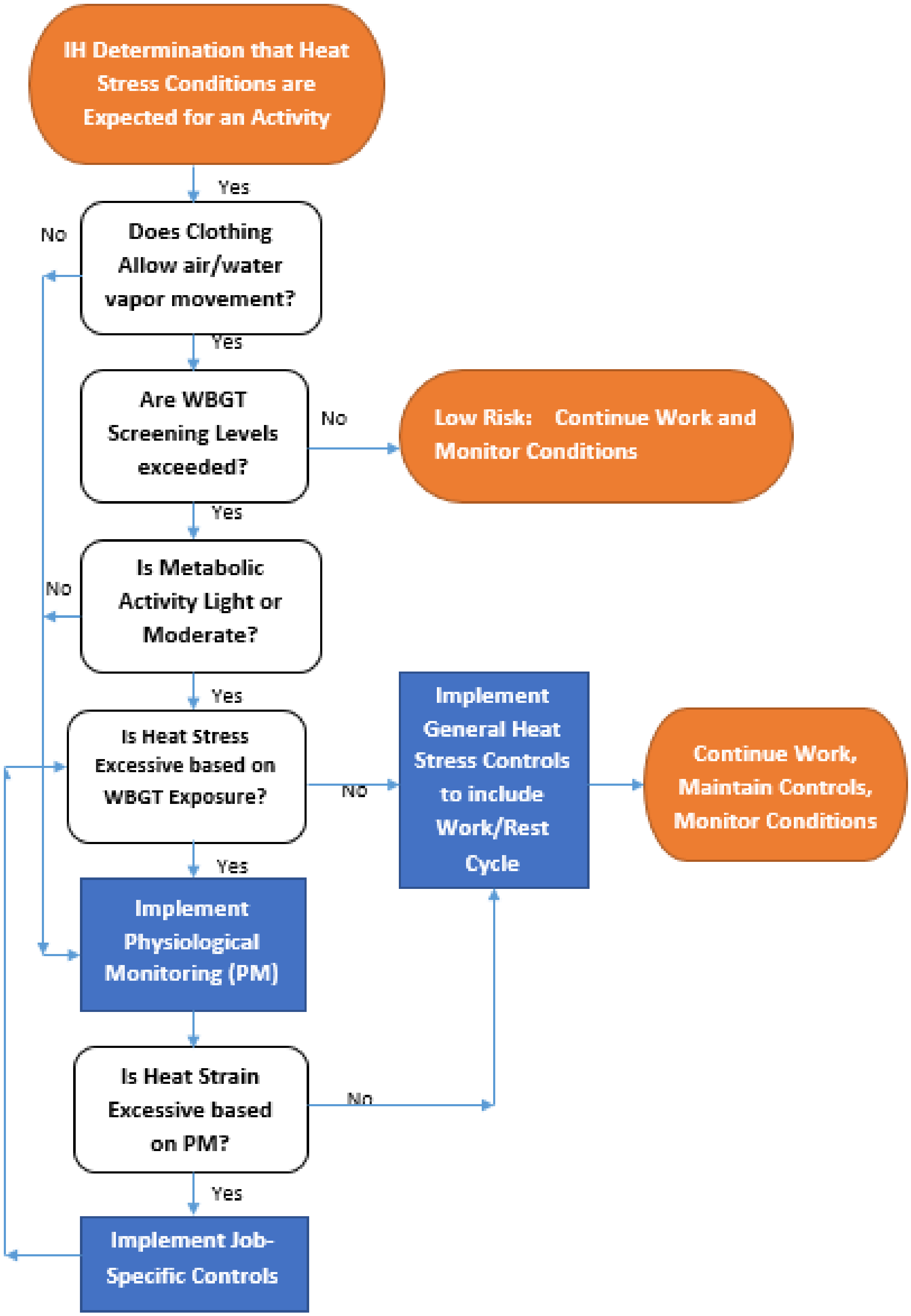
ACGIH, *Documentation of the Threshold Limit Values® for Physical Agents*, 7th edition, Heat Stress and Strain, 2009

IHTE-2014-003, *Control of Heat Stress and Heat Strain, Establishing a Work-Rest Regimen Based on a Time-Weighted, Wet Bulb Globe Temperature (WBGT)*

IHTE-2017-001, *Heat Stress Clothing Adjustment Factor Table*

IHTE-2017-002, *Use of Hanford Meteorological Station for WBGT Measurements*

Figure 1 – CPCCo Decision Logic for Heat Stress Control



Appendix A - Glossary

Term	*Definition*
Acclimatization	The temporary adaptation of the body to work in the heat that improves the ability to tolerate heat stress with a reduction of heat strain that occurs gradually when a person is exposed to it.
Clothing Adjustment Factor (CAF)	Clothing affects heat stress exposure depending on the amount of insulation, ventilation, and evaporative resistance of the ensemble. Measures to express thermal characteristics of clothing are the WBGT Clothing Adjustment Factor (CAF), assigned through laboratory trials following a heat stress protocol in which temperature and humidity increase until the participant loses the ability to thermo-regulate.
Cool Down Area	A rest area near the worksite where workers periodically enter to cool down after working in a hot environment. The cool down area should be shaded and maintained cooler than the work area, and in a radiological low dose or contamination area.
Excessive Heat Strain	Excessive heat strain is defined as showing one or more of the following: Core body temperature >100.4°F Sustained heart rate >180 beats per minute minus the person's age for several minutes. The default duration to be considered sustained is 5 minutes. Sudden severe fatigue, nausea, dizziness, lightheadedness.
Heart Rate Monitoring	Measurement of an individual's heart or pulse rate to determine the physiological effect from heat stress exposure and determine the individual's recovery rate.
Heat Illness	A serious medical condition resulting from the body's inability to cope with a heat load, and includes heat cramps, heat exhaustion, heat syncope, and heat stroke.
Heat Strain	The overall physiological response resulting from heat stress as recognized by: Increased core body temperature Increased heart rate Increased sweating and/or loss of body weight from sweating When physiological responses to heat are not controlled, heat strain may progress to Heat Illness.

Appendix A - Glossary

Term	*Definition*
Heat Stress	The net heat load to which a worker may be exposed from the combined contributions of metabolic heat, environmental factors (air temperature, humidity, air movement, radiant heat), and clothing requirements. Heat stress occurs when the body produces or gains more heat than it is capable of giving off or losing.
Heat Stroke	Heat stroke is a life-threatening condition requiring IMMEDIATE medical attention and occurs when the core body temperature increases to dangerous levels after the body fails to thermo-regulate.
Impermeable Clothing	Impermeable means not allowing fluid to pass through. Impermeable clothing is worn to provide the employee protection against a liquid or vapor (e.g., limited-use water- or vapor-barrier clothing), or from an atmosphere/environment (e.g., encapsulating or Level A suit, some electrical protective clothing).
Job-Specific Controls	Job-specific controls are implemented when there is a potential for excessive heat strain and include any combination of engineering and administrative controls and use pf personal protective equipment that reduces heat stress to an acceptable level.
Pre-Work Resting Heart Rate	The pre-work resting heart rate for people at rest, before engaging in a work activity, is identified as equal to or less than 120 beats per minute (bpm) for CPCCo.
Professional Judgment	The process of forming an opinion or evaluation by the application and appropriate use of specialized knowledge gained from extensive academic preparation through formal education, observation, experimentation, inference, and analogy, which is also characterized by conformance with technical and ethical standards within a discipline.
Recovery Heart Rate (RHR)	After sustained activity at 75% of the maximum heart rate, the heart needs time to recover or return to the normal, resting heart rate. The heart rate is measured 1 minute after a peak work effort. The RHR should not exceed 120 beats per minute (bpm).
Rest Period	Time where the individual ceases engaging in strenuous activity in order to allow the body to dissipate heat, slow the heart, and provide greater blood flow to the skin.
Sustained Target Heart Rate (STHR)	The heart rate when engaged in a sustained activity and/or in a hot environment that corresponds to 75% of the maximum heart rate. To calculate the maximum sustained target heart rate for an individual, use the formula: 180 bpm - Age (in years).

Appendix A - Glossary

Term	*Definition*
Threshold Limit Value (TLV)® and Action Limit (AL) for Heat Stress	According to the American Conference of Governmental Industrial Hygienists (ACGIH®), the Threshold Limit Value (TLV) for heat represents the conditions under which it is believed that nearly all heat acclimatized, adequately hydrated, unmedicated, healthy workers may be repeatedly exposed without adverse health effects. The Action Limit (AL) is similarly protective of unacclimatized workers.
Wet Bulb Globe Temperature (WBGT)	The WBGT identifies 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. The WBGT factors radiant heat, ambient dry bulb temperature and humidity into a single value. WBGT values measure the environmental heat load exposure but do not predict the micro-climate inside protective clothing. The combined WBGT and CAF is the effective WBGT.
Work-Rest Cycle	The proportion of time spent working and then resting during one-hour increments, established by the WBGT index, clothing ensemble, activity level (metabolic rate), and acclimatization status.

Appendix B - Setup and Use of SlateSafety Band V2 System

The SlateSafety Band V2 are physiological monitoring devices that are capable of remotely monitoring workers in a wide range of scenarios. The Band V2 is equipped with cellular, or Bluetooth connectivity, and the devices themselves can alert workers with haptic (vibration) and/or visual (LED lights) feedback.

The Band V2 is equipped with global positioning system (GPS) capabilities. The GPS feature shall be disabled by the manufacturer. The GPS capabilities cannot be enabled by Administrators or Group Leaders once disabled by the manufacturer.

Adding New Users to the Slatesafety Software Platform

Actionee	*Step*	*Action*
OS&IH personnel (Group Leader or Admin level permissions)	1.	ENSURE that new individuals being input as users are not already in the SlateSafety software platform.
	2.	COLLECT and INPUT worker identifier information including age.
	3.	ASSIGN User role, as applicable.

NOTE:	*Cyber Security requires that only the correct birth year is input for all users to minimize Personal Identifiable Information maintained within the software platform.*

	4.	ENSURE no gender, height or weight data is input.
	5.	ASSIGN the User to the appropriate Group.
	6.	ASSIGN Loadout
	7.	ENSURE no email address for Users.
	8.	CLICK “Submit”

Appendix B - (Cont.) Setup and Use of SlateSafety Band V2 System

Use of the SlateSafety V2 Arm Bands

Once users are added to the SlateSafety software platform, follow the steps below to use the Band V2 devices.

Actionee	*Step*	*Action*
OS&IH personnel (Group Leader or Admin level permissions)	1.	VERIFY worker identifier information, including age, is up to date.
	2.	ISSUE Band V2 device to worker before work activities start.
	3.	ENSURE worker understands what the haptic vibrations indicate and their response
	4.	RECORD Band V2 device ID on physiological monitoring form.
	5.	ASSIGN Band V2 ID to associated worker into the SlateSafety platform.
	6.	ENSURE Band V2 is communicating to the SlateSafety Platform.
	7.	FOLLOW Continuous Physiological Monitoring steps 3.7.1.4 through 3.7.1.6.
	8.	COLLECT Band V2 device(s) after work activities end.
	9.	UNASSIGN workers from associated bands within the SlateSafety platform.
	10.	CLEAN Band V2 device(s) with approved cleaning wipe.
	11.	PLACE Band V2 device(s) on charger.

Appendix B - (Cont.) Setup and Use of SlateSafety Band V2 System

Export of SlateSafety Data

The following steps provide direction for exporting data collected from Band V2 devices for and attaching into SWIHD.

Actionee	*Step*	*Action*
OS&IH personnel (Group Leader or Admin level permissions)	1.	Select "New Export"
	2.	INPUT "name" of export (e.g. SWIHD survey number, or other identifier)
	3.	SELECT the date of the work activity
	4.	SELECT Users and VERIFY the workers selected are only those for the specific work activity
	5.	SELECT "Band Biometrics" AND "Band Notifications"
	6.	SELECT the following options: • Measurement System – "Imperial" • File Type – "CSV" • Time Zone – "Pacific Time – United States" • Timestamp Format – "Local M-D-Y, 24h"
	7.	CLICK "Submit"
	8.	DOWNLOAD <u>AND</u> SAVE zip file
	9.	ATTACH file(s) to SWIHD survey