August 25, 2014

Mr. Vito Nuccio
Reactor Administrator
Department of the Interior
U.S. Geological Survey
PO Box 25046 MS 406
Denver, CO 80225-0046

SUBJECT: U.S. GEOLOGICAL SURVEY – REQUEST FOR ADDITIONAL INFORMATION AND CLARIFICATION TO PREVIOUS RESPONSES TO THE U.S. NUCLEAR REGULATORY COMMISSION REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE RENEWAL REVIEW (TAC NO. ME1593)

Dear Mr. Nuccio:

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of the U.S. Geological Survey (USGS) application dated January 5, 2009 (a redacted version of the safety analysis report is available on the NRC's public Web site at www.nrc.gov under Agencywide Documents Access and Management System (ADAMS) Accession No. ML092120136), as supplemented, for the renewal of Facility Operating License No. R-113 for the USGS TRIGA Reactor (GSTR).

The NRC staff requires additional information and clarification on questions that have arisen during our review. A new request for additional information is provided in the Enclosure. Additionally, the NRC staff reviewed the information provided by USGS letters dated May 17, and October 31, 2013 (ADAMS Accession Nos. ML13162A662 and ML13311A047, respectively), to our request for clarification sent by an NRC letter dated July 15, 2013 (ADAMS Accession No. ML13190A052) and has identified additional clarification that is needed in the Enclosure. Please provide your responses to the enclosed request for additional information within 45 days of the date of this letter.

In accordance with 10 CFR 50.30(b), you must execute your response in a signed original document under oath or affirmation. Your response must be submitted in accordance with 10 CFR 50.4, "Written communications." Information included in your response that is considered sensitive or proprietary that you seek to have withheld from the public, must be marked in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." Any information related to security should be submitted in accordance with 10 CFR 73.21, "Protection of Safeguards Information: Performance requirements." Following receipt of the additional information, we will continue our evaluation of your renewal request.

If you have any questions about this review, or if you need additional time to respond to this request, please contact me by telephone at (301) 415-0893 or by electronic mail at Geoffrey.Wertz@nrc.gov.

Sincerely,

/RA/ Alex Alexander for

Geoffrey A. Wertz, Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-274
License No. R-113

Enclosure:
Request for additional information

cc: See next page

cc:

Environmental Services Manager
480 S. Allison Pkwy
Lakewood, CO 80226

State of Colorado
Radiation Management Program
HMWM-RM-B2
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Mr. Timothy DeBey
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Test, Research, and Training
Reactor Newsletter
Universities of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

If you have any questions about this review, or if you need additional time to respond to this request, please contact me by telephone at (301) 415-0893 or by electronic mail at Geoffrey.Wertz@nrc.gov.

Sincerely,

Geoffrey A. Wertz, Project Manager
Research and Test Reactors Licensing Branch
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ADAMS Accession No.: ML14211A586 *concurrence via e-mail NRR-088

OFFICE	NRR/DPR/PRLB*	NRR/DPR/PRLB	NRR/DPR/PRLB	NRR/DPR/PRLB
NAME	GWertz	PBlechman	AAdams	GWertz (AAlexander for)
DATE	08/25/2014	08/25/2014	08/25/2014	08/25/2014

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REQUEST FOR ADDITIONAL INFORMATION AND CLARIFICATION

FOR THE RENEWAL OF

THE U.S. GEOLOGICAL SURVEY TRIGA REACTOR

LICENSE NO. R-113; DOCKET NO. 50-274

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of the U.S. Geological Survey (USGS) TRIGA Reactor (GSTR) license renewal application dated January 5, 2009 (a redacted version of the safety analysis report is available on the NRC's public Web site at www.nrc.gov under Agencywide Documents Access and Management System (ADAMS) Accession No. ML092120136), as supplemented. During this review, we identified an area needing additional information. Please note that this new RAI is numbered (No. 28) to follow sequentially from the RAIs provided in our letter dated March 12, 2012 (ADAMS Accession No. ML12075A001).

Additionally, the NRC staff has reviewed the information provided by the USGS by letters dated May 17, and October 31, 2013 (ADAMS Accession Nos. ML13162A662 and ML13311A047, respectively), to our request for information sent by NRC letter dated July 15, 2013 (ADAMS Accession No. ML13190A052), and has identified additional clarification that is needed in the attached table. Provide your responses within 45 days of the date of this letter.

The page number in the brackets [ ] in the table below references the information provided by the USGS letter dated May 17, 2013.

28. The GSTR Safety Analysis Report (SAR), Section 13.2.6.2, discusses limitations on the release of iodine isotopes due to a failed fueled experiment. The SAR states that the limit of 1.5 curies of iodine isotopes, as specified in GSTR Technical Specification (TS) 14.3.8.2, is acceptable because it is bounded by the maximum hypothetical accident (MHA) analysis, which provides an iodine inventory, as identified in the MHA analysis, of approximately 5413 curies (GSTR SAR Table 13.1).

    Based on its review of your May 17, 2013, response to RAI 15.3, the NRC staff noted that the amount of iodine released in the MHA scenario was 83.53 millicuries [Table 13.4]. This occurs because the iodine isotope release inventory is modified by the temperature dependent release fraction of the fuel. The 83.53 millicuries is much less than 1.5 curies associated with the fueled experiment as described in GSTR TS 14.3.8.2. Additionally, the MHA assumes an atmospheric release to the reactor bay. The GSTR SAR does not identify whether a failed fueled experiment occurs in the same location, or if it has the potential to occur in the laboratory area or in transit with greater radiological consequences. As such, our review has determined that the basis for the limit of 1.5 curies of iodine isotopes can not be substantiated.

Enclosure

NUREG-1537, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors,” Chapter 13, “Accident Analysis,” Section 13.2, “Accident Analysis and Determination of Consequences,” provides detailed guidance on evaluating the potential consequences of a failed fueled experiment. The following information is requested:

28.1. Provide the initial conditions and assumptions for the failed fuel experiment accident;

28.2. Define the limitation of the fueled content of the fueled experiment including any structural or containment requirements;

28.3. Provide the limiting source term for the failed fueled experiment (e.g., iodine, krypton, xenon);

28.4. Identify the possible locations where the failed fuel experiment could occur, and release pathways to the facility and environment (e.g., incore, experiment station, laboratories, etc.);

28.5. Provide the inventory of isotopes from a failed fueled experiment assuming a 100 percent release of gaseous isotopes;

28.6. Explain how the failed fueled experiment source term is bounded by the MHA, or provide a comprehensive analysis that demonstrates acceptable compliance with 10 CFR Part 20, “Standards for Protection Against Radiation”; this analysis shall include consideration of the limiting location of the release, the effect of ventilation from the location, occupancy factors, how conditions required to comply with the analysis (e.g., temperature, exposure limits, decay times, etc.) will be imposed on operators (e.g., technical specifications, procedures, administrative controls, etc.), and the resulting dose to occupational workers and the public at all appropriate locations; and,

28.7. Provide updated TSs, and bases, as appropriate.

RAI No.	Original RAI	Information Needed
9	Describe the limiting core configuration (LCC).	• Provide the peak fuel temperature for aluminum clad fuel element in the operating core (OC) (Figure 1) and LCC (Figure 2). [page 1] • Describe whether any restrictions on the locations of any aluminum clad fuel elements are required based on the peak fuel temperature in either the OC or LCC, and identify where such restrictions will be placed in the technical specifications. [page 1] • The NRC staff has independently calculated the shutdown reactivity of the OC configuration using the information provided in the response to RAI No. 9 (excess reactivity $4.84; shim 1, shim 2, and the transient control rod worth's, respectively, as -$2.16, -$2.25, -$2.06). The NRC staff calculations result in a shutdown reactivity of -$1.63. Explain the USGS calculated result of -$1.75. [page 4] • Provide numerical data for information from Figure 7. [page 7]

12	Describe the departure from nucleate boiling ratio (DNBR) analysis.	• Provide details of your calculation of the RELAP fuel element cross-sectional area for each region (zirc rod, fuel, any gaps, cladding, and coolant). [page 8] • Confirm that the GSTR RELAP analysis of your OC and LCC are performed at fuel element powers corresponding to the operation of those configurations at 1100 kW (the limiting safety system setting setpoint) and at an inlet temperature that corresponds to the bulk water temperature limit of 60 degrees Centigrade (C). Confirm that the DNBR at any elevation of the fuel element is > 2.00, that no fuel temperature limits are observed, and that the coolant flow is uniform, stable, and always remains in the liquid phase only. Provide graphic results for the fuel channel showing fuel element elevation and time dependent liquid velocity and liquid volume fraction. Confirm that your model has zero flow at zero power. [page 9] • Please confirm the maximum fuel temperature of the aluminum clad fuel element for the pulsing analysis. [page 9] • The temperatures in Table 3 do not match the temperatures provided in Figure 7. Please explain the differences. [page 10] • The results of the “Characterization of the response of GSTR to a reactivity pulse and an uncontrolled rod withdrawal transient event” did not provide peaking factors or explain their use. Provide the peaking factors, and explain their use in the analyses (i.e., were they included in the model or applied to the results obtained from a model representing the average core or channel). [page 10] • For the uncontrolled rod withdraw analysis, explain whether in your model the withdrawn control rod continues until fully withdrawn, or if it inserts upon receiving the scram signal. [page 11] • GSTR provided a temperature of 1020 degrees Kelvin (K) and then converted it to 727 degrees C. The NRC staff converted 1020 degrees K to 747 degrees C. Explain the difference. [page 11]

15.3	Explain the methods used to determine the maximum hypothetical accident (MHA) doses	• The GSTR response to RAI No. 15.3 provided a volume-averaged fuel temperature of 423.2 degrees C. The NRC staff confirmatory analysis calculated a significantly lower volume averaged fuel temperature. In order for NRC staff to fully understand the GSTR fuel temperature, provide an explanation of the fuel element nodal structure and a description of the nodal fuel temperature calculations for the fuel temperatures reported. Describe what value of the fuel temperature is used for the release fraction calculation used in the MHA analysis. [page 13] • The GSTR response assumed a 5 minute decay of the released inventory associated with shutdown and fuel movement. However, NUREG-1537, Part 2, Chapter 13, Accident Analysis, MHA, page 13-5, states that "All fission products in the gap are released rapidly." As such, the 5 minute decay does not appear consistent with the guidance in NUREG-1537. Provide a revised analysis to correct the 5 minute delay or justify why no change is needed. [page 15] • The NRC staff has completed confirmatory analysis of the MHA results using HOTSPOT 2.07.2, and was unable to reproduce the GSTR dose results for the atmospheric release scenario at the Emergency Assembly Area and the Building 21 East Entrance using the assumptions stated in the response to RAI No. 15.3 (see shaded area in the attached Table 1, of this RAI, for NRC staff confirmatory calculations). Provide details of the total effective dose equivalent (TEDE) dose calculations at these locations. [page 22]
24.3	Basis for Shutdown Margin Definition	The GSTR analysis provided in response to RAI No. 9 appears to establish the GSTR Core Excess Reactivity for TS 14.3.1.1.2 as $6.18. Using the GSTR control rod worth's as provided in the GSTR response to RAI No. 9, the NRC staff confirms that the shutdown reactivity of the GSTR using the stuck control rod criteria would be -$1.20 which satisfies the existing TS shutdown margin specification of -$0.55 (TS 14.3.1.1.1). The proposed GSTR TS 14.3.1.1.1, Shutdown Margin, of $0.30 appears to unnecessarily reduce the shutdown margin TS requirement. Advise if GSTR still seeks to establish TS 14.3.1.1.1, Shutdown Margin, of $0.30, and the underlying basis for such a request. [page 24]

Table 1

Location	Distance (meter)	Radiation Dose to Member of Public
		NRC Confirmatory Calculation (GSTR SAR Table 13.6) TEDE (mrem)
Building 15 south door	11	53 (53)
Emergency assembly area	32	10 (6.1)
Building 21 east entrance (West of Building 15)	49	7.8 (4.3)
Average of eastern intersections	100	2.9 (2.4)
Building 16 west entrance	175	1 (0.96)
-	200	0.8 (0.76)
-	250	0.52 (0.5)
Nearest Unrestricted Location	475	0.15 (0.14)
Residence	640	0.082 (0.081)
School	720	0.065 (0.065)

Attachment