RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
FOR LICENSE RENEWAL APPLICATION FOR
FACILITY OPERATING LICENSE NO. R-120 FOR
THE NORTH CAROLINA STATE UNIVERSITY
PULSTAR RESEARCH REACTOR (EPID NO. L-2017-RNW-0026)

SUBMITTAL 1

NORTH CAROLINA STATE UNIVERSITY
LICENSE NO. R-120; DOCKET NO. 50-297

NOVEMBER 1ST, 2018

1. Financial Qualifications Report (ADAMS Accession No. ML17088A828)

The NCSU LRA Financial Qualifications Report provided annual funding and operating expenditures, in Table 1, "PULSTAR Reactor Facility Annual Funding," and annual operating expenditures in Table 2, "PULSTAR Reactor Facility Annual Operating Expenditures," for fiscal years 2018 through 2022. However, based on the financial information provided, as referenced above, the NRC staff is unable to verify that the PULSTAR facility continues to operate within the definition of 10 CFR 50.21 as a class 104(c) research facility.

The regulations in 10 CFR 50.21(c), provide the definition of a class 104(c) facility, and which states, that the facility is "a production or utilization facility, which is useful in the conduct of research and development activities of the types specified in section 31 of the [Atomic Energy] Act, and which is not a facility of the type specified in paragraph (b) of this section or in [10 CFR] 50.22." Regulations in 10 CFR 50.22 state, in part, "that in the case of a production or utilization facility which is useful in the conduct of research and development activities of the types specified in section 31 of the [Atomic Energy] Act, such facility is deemed to be for industrial or commercial purposes if the facility is to be used so that more than 50 percent of the annual cost of owning and operating the facility is devoted to the production of materials, products, or energy for sale or commercial distribution, or to the sale of services, other than research and development or education or training."

Provide a confirmatory statement that no more than 50 percent of the cost of owning and operating the facility is devoted to the production of materials, products, or energy for sale or commercial distribution, or to the sale of services, other than research and development or education or training or justify why no changes are needed.

RESPONSE

The following statement has been added to Section 2 of the Financial Qualifications Report:

> Pursuant to the requirements of 10 CFR 50.21(c) and 10 CFR 50.22 concerning a class 104(c) research facility, no more than 50 percent of the annual cost of owning and operating the PULSTAR facility is devoted to the production of materials, products, or energy for sale or commercial distribution, or to the sale of services, other than research and development or education or training.

Section 15.2, last paragraph, of the LRA SAR will also be edited from:

> Funding for internal N.C. State academic R&D is included under the Federal Contracts and Grants line in Table 15-1 above. The NCSU PULSTAR reactor is also a user facility and as such is utilized by external academic, governmental, and commercial entities for research and development and other irradiation and testing activities. The total projected revenue from all service user activities is estimated under the Services Cost Recovery line of Table 15-1. While the facility does perform some service work for commercial users (amounting to less than 50% of the annual Services Cost Recovery totals given in Table 15-1), the revenue generated from these activities represents significantly less than 50% of the total annual cost of operating the facility as detailed in Table 15-2. In accordance with 10 CFR Part 50.21, the NCSU PULSTAR reactor should therefore be licensed as a Class 104 facility.

To:

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> Therefore, pursuant to the requirements of 10 CFR 50.21(c) and 10 CFR 50.22 concerning a class 104(c) research facility, no more than 50 percent of the annual cost of owning and operating the PULSTAR facility is devoted to the production of materials, products, or energy for sale or commercial distribution, or to the sale of services, other than research and development or education or training, and as such, the NCSU PULSTAR Reactor should be licensed as a Class 104 facility.

An updated Financial Qualifications Report has been included as Attachment 1 of this submittal.

2. Environmental Report (ADAMS Accession No: ML17088A836)

The NCSU LRA letter (ADAMS Accession No: ML17088A819) requested a power level increase of its Facility Operating License from 1.0 megawatt (MWt) to 2.6 MWt. Included in the LRA environmental report (ER), Section 4, "Environmental Effects of Facility Operation," was the following statement: "Operation of the reactor at 2 MW will not cause a significant increase in radiation levels or effluent." The NRC staff is not clear if the ER was performed at the proposed 2.0 MWt or 2.6 MWt power levels.

The regulations in 10 CFR 51.45(c) contain the requirements for an applicant's ER, and states that an ER "…should contain sufficient data to aid the Commission in its development of an independent analysis."

Provide an updated ER with an environmental impact analysis that describes the operational changes associated with the proposed power level increase including effluents, doses, cooling demand, makeup water usage, and waste generation, including batch discharges to the sanitary sewer for operation at the proposed power level of 2.6 MWt, or justify why no changes are needed.

Note: The updated ER should properly bound the impacts commensurate with the proposed power level increase, including reference to a documented analysis methodology that identifies assumptions and accounts for any margins for instrument inaccuracies and measurement uncertainty in determining maximum power for the analysis.

RESPONSE

Per communication with NRC regarding the peak cladding temperature limit and the oxidation limit, the *Safety Analysis for Assessing 2 MW Power Upgrade for the NCSU PULSTAR Reactor* is being revised and will provide the basis for the power level to be used in the Environmental Report. An updated Environmental Report will be supplied in a future submittal of the response to this RAI.

3. Safety Analysis Report (ADAMS Accession No: ML17201Q129)

The NCSU LRA requested a power level increase from 1.0 MWt to 2.6 MWt. Included in LRA SAR, Section 11, "Radiation Protection Program and Waste Management," were radiation dose calculations that appear to assume operation at 2.0 MWt. The NRC staff is not clear if the dose calculations were performed at 2.0 MWt rather than the proposed 2.6 MWt power level.

The regulations in 10 CFR Part 20 require that doses to workers and members of the public be limited. LRA SAR Section 11 provided various dose calculations that would be necessary to make this determination (i.e., the concentrations of and the doses to workers/members of the public from any radiological effluents).

Provide clarification that the dose calculations provided in LRA SAR Section 11 comply with the limits in 10 CFR Part 20 for the proposed power level increase of 2.6 MWt or justify why no changes are needed.

RESPONSE

Per communication with NRC regarding the peak cladding temperature limit and the oxidation limit, the *Safety Analysis for Assessing 2 MW Power Upgrade for the NCSU PULSTAR Reactor* is being revised and will provide the basis for the power level to be used in Section 11 of the LRA SAR. An updated LRA SAR Section 11 will be supplied in a future submittal of the response to this RAI.

4. Reactor Operator Training and Requalification Program (ADAMS Accession No. ML17088A840)

The regulations in 10 CFR 55.59, "Requalification," paragraph (a)(2) state: "Each licensee shall – Pass a comprehensive requalification written examination and an annual operating test."

ROTRP Section 2.c states, in part: "The responsibility for this program rests with the Manager of Engineering and Operations (or a duly authorized representative). This responsibility shall cover the following items: (c) Granting of exemptions to the requalification program as provided for in this plan."

The "granting of exemptions to the requalification program" statement is not explained anywhere in the ROTRP. Revise the ROTRP to clarify the use of this statement or justify why no changes are needed.

RESPONSE

The ROTRP does not grant any exemptions. Therefore Section 2.c has been deleted from the ROTRP. An updated ROTRP has been included as Attachment 2 of this submittal.

5. Reactor Operator Training and Requalification Program (ADAMS Accession No. ML17088A840)

The regulations in 10 CFR 55.59(c)(4)(iii) state: "The requalification program must include – Systematic observation and evaluation of the performance and competency of licensed operators and senior operators by supervisors and/or training staff members, including evaluation of actions taken or to be taken during actual or simulated abnormal and emergency procedures."

ROTRP Section 3.f states, in part: "For the first 12 month interval and for the second 12month interval of the 24 month period, the licensed individual shall (f) Complete a review of documents, including abnormal and emergency procedures.

"ROTRP Section 5, "Evaluation," makes no mention of how the licensee is going to meet the requirements in 10 CFR 55.59(c)(4)(iii). Revise the ROTRP to state how the 10 CFR 55.59(c)(4)(iii) requirements will be satisfied or justify why no changes are needed.

RESPONSE

Consistent with 10 CFR 55.59(c)(4)(iii), Section 4.4 of the ROTRP details what the operating test will include for actual or simulated responses to abnormal emergency situations.

Therefore to be consistent with ANSI/ANS-15.4-2016 Section 5.5 Examination administration and evaluation, the following has been added to Section 5.2 of the ROTRP:

> A grade equal to or greater than 70% will constitute a passing grade for the annual operating examination discussed in Section 4.4.

In addition, a typographical error in the 4th paragraph of Section 4.4 of the ROTRP referencing 10 CFR 55.5(4)(iii) has been corrected to read 10 CFR 55.59(c)(4)(iii).

An updated ROTRP has been included as Attachment 2 of this submittal.

6. Supporting Information

The regulations in 10 CFR 50.9, "Completeness and accuracy of information," require that information provided to the Commission by a licensee shall be complete and accurate in all material respects.

The NRC staff, in its review of the NCSU LRA, finds that the following supporting information is necessary to continue its review:

a. North Carolina State University PULSTAR Reactor, "Safety Analysis for Assessing 2 MW Power Upgrade for the NCSU PULSTAR Reactor," March 2017.

b. North Carolina State University, Burlington Hall Research Reactor Piping Upgrade Final Engineering Report, Enercon Services, October 2013.

c. North Carolina State University PULSTAR Reactor, Calculation No. NRP-98-01-Criticality Analysis for a 250 Fresh Fuel Pin Storage Rack, December 1998(SAR Reference 13-11).

d. Hey, B.E., Computation of Delayed Fission Product Gamma Ray Dose Rates from NCSU PULSTAR Reactor Using a Monte Carlo Number Albedo Approach, Master Thesis, 1984 (SAR Reference 13-16).

Provide the following information or justify why the supporting information cannot or will not be provided.

RESPONSE

The supporting information requested in (b), (c), and (d) are included as Attachments 3, 4, 5 and 6 of this submittal.

The document requested in 6(a) *Safety Analysis for Assessing 2 MW Power Upgrade for the NCSU PULSTAR Reactor* is being revised, per communication with NRC regarding the peak cladding temperature limit and the oxidation limit, and will be supplied in a future submittal. The cladding temperature limits for PULSTAR type fuel was discussed during a teleconference with the NRC on August 1st, 2018 and detailed in a follow-up email from the NRC on the same date.