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 RJohnson

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Mr. Vern Witherill  
 Waste Management Project Office  
 United States Department of Energy  
 Nevada Operations Office  
 P.O. Box 14100  
 Las Vegas, NV 89114

Dear Mr. Witherill:

Enclosed are copies of the viewgraphs used by NRC staff members in their two presentations during the NNWSI Project/NRC Waste Package meeting held at Lawrence Livermore National Laboratory July 23-24, 1985. This material, along with the items Lyn Ballou of LLNL recently sent you, constitutes the Waste Package Meeting Summary. The one item not included is a hard copy of J. Bates's slides; if Lyn Ballou can obtain that material, it will be added to the summary.

If you have any questions, please do not hesitate to contact me (FTS 427-4611).

Sincerely,

~~Newton King Stablein~~

Newton King Stablein  
 NNWSI Project Manager  
 Repository Projects Branch  
 Division of Waste Management  
 Office of Nuclear Material  
 Safety and Safeguards

cc: M. Glora, SAIC  
 (w/o enclosures)

Enclosure: NRC Viewgraphs

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**§60.135(b)(1) EXPLOSIVE, PYROPHORIC,  
AND CHEMICALLY REACTIVE MATERIALS**

**THE WASTE PACKAGE SHALL NOT CONTAIN EXPLOSIVE OR PYROPHORIC  
MATERIALS OR CHEMICALLY REACTIVE MATERIALS IN AN AMOUNT THAT  
COULD COMPROMISE THE ABILITY OF THE UNDERGROUND FACILITY TO  
CONTRIBUTE TO WASTE ISOLATION OR THE ABILITY OF THE GEOLOGIC  
REPOSITORY TO SATISFY THE PERFORMANCE OBJECTIVES.**

**DON'T REKEY  
REFERENCE IT  
ONLY**

**§60.135(b)(2) FREE LIQUIDS**

**THE WASTE PACKAGE SHALL NOT CONTAIN FREE LIQUIDS IN AN AMOUNT THAT COULD COMPROMISE THE ABILITY OF THE WASTE PACKAGES TO ACHIEVE THE PERFORMANCE OBJECTIVES RELATING TO CONTAINMENT OF HLW (BECAUSE OF CHEMICAL INTERACTIONS OR FORMATION OF PRESSURIZED VAPOR) OR RESULT IN SPILLAGE AND SPREAD OF CONTAMINATION IN THE EVENT OF WASTE PACKAGE PERFORATION DURING THE PERIOD THROUGH PERMANENT CLOSURE.**

HOW RELIABLE DOES THE WASTE PACKAGE CONTAINMENT HAVE TO BE?

VUGRAPHS FOR A TALK TO BE PRESENTED BY E.A. WICK AT AN NEA/OECD WORKSHOP IN ALBUQUERQUE, NEW MEXICO, NOVEMBER 13-15, 1984. THE WORKSHOP IS ENTITLED, "SOURCE TERM FOR RADIONUCLIDE MIGRATION FROM HIGH-LEVEL NUCLEAR WASTE OR SPENT NUCLEAR FUEL UNDER REALISTIC REPOSITORY CONDITIONS."

No. 1

### **NRC's RESPONSIBILITY**

**UNDER THE ENERGY REORGANIZATION ACT OF 1974, NRC HAS  
RESPONSIBILITY TO LICENSE DISPOSAL OF HLW BY DOE**

**THE NUCLEAR WASTE POLICY ACT OF 1982 STATES THAT IT IS FEDERAL  
RESPONSIBILITY TO PROVIDE FOR HLW AND SPENT FUEL REQUIRING  
PERMANENT DISPOSAL.**

**THUS, DOE HAS RESPONSIBILITY FOR DISPOSAL OF HLW AND SPENT FUEL  
AND NRC HAS RESPONSIBILITY TO LICENSE THE DOE REPOSITORY OR  
REPOSITORIES.**

No. 2

## REGULATORY REQUIREMENT FOR CONTAINMENT

10 CFR 60 (TECHNICAL CRITERIA) SPECIFIES (PARAGRAPH 60.113) THAT THE ENGINEERED SYSTEM OF BARRIERS SHALL BE DESIGNED SO THAT, ASSUMING ANTICIPATED PROCESSES AND EVENTS, CONTAINMENT OF THE HLW WILL BE SUBSTANTIALLY COMPLETE DURING THE PERIOD WHEN RADIATION AND THERMAL CONDITIONS IN THE ENGINEERED BARRIER SYSTEM ARE BEING DOMINATED BY FISSION PRODUCT DECAY. (300 TO 1000 YEARS)

No. 3

**REGULATORY REQUIREMENT FOR RELEASE AFTER THE CONTAINMENT PERIOD**

10 CFR 60 (PARAGRAPH 60.113) ALSO SPECIFIES THAT THE RELEASE RATE OF ANY RADIONUCLIDE FROM THE ENGINEERED BARRIER SYSTEM FOLLOWING THE CONTAINMENT PERIOD SHALL NOT EXCEED ONE PART IN 100,000 PER YEAR OF THE INVENTORY OF THAT RADIONUCLIDE CALCULATED TO BE PRESENT AT 1000 YEARS FOLLOWING PERMANENT CLOSURE, OR SUCH OTHER FRACTION OF THE INVENTORY AS MAY BE APPROVED OR SPECIFIED BY THE COMMISSION.

No. 9

HOW MANY WASTE PACKAGES CAN FAIL?

DEPENDS UPON:

1. ESTIMATED RATE OF RELEASE FROM A FAILED PACKAGE
2. WHEN FAILURE OCCURS

No. 10A

EXAMPLE CALCULATION OF ACCEPTABLE RELEASE

PERMISSIBLE ANNUAL RELEASE =

$$1 \times 10^{-5} \times 1000 \text{ YR INV. (CI)} \times \frac{1000 \text{ YR INV. (CI)}}{\text{CURRENT INV. (CI)}}$$

No. 10B

EXAMPLE CALCULATION OF ACCEPTABLE RELEASE  
(CONTINUED)

TOTAL ACTIVITY IN CURIES OF INVENTORY IN ONE BWR SPENT FUEL ROD

10 YRS

960

300 YRS

11

1000 YRS

4.6

THIS EXAMPLE IS ALSO TRUE ON A RELATIVE BASIS OF THE TOTAL  
INVENTORY OF SPENT FUEL WASTE PACKAGES IN THE REPOSITORY AT  
10, 300 AND 1000 YRS.

No. 10C

EXAMPLE CALCULATION OF ACCEPTABLE RELEASE  
(CONTINUED)

THEREFORE, THE PERMISSIBLE ANNUAL RELEASE AT 10 YEARS AFTER  
EMPLACEMENT MAY BE CALCULATED AS A FRACTION OF THE TOTAL  
RADIONUCLIDE INVENTORY AT THAT TIME.

FOR EXAMPLE,

$$\frac{4.6 \text{ Ci}}{960 \text{ Ci}} \times 1 \times 10^{-5} \times \text{INV. 10 YRS AFTER EMPLACEMENT}$$

$$= 4.8 \times 10^{-8} \text{ OF CURRENT INVENTORY}$$

No. 11A

EXAMPLE CALCULATION OF ACCEPTABLE NUMBER OF WASTE PACKAGE FAILURES

ASSUMPTIONS:

1. No. OF SPENT FUEL WASTE PACKAGES IN THE REPOSITORY =  
10,000
2. A FAILED PACKAGE RELEASES  $1 \times 10^{-5}$ /YR OF INV. IN THE  
PACKAGE

THUS, THE FRACTIONAL RATE OF RADIONUCLIDE RELEASE FROM A FAILED  
WASTE PACKAGE WOULD BE:

$$\frac{1 \times 10^{-5} \text{ /YR} \times \frac{\text{NUMBER OF CURIES}}{\text{PACKAGE}}}{\frac{\text{NUMBER OF CURIES} \times 10,000 \text{ PACKAGES}}{\text{PACKAGE} \quad \text{INVENTORY}}} =$$

$$1 \times 10^{-9} \text{ /YR} \times \text{INVENTORY}$$

No. 11B

EXAMPLE CALCULATION OF ACCEPTABLE NUMBER OF WASTE PACKAGE FAILURES  
(CONTINUED)

THEREFORE, THE NUMBER OF WASTE PACKAGE FAILURES THAT COULD  
BE TOLERATED 10 YRS AFTER EMPLACEMENT IN A REPOSITORY  
CONTAINING 10,000 WASTE PACKAGES IS:

$$\frac{\text{ACCEPTABLE RELEASE } (4.8 \times 10^{-8} / \text{YR})}{\text{RELEASE PER PACKAGE } (1 \times 10^{-9} / \text{YR})} = 48$$

THEREFORE, 48 PACKAGES COULD FAIL WITH A RELEASE RATE OF  $1 \times 10^{-5} / \text{YR}$  PER PACKAGE

CONCLUSIONS

NRC HAS NOT DEFINED "SUBSTANTIALLY COMPLETE" CONTAINMENT.  
SOME OF THE IDEAS BEING CONSIDERED ARE:

- A. A RADIONUCLIDE RELEASE RATE THAT DOES NOT EXCEED THE ABSOLUTE QUANTITIES PERMITTED IN THE POST CONTAINMENT PERIOD, I.E.,  $1 \times 10^{-5}$ /YR OF THE RADIONUCLIDE INVENTORY OF THE REPOSITORY AT 1000 YEARS.
- B. SINCE THE RADIONUCLIDE INVENTORY IS LARGER DURING THE CONTAINMENT PERIOD, THE FRACTIONAL RELEASE OF RADIONUCLIDES AT THE TIME OF CONTAINMENT FAILURE MUST BE CORRESPONDINGLY SMALLER.