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February 11, 2011

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 Letter of February 1, 2011 Concerning R-113 License Renewal

Mr. Wertz:

This response is to address your letter of February 1, 2011, which includes several requests. Your request 1) is for a list of unanswered RAIs needing outside assistance and a justification or basis and schedule for responses. This list is:

RAI number	Justification or basis	Schedule
8	USGS does not have the computer codes nor the in-house expertise to perform the desired analyses	The schedule for performing these analyses is currently unknown. Our expectations were that a DOE contractor would perform these analyses; however, an email from a DOE contractor on 2/3/11 indicates that our expectations will not be met. Alternative methods of getting the required assistance are being pursued. Due to this unanticipated change, our estimate for completion of these answers is now 18 months from March 1, 2011.
9	USGS does not have the computer codes nor the in-house expertise to perform the desired analyses	
10	USGS does not have the computer codes nor the in-house expertise to perform the desired analyses	
11.1 - 11.3	USGS does not have the computer codes nor the in-house expertise to perform the desired analyses	
12	USGS does not have the computer codes nor the in-house expertise to perform the desired analyses	
15.1	USGS does not have the computer codes nor the in-house expertise to perform the desired analyses	

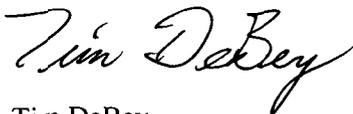
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Request 2) is for a list of unanswered RAIs that can be answered internally by the GSTR staff, with a schedule. This list is:

RAI number	Schedule
1	The staff will submit responses to these questions at an average of one per month for each subject question (i.e., 16.1-16.3 will be answered as one question). Question 24 will need the results from external analyses before it can be answered by the staff.
2	
3	
6	
7	
14.1 -14.2	
15.2 - 15.3	
16.1 - 16.3	
17.1 - 17.2	
18	
20	
21.1 - 21.3	
22.1 - 22.2	
23.1 - 23.4	
24.1 - 24.13	
25.1 -25.6	

Our responses to Questions 13.1, 13.2, and 13.3 are provided in the attachment to this letter.

Sincerely,



Tim DeBey  
U.S. Geological Survey  
Reactor Supervisor

**I declare under penalty of perjury that the foregoing is true and correct.**

**Executed on 2/11/11**

Copy to:  
Betty Adrian, Reactor Administrator  
Denver Federal Center MS 975

## USGS Response to October, 2010 RAI Question 13.

## Question:

13. In order to complete the environmental assessment, please provide environmental monitoring data from 1986 to April 2010 (or the latest period of data collection) for the following:
  - 13.1 The leakage of reactor coolant from the reactor tank, which could have begun before the 1987 shutdown and the 1988 reactor tank replacement.

13.1 Response - The reactor tank leakage, discovered March 17, 1987 caused a groundwater sampling well to be installed. The well location was chosen by a USGS hydrologist to be downstream of the reactor tank, at a distance of approximately 180 feet. Ground water movement was estimated at 1 foot per day. The well was drilled to a depth of 40 feet and the water table was found to be about 20 feet below the ground surface. At the 40 foot depth, there is a hard clay formation that acts as a barrier to water penetrating to deeper aquifers. The bottom of the reactor tank is 25 feet below the ground surface, and the tank is surrounded by a 4 foot thick layer of high density concrete, impeding water flow from the tank to ground water.

In April, 1987, the reactor tank water had a tritium concentration of 75,000 pCi/liter. The MDA for the tritium analyses was ~400 pCi/l. Since tritium would be the best indicator of reactor water leakage to ground water, it was the isotope selected for monitoring. The well water samples from 4/87 through 6/91 gave the following tritium results:

4/87	<MDA
6/87	<MDA
12/87	<MDA
6/88	<MDA
1/89	540 ± 340 pCi/l
6/89	<MDA
12/89	760 ± 440 pCi/L
6/90	<MDA
12/90	<MDA
6/91	<MDA

Reactor operations were resumed from June through September, 1987 after initial patching operations were completed on the reactor tank. Operations were ceased in

October of 1987 due to more holes appearing in the tank and the fact that the leakage rate had increased to 0.7 liter/hr. The tank was then emptied of the reactor components and all reactor water was removed from the tank. The reactor was not operated again until a new tank liner had been installed in the fall of 1988.

Question:

- 13.2 Water leakage from a 3,000 gallon underground tank, first identified to be leaking in June 2006 at a maximum of 13.8 gallons per day.

Any pertinent data are of interest, including but not limited to ground water tritium and soil gamma spectrometry results for samples taken at or near the leak locations. Provide the data not already reported to the NRC (e.g., not submitted in annual reports), or indicate in which report submitted to the NRC the data can be found.

13.2 Response - The following information concerns the leakage of water from a storage tank that was located in a room adjacent to the reactor bay.

To summarize the storage tank leakage in the summer of 2006, the net leakage rate was determined to be between 1.0 and 1.5 gallons per day. The only licensed radioisotope detected in the tank water was Co-60. Weekly groundwater analyses from the well that is approximately 180 feet downstream from the leaking tank showed no detectable Co-60 (nor any other reactor-produced isotopes). This sampling was performed on July 10, July 17, August 7, August 14, August 22, August 29, September 5, September 12, September 19, September 26, October 11, October 17, and October 24 of 2006. Gamma spectrometry of the tank water was also performed weekly. These tests continued to show that Co-60 was the only licensed isotope in the tank water, and the levels varied from  $5.6e-8$  to  $1.3e-7$  Ci/ml (below regulatory limits). The tank continued to leak at this small rate until August 15, 2006, when the tank was emptied by disposal of the water (about 2750 gallons) to the sanitary sewer. We received prior approval from the Denver Wastewater board for this disposal. Our calculations showed that less than 0.35 microCurie of Co-60 leaked from the tank and less than 1.5 microCurie of Co-60 was disposed into the sanitary sewer system. These levels are far below regulatory limits. Cobalt-60 has a half life of 5.2 years.

No tritium analyses were ever done of the storage tank water. Analyses for gross alpha and beta activities were conducted on the storage tank from April 1989 through December 2000. These analyses typically gave results of  $<1$  pCi/l alpha activity and  $<100$  pCi/l beta activity, so this sampling was discontinued. Routine sampling of the groundwater near the reactor building continuously showed typical historical tritium levels in the water, normally  $<MDA$ . These data are given in the table below. The bottom of the storage tank is also approximately 12 feet above the ground water level.

Date	tritium (pCi/l)	MDA (pCi/l)
10/4/2006	480 + 380	370
1/15/2007	134 +142	295
3/30/2007	60 + 162	360
6/28/2007	60 + 162	360
1/16/2008	726 + 150	256
6/25/2008	negative	339
12/22/2008	313	287

On October 24, 2006, a soil core was removed from below the leaking tank, at distances ranging from about 6" to 24" below the concrete shell of the tank. This soil core was analyzed by gamma spectrometry and no Co-60 was found in the core. Based on this finding, we stopped our weekly sampling of groundwater and concluded that no Co-60 reached the soil below the tank. We believe that the 0.35 microCurie of leaked Co-60 is retained in the 16" thick concrete shell of the tank. As of February, 2011, this 0.35 microCurie of Co-60 has decayed to approximately 0.19 microCurie.

**Question:**

- 13.3 Following the June 2006 leaking tank repairs, potential corrective actions were identified in NRC inspection report 030-03728/06-01. Please provide information on what corrective actions were implemented and the basis for those actions. If a second monitoring well was constructed, please provide the data for tritium, gamma spectrometry, and any other analytical results obtained for samples collected from the well.

13.3 Response - The following corrective actions were taken regarding the leakage of water from a storage tank that was located in a room adjacent to the reactor bay.

- a. The tank was completely dewatered and lead bricks were implemented to provide shielding from the one item still stored in the tank.
- b. A ground core was taken from the earth below the storage tank and it was analyzed on a gamma spectrometer. No licensed materials were detected in the core samples, indicating that no Co-60 leaked into the soil beneath the tank.

A second ground water sampling well was never proposed nor constructed.