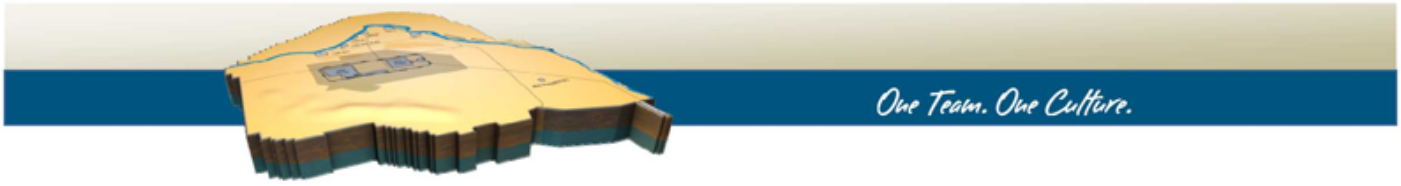

Administrative Procedure

PRC-PRO-SH-121

Heat Stress Control

Revision 2, Change 1

Published: 11/06/2017
Effective: 11/06/2017

Program: Occupational Safety and Industrial Hygiene
Topic: Occupational Safety and Industrial Health

Technical Authority: Hill, Elizabeth
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Use Type: Administrative

- Central Plateau Surveillance and Maintenance :
  Categorical Exclusion: GCX-2 (Editorial Changes)
  Screener: Kraemer, Laurie
- 100 K Facility :
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- Canister Storage Building/Interim Storage Area :
  Categorical Exclusion: GCX-2 (Editorial Changes)
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- Plutonium Finishing Plant :
  Categorical Exclusion: GCX-2 (Editorial Changes)
  Screener: Kraemer, Laurie
- Solid Waste Operations Complex :
  Categorical Exclusion: GCX-2 (Editorial Changes)
  Screener: Kraemer, Laurie
- Transportation :
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  Screener: Kraemer, Laurie
- Waste Encapsulation Storage Facility :
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  Screener: Kraemer, Laurie
- 324 Facility :
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  Screener: Kraemer, Laurie
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JHA: Administrative
Periodic Review Due Date:09/19/2022
Rev. 2, Chg. 1

Change Summary

Description of Change

Add definition of "Impermeable Clothing" and clarify "Impermeable" ensembles.

Heat Stress Control

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1.0 INTRODUCTION

1.1 Purpose

This procedure establishes requirements for working in CH2M HILL Plateau Remediation Company (CHPRC) areas where there is a potential for heat stress, and provides a process to mitigate heat strain and prevent heat stroke. This procedure implements some of the CHPRC Worker Safety and Health Program Plan requirements and is in compliance with Title 10, *Code of Federal Regulations* (CFR), Part 851, *Worker Safety and Health Program.*

1.2 Scope

This procedure applies to all CHPRC activities having a potential for heat stress, and applies to all CHPRC employees, including subcontractors.

1.3 Applicability

This Level 2 procedure is applicable to CHPRC employees and subcontractors who work in areas having a potential for heat stress.

1.4 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

CHPRC's heat stress control program follows the process identified in Figure 1, "CHPRC 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 exposure screening data, and establish Work-Rest cycles.

3.1 Preparation for Seasonal Heat Stress

Actionee	*Step*	*Action*
Responsible Manager (RM)	1.	Prior to the onset of warm weather or reaching the heat stress criteria identified in Section 3.2, PREPARE for anticipated work in heat stress conditions, to include: • Inventory planning and ordering of supplies needed for working in hot conditions and for establishing cool zones • Ensuring cool zone equipment is maintained and fully operational • Performing equipment readiness testing and/or preventive maintenance in cooler times of the year, or day • Planning for start time, and/or shift adjustments

3.2 Identification of Heat Stress Conditions

The following conditions require consideration for heat stress, and may require a *CHPRC Heat Stress Evaluation* (Site Form A-6007-263) by the project IH professional:

a. Predicted air temperatures greater than 85°F outdoors, or 90°F indoors
When working in single-layer cotton clothing (Clothing Adjustment Factor 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 steam pipes, boilers, heated vessels, welding operations, and heat reflected from or retained in asphalt surfaces.

d. Protective clothing is required
When wearing chemical- or radiological-protective clothing and/or or double-layer clothing (Clothing Adjustment Factor greater than zero), at air temperatures greater than or equal to 70°F; or wearing impermeable clothing (e.g., water- or vapor-barrier clothing or encapsulating suits) at any temperature.

e. High work intensity
Work at light to moderate metabolic levels (refer to 3.4.2.b) requires consideration for heat stress if other heat stress factors are present, such as warm temperatures (85°F for single-layer cotton clothing/70°F for protective or double-layer clothing); work at heavy and very heavy metabolic levels requires a *Heat Stress Evaluation* (Site Form A-6007-263) at any temperature.

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, in the presence of other factors such as warm air temperatures (90°F for single-layer cotton clothing/70°F for protective or double-layer clothing).

Actionee	*Step*	*Action*
RM/OS&IH	1.	IF heat stress conditions are not expected, or are expected to be adequately addressed using General Heat Stress Controls, THEN GO TO Section 3.3.
	2.	IF heat stress conditions are expected and Job-Specific Heat Stress Controls are required to mitigate hazards, THEN GO TO Section 3.4.

3.3 Implement General Heat Stress Controls

Actionee	*Step*	*Action*
RM/ Field Work Supervisor (FWS)	1.	IF potential heat stress conditions exist for a work activity having *Light to Moderate* metabolic demands, performed in single-layer poly-cotton coveralls or Level D work clothing, THEN: • CONSULT with OS&IH to determine worker acclimatization. • DETERMINE the WBGT screening value that signals implementation of the Work-Rest Cycle and/or Physiological Monitoring., • DETERMINE if WBGT monitoring should be requested for the project (e.g., work is around reflective surfaces, asphalt, etc.).

NOTE: *Hanford Meteorological Station WBGT readings must be representative of the employee's work area to be used to determine work/rest. Data from the nearest Hanford Meteorological Station that records WBGT data may only be used to monitor outdoor work that is located away from buildings/structures and reflective surfaces and asphalt, where workers are wearing single-layer cotton clothing (Level D).*

OS&IH	2.	On request, COLLECT AND RECORD WBGT data in accordance with PRC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*, using either:

Actionee	Step	Action
OS&IH		a. WBGT Data from the nearest Hanford Meteorological Station, in accordance with guidelines identified in Appendix C, "Use of Hanford Meteorological Station for WBGT Measurements." OR b. A local WBGT and the Site Wide Industrial Hygiene Database (SWIHD) IH WBGT Monitoring Field Log, when available. 1) IF the SWIHD IH WBGT Monitoring Field Log is not available, THEN USE the *CHPRC WBGT Monitoring Data Form* (Site Form A-6004-691), or equivalent.

FWS	3.	REVIEW the General Heat Stress Controls identified in Table 1, "General Heat Stress Controls,"
		AND IMPLEMENT the controls that are within the FWS's authority, such as:
		
		• Monitor heat stress conditions and reported heat-related symptoms;
		• Provide oral and written work instruction;
		• Take regularly scheduled breaks;
		• Encourage drinking small volumes of cool water regularly;
		• Encourage workers to self-limit exposures and/or report heat-related symptoms to their supervisor;
		  ○ Encourage the buddy system of coworker observation;
		• Adjust expectations of worker performance and take into consideration individual factors, such as:
		  ○ Those who are not acclimatized.

FWS/ Workers	4.	PROVIDE cool water AND ENCOURAGE workers to consume adequate quantities before entering the work area and/or on breaks.

NOTE: *When radiological and/or chemical 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 PRC-PRO-RP-40196, *Drinking Liquids in Contamination Areas*.

6. IMPLEMENT controls (e.g., a rest area that is shaded and cooler than the work environment).

Actionee	Step	Action

NOTE: *Symptoms of excessive heat strain include sudden and severe fatigue, nausea, dizziness or lightheadedness.*

FWS/ Workers

7. OBSERVE yourself and co-workers for signs and symptoms of excessive heat strain
   AND IMMEDIATELY REPORT those who show signs and symptoms to the FWS.

   a. IF signs and symptoms of excessive heat strain are shown by a worker
      THEN RESPOND to the situation, with worker feedback, as either:

      1) A medical emergency.

         a) CALL 911 (373-0911 from a cell phone)
            AND ASSIST worker until emergency responders arrive.
         b) PERFORM notification and follow-up actions identified in PRC-PRO-SH-077, Reporting, Investigating, and Managing Health, Safety and Property/Vehicle Events.

      OR

      2) A situation that requires prompt medical evaluation from the onsite medical provider.

         a) (FWS or designee) ACCOMPANY worker to the Medical Provider.
         b) PERFORM notification and follow-up actions identified in PRC-PRO-SH-077.

3.4 Perform a Heat Stress Evaluation

The *CHPRC Heat Stress Evaluation* (Site Form A-6007-263) evaluates the following parameters:

- Location/Task Heat Stress Factors
- Metabolic Demands of the Work Activity/Task
- Clothing Ensemble and Clothing Adjustment Factor
- Worker Acclimatization Status
- Heat Stress Control set and Monitoring plan

A documented equivalent hazard evaluation that addresses the listed parameters may be used in lieu of a *CHPRC Heat Stress Evaluation* (Site Form A-6007-263).

Actionee	Step	Action
IH Professional	1.	IF heat stress conditions are expected and Job-Specific Heat Stress Controls are required to mitigate hazards, THEN PERFORM a *CHPRC Heat Stress Evaluation* (Site Form A-6007-263), or equivalent hazard documentation.
	2.	DOCUMENT the following parameters in the *CHPRC Heat Stress Evaluation* (Site Form A-6007-263), or equivalent, with RM/Line Operations input: a. Location/Task Heat Stress Factors. b. Metabolic Demands of the Work Activity/Task. 1) USE Table 2, "Metabolic Rate Categories and Work Level" or an approved e-tool such as the Metabolic Rate Calculator. c. The Clothing Ensemble and Clothing Adjustment Factor (CAF) for personal protective equipment (PPE) worn, using Table 3, "Additions to Measured WBGT Values based on Clothing Adjustment Factors." 1) IF a CAF for an ensemble is not shown THEN PERFORM one of the following: • Refer to IHTE-2017-001 Heat Stress Clothing Adjustment Factor (CAF) Table, for additional CAF information. • Work with the Heat Stress TA to extrapolate a CAF. • Plan work activity using Physiological Monitoring.

NOTE: *According to the American Conference of Governmental Industrial Hygienists (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.

1) USE "Unacclimatized" as the default status.

Actionee	Step	Action
IH Professional		e. The Heat Stress Control Set using a graded approach and taking into consideration the hierarchy of controls.
		1) IDENTIFY the WBGT value that signals implementation of job-specific heat stress controls from Table 4, "WBGT Screening Criteria for Heat Stress Exposure."
		a) IDENTIFY the WBGT value(s) initiating Work-Rest Cycles, and/or Physiological Monitoring.
		3. IDENTIFY Engineered Controls as the primary means to reduce heat stress, such as those described in Table 5, "Job-Specific Heat Stress Controls."

NOTE: *When work site temperatures are greater than 95°F, air must be cooled before using fans or forced air ventilation.*

4. IF Engineered Controls are not adequate to reduce the potential for causing heat stress
   THEN IDENTIFY Administrative Controls to further reduce exposure to heat stress, such as:

   - ADJUST the work schedule for cooler times of the day.
   - ADJUST the work load or rate.
   - ESTABLISH Work-Rest cycles.
   - ADJUST the length of the rest period.

NOTE: *Use of cooling vests/suits have been shown to significantly limit worker heat retention and storage. Use of cooling suits in a Radiological Controlled Area needs to be planned with RadCon to address the potential for wicking of radionuclides through the Anti-c's and potentially contaminating under-garments and/or the vortex cooling unit. Note that a CAF reduction is not applied to cooling vests/suits.*

5. IF Engineered and/or Administrative Controls are not adequate to reduce the potential for causing heat stress,
   THEN CONSIDER use of supplemental PPE, or alter PPE selection to minimize heat stress burdens on the worker.

Actionee	Step	Action
IH Professional		a. CONSIDER use of personal cooling devices and accessory equipment such as: • Heat reflective clothing • Cooling ties and scarves • Cooling vests • Vortex vest/suit 1) VERIFY concurrence with RadCon before identifying cooling devices for activities occurring in radiological-controlled areas. b. WHEN work requires the use of radiological or chemical protective clothing in a radiological-controlled area, THEN IDENTIFY the clothing ensemble with RadCon support, taking worker heat stress into consideration. 1) USE PRC-1209-CDMP-0118, *CHPRC Disposable Radiological PPE Selection Criteria,* and Table 1 or IHTE-2017-001, "Additions to Measured WBGT Values based on Clothing Adjustment Factors," to determine the appropriate ensemble with the lowest heat stress burden. 6. IDENTIFY emergency egress and response to be used in the event of excessive heat strain, if not already identified in the project Health and Safety Plan, or in Project/Work Control documents. 7. SUBMIT the record copy of the *CHPRC Heat Stress Evaluation* (Site Form A-6007-263) to the Information and Records Management (IRM) Service Provider at Mail Stop A5-05.

3.5 Implement Job-Specific Heat Stress Controls

Actionee	*Step*	*Action*
RM/FWS/IH Professional	1.	WHEN heat stress conditions exist for a work activity THEN REFER to Table 5, "Job-Specific Heat Stress Controls" or to the control set identified on the *CHPRC Heat Stress Evaluation* (Site Form A-6007-263) or equivalent document AND PERFORM one of the following: a. IMPLEMENT Job-Specific Heat Controls using a graded approach, or as identified in the *CHPRC Heat Stress Evaluation* (Site Form A-6007-263), or equivalent document. 1) Observation of symptoms of excessive heat strain as a control is permitted only for limited work scope under the direct control of an IH Professional, with concurrence of the Heat Stress TA. OR b. IMPLEMENT Physiological Monitoring directly, in combination with other Job-Specific Controls, as identified in the *CHPRC Heat Stress Evaluation* (Site Form A-6007-263), or equivalent document.
	2.	PROVIDE cool water AND ENCOURAGE workers to consume adequate quantities before entering the work area and/or on breaks.
NOTE:		*When radiological and/or chemical particulate contamination is present, or potentially present, decontamination practices may be required prior to entering the drinking station.*
FWS/ Workers	3.	IF heat stress condition exist in a radiological-controlled area, THEN PROVIDE water at drinking stations in accordance with PRC-PRO-RP-40196.
FWS/ OS&IH/ Workers	4.	REVIEW the following information at the pre-job briefing: a. Heat stress controls and monitoring for the work activity. b. Information from Table 6, "Guidelines for Limiting Heat Strain," to include a review of symptoms of excessive heat strain.
FWS/ Workers	5.	OBSERVE yourself and co-workers for signs and symptoms of excessive heat strain AND IMMEDIATELY REPORT those who show signs and symptoms to the FWS. a. IF signs and symptoms of excessive heat strain are shown by a worker, THEN RESPOND to the situation, with worker feedback, as:

Actionee	Step	Action
FWS/ Workers		1) A medical emergency. a) CALL 911 (373-0911 from a cell phone) AND ASSIST worker until emergency responders arrive. b) PERFORM notification and follow-up actions identified in PRC-PRO-SH-077. OR 2) A situation that requires prompt medical attention from the onsite medical provider. a) (FWS or designee) ACCOMPANY worker to the Medical Provider. b) PERFORM notification and follow-up actions identified in PRC-PRO-SH-077.
FWS	6.	CONTACT the IH Professional when the need for Physiological Monitoring is reached.
OS&IH	7.	WHEN using a graded approach to heat stress mitigation THEN COLLECT AND RECORD WBGT data in accordance with PRC-PRO-SH-409, using either: a. WBGT Data from the nearest Hanford Meteorological Station in accordance with guidelines identified in Appendix C, “Use of Hanford Meteorological Station for WBGT Measurements,” OR b. A local WBGT and the SWIHD *IH WBGT Monitoring Field Log*, when available. • IF the SWIHD *IH WBGT Monitoring Field Log* is not available, THEN USE the *CHPRC WBGT Monitoring Data Form* (Site Form A-6004-691), or equivalent.
	8.	On request, CALCULATE hourly TWA-WBGT and TWA-Metabolic Rates, and/or Safe Work Times, to better estimate the timing of Work-Rest cycles, AND COMMUNICATE revised Work-Rest cycle information to the FWS.

Actionee	Step	Action
OS&IH	9.	VERIFY implementation of Job-Specific Heat Stress Controls, to include collection of WBGT and/or Physiological Monitoring measurements. a. WHEN the WBGT value in Table 3, "WBGT Screening Criteria for Heat Stress Exposure," reaches the point where Work-Rest cycles are required using the graded approach, THEN IMPLEMENT Work-Rest cycles in accordance with Table 3. b. WHEN the WBGT value in Table 3, "WBGT Screening Criteria for Heat Stress Exposure," reaches the point where Physiological Monitoring is required using the graded approach, OR IF Physiological Monitoring is identified as the primary approach, THEN IMPLEMENT Physiological Monitoring in accordance with Section 3.6, "Implement Physiological Monitoring," and Appendix B, "Physiological Monitoring."

3.6 Implement Physiological Monitoring

Three pathways are identified for routine physiological monitoring:

1) Continuous monitoring wearing a heart/temperature monitor,
2) Intermittent monitoring using a finger pulse oximeter (or talking the pulse manually) and using an body/ear thermometer,
3) Observation of symptoms of excessive heat strain, permitted for limited work scope under the direct control of an IH Professional, with approval by the Heat Stress TA.

The procedure steps described in this section apply to intermittent monitoring using a finger pulse oximeter and/or thermometer. Projects that select continuous monitoring will develop monitoring work steps to correspond with the instrument selected for use. For additional information on physiological measurements, refer to Appendix B, "Physiological Monitoring."

Actionee	Step	Action
OS&IH	1.	Before starting work, DISCUSS the following with project personnel: a. Physiological Monitoring data is designated "Official Use Only" (OUO), shared only by OS&IH, the FWS, and the employee during the work evolution, to prevent excessive heat strain. b. All workers are monitored. • 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. • Workers do not receive exposure reports for Physiological Monitoring but may access monitoring information in accordance with PRC-PRO-SH-409.

Actionee	Step	Action
OS&IH		c. ESTABLISH if *Heart Rate w*ill be monitored continuously (e.g., wearing a chest-strap heart monitor) or intermittently (e.g., using finger pulse rate monitor) during the work evolution. 1) EXPLAIN that *Body Temperature* may be used in lieu of heart monitoring, <u>AND</u> 2) *Body Temperature m*easurement is required as a follow-up measure where heart rate monitoring criteria, identified in Appendix B, are exceeded.
OS&IH/FWS/ Workers	2.	Before starting work, DISCUSS the flow of communications between the OS&IH, workers, the FWS, and the IH Professional in the event of excessive heat strain. a. OS&IH directly communicates with the worker and/or FWS during monitoring. b. OS&IH follows up with communications to the FWS and IH Professional, as soon as practicable, to identify workers directed to take the following actions related to Physiological Monitoring results: • Take a rest period, or extend the rest period because heart rate measurement criteria are temporarily exceeded; • Exit the work area after two rest periods when heart rate recovery time is outside of tolerance, and/or body temperature is outside of tolerance. c. <u>IF</u> a worker is directed to exit the work area due to Physiological Monitoring data, <u>THEN</u> DETERMINE, with worker, FWS and OS&IH input, the situation as one of the following: 1) A medical emergency. ○ CALL 911 (373-0911 from a cell phone) and MONITOR/COOL the individual until help arrives. ○ NOTIFY the Project Safety Manager/RM as soon as practicable <u>AND</u> COMPLETE an Event Report in accordance with PRC-PRO-SH-077.

Actionee	Step	Action
OS&IH/FWS/ Workers		2) A non-emergency situation that requires prompt follow-up with the medical provider. ○ FWS or designee to accompany individual to the medical provider. ○ NOTIFY the Project Safety Manager/RM as soon as practicable AND COMPLETE an Event Report in accordance with PRC-PRO-SH-077. 3) A non-emergency that does not require medical follow-up, but releases the individual for reassignment to an alternate task that does not involve heat stress exposure.
OS&IH	3.	Where *Heart Rate* monitoring is identified, PERFORM the following AND RECORD data on A-6007-287, *CHPRC Physiological Monitoring,* or equivalent: a. MEASURE AND RECORD each worker's *Resting Heart Rate* (or *Body Temperature*) before they dress out. 1) IF the *Resting Heart Rate* exceeds 100 heart beats per minute (bpm) and the individual does not qualify to work in a heat stress environment based on *Heart Rate* THEN MEASURE *Body Temperature* (see step 4) to determine if body temperature exceeds 100.4°F for unacclimatized, or 101.3°F for acclimatized. a) WHEN *Body Temperature* is used as the physiological measurement for an individual, instead of *Heart Rate,* THEN CONTINUE monitoring *Body Temperature* (instead of *Heart Rate)* for the individual, for the remainder of the shift. 2) IF the *Resting Heart Rate* AND the *Body Temperature Measurement* are both outside of tolerance THEN COMMUNICATE to the FWS that the individual does not qualify for work in a heat stress environment for that shift. b. SET the initial measurement interval to no more than 30 minutes after work begins for intermittent monitoring AND ADJUST the monitoring interval, as appropriate, not to exceed 1 hour between measurements.

Actionee	Step	Action
OS&IH		c. MEASURE AND RECORD a *Sustained Heart Rate (SHR)* while the worker is working, AND COMPARE to the *SHR* criterion of less than [180 minus the individual's age in years] (Refer to Table 6, "Guidelines for Limiting Excessive Heat Strain"). d. IF an individual's *SHR e*xceeds (180 - age) THEN PERFORM the following: 1) SIGNAL the individual to rest for 10 to 15 minutes (while inside the work area). 2) RECHECK the *Heart Rate* after the individual has rested 10-15 minutes AND COMPARE to the *Recovery Heart Rate (RHR)* criterion of less than or equal to 120 bpm. a) IF the individual's *Heart Rate* is greater than 120 bpm after the first rest period, THEN CONTINUE rest for a second 10- to 15-minute period. b) RECHECK the *Heart Rate* after the individual has completed the second rest period AND COMPARE with the *RHR o*f 120 bpm. i. IF the *RHR e*xceeds 120 bpm after the second rest period, THEN DIRECT the worker to exit the work area. ii. MEASURE the workers final *Heart Rate* or *Body Temperature* after they exit the work area, AND DETERMINE follow-up actions in accordance with step 3.6.2.c. c) IF the *RHR d*oes not exceed120 bpm THEN ALLOW the individual to continue working. 4. WHEN an individual's *Heart Rate* exceeds the stated criteria THEN COLLECT a *Body Temperature* (forehead, axillary or tympanic membrane) as an alternate and/or follow*up screening measurement. a. APPLY a correction factor to forehead and axillary temperature measurements in accordance with Appendix B. b. USE the tympanic temperature as a direct measure of Body Temperature.

Actionee	Step	Action
OS&IH		c. IF the corrected forehead or axillary temperature measurement, or actual tympanic membrane temperature exceeds 100.4°F for unacclimatized, or 101.3°F for acclimatized, THEN PERFORM the following: 1) DIRECT the individual to exit the work area AND MONITOR their condition outside of the work area. 2) NOTIFY the FWS and IH Professional for follow-up actions in accordance with step 3.6.2.c.
IH Professional	5.	WHEN *Heart Rate* and *Body Temperature* measurements are not feasible for a given work activity and/or other physiological measurements are deemed more appropriate, THEN CONSULT the TA to determine other feasible methods.
OS&IH	6.	DOCUMENT Physiological Monitoring measurements using Site Form A-6007-287, *Physiological Monitoring,* or equivalent. a. ATTACH Physiological Monitoring data to a SWIHD survey, under the "Generic" survey tab, AND MARK the survey as "OUO."

3.7 Employee Information and Training

Actionee	Step	Action
RM	1.	VERIFY that employees working in, or supervising work in hot environments, receive the computer-based training Course 620193, *CHPRC Temperature Extremes,* every 2 years.
RM/FWS	2.	CONDUCT AND DOCUMENT work-specific heat stress training 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.
RM/IH Professional	3.	VERIFY the Employee Job Task Analysis (EJTA) is marked for "Work in Hot Environments" and/or "Greenhouse Work," as applicable, in accordance with PRC-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.

Actionee	Step	Action
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 (e.g., adequate water consumption, rest, good physical conditioning).
Employees/ FWS	7.	RECOGNIZE the signs and symptoms of excessive heat strain AND IDENTIFY when an emergency situation is occurring.
	8.	RESPOND appropriately to an emergency situation:
		a. IF signs and symptoms of excessive heat strain are experienced by a worker, or are observed in co-workers, THEN INFORM the FWS immediately.
		b. IF the FWS, with feedback from affected worker, deems the situation a medical emergency, THEN CALL 911 (373-0911 on a cell phone).
Employees/ FWS		1) ASSIST/COOL worker until emergency responders arrive.
		2) PERFORM notification and follow-up actions identified in PRC-PRO-SH-077.
		c. IF the FWS, with feedback from affected worker, deems the situation a non-emergency, THEN REPORT to the Medical Provider.
		1) PERFORM notification and follow-up actions identified in PRC-PRO-SH-077
OS&IH	9.	INVESTIGATE cases of heat strain as requested by OS&IH management.

4.0 FORMS

CHPRC Heat Stress Evaluation, A-6007-263

5.0 RECORD IDENTIFICATION

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

Records Capture Table

Name of Record	Submittal Responsibility	Retention Responsibility
CHPRC Heat Stress Evaluation, A-6007-263	OS&IH Preparers	IRM Service Provider

6.0 SOURCES

6.1 Requirements

10 CFR 851, *Worker Safety and Health Program*

PRC-MP-SH-32219, *10 CFR 851 CHPRC Worker Safety and Health Program Description*

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

6.2 References

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

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

PRC-1209-CDMP-0118, *CHPRC Disposable Radiological PPE Selection Criteria*

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

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

PRC-PRO-SH-077, *Reporting, Investigating and Managing Health, Safety and Property/Vehicle Events.*

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

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

PRC-PRO-WKM-079, *Job Hazard Analysis*

6.3 Bases

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

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

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

Figure 1 – CHPRC Decision Logic for Heat Stress Control

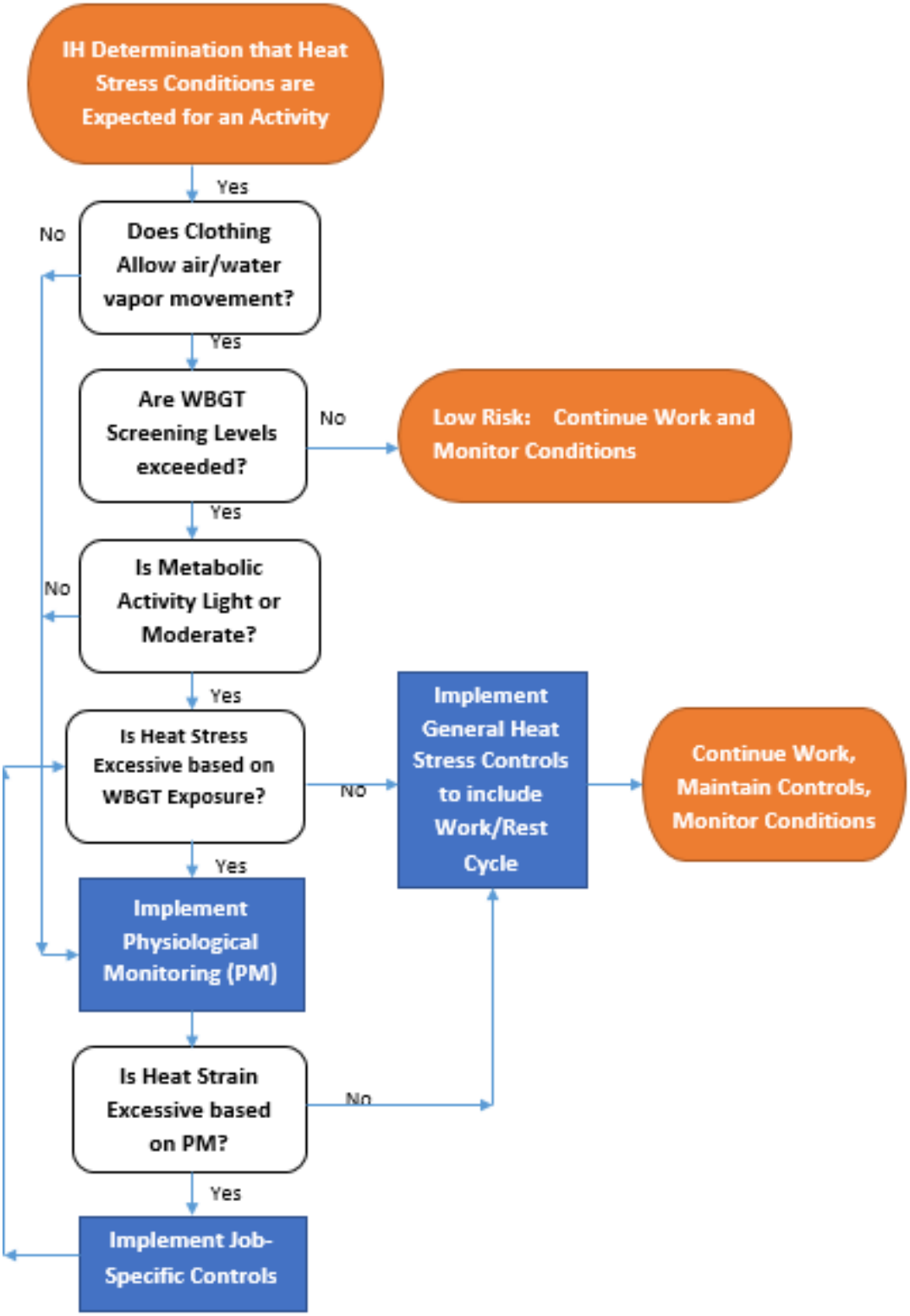

Table 1. General Heat Stress Controls

Implement General Heat Stress Controls:

- 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;
- Encourage drinking small volumes of cool water regularly, such as 1 cup every 20 minutes;
- Encourage workers to self-limit exposures and/or report heat-related symptoms to their supervisor;
  - Encourage the buddy system/coworker observations;
- Encourage healthy lifestyles such as maintenance of electrolyte balance and ideal body weight;
- Adjust expectations of worker performance and take into consideration individual factors, such as:
  - Those returning to work after absence from hot exposure conditions,
  - Those not acclimatized to wearing specialized PPE.

Table 2. Metabolic Rate Categories and Work Level

Work Level Category	Metabolic Rate* [W], 154 lb person	Metabolic Rate [W], 200 lb person	Metabolic Rate [W], 250 lb person	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, ○ Reading instruments, ○ Verifying lock and tag, ○ Using a table saw or 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.

Notes:

- 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. As appropriate**, *consider* incorporating a range for the metabolic work level** to account for those weighing more than the default 154 pounds, such as “Light-Moderate” or “Moderate-Heavy.”

Table 3. 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

Table 4. 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	87.8-87.8	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

Notes:

- Table 4 is intended as an **initial screening tool** to evaluate if a heat stress situation may exist.
- See Table 2, *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 4.
- 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 hourly time-weighted average (TWA)-WBGTs.** TWAs for Work Rates should also be used when the work demands vary within the hour. (See *2009 Documentation, p 22).*
  - **TWA-WBGT = $[(WBGT_W \times t_W) + (WBGT_R \times t_R)] / t_{W+R}$**
  - **TWA-Metabolic Rate = $[(MR_W \times t_W) + (MR_R \times t_R) / t_{W+R}$**
- 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, when 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®" section of 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.

Table 5. Job-Specific Heat Stress Controls

Implement Job-Specific Controls where heat strain may be *excessive:*

- **Engineered Controls** that reduce the metabolic work rate, provide general air movement, reduce process heat and water vapor release, and shield radiant heat sources; e.g.,
  - Mechanical assistance with tasks, as feasible
  - Containment tents/enclosures with recirculating or once-though air conditioning, or swamp cooling
  - Misters (fan-mounted, tubing runs)
  - Fans
  - Designated shaded rest area
  - Portable swamp coolers
  - Heat shielding/Insulation.

- **Administrative Controls** that set acceptable exposure times, allow sufficient recovery, and limit physiological strain; e.g.,
  - Pre-job briefing on heat stress associated with the work scope
  - Work/rest cycle in accordance with Table 3 or the *Heat Stress Evaluation* (A-6007-263)
  - Physiological Monitoring in accordance with Table 4, and/or the *Heat Stress Evaluation* (A-6007-263)
  - Industrial Hygienist control of specific work scope
  - Adjusted shift or start time (work in cooler part of day)
  - 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; e.g.,
  - Cooling suit/vest and accessories (e.g., cool tie/scarf, vortex)
  - Camel back water hydration when wearing PPE, including air-fed hood.

Table 6. Guidelines for Limiting Excessive Heat Strain

EXCESSIVE HEAT STRAIN

One or more of the following measures may identify excessive heat strain. An individual's exposure to heat stress should be discontinued when any of the following occur:

a) Sustained (several minutes) 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; or

b) Body core temperature is greater than 101.3°F for medically selected and acclimatized workers; or greater than 100.4°F in unselected, unacclimatized workers; or

c) Recovery heart rate at one minute after a peak work effort exceeds 120 bpm; or

d) There are symptoms of sudden and severe fatigue, nausea, dizziness or lightheadedness.

Appendix A - Glossary

Term	*Definition*
Acclimatization	The gradual physiological adaptation that improves an individual's ability to tolerate heat stress, with a reduction in heat strain. Because acclimatization is to the level of the heat stress exposure, a person will not be fully acclimatized to a sudden higher level, such as during a heat wave. **Acclimatized Status:** Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. For purposes of the TLV®, a worker is considered acclimatized when they have a recent history of heat-stress exposures of at least 2 continuous hours, in 5 of the last 7 to 10 of the last 14 days.
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), which is assigned through laboratory wear 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 located near the worksite, where workers periodically enter to cool down after working in a hot environment. Ideally, The cool down area should be shaded and maintained cooler than the work area.
(Core) Body Temperature	Core body temperature is found in the blood supplying organs such as the brain and those in the abdominal and thoracic cavities. An internal core body temperature of 100.4°F for unacclimatized and 101.3°F for acclimatized, is the limit for daily prolonged work under heat stress conditions. In general, the forehead temperature is lower (up to 1°F) than the oral temperature, and the normal ear temperature is higher (up to 1°F) than the oral temperature.
Excessive Heat Strain	Excessive heat strain is defined as showing one or more of the following: • Core body temperature >101.3 °F for acclimatized or >100.4 for non-acclimatized • Sustained heart rate >180 beats per minute (minus the person's age) for at least 3 minutes • Sudden, severe fatigue, nausea, headache, dizziness, feeling faint, lightheaded.
Forehead Temperature	A forehead thermometer may be used to estimate body temperature during PM with a correction factor. Forehead temperature measurements may show bias (low side) while wearing PAPR hoods from cool air introduced into the hood.
General Controls	General controls are implemented BEFORE there is the potential for excessive heat strain. General Controls include: written instructions, annual training, drinking small volumes of water regularly (1 cup every 20 minutes), self-reporting of symptoms and self-limitation of exposures, and use of the buddy-system in reporting symptoms,
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 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-Related Illness.

Appendix A - (Cont.) 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. A mild or moderate heat stress may cause discomfort and adversely affect performance, but is not harmful to health, according to the ACGIH®. As heat stress approaches a worker's tolerance limits, the risk of Heat-Related Illness increases.
Heat Stroke	Heat stroke is a life-threatening condition requiring IMMEDIATE medical attention, and occurs when the core body temperature increases after the body fails to thermo-regulate. Hot, dry, flushed skin (body no longer sweats), convulsions and semi-consciousness are symptoms.
Impermeable Clothing	Impermeable means not allowing fluid to pass through. Impermeable clothing are those ensembles worn for purposes of providing 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).
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. Use of Job-specific controls require worker monitoring.
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, the heart needs time to recover or return to the normal, resting heart rate. The pulse is measured after 1 minute of rest from a peak work effort. Guidelines indicate the RHR should not exceed 120 beats per minute (bpm). If exceeded, then additional recovery time is required for the individual. At CHPRC, the key feature for RHR evaluation is that the individual's heart rate decreases significantly during rest, showing they are maintaining homeostasis. If an individual's heart rate does not decrease significantly during rest, then they are not recovering physiologically and are showing symptoms of heat strain.
Resting Heart Rate	The baseline heart rate for people at rest, before engaging in a work activity, is identified as less than 100 beats per minute (bpm) for CHPRC.
Rest Period	A period of 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. When the body is exposed to heat stress, the initial rest period should allow the individual a place to sit in a cooler, shaded area, and to take water. After the initial recovery period (first break), extended rest periods may be used for light-duty activities such as paperwork.
Sustained Heart Rate (SHR)	The heart rate, when engaged in a sustained activity and/or in a hot environment, is normally 75-85% of the maximum heart rate. To calculate the sustained heart rate, use the formula: 180 bpm - Age (in years). The heart rate after sustained activity should not exceed 180 - Age. If temporarily exceeded, then follow-up actions are required, such as monitored rest and consultation about the need for medical attention.

Appendix A - (Cont.) Glossary

Term	*Definition*
Temperature Correction Factor	*Body Temperature* measurements require a correction factor if they are NOT taken with a rectal or tympanic (ear) thermometer. Forehead T °F — Approximate Correction Factor (Multiply) — Rectal/Ear T °F 98.4 - 99.3 — 1.018 — 100.4 - 101 99.4 – 101.1 — 1.016 — 101.1 – 102.4 101.2 – 102 — 1.014 — 102.5 – 103.5
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 (i.e., maintaining core temperature within +/- 1°C or 1.8 °F of normal). The Action Limit (AL) is similarly protective of unacclimatized workers and represents conditions for which a heat stress management program should be considered.
Tympanic Membrane Temperature	An infrared tympanic membrane thermometer may be used to directly estimate core body (e.g., brain) temperature during Physiological Monitoring. For adults, the normal ear temperature is 99.5°F. Tympanic temperature measurements may show bias in the following cases: 1) while wearing PAPR hoods; 2) if there is a wax buildup inside the ear, and 3) during times of ear infection.
Wet Bulb Glove 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 resting during one hour increments, established by the WBGT index, clothing ensemble, activity level (metabolic rate), and acclimatization status.

Appendix B - Physiological Monitoring

Background Information

CHPRC adopted the 2005 ACGIH® TLV®s in accordance with requirements identified in 10 CFR 851. In 2006, ACGIH® significantly improved the TLV®s and Work-Rest tables for heat stress. There have been minor changes to the TLV®s ever since. Use of the revised heat stress TLV® and Action Limit (2006-2017) reduces uncertainty and is deemed better than the 2005 TLV® because it provides equivalent or better worker protection.

Physiological monitoring plays a prominent role in this procedure in maintaining the heat stress TLV® or Action Limit (for unacclimatized). Physiological monitoring provides screening data for work activities having the potential for excessive heat strain, so that the TLV® (or Action Limit for unacclimatized) can be maintained and heat stroke prevented.

This appendix provides a process for collecting physiological measurements, and interpretative guidance. The most widely recognized Physiological measures for evaluating excessive heat strain are:

- The S*ustained Heart Rate (SHR) a*nd *Recovery Heart Rate (RHR),*
- *Body Temperature,*
- Symptoms of excessive heat strain.

Working at the S*ustained Heart Rate (SHR)* identified by the 2006-2017 TLV® represents a cardiovascular demand of ~75% of the worker's maximum aerobic capacity. For nearly all workers, working at the heat stress TLV®, or Action Limit (for unacclimatized), allows individuals to maintain homeostasis, preventing heat stroke.

Sustained Heart Rate (SHR)

Measurement of the *Sustained Heart Rate* is different for intermittent and continuous monitoring:

1) Intermittent Monitoring: Measurements are discrete, taken in the work area while the worker is working. The worker stops for a few moments and removes the outer work glove for a discrete finger pulse measurement. The results are compared to the criterion for *SHR*.

2) Continuous Monitoring: Heart rates are continuously monitored on a remote monitor. If an individual shows an increasing heart rate that is sustained at a rate above the criterion, over a one-to-three minute time interval, then the worker is signaled to take a rest.

NOTE: *Some medications could bias Physiological Monitoring measurements, such as heart, migraine and blood pressure medications (e.g., beta-blockers). The effects of these medications may cause a lowering of the heart rate. For those working in a heat stress environment AND taking medications such as beta-blockers, a rule of thumb regarding heat strain:*

"If you reach a point in your work where it is too hard to talk, it is probably too much and you need to rest."

Sustained Heart Rate (SHR) and R*ecovery Heart Rate (RHR) Criteria*

- A baseline *Resting Heart Rate* (≤100) is established before entering the work environment.
- A *SHR* that does not exceed 180 beats per minute (bpm) minus the individual's age in years (e.g., 180 – age), is expected for individuals assessed with normal cardiac performance.
    - For *Heart Rate* monitoring using a chest strap (read on a remote monitor), *SHR* is a sustained rate over several (2-3) minutes. An individual's heart rate may exceed (180-age), however the *SHR* is evaluated over a period of several minutes.

- For *Heart Rate* monitoring using a chest strap (read on a remote monitor), a *RHR* <110 bpm after one minute of rest, indicates that the worker is not experiencing heat strain.
    - A *RHR* at one minute after a peak work effort >120 bpm indicates that the worker is experiencing excessive heat strain.

Body Temperature

At CHPRC, *Body Temperature* measurement is used as a screening tool in combination with heart rate monitoring.

- A core body temperature of ≤ 101.3°F is expected for acclimatized workers.
- A core body temperature of ≤ 100.4°F for unacclimatized workers, is expected.

Estimates of core body temperature measurements may be taken with:

- A tympanic membrane (ear) thermometer
- Forehead thermometer
- Axillary (underarm) temperature sensor in a heart monitor worn on a chest strap
- A temperature pill, taken internally, to assess core body temperature (requires special approvals/documentation).

Forehead and axillary (underarm) temperature measurements are not direct measures of deep core body temperature and require a **variable temperature correction**, shown below. Tympanic temperatures are a direct measure of brain temperature, deemed a close estimate of core body temperature as measured by a rectal thermometer. At CHPRC, temperature corrections for tympanic membrane measurements are not required.

Forehead/Axillary T °F	Correction Factor (Multiply by)
98.4 - 99.3	1.018
99.4 - 101.1	1.015
101.2 - 102	1.014
102.3 - 103.1	1.013

NOTE: *A bias on the low side (underestimate) could be seen in both forehead and tympanic measurements for those wearing a respirator hood that provides cool air to the ear/forehead.*

Symptoms of Excessive Heat Strain

Symptoms of excessive heat strain may include heat rash, headache, sudden and severe fatigue, unusual irritability, nausea, dizziness, lightheadedness, or fainting. Observation of symptoms are an integral part of the heat stress control plan. NEVER ignore symptoms. ALWAYS report symptoms to the FWS or OS&IH.

Appendix C - Use of Hanford Meteorological Station for WBGT Measurements

Direction to measure WBGT and other heat stress measurements follow the conventions identified by the ACGIH® in *Threshold Limit Values® for Physical Agents*.

While it is true that WBGT heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed to heat stress, it is also permissible to use measurements from WBGTs that are not on the work site, **provided the readings are representative of the employee's work area.**

Data collected by local WBGTs are comparable to data collected by the met station WBGTs; i.e., within the accuracy range of the instruments. Note that it is not uncommon for two WBGT meters to have slightly different readings, up to a difference of a few °F. The use of Hanford Meteorological (Met) Stations with WBGT and weather data for outdoor work is approved, with certain cautions:

- Use of Met station WBGT data is best suited, and may only be applied, to outdoor work, away from buildings and structures, reflective surfaces and heat sinks, where workers are wearing level D apparel.
- The Met station does not observe Daylight Savings Time (DST) and all measurements are reported as Pacific Standard Time (PST).
- Met stations that have WBGTs post measurements on the hour. A time lag could exist between when the measurement was recorded and when it is posted on the website, such that the data point may no longer reflect current conditions.
    - In this case, one may call the Met Station directly for the current WBGT measurement nearest to the work location.

CHPRC OS&IH does not collect Met Station WBGT information; it is obtained through contact with the Met Station. The data collected by the Met Station is saved under MSA rules. WBGT data is received by the shift office for some CHPRC projects. The shift office enters WBGT data into the logbook and broadcasts the information to project personnel via a paging system. WBGT data that is received by CHPRC shift offices and transmitted to CHPRC OS&IH, is not required to be entered into SWIHD.

The use of the WBGT should not be relied on as the only means to control heat stress. The WBGT is most appropriately used as a screening tool that provides an indication when worker heat strain may need to be controlled or further evaluated with Physiological Monitoring.