

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: PRECLOSURE SAFETY
ASSESSMENT**

PRESENTER: DAVID MICHLEWICZ, CHP

**PRESENTER'S TITLE
AND ORGANIZATION: MANAGER, SAFETY ASSESSMENT SECTION
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
WESTON TECHNICAL SUPPORT TEAM**

**PRESENTER'S
TELEPHONE NUMBER: (202) 646-6600**

MAY 16-17, 1989

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PRECLOSURE SAFETY ASSESSMENT

**ASSESSMENT OF THE RADIOLOGICAL EXPOSURES
AND RISKS TO WHICH MEMBERS OF THE PUBLIC
AND REPOSITORY WORKERS MAY BE EXPOSED AS
A RESULT OF ACTIVITIES TO BE CARRIED OUT AT
THE REPOSITORY PRIOR TO ITS PERMANENT
CLOSURE**

SCOPE OF PRESENTATION

- **NRC & DOE PRECLOSURE SAFETY REQUIREMENTS**
- **RESULTS OF ASSESSMENT OF CONCEPTUAL DESIGN**
- **ADDITIONAL INFORMATION NEEDS**
- **CURRENT AND FUTURE ACTIVITIES**

NRC AND DOE REQUIREMENTS

ROUTINE OPERATION

- **10 CFR 20 (PROPOSED) AND DRAFT DOE 5400.3**
 - WORKERS: 5 REM EDE
 - PUBLIC: 0.1 REM EDE

- **10 CFR 60.111 (40 CFR 191, SUBPART A)**
 - 25 MREM (WB), 75 MREM (THYROID), 25 MREM (OTHER ORGANS)

ACCIDENTS

- **10 CFR 60.2**
 - 0.5 REM WB, ANY ORGAN (FOR SAFETY CLASSIFICATION)

- **DRAFT DOE 6430.1A**
 - 25 REM (WB OR EDE) 300 REM (THYROID), 75 REM (LUNG)
 - 10^{-6} PER YEAR PROBABILITY CUTOFF

SUMMARY OF SAFETY ASSESSMENTS PERFORMED TO DATE FOR REPOSITORIES

- **PRELIMINARY SAFETY ASSESSMENTS AT REPOSITORIES HAVE BEEN PERFORMED BY NUMEROUS ORGANIZATIONS**
- **ANALYSES HAVE EXAMINED VARIOUS SITES AND REPOSITORY FACILITY DESIGNS INCLUDING TUFF, BWIP, SALT (GENERIC), AND SALT (DEAF SMITH)**

SUMMARY OF RADIOLOGICAL ASSESSMENTS OF NORMAL OPERATIONS PERFORMED TO DATE FOR YUCCA MOUNTAIN

● OCCUPATIONAL EXPOSURE

- PRIMARILY DUE TO DIRECT GAMMA RADIATION**
- CONTROLLED BY TIME-DISTANCE-SHIELDING**
- COLLECTIVE WORKER DOSE LESS THAN 100 MREM/YR
(SAND83-7436/1)**

● PUBLIC EXPOSURE

- PRIMARILY DUE TO INHALATION AND SUBMERSION IN
AIRBORNE EFFLUENTS FROM WASTE HANDLING (i.e. FISSION
PRODUCT GASES**
- FROM FAILED FUEL RODS AND CO-60 IN CRUD PARTICLES**
- CONTROLLED BY FILTRATION**
- DOSE TO A MAXIMUM INDIVIDUAL* IS ABOUT 0.01 MREM/YR
(SAND87-2070C)**
- COLLECTIVE POPULATION DOSE WITHIN 80km ABOUT 0.004
MAN-REM/YEAR**
- DOSE ESTIMATES WILL CHANGE AS DESIGN EVOLVES AND SITE
DATA ARE COLLECTED**

* AT AN ASSUMED DISTANCE OF 5km FROM SURFACE FACILITIES

SUMMARY OF ACCIDENT ANALYSES PERFORMED TO DATE FOR REPOSITORIES

- **A LARGE VARIETY OF POTENTIAL ACCIDENTS
HAVE BEEN ASSESSED INCLUDING:**
 - **EARTHQUAKES**
 - **FLOODS**
 - **TORNADOES**
 - **AIRCRAFT IMPACTS**
 - **UNDERGROUND NUCLEAR EXPLOSIONS (UNE)**
 - **HOIST CAGE DROPS**
 - **TRANSPORTER COLLISIONS/CRASHES**
 - **FUEL HANDLING ACCIDENTS**
 - **CRANE DROPS (CASK, CONTAINER, FUEL ASSEMBLY)**

SUMMARY OF ACCIDENT ANALYSES PERFORMED TO DATE FOR REPOSITORIES

(CONTINUED)

- **POTENTIAL OFFSITE DOSE CONSEQUENCES ARE MUCH LESS THAN FOR REACTORS AND REPROCESSING PLANTS BECAUSE THE SPENT FUEL IS AGED**
 - **LESS DECAY HEAT**
 - **FEWER SHORT-LIVED, HIGH SPECIFIC ACTIVITY GASES OR VOLATILE NUCLIDES**
 - **LESS INTRINSIC ENERGY AVAILABLE TO DISPERSE RADIOACTIVE MATERIAL**

SOURCES OF RADIONUCLIDE RELEASES

SPENT FUEL

- **RELEASES OF GASES, VOLATILES, AND PARTICULATES:**
 - FROM GAP WHEN CLADDING BREACHED
 - FROM PULVERIZATION DURING IMPACTS (BRITTLE FRACTURE)

VITRIFIED HIGH LEVEL WASTE

- **RELEASES OF PARTICULATES:**
 - FROM PULVERIZATION DURING IMPACTS (BRITTLE FRACTURE)
- **NO RELEASE OF GASES OR VOLATILES**

RADIONUCLIDES OF CONCERN

GASES

Kr - 85

H - 3

C - 14

VOLATILES

I - 129

Cs - 134, 137

PARTICULATES: SPENT FUEL & GLASS

Pu - 238, 239, 240, 241

Am - 241

Sr - 90

Cm - 244

Cs - 134, 137

Pm - 147

SUMMARY OF ACCIDENT ANALYSES PERFORMED FOR YUCCA MOUNTAIN

- **BASED ON CONCEPTUAL DESIGN**
- **CONSIDERED SURFACE FACILITIES (SAND84-2641)
UNDERGROUND FACILITIES (SAND88-7061) AND
EXPLORATORY SHAFT FACILITY (SAND89-7002)**
- **EMPLOYED PROBABILISTIC RISK ASSESSMENT
METHODOLOGY**
- **DIRECTED PRIMARILY AT IDENTIFYING STRUCTURES,
SYSTEMS AND COMPONENTS IMPORTANT TO
SAFETY**

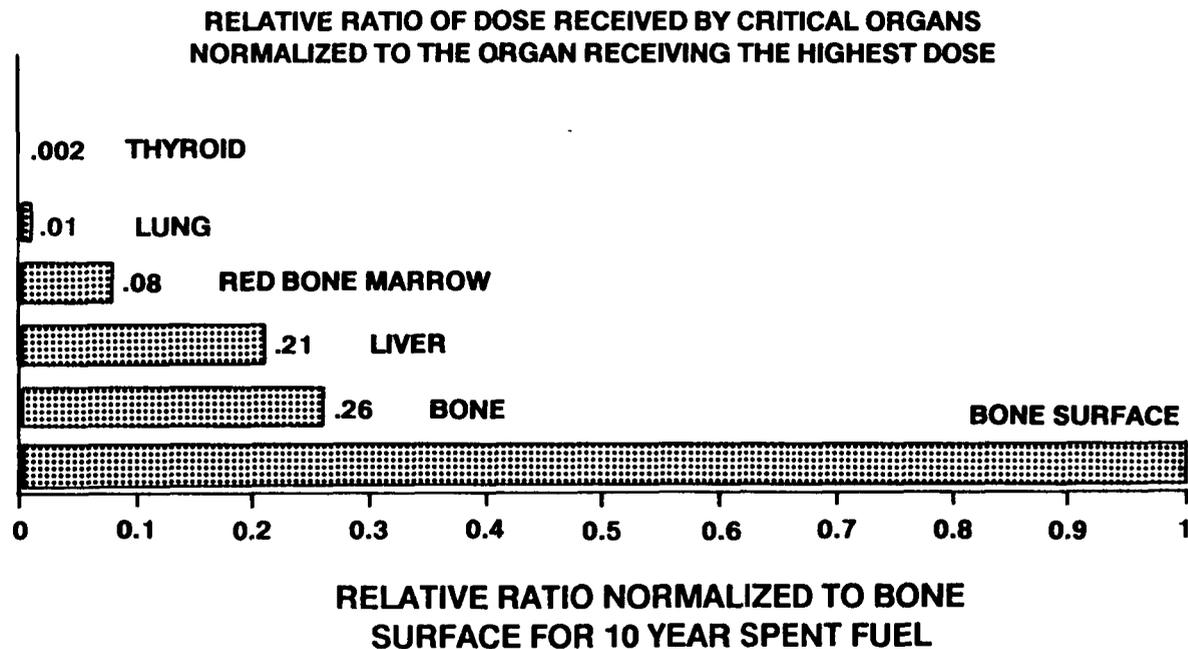
RESULTS OF SELECTED ACCIDENT ANALYSES OF YUCCA MOUNTAIN

<u>SCENARIO ANALYZED</u>	<u>ANNUAL PROBABILITY</u>	<u>DOSE* (REM)</u>
CASK DROP FROM A CRANE IN THE CASK RECEIVING AND PREPARATION AREA	5X10 ⁻⁵	0.39
OPEN CONTAINER DROP FROM A CRANE IN THE PACKAGING HOT CELL	5X10 ⁻⁷	2.1
TRANSPORTER COLLISION ON THE WASTE RAMP	5X10 ⁻⁷	0.089
TRANSPORTER SLIDE DURING EMPLACEMENT	5X10 ⁻⁶	0.089

SOURCE: TUFF SCP-CDR (SAND84-2641) AND SAND88-7061

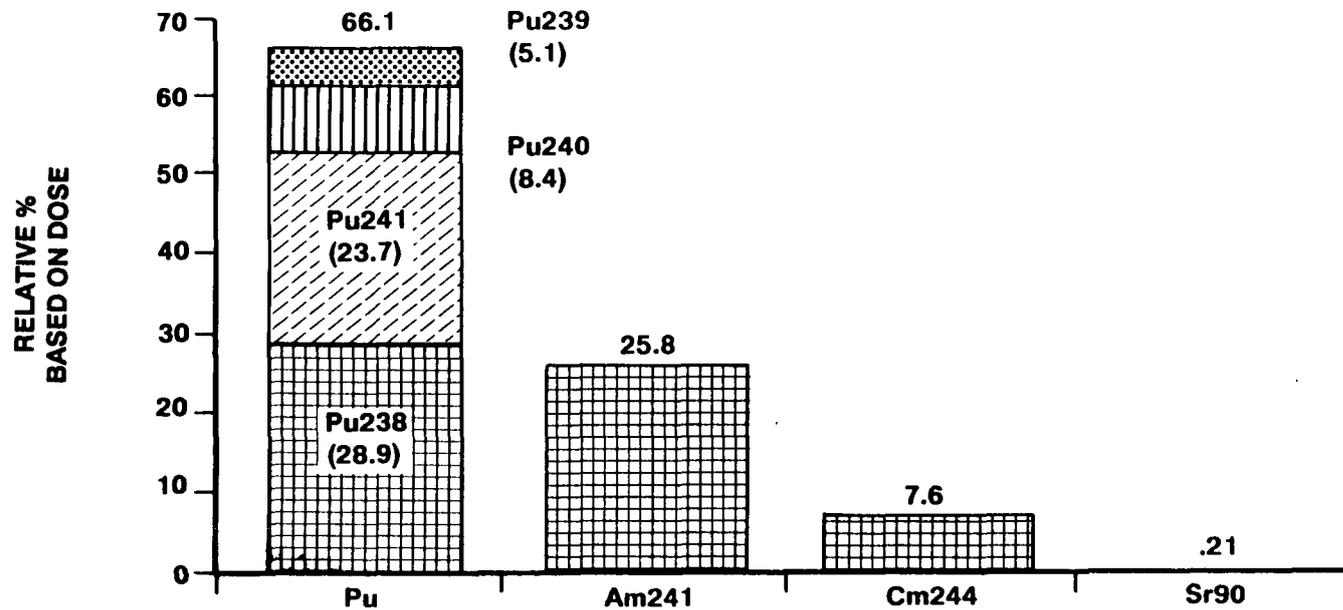
* AT AN ASSUMED DISTANCE OF 5 km FROM SURFACE FACILITIES

CRITICAL ORGANS FOR REPOSITORY ACCIDENTS...



...ARE DIFFERENT FROM THOSE FOR
REACTOR ACCIDENTS

PROMINENT ISOTOPIC CONTRIBUTORS TO BONE SURFACE DOSE FOR 10 YEAR AGED PWR SPENT FUEL



ADDITIONAL INFORMATION NEEDS

- **DESIGN INFORMATION**

- SHIELDING
- PROCESS STEPS
- EFFLUENT TREATMENT
- CONFINEMENT SYSTEM

- **SITE INFORMATION**

- ATMOSPHERIC DISPERSION
- ENVIRONMENTAL PATHWAYS
- POPULATION DISTRIBUTION

ADDITIONAL INFORMATION NEEDS

(CONTINUED)

- **ACCIDENT SOURCE TERM**
 - FUEL PULVERIZATION
 - PARTICLE SIZE DISTRIBUTION
 - BARRIER RETENTION

- **SCENARIO DEVELOPMENT**
 - INITIATING EVENTS
 - EQUIPMENT FAILURES
 - MINING TYPE INCIDENTS

SELECTED PRECLOSURE SAFETY ASSESSMENT ACTIVITIES FOR FY 1989

- **DEFINE BOUNDING CASE RADIONUCLIDE INVENTORY;
ORIGEN SENSITIVITY ANALYSIS**
- **EVALUATE TRANSPORTATION CASK CERTIFICATION
ANALYTICAL METHODS AND RESULTS FOR APPLICA-
BILITY TO REPOSITORY SAFETY ANALYSIS**
- **CHARACTERIZE PARTICLE TRANSPORT PHENOMENA**
- **ASSESS METHODOLOGIES FOR IDENTIFYING AND
SCREENING INITIATING EVENTS**

CONCLUSIONS

- **REPOSITORY REQUIREMENTS FOR PRECLOSURE SAFETY SIMILAR TO OTHER FACILITIES**
- **EXTENSIVE BODY OF SAFETY ASSESSMENT TECHNIQUES EXISTS**
- **CONCEPTUAL DESIGN HAS BEEN ANALYZED**
- **ADDITIONAL INFORMATION NEEDED ON SOURCE TERM AND DATA BASE DEVELOPMENT**