Heat Stress Mitigation

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CH2MHILL

Heat Stress

MISSION STATEMENT

"To implement recommendations for heat stress mitigation during planning, scheduling and execution of work. This includes providing information to the work force, real time monitoring, and use of heat mitigation equipment and other infrastructure changes necessary to allow safe, productive tank farm work during the summer months."

Heat Stress Mitigation

- **Protective clothing affects the body's ability to cool by reducing sweat evaporation**
- **From the OE Summary 2005-10**
  - At 83° with 60% humidity and impermeable protective clothing a worker can experience sunstroke, heat cramps and heat exhaustion
  - Workers experiencing heat stress may have trouble concentrating and may become disoriented to the extent they can no longer tend to their own well-being

Heat Stress Mitigation, cont.

Heat Index Chart

Environmental Temperature (°F)

RH%	85	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
90	102	119	123	128	132	137	141	146	152	157	163	168	174	180	186	193	199
85	100	115	119	123	127	132	136	141	145	150	155	161	166	172	178	184	190
80	97	112	115	119	123	127	131	135	140	144	149	154	159	164	169	175	180
75	96	109	112	115	119	122	126	130	134	138	143	147	152	156	161	166	171
70	94	106	109	112	115	118	122	125	129	133	137	141	145	149	154	158	163
65	92	103	106	108	111	114	117	121	124	127	131	135	139	143	147	151	155
60	90	100	103	105	108	111	114	116	120	123	126	129	133	136	140	144	148
55	89	98	100	103	105	107	110	113	115	118	121	124	127	131	134	137	141
50	87	96	98	100	102	104	107	109	112	114	117	119	122	125	128	131	135
45	87	94	96	98	100	102	104	106	108	110	113	115	118	120	123	126	129
40	86	92	94	96	97	99	101	103	105	107	109	111	113	116	118	121	123
35	85	91	92	94	95	97	98	100	102	104	106	107	109	112	114	116	118
30	84	89	90	92	93	95	96	98	99	101	102	104	106	108	110	112	114

Note: Exposure to full sunshine can increase heat index values by up to 15°F.

Apparent Temperature (°F)	Heat-stress risk with physical activity or prolonged exposure
80° – 90°	Fatigue possible.
90° – 105°	Sunstroke, heat cramps, and heat exhaustion possible.
105° – 130°	Sunstroke, heat cramps or heat exhaustion likely; heatstroke possible.
130° and up	Heat stroke highly likely with continued exposure.

Heat Stress Mitigation, cont.

Elements of an effective program:

- Worker training **– Basic training then reinforced by safety topics and pre-job briefings**
- Good health practices
  - Fluid intake – Cool water, fruit juice or Gatorade
    - Avoid coffee, tea and colas, as they are diuretics
  - Balance diet – Eat light before exposure

Heat Stress Mitigation, cont

- **Engineered Controls**
- **Administrative Controls**
- **Personal Protective Equipment**
- **Physiological and Work Site Monitoring**

Actions Taken

- **We performed work force indoctrination**
  - Focus articles – Three Issued
  - Tail Gate information was distributed each week starting the first of June
  - Distribution of the OSHA Quick Card for Heat Stress
- **IH Program performed a Management Assessment during the month of June to evaluate the company's readiness**

Actions Taken, cont.

- **Engineering Controls:**
  - AW Farm containment
    - Work space was cooled by recirculation air conditioning with 9 degree benefit
    - Suiting area/control point was cooled by swamp air conditioning
    - During periods of high radiant heat load, Containments and work areas were covered with shade netting. In some cases, the gap was insulated with a mister. Netting provided up to 10 degree benefit
    - Cool-down area in the farm, for those outside the containments used on Clean Out Box Work at the evaporator utilized net shading and mister

Actions taken, cont.

- **Administrative Controls**
  - Emphasized Self-determination
  - Work/rest regimen
  - Scheduling hot work to a time of day of lower heat stress
  - Emphasized must watch out for each other

Actions Taken, cont.

- **Providing ability to drink water in CA/RBA**
- **Personal Protective Equipment**
  - Cool-down vests in heat of day
    - Artic/Heat vest is being used by selected members of the WFO Pit Crew
    - After initial success, the Artic Vest was issued on wide scale to support WFO activity

Actions Taken, cont.

- **OREX Polyvinyl Alcohol (PVA) Coveralls were Piloted by Sampling Crew, SY Farm Construction Crew. And Evaporator Maintenance Crew**
- **The Coveralls are:**
  - 70% Lighter
  - They are 20% more breathable
  - They are disposable
  - They are in line with our laundry cost
  - SRS concluded that they were cheaper
  - The crews found them cooler and lighter.

Actions Taken, cont.

- Initially there were issues with tearing of the coveralls along the crotch seam. This was mitigated by improved taping technique at the ankle and wearing one size larger to minimize strain on the seam.
- After discussions with the distributor, we ordered a higher quality that had reinforced crotch seams. This sewing technique is being evaluated on all future manufacturing.
- The water repellent model was used during Evaporator Maintenance in areas with both potential water areas and high contaminated levels. Eliminates one set of PPE for the Workers.
- Done in lieu of imperemable rain suits in addition to one set of PPE coveralls. This allowed two sets of more breathable PPE coveralls and improved worker comfort.

Actions Taken, cont.

- **Jobsite and Personnel Monitoring**
  - Improved knowledge of Wet Bulb Globe Temperature (WBGT) chart.
  - Conducting a pilot of physiological monitoring by finger pulse measurement
    - Pulse rate used to establish work/rest regimen
    - Primarily used when workers are required to wear impermeable suits when WBGT is >75 degrees
    - Procedure for pilot was issued as a controlled procedure within the heat stress mitigation procedure.
    - Based on other successful implementation at Hanford
    - Supported by our Medical Provider

WBGT CHART

		ACCLIMATIZED				UNACCLIMATIZED			
	Work Demands	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
ONE CLOTHING LAYER	100% Work	85.1 F	81.5 F	78.8 F	N/A	81.5 F	77.0 F	72.5 F	N/A
	75% Work 25% Rest	86.9 F	83.3 F	81.5 F	N/A	84.2 F	79.7 F	76.1 F	N/A
	50% Work 50% Rest	88.7 F	85.1 F	83.5 F	81.5 F	86.0 F	82.4 F	79.7 F	77.0 F
	25% Work 75% Rest	90.5 F	87.8 F	86.0 F	85.1 F	87.8 F	84.2 F	82.4 F	79.7 F
TWO LAYERS	100% Work	78.8 F	75.2 F	72.5 F	N/A	75.2 F	70.7 F	66.2 F	N/A
	75% Work 25% Rest	80.6 F	77.0 F	75.2 F	N/A	77.9 F	73.4 F	69.8 F	N/A
	50% Work 50% Rest	82.4 F	78.8 F	77.0 F	75.2 F	79.7 F	76.1 F	73.4 F	70.7 F
	25% Work 75% Rest	84.2 F	81.5 F	79.7 F	78.8 F	81.5 F	77.9 F	76.1 F	73.4 F
THREE LAYERS	100% Work	76.1 F	72.5 F	69.8 F	N/A	72.5 F	68.0 F	63.5 F	N/A
	75% Work 25% Rest	77.0 F	74.3 F	72.5 F	N/A	75.2 F	70.7 F	67.1 F	N/A
	50% Work 50% Rest	79.7 F	76.1 F	74.3 F	72.5 F	77.0 F	73.4 F	70.7 F	68.0 F
	25% Work 75% Rest	81.5 F	78.8 F	77.0 F	76.1 F	78.8 F	75.2 F	73.4 F	70.7 F

Summary

- **Ongoing process to improve worker safety and productivity during work activities that have high potential for heat stress**
- **CH2M HILL improved the knowledge base, PPE, Engineered controls, Administrative controls, and medical monitoring to improve response to heat stress**
- **Resulted in significally fewer First Aid Cases and more company productivity during the Summer months.**
- **Through our interaction with the Work Force, we are listening to what they need then working to implement mitigators.**