10CFR50.90

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
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February 7, 2011

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING THE APPLICATION FOR LICENSE RENEWAL (TAC NO. ME1587)

Sir:

By letter dated July 19, 2010, the Nuclear Regulatory Commission requested additional information necessary to allow processing of our research reactor license renewal application (License R-84, Docket 50-170).

By letter of December 22, 2010 and phone conversations with Mr. Walter Meyer, we were granted an extension until February 7, 2011 to provide answers to questions 4, 8, 9, 12, and 13.

Initial responses to those five questions are enclosed. A more complete response to question 4 will be provided as soon as possible. Question 12 has been submitted for outside technical assistance (along with questions 3, 5, and 6) as allowed by your letter of December 22, 2010.

If you need further information, please contact Mr. Steve Miller at 301-295-9245 or millers@afrri.usuhs.mil.

I declare under penalty of perjury that the foregoing and all enclosed information is true and correct to the best of my knowledge. Executed on February 7, 2011.

Enclosures:
as

for MARK A. MELANSON
COL, MS, USA
Director

A020
NRR

4. NUREG-1537, Part 1, Section 13.1.1 provides guidance identifying as an acceptable Maximum Hypothetical Accident (MHA) for TRIGA reactors, the failure of one fuel element in air. The potential consequences of the postulated MHA scenario excess and bound all credible accidents. Section 13.2.3 of the SAR discusses the Design Basis Accidents (DBA) providing dose consequences to members of the public. The SAR does not specifically present an MHA analysis. Instead two DBA analyses are presented, which incorporate assumptions that result in doses that appear to not be bounding. Identify an MHA scenario whose potential consequences bound all credible accidents.

This question will require additional calculations to determine the occupational dose associated with the MHA. Following a review of supplemental and reference material, we will contact our relicensing project manager to discuss a submission timeline.

8. NUREG-1537, Part 1, Section 13.1.5 provides guidance to licensees to systematically analyze and discuss credible accidents in each accident category. Identify potential scenarios that could lead to accidents involving mishandling or malfunction of fuel. Analyze scenarios that are judged credible.

NUREG-1537, Part 1, Section 13.1.5 lists the following initiating events:

- Overheating of fuel during steady-power or pulsed operation
- Dropping or otherwise damaging fuel in any location
- Dropping, impact, or other malfunction of a non-fueled component
- Operation (including pulsing) with damaged fuel, such as water-logged pin- or rod-type fuel

By design, AFRRI fuel elements cannot overheat under normal steady state or pulsed operations. This is due to the intrinsic negative fuel temperature coefficient attributable to neutron spectrum hardening from the U-ZrH fuel, Doppler broadening of the U-238 neutron resonance absorption peaks, and a decrease in fuel and moderator density at high temperatures. The total prompt negative temperature coefficient is approximately -0.0126% $\Delta k/k$ per $^{\circ}$C. The total steady-state negative temperature coefficient of reactivity is approximately -0.0051% $\Delta k/k$ per $^{\circ}$C.

During annual shutdown/maintenance, fuel elements and/or control rods with fuel followers are removed from the core and placed into the storage racks within the reactor pool. It is possible to have either a control rod or a fuel element removed from the reactor pool entirely during maintenance. AFRRI Reactor Facility Procedure 7 specifically delineates that irradiated fuel elements to be removed unshielded from the pool require a Special Work Permit from the Safety and Health Department; and that fuel elements with a power history greater than 1 kW in the previous two weeks are not to be removed from the reactor pool. Other instances, such as moving the in-core experiment tube (CET), may involve moving fuel elements from one location in the reactor core to another location, one fuel element at a time.

The MHA is the worst case scenario involving fuel cladding failure of one fuel element in air; and no more than one fuel element is removed from the core at a time. The MHA considers the release of fission products in air, as the same release of activity in water results in fewer fission products being released beyond the reactor pool by a factor of 10^3 (App. C, Tables 4 and 6, Jan 2000 SAR). All possible accidents involving mishandling and/or damaging of fuel elements or control rods, to include dropping, impact, or other malfunction of a non-fueled component, or operation with damaged fuel are also bounded by the MHA.

9. NUREG-1537, Part 1, Section 13.1.8 provides guidance to the licensee to demonstrate that the reactor can withstand external events and the potential associated accidents. Identify potential external events and demonstrate that the external event consequences show compliance with the regulations in 10 CFR Part 20.

NUREG-1537, Part 1, Section 13.1.8 lists the following external events and the potential associated accidents:

- Meteorological disturbance, such as hurricane, tornado, or flood
- Seismic event
- Mechanical impact or collision with building
- Event caused by humans, such as explosion or toxic release near the reactor building

During the course of nearly 50 years of operation, there have been numerous hurricanes and other meteorological events that have affected the 20889 zip code, within which the AFRRI facility is located. The most severe result of a meteorological event has been the loss of power which resulted in a controlled reactor shutdown. Meteorological disturbances are tracked in advance of their arrival, and safety precautions are taken as outlined in the AFRRI Emergency Plan, to ensure that reactor operations are not conducted during such disturbances. An unanticipated loss of power would result in a cessation of reactor operations automatically. Reactor instrumentation affected by loss of commercial power is described in the SAR.

The largest earthquakes ever recorded within a 50 mile radius of AFRRI did not exceed 3.7 on the Richter scale (Maryland Geological Survey, 1758-2005), and did not result in any damage or injuries within a 50 mile radius of AFRRI. There is no recorded incident where a magnitude 3.7 earthquake produced detectable structural damage to any building within a 50 mile radius within the last 50 years. AFRRI is situated in a zone where the probability for seismic activity is very remote. The fault line known to exist nearest AFRRI is approximately 19 miles away and extends from 30°07' N latitude, 77°26' W longitude in Montgomery County to 39°20' N latitude, 77°12' W longitude in Howard County. Therefore, seismic events in the D.C. area are not a viable threat to the integrity of the AFRRI reactor facility.

Approximate relationships among earthquake magnitude, intensity, and area affected (after U.S. Geological Survey, 1981, 1989).			
General Description	Richter Magnitude	Modified Mercalli Intensity	Distance Felt (miles)
Microearthquake	below 2.0	--	--
Perceptible	2.0-2.9	I--II	--
Felt generally	**3.0-3.9**	**II-III**	**15**
Minor	4.0-4.9	IV-V	30
Moderate	5.0-5.9	VI-VII	70
Large (Strong)	6.0-6.9	VII-VIII	125
Major (Severe)	7.0-7.9	IX-X	250
Great	8.0-8.9	XI-XII	450

Mechanical impact or a collision with the AFRRI complex would not directly affect the reactor, as none of the access areas surrounding the AFRRI complex are adjacent to the reactor. The AFRRI reactor is housed in more than 14 feet of water and is surrounded by a minimum of 9 feet of high density concrete in all horizontal axes. There is no access to the external walls of the reactor pool. There is no credible scenario in which the reactor pool could sustain damage from an external explosion. With no chemical manufacturing facility in the vicinity of AFRRI, there is no scenario in which a toxic release would damage the AFRRI reactor.

Maryland Geological Survey. Summary of Maryland Earthquakes, 1758-2005. Downloaded from http://www.mgs.md.gov/esic/publications/download/FactSheet13.pdf on February 1, 2011.

U.S. Geological Survey. Earthquakes and Maryland. Downloaded from http://www.mgs.md.gov/esic/brochures/earthquake.html on February 1, 2011.

12. NUREG-1537, Part 1, Section 13.1.6 provides guidance for the licensee to discuss events that could result from experiment malfunction. The licensee is requested to justify its assumption that the release of irradiation Argon accident scenario is the worst conceivable case for radiological consequences from an experiment. The licensee should present a range of experimental malfunction accidents considered. The Argon activation assumptions and calculations should be presented in more detail.

This question has been referred to DOE for computational assistance and will be ready for submission by December 31, 2011.

13. NUREG-1537, Part 1, Section 13.1.3 provides guidance to licensees to systematically analyze and discuss credible accidents in each category. Section 13.2.1.4 of the SAR describes the radiation levels in the reactor floor and roof areas due to the unshielded reactor core after a postulated large loss-of-coolant accident event. The analysis also provides the consequent maximum dose rates at various locations on the reactor floor and the reactor building roof. Please provide accumulated doses to the reactor building occupants and the maximally exposed member of the public considering any evacuation procedure and potential residence time for staff. The results should show compliance with the regulations in 10 CFR Part 20.

As described in the SAR, the predicted dose rates that would result from a loss of pool water are approximately 300 mrem/hr near the reactor pool (10 ft. away on the deck), 3.2 rem/hr on the roof above the reactor, <10 mrem/hr within the AFRRI facility but outside of the reactor room, and <1 mrem/hr for individuals outside of the facility and at least 20 meters from the east wall of the reactor room (maximally exposed member of the public). The bases for these dose rates are provided in Appendix C of the SAR. Based on evacuation procedures at the AFRRI facility, accumulated doses can be estimated for reactor staff, AFRRI staff, and members of the public. Evacuation of staff from the reactor room occurs in less than 5 minutes, resulting in an accumulated dose of <25 mrem. Roof access above the reactor is monitored by video surveillance. This would ensure that personnel could be located and evacuated in less than 5 minutes, resulting in an accumulated dose of <270 mrem. Access to the roof is restricted,and therefore not considered public. Evacuation of the entire AFRRI facility can be accomplished within approximately 15 minutes, resulting in a worst case accumulated dose to an individual of <2.5 mrem. It would take approximately 15 minutes to secure the area surrounding AFRRI to restrict public access, resulting in an accumulated dose of <0.25 mrem to the maximally exposed member of the public. Each of these doses is in compliance with 10 CFR Part 20.