A Unique Approach to Prevention of Heat Strain in D&D Workers

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**Charles J. Satterwhite, CIH,** is certified in the Comprehensive Practice of industrial Hygiene with more than 25 years experience in laboratory, nuclear, university, construction/D&D, and manufacturing settings. Mr. Satterwhite is currently the Industrial Hygiene Lead for the K-27 D&D Project. He has served in leadership roles in the Health And Safety community including former President of the Tennessee Valley Section American Industrial Hygiene Association. Having been involved in Radiological and Asbestos Abatement work at three Oak Ridge DOE Sites (ETTP, ORNL, and Y12) before work controls included systematic consideration of Heat Stress, this subject has been a special interest since the mid 1980’s.

**Ram S. Suga, CIH, CSP, CHMM,** is an experienced Environmental, Safety, and Health (ES&H) Professional specializing in Industrial Hygiene, Industrial Safety and Hazardous Waste Management. With certifications including CIH, CSP and CHMM, he has a wide and varied background of over 25 years in the analytical, nuclear, chemical, construction and D&D areas.

He is currently the Industrial Hygiene Lead for K-25 and has also conducted ES&H oversight of field activities at Paducah KY, Portsmouth OH, Oak Ridge, TN and Brookhaven National Lab. NY. He is a Fellow in Industrial Hygiene from AIHA, a Champion of Excellence from ACHMM, Six Sigma Yellow Belt and a Human Performance Improvement Facilitator. He has co-authored several publications for AIHA. He has also been chairmen for several AIHA committees. He has been conducting professional development courses in many fields if interest in ES&H for many professional organizations since 1980.
Objectives

- Overview of Decontamination/Demolition - CERCLA Cleanup Project to highlight the ES&H challenges we face
- Review Hazards and Unique Health and Safety (and Security) Challenges
- Discuss “marriage” of Radiological Controls with Industrial Hygiene Controls (e.g., Asbestos/Hazwoper)
- Provide an Overview of Heat Stress Controls
- Creatively Solving Challenges - Heat Stress
- Questions

K-27 building - is a rectangular three-story building with the same process design as the K-25 Building.
Description of the uranium enrichment process:

- Process for separation of the naturally occurring $^{235}\text{U}$ and $^{238}\text{U}$
- Most significant isotope separation process of the Manhattan Project.
- Gaseous $\text{UF}_6$ is passed through converters/compressors many times - each time increasing the “enrichment” of the product
- The process is based on separation due to the slight mass differences of 235/238
- Requires Fluorinated gas handling capability e.g., nickel plated or lined pipes and containers
Primary Hazards:

- Asbestos – Process Pipe, Steam Pipe (UF6 had to be kept warm to stay gaseous), and Transite Siding – 29 CFR 1926.1101
- Radiological – Uranium / Technetium Inside Process Equipment – 10 CFR 835
Asbestos Abatement
Primary Hazards (continued):

- Nuclear Criticality Issues – 10 CFR 830
- Buildings Must be Criticality Incredible Prior to Demolition
Primary Hazards (cont.):

- **Mold** – Minimum of P-95 Facepiece Filtering Mask required for entry
- **Mercury** – Thousands of mercoid switches throughout.
Primary Hazards (continued)

- Noise
- Process gas - \((\text{UF}_6, \text{Fluorine etc})\)
- Hydrogen Fluoride (reaction of moist E. Tennessee air with \(\text{UF}_6\) produces \(\text{UO}_2\text{F}_2\) and HF)
- Elevated Work, Physical Hazards, Hot Work
- HAZWOPER
Vault Cleanout
Preparing for Demolition

Structures cut open to Foam

Foaming equipment to stabilize contaminants

Performing hot work on valves
VPDI and Foaming

Foaming Truck Alley Pipe

Vent Purge Drain/Inspect
K-25: Preparing for Demolition

Sawzall cutting

Converter Removal

Intrusive Sampling
High Risk Equipment Removal

Pipe Removal

K-25/K-27 D&D
Committed To Zero Accidents
UNIQUE HEAT STRESS APPROACH

…To Manage Heat STRAIN

- TRAINING
- WBGT TABLES
- RADIO / PAGER COMMUNICATION OF WBGT
- H.E.A.R.T. CARD
- PHYSIOLOGICAL MONITORING USING POLAR™ HEART RATE MONITOR
- Air Conditioning Zones (Not feasible to cool entire Large Building Area)
- Cool Rooms (Drinking water accommodated in “islands” within contamination areas)
- “Swamp Coolers” and Cooling Fans
- Modified PPE (e.g., reduce from tyvek to aprons where feasible) to mitigate hazard (with heat strain in mind)
- Daily IH participation in POD/Tailgate mtgs.
UNIQUE HEAT STRESS APPROACH

- *POLAR*™ Heart Rate Monitor:
H.E.A.R.T. CARDS: (Heat Evaluation And work-Rest regimen Tool)
Air Conditioner Being Used in K-25 Building for Heat Relief
Physiological Monitoring

- WBGT Tables from Current ACGIH TLV Booklet
- Remember: For work beyond recommended maximum limits on WBGT Table - Physiological monitoring is absolutely REQUIRED
Individual Crew Assessment

- IH and GFs (and Foreman as necessary)
  - As a Team, review job scope, conditions, PPE, etc.
  - Categorize Work (L/M/H) and PPE (5 Categories)
  - Flow information to individualized Heart Card for Crew
  - Physiological Monitoring
HEART (Heat Evaluation And work-Rest regimen Tool) Card

- Signing in – Acclimatized?
- Baseline at rest (e.g., before stretching)
- Use Heart Rate Monitor during work period
- Guidance on max heart rates during work/“at rest”
- Time – WBGT – place to write it when communicated

Acclimatization

- For new employees or workers who have been off work for extended absences, contact IH for individual guidance
Summary:

- Significantly More Effective (Safer) than Just Work/Rest
- Allows Individual Monitoring
- More Practical Than Work/Rest
- Only one Recordable ("Dehydration" Case) In Three Years
- High User Acceptance
- Management Acceptance
- **Peace of Mind** for Industrial Hygienist/Health Physicist