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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: U.S. Geological Survey TRIGA Reactor (GSTR), Docket 50-274, License R-113
Request for Additional Information (RAI) dated September 29, 2010

Subject:Response to Question 15.2 of the Referenced RAI

Mr. Wertz:

Question 15.2: GSTR SAR Subsection 13.2.1.2 states that the HOTSPOT computer code and "uniform dispersion with 10 CFR Part 20 Appendix B conversion factors" were used to calculate doses to the public. The HOTSPOT computer code is a single isotope-based dose calculation model using Federal Guidance Report (FGR) No. 11 or FGR No. 13 dose conversion factors and requires site-specific meteorology in terms of stability and wind speed. Therefore, please provide the process and assumptions used in applying the HOTSPOT computer code to determine public doses presented in Table 13.6.

Response: The HOTSPOT code was developed at Lawrence Livermore National Laboratory (LLNL) for the U.S. Department of Energy. It is not a single isotope-based dose calculation model and it does not require site-specific meteorology. The HOTSPOT code is specifically designed so that a custom-defined mixture of radionuclides can be input to the code to get results for a wide range of accident scenarios. The code is also designed such that site-specific meteorology may be used, but it is not required. Therefore, the HOTSPOT code output is directly applicable and usable for the GSTR accident analyses without requiring any additional assumptions. The usage and requirements of the HOTSPOT code were verified with LLNL employee Fernando Aluzzi (narac@llnl.gov) Phone: 925-422-9159.

More information about the HOTSPOT code can be accessed at the web site of the National Atmospheric Release Advisory Center: **https://narac.llnl.gov/HotSpot/HotSpot.html**

The HOTSPOT website states that its atmospheric dispersion models are designed for near-surface releases, short-range (less than 10 km) dispersion, and short-term (less than 24 hours) release durations in unobstructed terrain and simple meteorological conditions. These models provide a fast and usually conservative means for estimation of the radiation effects associated with the atmospheric release of radioactive materials.

The HOTSPOT codes have been developed for the Windows operating system(s).

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The HOTSPOT Radionuclide Library incorporates Federal Guidance Reports 11, 12, and 13 (FGR-11, FGR-12, FGR-13) Dose Conversion Factors (DCFs) for inhalation, submersion, and ground shine. FGR-12 DCF values are used for submersion and ground shine. In addition to the inhalation 50-year Committed Effective Dose Equivalent DCFs, acute (1, 4, 30 days) DCFs are available for estimating deterministic effects. This acute mode is used for estimating the immediate radiological impact associated with high-acute radiation doses (applicable target organs are the lung, small intestine wall, and red bone marrow).

DOE completed an evaluation of HOTSPOT V2.07.1 in March 2007, which was based upon the DOE's safety software quality assurance criteria defined in DOE G 414.1-4. The results of the evaluation were documented in a report with recommendations. LLNL completed implementing recommendations identified. Subsequently DOE approved HOTSPOT V2.07.1 for inclusion in the Central Registry in June 2010. It is our belief that the HOTSPOT code is extremely well-suited to use in the evaluation of radionuclide releases from accidents at the GSTR.

Update on neutronic/thermal hydraulic analyses-

Recent work has focused on validation of the low-power MCNP model for the GSTR. This work should be complete by March. The control rod adjustments are complete with each control rod's absorber volume corrected to match the neutron flux in four axial regions. This method yields the most improvement in control rods with higher depletion. Rods with relatively little boron depletion have less void to be redistributed, leading to much less improvement. While it is possible to further improve on this technique, the reactivity worth curve for each rod is currently within $0.10 of the measured values, and the total control rod worth is $0.12 above the measured value. This is sufficiently accurate to support the remainder of the relicensing calculations.

The predicted total core reactivity, however, is still elevated with the control-rods in the measured critical positions. Currently the bias is just under $1.00, which is comparable to the documented bias from the ENDF/B-VII.0 libraries. The bias from the ENDF/B-VII.0 libraries can be corrected by reducing the beginning of life enrichment within the fuel to a value closer to 19 wt%. Such a drop in the enrichment is somewhat unrealistic, and alternatives include setting the initial enrichment to 19.75 wt% and adjusting the burnup to compensate for the ENDF/B-VII.0 bias. Literature indicates that an enrichment of 19.75 wt% is a good approximation when the specific value for the initial enrichment is unknown, as is the case for the GSTR. Following this adjustment, verification of the MCNP model's predicted flux profiles will finish the validation of the model.

Sincerely,

Tim DeBey

Tim DeBey
USGS Reactor Supervisor

I declare under penalty of perjury that the foregoing is true and correct.
Executed on 2/27/12

Copy to:

Betty Adrian, Reactor Administrator, MS 975
USGS Reactor Operations Committee