

Physiological Monitoring for Heat Stress Management

Hanford Advisory Board
Tank Waste Committee

Edward Sinclair,
Washington River Protection Solutions

April 19, 2017



What is Physiological Monitoring (PM)?

- A basic way to measure the level of an individual's heat **strain** in response to heat **stress** conditions. This includes heart rate monitoring and body temperature measurement.
- PM does not include parameters that may be considered medical monitoring (measuring blood pressure, oxygen saturation, urine testing, or cardiac rhythm).



Tank farm crews work on a riser, left, and dig trenches for electrical conduit in C Farm.

When did WRPS begin its PM Program?

- WRPS first implemented its PM program in the field late in the 2014 heat stress season
- WRPS conducted full-season monitoring in 2015 and 2016
- The heat stress season runs from early May through the end of September
- PM program is part of a robust WRPS Heat Stress Program



Tank Farm workers performing head space sampling activities.



washington river
protection solutions

Results of Physiological Monitoring Program

- Eliminated heat stress disorders
- Removed employees from heat stress-related tasks before they developed heat-stress disorder symptoms
- Provided management with a quantitative measurement of each employee's response to heat strain
- Helped build employee confidence in the Heat Stress Control Program



Tank farm work often requires multiple layers of protective clothing and respiratory equipment, including SCBA.



Physiological Monitoring Instrumentation

- Physiological monitoring is conducted using an industrial hygiene (IH) approved device
- A variety of instruments were evaluated and the technical literature was reviewed to make informed selections
- IH personnel and the Occupational Medical Provider (HPMC) approved the selected instruments
 - The Nonin pulse rate monitor
 - Polar H7 heart rate monitor
 - Braun Thermoscan tympanic membrane thermometer





washingtonriver
protection solutions

Nonin Pulse Rate Monitoring

- Nonin pulse oximeter (Onyx Vantage or Onyx II models)
- Resting and periodic heart strain evaluation data





Nonin Pulse Rate Monitoring

- Physiological heart rate measurements are used to obtain an estimate of heat strain experienced by a worker
- This device collects a short-time sample but does not represent the overall worker heart rate variability over the work period
- This is an objective physiological measurement
 - It is not a medical or clinical procedure
 - It must be accurate enough to evaluate heat strain

Polar H7 Heart Rate Monitoring

- Physiological heart rate monitoring using a Polar H7 pulse oximeter



Polar H7 Heart Rate Monitoring

- Physiological heart rate measurements are used to obtain an estimate of heat strain experienced by a worker
- The device can provide a real-time reading as well as continuous readings to allow peak rate and recovery rate data to be collected in graphical and data file format
- This is an objective physiological measurement
 - It is not a medical or clinical procedure



Braun Thermoscan Thermometer Monitoring

- Measures the tympanic membrane temperature that is used for the purpose of evaluating heat strain in workers
- Temperature of the tympanic membrane does not require a correction factor when read using an infrared thermometer (Braun Thermoscan) to approximate body core temperature
- This is an objective physiological measurement
 - It is not a medical or clinical procedure
 - It must be accurate enough for assessing heat strain





washington river
protection solutions

Braun Thermoscan Thermometer Monitoring

- Body core temperature must be less than 100.4 degrees F or 38 C
- If body core temperature measurement is > 100.4 degrees F, discontinue exposure to thermal stress immediately and take precautions to cool the worker
- Consider whether symptoms are present that require first aid or medical assistance

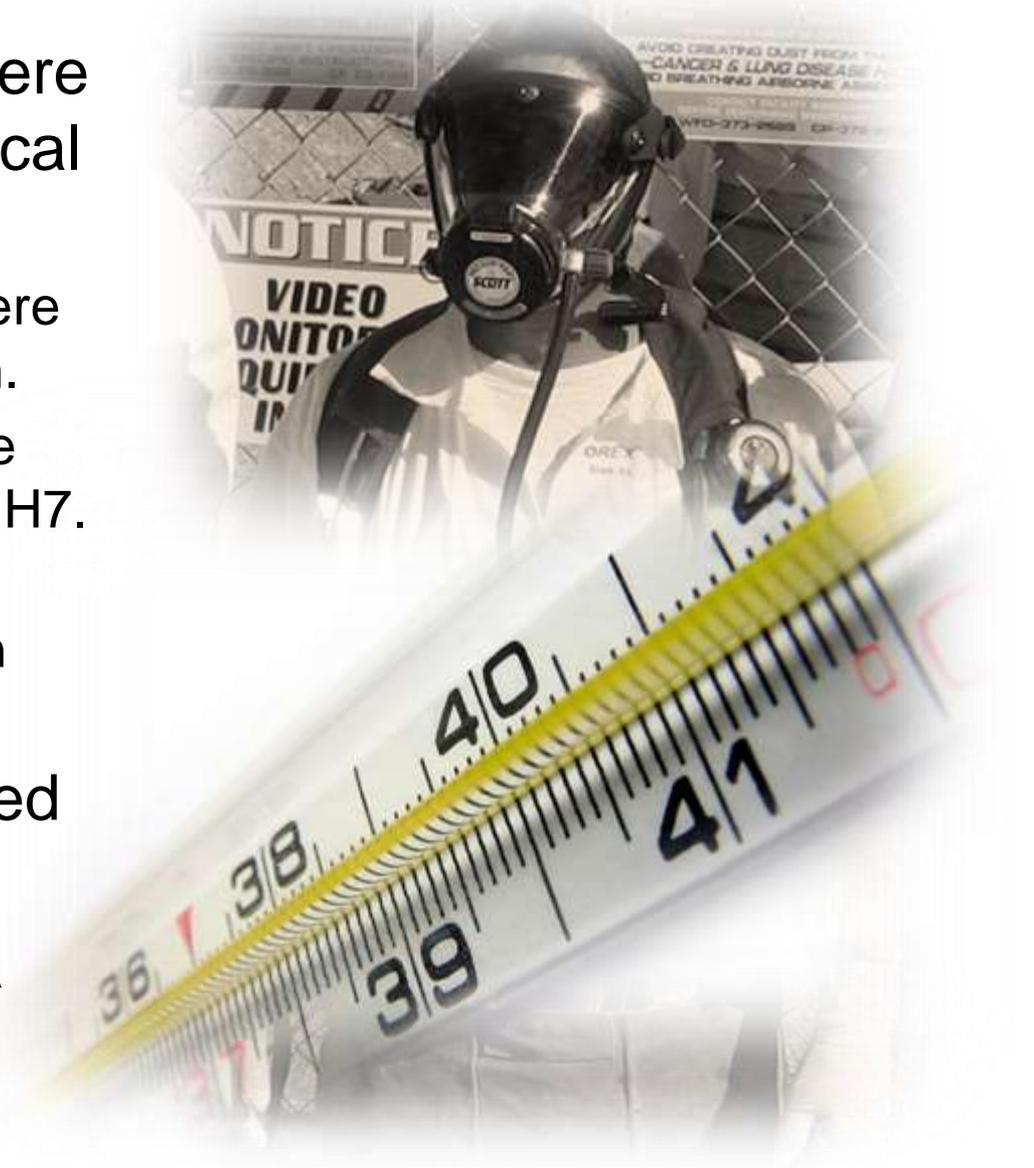


- 2,290 times employees were monitored with physiological monitoring
 - 1,682 times employees were monitored using Nonin
 - 484 times employees were monitored using Polar H7
 - 24 times employees were monitored using Braun Thermoscan
- 3 employees were removed from work
- 0 employees developed a heat-related disorder



Physiological Monitoring Data for FY 2016

- 2,729 times employees were monitored with Physiological Monitoring
 - 2,529 times employees were monitored using the Nonin.
 - 111 times employees were monitored using the Polar H7.
 - 78 times employees were monitored using the Braun Thermoscan.
- 0 employees were removed from work.
- 0 employees developed a heat-related disorder.





washingtonriver
protection solutions

WRPS PM Program Earns National Recognition

- WRPS received the 2017 Campbell Innovation Challenge award for PM program for creative thinking, strategic implementation of innovation
- PM program was determined a best practice in the DOE complex at 2015 Energy Facility Contractors Group (EFCOG) Symposium



WRPS President Mark Lindholm receives the Innovation Challenge Award on Feb. 21 at the Campbell Symposium in New Orleans.

WRPS has shared PM materials with:

- Center for Construction Research and Training
- Fluor B&W Portsmouth
- Idaho National Laboratory
- Los Alamos National Laboratory
- Mission Support Alliance
- Pacific Northwest National Laboratory
- Savannah River Nuclear Solutions
- Savannah River Remediation
- Waste Isolation Pilot Plant
- Energy Facility Contractors Group (EFCOG) IH/Occupational Safety special interest group



WRPS has shared PM training materials with many contractors, including Hanford's Mission Support Alliance.

Please contact Edward Sinclair:
edward_e_sinclair@rl.gov

