Civilian Radioactive Waste
Management System

Management & Operating
Contractor

TRW Environmental Safety
Systems Inc.

Systems Engineering

Presentation to the Nuclear Waste Technical Review Board
Arlington, VA

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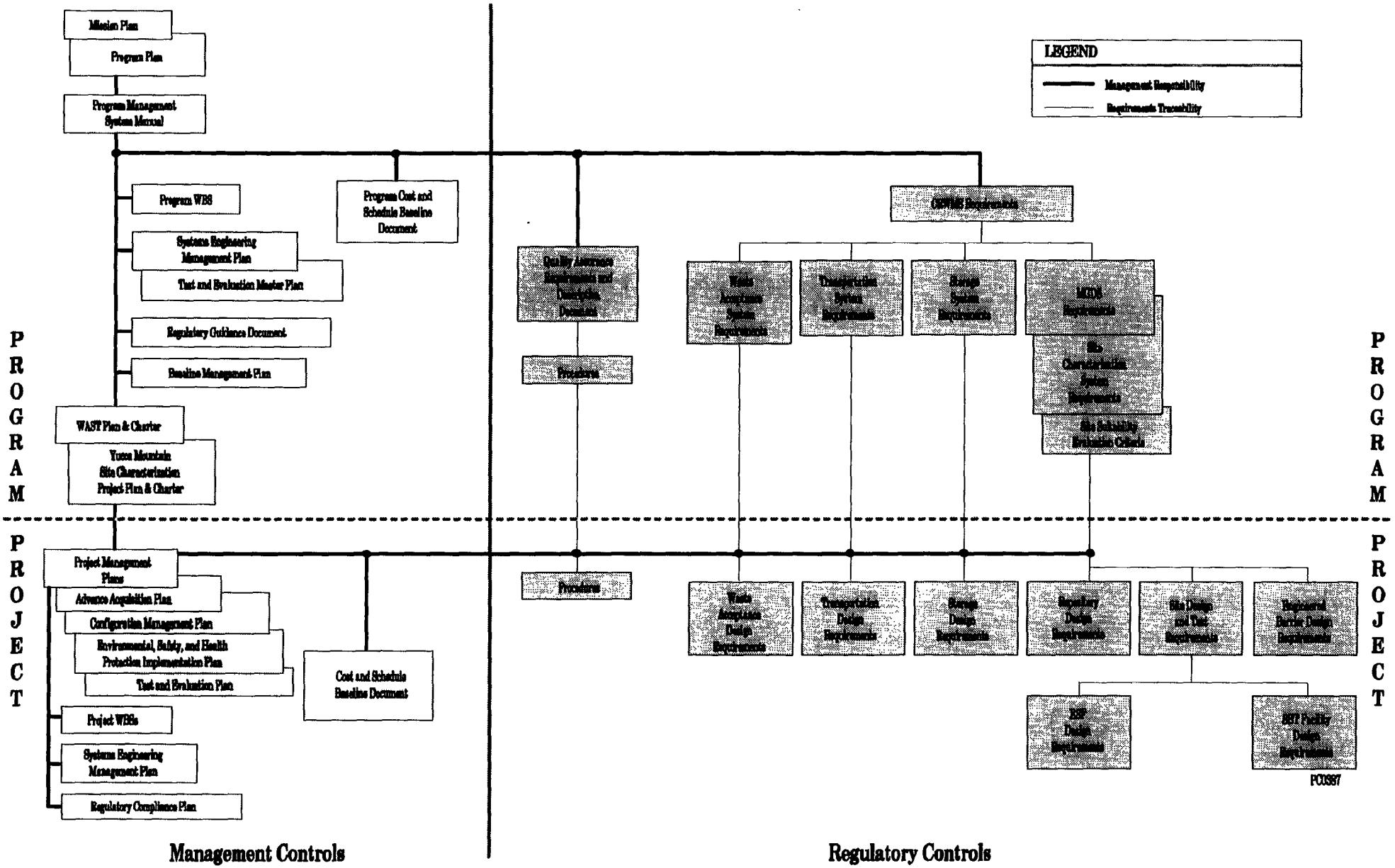
Overview

- **Updated Systems Engineering Management Plan**
- **Working in hot environments**

Document Hierarchy



SEMP

- Development of the Multi-Purpose Canister (MPC)
- Prerequisites and products of each phase
- Technical reviews scheduled through FY96
- TBV and TBD requirements
- Specialty Engineering Program Plans

Development of the MPC

- Acquisition process for the MPC procurement
- Technical baseline and related documentation
- Technical reviews

Phase Prerequisites and Products Example

Phase	Doc at Start	Products of Phase
Conceptual	CRD	SRD, plans
Preliminary	SRD	DRDs, analyses
Detailed	DRDs	Design packages
Fabrication/ Construction	Design packages	As-built design package Manuals
Operation	Manuals	

Technical Reviews

- CRWMS element/segment
- Technical review
- Date
- Example
  - CRWMS segment: MPC procurement
  - Review: Safety Analysis Design Review
  - Date: FY96, 3rdQ

TBV and TBD Requirements

- **Requires projects to determine the technical cost, schedule, and programmatic risks associated with proceeding without closure**

Specialty Engineering Program Plans

Human Factors Engineering Program Plan:

- Activities/phase
- Operational concept
- Functional allocation
- Task analysis

Specialty Engineering Program Plans

System Safety Program Plan:

- Activities/phase
- System Safety Analyses
- System Safety Working Group
- Hazard tracking and risk resolution database

Specialty Engineering Program Plans

Integrated Logistics System Program Plan:

- Activities/phase
- Logistics Support Analysis (LSA)
- Maintenance concept
- Provisioning concept
- Failure Reporting Analysis and Corrective Action System (FRACAS)

Specialty Engineering Program Plans

RAM Program Plan:

- Activities/phase
- Program reliability requirements
- Allocation of RAM performance requirements
- Trade-off analyses

Working in Hot Environments

- Purpose
- Heat gain and loss
- Heat stress
- Design requirement
- Heat stress measurements
- Repository temperatures

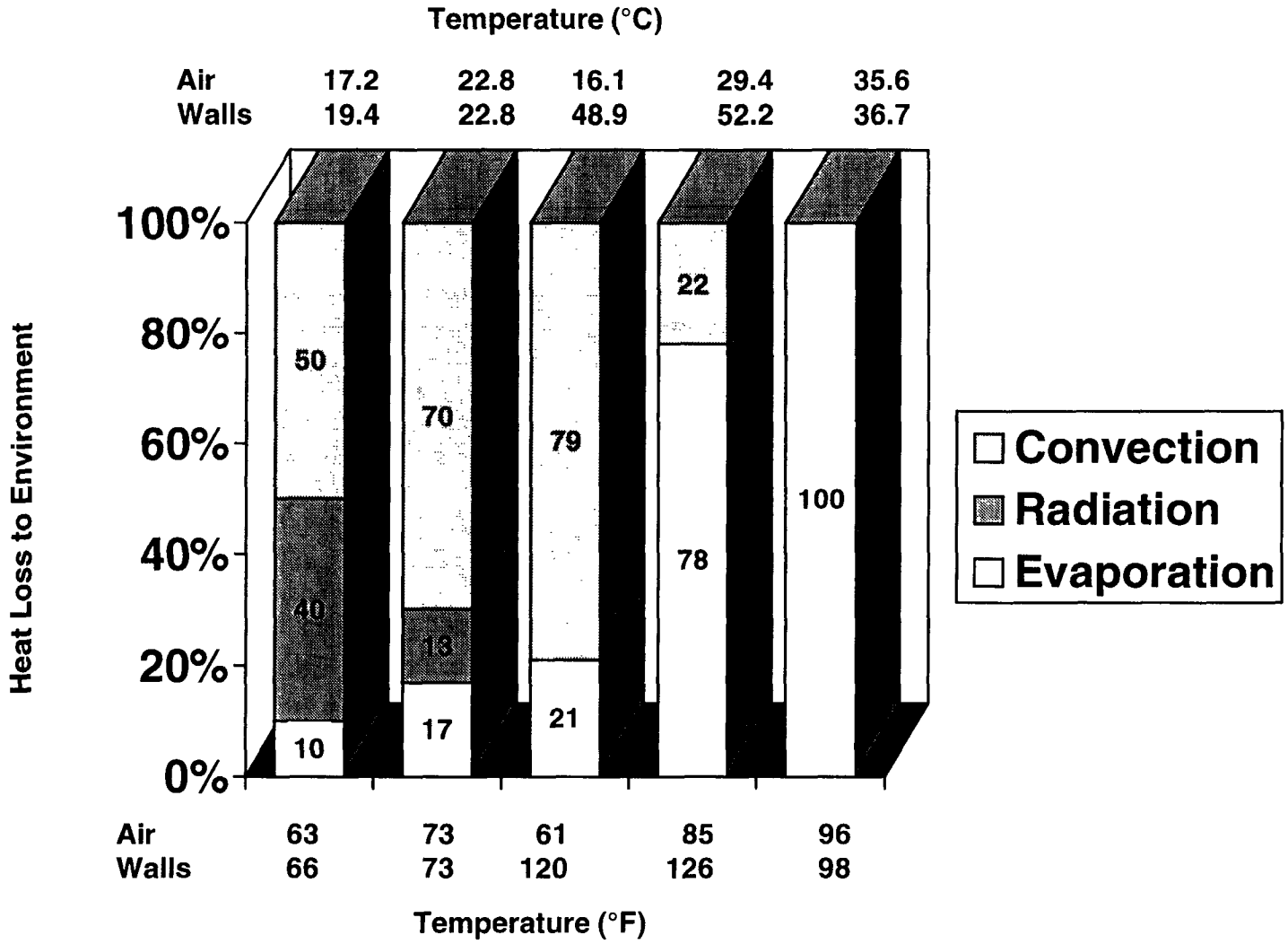
Purpose

- **Provide background for the need for establishing a temperature requirement for workers**
- **Provide input to concept of operations**

Heat Gain and Loss

- $S = M \pm C \pm R - E$
- Heat gain sources
  - Human metabolism
  - Convective heat
  - Radiative heat
- Heat loss sources
  - Convective heat
  - Radiative heat
  - Evaporation

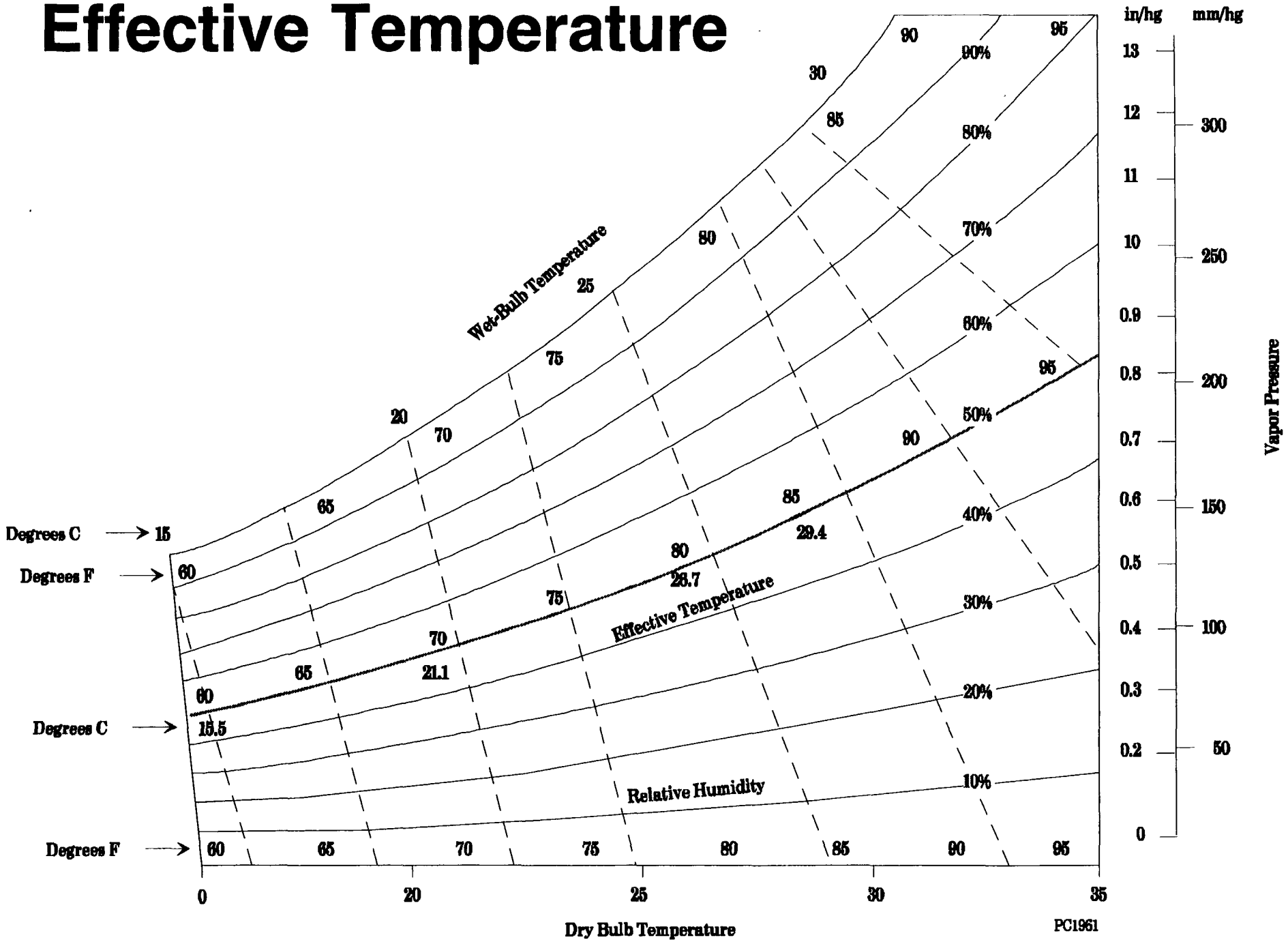
Heat Loss to Environment



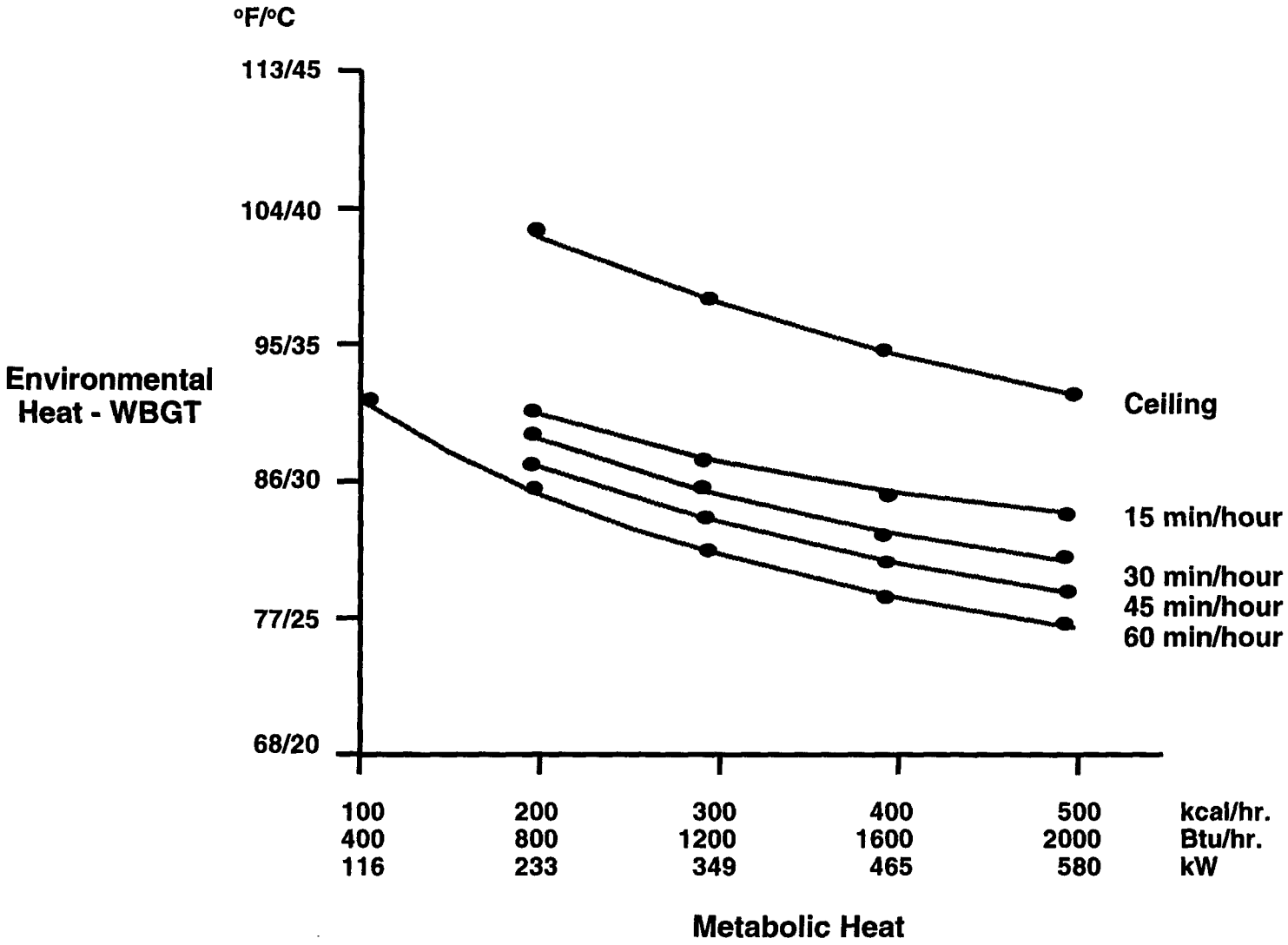
Heat Stress

- Heat cramps
- Heat exhaustion
  - Deep core temperature exceeding $37^{o} \pm 1^{o}C$ ($98.6^{0} \pm 1.8^{0}F$)
  - Headache, nausea, vertigo, weakness, confusion, loss of consciousness, convulsions
- Heat stroke
  - Medical emergency
  - Multi-system lesions
  - Can be fatal

Effective Temperature



NIOSH Guidelines



Proposed Repository Design Temperatures

- Temperatures by phase
  - Operations, emplacement, caretaker, and backfilling
- Temperatures by location
  - Access drifts, emplacement drifts, and perimeter drifts