

HUMAN FACTORS ACTIVITIES UPDATE

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**NUCLEAR WASTE TECHNICAL REVIEW BOARD
TRANSPORTATION & SYSTEMS PANEL MEETING
SEPTEMBER 25, 1991
ARLINGTON, VA**

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

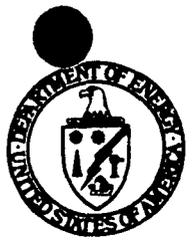


OVERVIEW

- **THE NWTRB IDENTIFIED THE NEED FOR A HUMAN FACTORS ENGINEERING PROGRAM WITHIN DOE AND RECOMMENDED SUCH A PROGRAM BE ESTABLISHED**

DOE ACTIONS:

- **CASK DEVELOPMENT CONTRACTORS WERE REQUIRED TO INCLUDE HUMAN FACTORS ENGINEERING (HFE) SPECIALISTS AS PART OF THEIR DESIGN TEAM**
- **DEVELOPED A DRAFT HUMAN FACTORS IMPLEMENTATION PLAN FOR THE TRANSPORTATION PROGRAM**



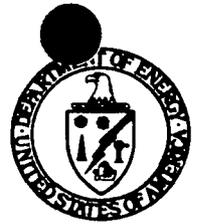
CURRENT STATUS

- **HUMAN FACTORS ENGINEERING IS BEING APPLIED TO CASK DEVELOPMENT**
 - **CASK DESIGNS HAVE BEEN REVIEWED TO DEFINE OPPORTUNITIES TO MINIMIZE:**
 - - **TURNAROUND TIME**
 - - **WORKER RADIATION EXPOSURE**
 - - **HUMAN ERRORS**
 - - **EQUIPMENT HANDLING**
 - - **INSPECTION TIME**
 - - **SERVICE AND MAINTENANCE TIME**



CURRENT STATUS (CONT)

- **EXAMPLES OF SPECIFIC DESIGN CHANGES MADE TO THE GA CASKS THAT WERE IDENTIFIED AS A RESULT OF HUMAN FACTORS ENGINEERING REVIEW INCLUDE:**
 - - **ADDED DEFINITIONS OF ROBOTIC, REMOTE, AND HANDS-ON AS THEY RELATE TO OPERATING PROCEDURES AND IDENTIFIED WHICH METHOD IS ASSUMED FOR EACH OPERATION.**
 - - **ADDED MATCH MARKS TO THE IMPACT LIMITER AND CASK TO AID IMPACT LIMITER INSTALLATION.**
 - - **ADDED MARKINGS ON THE CASK TO INDICATE ITS CORRECT ORIENTATION ON THE TRAILER.**



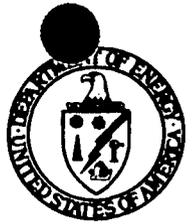
CURRENT STATUS (CONT)

- - ADDED DETAILED LABELS TO CLARIFY THE GAS SAMPLING PORT/LEAKAGE CHECK PORT.
- - ADDED POSITIVE INDICATION TO SHOW WHEN THE LIFTING YOKE IS FULLY SEATED IN TRUNNIONS.
- - MOVED BOTTOM DRAIN TO SIDE TO ELIMINATE THE NEED FOR THE OPERATOR TO REACH UNDER THE CASK.



CURRENT STATUS (CONT)

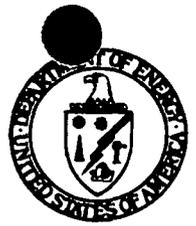
- **EXAMPLES OF SPECIFIC DESIGN CHANGES MADE TO THE B & W CASK THAT WERE IDENTIFIED AS A RESULT OF HUMAN FACTORS INCLUDE:**
 - - **REPOSITIONED AND REDESIGNED THE FILL AND DRAIN LINES (REDUCES RADIATION EXPOSURE).**
 - - **ELIMINATED BASKET ALIGNMENT DOWELS AND REPLACED WITH KEYS AND KEYWAYS (FOR EASE OF OPERATION).**
 - - **REDESIGNED BASKET RETAINING RING (EASE OF OPERATION RESULTS IN REDUCED RADIATION EXPOSURE).**



CURRENT STATUS (CONT)

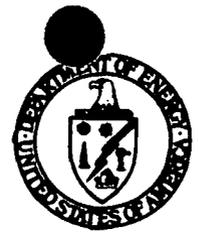
- - **CHANGED FROM LEFT HAND TO RIGHT HAND THREADS (REDUCES THE POSSIBILITY OF MISTAKES AND THE ASSOCIATED RADIATION EXPOSURE).**

- - **CHANGED THE DRAIN AND FILL LINES TO BE OF A DIFFERENT DESIGN TO ELIMINATE MISCONNECTION.**



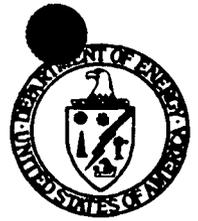
CURRENT STATUS (CONT)

- **DRAFT HUMAN FACTORS IMPLEMENTATION PLAN**
 - **ESTABLISHES HUMAN FACTORS ENGINEERING AS AN INTEGRAL PART OF THE TRANSPORTATION SYSTEM**
 - **PROVIDES A STRUCTURED APPROACH TO HUMAN FACTORS ENGINEERING TAILORED TO ASSURE THAT THE TRANSPORTATION SYSTEM MEETS ITS PERFORMANCE OBJECTIVES**
 - **COVERS ALL PHASES OF THE TRANSPORTATION LIFE CYCLE AND ALL ELEMENTS OF THE SYSTEM INVOLVING OR AFFECTING PEOPLE**
 - **EMPLOYS A TOP-DOWN APPROACH IN IMPLEMENTING HUMAN FACTORS ENGINEERING WITHIN THE SYSTEM BUT A BOTTOM-UP APPROACH IN THE IDENTIFICATION OF SPECIFIC HUMAN FACTORS ISSUES**



CURRENT STATUS (CONT)

- **REQUIRES THE USE OF COMPUTER-BASED MODELS AND/OR PHYSICAL MOCK-UP TO EXPERIMENTALLY EXAMINE THE ROLE OF HUMANS WITHIN THE SYSTEM'S DESIGN**
- **IDENTIFIES THE SPECIFIC HUMAN FACTORS ACTIVITIES THAT WILL BE ACCOMPLISHED DURING EACH PHASE OF SYSTEMS DEVELOPMENT**
- **IDENTIFIES SPECIFIC HUMAN FACTORS ISSUES IN EACH OF THE TRANSPORTATION SYSTEMS ELEMENTS AND SYSTEM DEVELOPMENT PHASES**
- **PROVIDES HUMAN FACTORS DATA MANAGEMENT REQUIREMENTS**



PROPOSED ACTIONS

- **CASK DEVELOPMENT**

- **HUMAN FACTORS ENGINEERING WILL BE APPLIED THROUGHOUT CASK DESIGN, LICENSING, AND PROTOTYPE ACCEPTANCE.**
- **HUMAN FACTORS ENGINEERING SPECIALISTS WILL MONITOR DESIGN CHANGES OR MODIFICATIONS MADE DURING THE LICENSING PROCESS.**
- **HUMAN FACTORS ENGINEERING SPECIALISTS WILL BE INVOLVED DURING THE PROTOTYPE CASK ACCEPTANCE PROCESS.**



PROPOSED ACTIONS (CONT)

- **IMPLEMENTATION PLAN**

- **FUTURE OCRWM WORK INVOLVING ELEMENTS OF HUMAN FACTORS ENGINEERING INCLUDE:**

- - **TRANSPORTATION SYSTEM DEFINITION/COMPOSITION**
- - **TRANSPORTATION SYSTEM FUNCTIONS AND ALLOCATION**
- - **OPERATIONS TEST PLANNING**
- - **NEED FOR CONTINUED HUMAN FACTORS ENGINEERING INPUT TO ONGOING AND NEW CASK DESIGNS**
- - **OPERATIONS ASSESSMENT OF INTERMODAL TRANSPORTATION**

SYSTEMS SAFETY ACTIVITIES UPDATE

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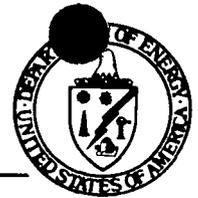
OVERVIEW

- **THE NWTRB IDENTIFIED THE NEED FOR A SYSTEMS SAFETY PROGRAM WITHIN DOE AND RECOMMENDED SUCH A PROGRAM BE ESTABLISHED**
- **OCRWM OBTAINED THE SERVICES OF A PROFESSIONAL SYSTEMS SAFETY ENGINEER TO REVIEW THE TRANSPORTATION PROGRAM TO:**
 - **DESIGN AN OCRWM TRANSPORTATION SYSTEMS SAFETY PROGRAM AND PLAN**



CURRENT STATUS

- **CONSULTANT HAS PREPARED DRAFT SYSTEMS SAFETY DOCUMENTS:**
 - **AN OCRWM SYSTEMS SAFETY PROGRAM**
 - - **ESTABLISHES SYSTEMS SAFETY MANAGEMENT AND ENGINEERING TASKS**
 - **AN OCRWM TRANSPORTATION SYSTEMS SAFETY PLAN**
 - - **PROVIDES GUIDANCE TO IDENTIFY HAZARDS AND ASSOCIATED RISKS DURING DEVELOPMENT, OPERATION, AND DISPOSAL OF TRANSPORTATION SYSTEM**
 - **SUPPLEMENTAL TECHNICAL GUIDANCE DOCUMENT**
 - - **PROVIDES GUIDANCE TO TAILOR SYSTEMS SAFETY REQUIREMENTS TO MEET BOTH REGULATED AND DOE SAFETY/MISSION STANDARDS**



CONCLUSIONS OF CONSULTANT'S REPORT

- **SYSTEMS SAFETY IS BROADER THAN THE TRANSPORTATION PROGRAM**
 - **APPLIES TO ALL OCRWM PROGRAM ELEMENTS**
- **NEED TO ESTABLISH A SYSTEMS SAFETY COMPONENT OFFICE WITHIN OCRWM**
- **OCRWM CONTRACTORS WILL NEED TO BE HEAVILY INVOLVED IN THE SYSTEMS SAFETY PROCESS**



PROPOSED ACTIONS IN CONSULTANT'S REPORT

- ESTABLISH FORMAL SYSTEMS SAFETY ORGANIZATION WITHIN OCRWM

- IMPLEMENT OCRWM SYSTEMS SAFETY CONCEPTS AND PRACTICES WITHIN THE TRANSPORTATION PROGRAM