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U.S. Nuclear Regulatory Commission
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Subject: Texas A&M University System Texas Engineering and Experiment Station Nuclear Science Center (TAMU NSC), Docket 50-128, License R-83 Supplemental Information for TAMU RAI Question no. 32 (c).

The enclosed document is supplemental information to the TAMU RAI responses for question no. 32 (c) on the conversion from HEU to LEU Fuel. The table provided was in response to the telephone conversation with Alexander Adams, NRC Project Manager.

If you have any questions, please contact me at 979-845-7551.

Sincerely,

W. D. Reece
Director, NSC

xc: 2.11/central file
Fuel Conversion File
A. Adams, NRC Project Manager

A020

Design Basis Accident Analysis.

The Design Basis Accident is the loss of fuel cladding integrity for one element and the simultaneous loss of pool water.

Fission product release to air within the reactor building

Calculations were performed to determine (a) dose rate from gamma emitters uniformly dispersed throughout the volume of the reactor building, (b) the dose to lungs from beta emitters for an individual remaining in the reactor building for 5 minutes, and (c) the thyroid dose to an individual remaining in the reactor building for 5 minutes. The radionuclide inventories used in the calculations are as submitted in the original RAI for 30/20 fuel and the release fraction (2.6E-5) is as submitted also.

(a) Whole body exposure from gamma emitters
The amount of volatiles released to the reactor building would be 0.54 Ci. If this activity is distributed uniformly in the building volume, the resulting concentration would be 1.1E-04 uCi/cc. The resulting maximum dose rate is calculated to be 3 mR/h. An individual remaining in the building for 5 minutes after a release would receive a whole body dose of 0.25 mrem.

(b) Dose to the lungs
The lung is the critical organ when considering inhalation of insoluble volatiles. Beta emitting nuclides deposit much more of their decay energy in lung tissue than do gamma emitting nuclides and are therefore more important in lung dose. In these calculations we assume all decay energy is absorbed in the lung to be conservative. The lung dose to an individual remaining in the reactor building for 5 minutes after the release would be 0.018 rads.

(c) Thyroid dose
The thyroid dose was calculated for a person remaining in the reactor building for 5 minutes after the fission product release. We assume the "standard man" breathing rate of 1.25 m^3/h. For calculation of thyroid dose, we used Dose Conversion Factors for Iodine isotopes (Ref. Federal Guidance Report 11).

For the Operating Personnel inside the reactor building for 5 minutes after release, the thyroid dose is calculated to be 3.7 rem.

Calculation methods for Atmospheric Release of Radioactivity

We also calculated the exposure in the unrestricted areas using the HOTSPOT code (Homann, 2005) assuming worst case conditions (wind speed of 2 m/s, wind stability class F.) During an accident the ventilation system will be shut down, so all releases are assumed at ground level, leaking from the building. Ground level releases are also the most conservative – the doses are equal to or higher than stack releases. We take no credit for iodine plate out or for decay of isotopes during holdup, assuming all the inventory eventually escapes. We also assume no evacuation so that the unrestricted area is occupied during the entire release.

The Total Effective Dose Equivalent (TEDE) to personnel just outside the site boundary is calculated to be 6.2 mrem and the thyroid dose to be 71 mrem. These doses include ground shine additions. A conservative calculation was also performed to determine the whole body dose and thyroid dose to personnel in the closest permanently occupied area, 800 meters from the stack. The TEDE at this location is 0.14 mrem and the thyroid dose is 1.8 mrem.

Table 1 summarizes the whole body dose and thyroid dose to personnel inside the reactor building, at the fence line, and at the nearest residence following the release of fission products.

Table 1. Summary of Radiation Exposures following the release of fission products from a single fuel element.

Building Ventilation Shut down:	Whole body Dose	Thyroid Dose
1. Maximum exposure to operating personnel in 5 minutes after release	0.25 mrem	3700 mrem
2. Maximum exposure to personnel in unrestricted area	6.2 mrem	71 mrem
3. Exposure to personnel in nearest permanently occupied area (nearest resident)	0.14 mrem	1.8 mrem

References

1. F. A. Gifford, Jr. Atmospheric Dispersion Calculations Using the Generalized Gaussian Plume Model, Nuclear Safety. 1960.

2. NUREG/CR-2387. Credible Accident Analyses for TRIGA and TRIGA-Fueled Reactors. 1982.

3. Homann, S. G., Hotspot Version 2.06, Lawrence Livermore National Laboratory, www.llnl.gov/mai/technologies/hotspot, March 31, 2005

4. Federal Guidance Report 11. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion PDF [EPA 520/1-88-020]. 1988.