From:	Benjamin Beasley
To:	Joseph Giacinto
Cc:	Lester Towell; Patricia Vokoun; Kenneth Erwin
Subject:	[External_Sender] Re: ACU - RCI review response request
Date:	Wednesday, September 27, 2023 5:39:01 PM

Joe,

I confirm that the information in the Environmental Review Requests for Confirmatory Information that you transmitted on September 21, 2023 is correct without exception. The requests for confirmatory information that I have reviewed and confirm are:

- RCI-WR-1
- RCI-WR-4
- RCI-WR-5
- RCI-WR-6
- RCI-WR-8
- RCI-CR-4
- RCI-CR-5
- RCI-CR-6
- RCI-CR-7
- RCI-RH-1
- RCI-RH-3 and RCI-RH-4
- RCI-RH-5 and RCI-RH-6
- RCI-RH-7
- RCI-RH-8
- RCI-FC-1
- RCI-WM-1
- RCI-WM-2
- RCI-WM-3
- RCI-WM-4
- RCI-TR-1
- RCI-AC-1

Regards,
Ben
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Benjamin Beasley

NEXT Lab – Director of Licensing

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Abilene Christian University | NEXT Lab

On Thu, Sep 21, 2023 at 4:08 PM Joseph Giacinto <Joseph.Giacinto@nrc.gov> wrote:

> On March 9, 2023, the US Nuclear Regulatory Commission issued its plan for conducting an environmental audit (ML23061A126) related to the Abilene Christian University (ACU) construction permit application for a molten salt research reactor which included information need items (ML23061A132 and ML23159A012). The plan described the scope, logistics, and other aspects of the staff's environmental audit which included discussion of the information items with the ACU staff during the audit.
>
> As part of the ongoing audit, the staff has reviewed supporting documents which contain information that will likely be used in its environmental assessment. To the best of the staff's knowledge, some of the information reviewed is not on the docket or accessible in the public domain. Therefore, we request that ACU submit confirmation via email reply that the information gathered during the audit which is listed in the attached file is correct or provide the associated correct information. As discussed with ACU, a mutually agreeable response date to this request is within one week from the date of this email message.
>
> Please let us know of any questions or comments.
>
> Joe Giacinto
>
> Project Manager
>
> US NRC

Abilene Christian University Research Reactor
Construction Permit Application
Environmental Review Requests for Confirmatory Information

Regulatory Basis

Construction permit (CP) requirements are specified in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." Abilene Christian University (ACU) submitted an Environmental Report (ER) as part of its CP application in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." The Nuclear Regulatory Commission's (NRC) regulations at 10 CFR Part 51, which implement Section 102(2) of the National Environmental Policy Act (NEPA) of 1969, include requirements for applicants to provide information as may be useful in aiding the NRC staff in complying with NEPA. Review guidance for the staff is provided in the Final Interim Staff Guidance for Augmenting NUREG–1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors", Parts 1 and 2 (ML12156A069 and ML12156A075).

Request for Confirmatory Information

On March 9, 2023, the NRC issued its plan for conducting an environmental audit (ML2306A126) related to the ACU CP application. As part of the audit, the staff reviewed documents on the applicant's electronic information portal provided in response to the staff audit items outlined in the attachments to the audit plan. Additionally, the staff held discussions with applicant staff related to these audit items. To the best of the staff's knowledge, some of the information reviewed is not on the docket or accessible in the public domain; therefore, the staff requests that ACU submit confirmation that the information described in the Request for Confirmatory Information (RCI) items below is correct or provide the associated corrected information.

Hydrogeology and Water Resources

RCI-[WR-1]:
Relating to water usage, confirm that ACU estimated water usage of approximately 2000 gallons per day for SERC facility based on a daily average water usage rate of 50 gal per day per person and 40 occupants in the building and that the usage rate is based the 2012 government report on water usage in large commercial buildings (https://www.eia.gov/consumption/commercial/reports/2012/water/) but may need to be adjusted based on the final laboratory configuration and associated processes.

RCI-[WR-4]:
Confirm that the Waste Management Plan will be reviewed at OL stage for as needed modifications to address radioactive and mixed waste as the current WMP does not address these wastes and that a review of the Spill prevention and Control Plan will be reviewed at OL stage for modifications to include the SERC facility.

RCI-[WR-5]:
Confirm that:

a) The MSRR is a zero wastewater release facility and there is no connection from the reactor pit to the sanitary sewer system, therefore, no effluent releases are possible and there is no sewage effluent monitoring plan, and
b) The ACU Risk Management Office, Office of Institutional Compliance and Risk Management is the primary party that is responsible for providing oversight of administrative controls, monitoring best practices, ensuring environmental permitting requirements are met and stays informed of environmental issues on the ACU campus.

RCI-[WR-6]:
Confirm that ACU is not a permitted user of the Industrial Pretreatment Program of the City of Abilene nor is an NPDES permit holder. Due to low discharge levels, ACU remains below the threshold that is required to be a permitted user of the City of Abilene Industrial Pretreatment program. Under normal operations of the MSRR, ACU will remain below that threshold and thus will not require that permit.

RCI-[WR-8]:
Confirm that ER Chapter 19.4.12.1.7.1 will be corrected to state 121 mi (195.1 km) rather than 314 miles.

Historic and Cultural Resources

RCI-[CR-4]
Confirm that the SERC site boundary is the Area of Potential Effect (APE) as depicted in Figure 19.2-3 of the PSAR and a revision to § 19.3.7 will add "Although the MSRR will be installed in an existing building and no alteration to the character of historic properties will occur, the area of potential effects is defined as the site boundary identified in Figure 19.2-3."

RCI-[CR-5]
Confirm that no previous surveys have been conducted for the land designated for the SERC site because the land had already been disturbed prior to its acquisition by ACU and no historic or cultural resources will be affected by the installation of the MSRR in an existing building.

RCI-[CR-6]
a) Confirm that ACU has not corresponded with the Texas Historical Commission (SHPO) or with Tribes that have historical ties to the area prior to NRC initiating NHPA Section 106 consultation May 2023 and,
b) Confirm that ACU had a phone conversation with the Texas Historical Commission in which the THC reviewer requested photographs of the former elementary school in relation to the SERC to assist in her understanding of the potential historic property within the proposed action area/APE.

RCI-[CR-7]
Confirm that ACU used the following citations to draft the historic and cultural resources section of the PSAR. In addition, confirm that ACU will revise the PSAR to include a new section to include the references:

1. Texas Historical Commission. (2020). Texas Historic Sites Atlas [Map]. Texas.gov, https://atlas.thc.texas.gov/Map
2. Timothy K. Perttula, Thomas R. Hester, Stephen L. Black, Carolyn E. Boyd, Michael B. Collins, Myles R. Miller. J. Michael Quigg. Wilson W. Crook III, Byron Schroeder, Ellen Sue Turner, Drew Sitters, Nancy Velchoff, Richard A. Weinstein, and Thomas J. Williams, "Prehistory," Handbook of Texas Online, https://www.tshaonline.org/handbook/entries/prehistory, Published by the Texas State Historical Association.

Radiological Human Health

RCI-[RH-1]
With respect to PSAR Chapter 19, Section 19.4.9.2, Radiological Impacts, confirm that Table 19.4-4 will be updated in Revision 1 to the PSAR.

RCI-[RH-3] and RCI-[RH-4]
With respect to PSAR Chapter 19, Section 19.4.9.2, Radiological Impacts, confirm the following annual radiological gaseous effluent doses to nearby receptors based on an updated CAP88 calculation:

- Maximum Exposed Individual at 200 m north of the MSRR would receive 0.493 mrem/year including a hypothetical ingestion pathway
- Maximum fence line at 100 m north of the MSRR would receive 0.26 mrem/year
- Nearest full-time resident at 120 m west of the MSRR would receive less than 0.1 mrem/year

RCI-[RH-5] and RCI-[RH-6]
With respect to PSAR Chapter 19, Section 19.4.9.2, Radiological Impacts, confirm that CAP88 was selected due to its consideration of the pathways listed in RG 1.109 and has been utilized by other NRC licensed research reactors and the DOE. Also, that the CAP88 calculation assumes a local food source being grown directly in the path of the effluent plume that this results in the majority of the radiological.

RCI-[RH-7]
With respect to PSAR Chapter 19, Section 19.4.9.2.5, Dose to Maximally-Exposed Worker, confirm the following:

Dose rate targets will be set to limit the doses to radiation workers to less than 5 rem per year even if they worked all 2000 hours during a year at the location with the maximum dose rate and that the dose rate at the research bay perimeter would be less than 1 mrem/year to satisfy dose requirements for general public occupancy per 10 CFR Part 20. However, the reactor is not expected to operate 24/7 at full power. Studies have shown that it is relatively straightforward to reduce the dose rate by up to 2 orders of magnitude by installing additionally shielding in relatively limited regions over the reactor cell top plug. It should be emphasized that the dose rate will be confirmed by measurement at low power reactor operation, and additional shielding may be installed if needed, or other measures will be implemented to guarantee compliance with the requirements of 10 CFR Part 20.

RCI-[RH-8]

With respect to PSAR Chapter 19, Section 19.4.9.3, Radiological Monitoring, confirm that in the SERC there would be area radiation monitors alongside CAMS in the research bay, reactor cell, reactor cell air outlet, fuel handling system enclosure, primary heat removal system enclosure, helium gas management system enclosure, and the radiochemistry labs. While the stack airway intake has a CAM, it does not have an area monitor as it is not accessible. Additionally, ACU will support State monitoring and expects that TLDs will be placed at the MSRR fence line as is done at other nuclear facilities in Texas. ACU will also have exterior TLDs, stack detection capabilities and periodic exterior building surveys to cover the primary exposure pathways of concern such as exposure to airborne radionuclides and streaming paths from within the SERC building structures (such as the reactor cell).

Fuel Cycle and Radioactive Waste Management

RCI-[FC-1]

With respect to PSAR Chapter 19, Section 19.2.2, Non-Power Reactor, confirm that ACU expects the necessary amount of molten salt over 20 years of operation is 500 kg of UF_4 HALEU at up to 19.75 wt% U-235 and 2,200 kg of FLiBe where 50% as fuel salt and 50% as coolant salt, at 67.2 percent LiF and 27.8 percent BeF_2, with the lithium being enriched to greater than 99.99 percent Li-7 in the fuel salt. All UF_4 HALEU and FLiBe materials are anticipated to be provided by DOE.

RCI-[WM-1]
With respect to PSAR Section 19.2.5.1, Radioactive Waste, PSAR Section 19.4.9.2., Radiological Impacts, and PSAR Section 19.4.10, Waste Management, confirm the following:

Radioactive wastes from NEXT academic research activities involving the MSRR can be difficult to quantify at this stage of MSRR development due to the variable and irregular research activities yet to be fully developed. Based on existing university research reactors that engage in radiochemical research and linearly extrapolating from such activities at the Texas A&M University and the University of Texas, it is anticipated that over 20 years, research activities at the MSRR will produce approximately 100 liters (5 liters per year) of liquid waste and 1,200 liters (60 liters per year) of solid waste in the form of contaminated reagents/aliquots, beakers and glassware, resins used in radiochemical separations, gloves, Tyvek, and other miscellaneous radiological lab waste. These wastes will most likely be Class A waste easily suited for commercial disposal.

Operational wastes from direct MSRR activities, such as managing salt chemistry health, are harder to predict at this stage of MSRR development. Current estimates for a sampling run of 5 samples at 0.1 grams per sample and 3 dissolutions per sample into 25 milliliters of solution per dissolution would yield a total of 375 milliliters of radioactive waste per sampling run. These radioactive wastes are expected to be below the concentration limits of 10 CFR 61. 55 for near surface disposal, especially regarding transuranic nuclide concentration levels after neutralization and potential concretion.

<u>Identification of types and quantities radionuclides and hazmat along with chemical form</u>

HAZMAT exists in multiple forms throughout the facility. The most notable non-radioactive hazmat is HF, Be, and the various chemical reagents to be utilized at the SERC. These are governed by ACU's "Chemical Hygiene Plan" and will have specific systems described in the FSAR.

Strictly radiologically speaking, the dissolved solid samples are in an acidic, aqueous solution prior to their neutralization and/or concretion, but in short, for each salt sampling run demanded by the technical specifications, approximately 375 milliliters of liquid radioactive waste will be generated.

<u>How radiological and hazmat will be used and stored</u>

Radiological and hazardous materials will be managed in accordance with both facility-level procedures, applicable radiation work permits and the waste management plan to be detailed in the FSAR, while mixed/purely hazardous materials will also be managed under the ACU's "Chemical Hygiene Plan" and the "Waste Management Plan."

<u>Capacity of onsite storage</u>

The research bay storage pit has an estimated total capacity of 1200 cubic feet, with actual

space utilized likely being significantly lower. This space is sufficient for 8 55-gallon drums. At this time, MSRR operational waste can only be estimated as 1000 fuel salt samples collected over the 20-year life of the reactor could be processed and disposed of in two 55-gal Type B waste drums. This is a conservative estimate because samples collected during early operation that do not pose a radiological issue may be stored outside of the storage pit.

Description of systems to collect, store, and process waste

Collection of solid waste would be performed using specially marked and labeled trash cans and with marked and label liners for hot waste. Once a bag is full, the bag would be transferred to the storage pit with a capacity of eight 55-gal waste drums.

Liquid waste accumulation will be formed in accordance with ACU 's status as a Conditionally Exempt Small-Quantity Generator. It is likely that the generated waste will be quickly neutralized into regular aqueous radioactive waste rather than mixed waste in order to ensure compliance with accumulation times.

Disposal plans

LLRW from MSRR operations are easily viable for disposal with a waste broker to the WCS. Because the fuel and coolant salts should be the property of DOE, (ACU is in good faith negotiations with DOE on a spent fuel contract), the DOE should reclaim them at the end of the reactor’s lifetime. The fuel and coolant salts are not waste and could be reused by DOE on other projects. There will be approximately 1600 kilograms of fuel salt (500 kg of UF4 mixed with 1100 kgs of FLiBe) and 1100 kilograms of FLiBe coolant salt.

Regarding radioactive waste during decommissioning, safe enclosure of the reactor is easily obtained with the reactor siting in the reactor bay for delayed decommissioning to allow shorter lived nuclides to decay away. Based on the knowledge gained from the long-term storage of spent fuel salt from the MSRE at Oak Ridge National Laboratory (e.g., ORNL/TM-13142 and other ORNL MSRE documents), the conditions should not be present for significant production of fluorine gas by radiolysis during storage of the spent fuel salt. The MSRR spent fuel salt can be safely stored and monitored until DOE takes possession and ships the spent fuel offsite to a designated DOE facility. Additionally, given the biological shielding is adequate for the operating reactor, the residual activation products will be easily shielded by the biological shield outer layer (Systems Pit Floor and Walls, and the Top Plug).

Waste minimization plans

The radioactive waste management plan will be explicitly included in the ALARA program. ACU intends that the internal reviews of the waste management plan will also include provisions to keep waste volumes and activities to a minimum.

RCI-[WM-2]
With respect to PSAR Section 9.2, Handling and Storage of Reactor Fuel, confirm the following:

Once initial operations have begun, there is no need for FLiBe replenishment. The 1100 kg of FLiBe fuel salt present at the beginning of operation will remain throughout the life of the reactor. During operation, the depletion of UF4 will require the addition of small amounts of HALEU UF4. This UF4 will likely be added as small slugs. The final design is yet to be determined.

Before initial operation, the fuel handling system will receive the salt from DOE. After cleaning

and purification of the reactor system and the salt, the salt will be transferred to the reactor system. Occasionally during operation (less than once per year), the fueled salt will be transferred from the reactor system to the storage system. These operations will not need the addition of fresh salt.

RCI-[WM-3]
With respect to PSAR Section 19.2.5.1, Radioactive Waste, PSAR Section 19.4.9.2.3, Liquid Sources of Radiation, and PSAR Section 19.4.10, Waste Management, confirm the following:

ACU's intent is to have a "zero liquid release" facility. Any radioactive liquid from any part of the facility would be collected in a separate piping/collection system for disposal processing. Namely, by placing the liquid radioactive waste into an approved transport packaging for removal by a waste broker for shipment to the WCS or through evaporation/absorption to remove the liquid and only have solid or gaseous radioactive waste streams into an approved transport packaging for removal and disposal at WCS by a waste broker.

RCI-[WM-4]
With respect to PSAR Section 19.2.5.1, Radioactive Waste, PSAR Section 19.4.9.2.2, Gaseous Sources of Radiation, and PSAR Section 19.4.10, Waste Management, confirm the following:

Tritium is generated within the fuel salt, coolant salt, and the air flowing through the reactor cell. Fuel salt dominates in the generation of tritium more than any tritium generated in the coolant salt and from air activation in the test cell. Tritium may diffuse into a variety of components, with the most likely candidates being diffusion into reactor structural materials, the gas management system, through the heat exchanger to the coolant salt where it may diffuse through the radiator tubes to the atmosphere. For estimating the annual dose to the maximally exposed individual from perpetual tritium releases, ACU assumes that any generated tritium within the facility will be released to the environment. This annual amount of tritium released to the environment is listed in Table 19.4-4. The WCS LLRW disposal site is suited to accept Class A, B, and C LLRW. ACU anticipates that almost all LLRW that is generated, including structural materials diffused with tritium, and not deemed scientifically useful will be disposed of at WCS.

Transportation of Radioactive Material

RCI-[TR-1]
With respect to PSAR Section 19.2.5, Waste Systems, and Section 19.4.9.2.4 Solid Radiation Sources, confirm the following:

It is anticipated that almost all waste generated prior to decommissioning will be shipped out via commercial waste broker in the same manner that Texas A&M University and University of Texas operations do, most likely for ultimate disposal at the WCS site in Andrews County, Texas. Commercial waste brokers can come as needed, but generators can often piggyback off of shipments made by other generators along the same route for a lower cost. Initial waste determination is made by ACU, although brokers may perform additional investigations or assaying. The WCS site is about 205 miles away.

The only currently anticipated treatment of radioactive waste is neutralization and potential concretion of the salt monitoring samples. MSRR project personnel have been in contact with a waste broker and when an operating license is granted, ACU will collaborate with the selected waste broker to optimize the waste disposal process to ensure waste quantities produced are ALARA. The waste neutralization, concretion, and determination of waste class will be performed

in accordance with “Concentration Averaging and Encapsulation Branch Technical Position, Revision 1.”

All shipments will be packaged in accordance with DOT and NRC regulatory requirements, including those for transport indices. Given that ACU does not expect any exclusive use shipments during operation, this means that the dose rate at 30 centimeters from any given package will likely not exceed 10 mrem per hour. Combined with the relatively few shipments, ACU does not believe the waste shipments will create substantial amounts of dose to the public.

While not directly applicable, experience at the Texas A&M University and University of Texas facilities have helped to provide general estimates for waste volumes in comparatively large research programs with unpredictable day-to-day generation rates.

Postulated Accidents

RCI-[AC-1]
Related to PSAR Chapter 19, Section 19.4.12, Postulated Accidents, confirm the following text is accurate:

The material-at-risk for release from a postulated accident could be the liquid fuel molten salt or from the on-site buildup of radioactive waste. The material-at-risks exists in only a few locations within the SERC facility. Such locations would include the reactor pit with the MSRR for the events described in Chapter 13 of the PSAR, the storage pit for the long-term decay-in-storage or waste awaiting collection by a waste broker, as well as radioactive waste generated from the analyses of liquid fuel molten salt samples in the health physics, salt chemistry, and radiochemistry laboratories. The liquid fuel molten salt samples would contain fission products and a certain quantity of transuranic radionuclides, depending on the power history of the molten salt samples. Thus, there is the potential for there to be transuranic wastes. When a sample analysis has been completed, ACU would suspend the salt samples in concrete to neutralize the hazardous (acidic) component of the sample aliquots and to stabilize the waste form as a solid . Once the salt samples are in this waste form, the chance for any accident condition (e.g., fire, hydrogen buildup and deflagration, etc.) that could result in a release of fission products and transuranics from the radioactive waste is negligible.