

March 19, 2014

Dr. Jeffrey A. Geuther, Manager  
Kansas State University  
KSU Nuclear Reactor Facility  
112 Ward Hall  
Manhattan, KS 66506-5204

SUBJECT: KANSAS STATE UNIVERSITY – REQUEST FOR ADDITIONAL INFORMATION  
REGARDING LICENSE AMENDMENT REQUEST OF FACILITY OPERATING  
LICENSE NO. R-88, FOR THE KANSAS STATE UNIVERSITY NUCLEAR  
REACTOR (TAC NO. ME8812)

Dear Dr. Geuther:

By letter dated April 9, 2012 (Agencywide Documents Access and Management System Accession No. ML12109A063), Kansas State University (KSU, the licensee) requested an amendment to the Facility Operating License No. R-88 for the KSU Research Reactor.

The U.S. Nuclear Regulatory Commission staff is continuing its review of your application for a license amendment regarding the use of up to four fuel elements of 12.5% uranium by weight in certain locations of the core of the KSU TRIGA Mark-II nuclear reactor facility. During our review, questions have arisen for which we require additional information and clarification. Please provide responses to the enclosed request for additional information within 45 days of the date of this letter.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 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."

J. Geuther

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If you have any questions about this review or if you need additional time to respond to this request, please contact me at 301-415-3965 or via electronic mail at [Spyros.Traiforos@nrc.gov](mailto:Spyros.Traiforos@nrc.gov).

Sincerely,

*/RA/*

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

Docket No. 50-188  
License No. R-88

Enclosure:  
Request for Additional Information

cc: See next page

Kansas State University

cc:

Office of the Governor  
State of Kansas  
Suite 2415  
300 SW 10<sup>th</sup> Avenue  
Topeka, KS 66612-1590

Thomas A. Conley, RRPJ, CHP  
Section Chief Radiation and Asbestos Control  
KS Dept of Health & Environment  
1000 SW Jackson, Suite 330  
Topeka, KS 66612-1365

Mayor of Manhattan  
P.O. Box 748  
Manhattan, KS 66502

Test, Research, and Training  
Reactor Newsletter  
University of Florida  
202 Nuclear Sciences Center  
Gainesville, FL 32611

J. Geuther

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Sincerely,

**/RA/**

Spyros A. Traiforos, Project Manager  
Research and Test Reactors Licensing Branch  
Division of Policy and Rulemaking  
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**ADAMS Accession No.: ML14065A539**

**NRR-088**

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<b>DATE</b>	03/10/2014	03/10/2014	03/19/2014	03/19/2014

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**REQUEST FOR ADDITIONAL INFORMATION**  
**REGARDING LICENSE AMENDMENT REQUEST FOR**  
**KANSAS STATE UNIVERSITY NUCLEAR REACTOR FACILITY**  
**LICENSE NO. R-88**  
**DOCKET NO. 50-188**

By letter dated April 9, 2012 (Agencywide Documents Access and Management System Accession No. ML12109A063), Kansas State University (KSU, the licensee) requested a license amendment to the Facility Operating License No. R-88 for the KSU Research Reactor.

The U.S. Nuclear Regulatory Commission (NRC) staff is continuing its review of your application for a license amendment regarding the use of up to four fuel elements of 12.5% uranium by weight in certain locations of the core of the KSU TRIGA Mark-II nuclear reactor facility. During our review, questions have arisen for which we require additional information and clarification.

The request for additional information (RAI) is based on a comparison of the KSU application to NRC NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," February 1996 and the American Nuclear Standards Institute/American Nuclear Society (ANSI/ANS) - 15.1-2007, "The Development of Technical Specifications [TSs] for Research Reactors."

1. NUREG-1537, Part 1, Section 4.5.2, "Reactor Core Physics Parameters," states, in part, that "the applicant should discuss the core physics parameters and show the methods and analyses used to determine them." Your license amendment application provided results of the reactor core modeled using Monte Carlo N-Particle 5 (MCNP5) as a 3D model by using the code output to compare the "perturbed core" with the "existing core." However, no information was provided in the application concerning the calculations from which the results were obtained. Provide a detailed description of the calculations performed, and the input of the MCNP5 code, including information concerning the comparison of the new core operation and performance, with that of the licensed reference core (limiting case).
2. NUREG-1537, Part 1, Section 4.5.2, "Reactor Core Physics Parameters," states, in part, that the information should include "[t]echnical specifications that control important design features, limiting conditions for operation, and surveillance requirements as discussed in Chapter 14 of this format and content guide." The proposed TS 5.1., "Reactor Fuel," Section 5.1.4, Bases, states that "[c]alculations show that 12%-load fuel in the E- and F- rings will not exceed the temperature of 8%-load instrumented elements in the B-ring." The application does not provide calculated values for the temperature and the power of the hottest rod and of the new 12% rods. Provide values of the calculated fuel temperatures and power.

Enclosure

3. NUREG-1537, Part 1, Section 4.5.1, "Normal Operating Conditions," states, in part, that "[t]he applicant should give in detail the effects of changes in configuration and fuel burnup." The application states that "the composition and density were adjusted to approximate core depletion." Provide the calculation details and method used to support this statement.
4. NUREG-1537, Part 1, Section 4.5.2, "Reactor Core Physics Parameters," states, in part, that the information should include "[t]he axial and radial distributions of neutron flux densities, justifications for the methods used, and comparison with applicable measurements." In figures 2 through 4 of the application, the power of one fuel element in the B-ring is higher than the other elements in the same ring. Explain the origin of this power peaking in the ring and elaborate on the effect of this peaking on the core power distribution.
5. NUREG-1537, Part 1, Section 4.5.1, "Normal Operating Conditions," states, in part, that the information in the SAR should include "[t]he number, types, and locations of all core components on the grid plate, including fuel, control rods...." The number of the fuel elements presented in the figures of the application are 79 (Figure 1) or 78 (Figures 2-4), while the number of the fuel elements in the SAR reference core is 83. Explain the apparent difference.
6. NUREG-1537, Part 1, Section 4.5.1, "Normal Operating Conditions," states, in part, that the information in the SAR should include "[t]he calculated core reactivities for all core configurations, including the limiting configuration that would yield the highest possible power density." The application states that "[t]here is some concern that local power peaking effects in 12% fuel would result in unacceptably high local fuel temperatures if the fuel is located near a control rod channel, which becomes a moderator channel upon rod withdrawal." Provide a quantitative analysis on the consequences (fuel element power and temperature) of locating the new fuel elements adjacent to control rods, including, defining the criteria on the distances, in order for the above potential event or accident to be evaluated. Also, provide the administrative controls necessary to prevent an unintentional installation of the new fuel in such positions and discuss the basis for whether these controls should be included in the TSs.
7. NUREG-1537, Part 1, Section 4.5.1, "Normal Operating Conditions," states, in part, that the information in the SAR should include "[d]iscussion of the safety considerations for different core configurations, including a limiting core configuration that would yield the highest power densities and fuel temperatures achievable with the planned fuel." The application states that "[t]he only accident in the SAR that can be credibly affected by increasing the fuel loading per element is the maximum hypothetical accident." Provide a justification.
8. In the application cover letter, under the title "Request for License Amendment," there are references to paragraphs 2.D.2 and 4.D.2 of the facility license. There are no such paragraphs in the current license. In the context of your text, it appears that the correct references are 2.B.2 and 2.B.4 respectively. Provide references to the correct paragraphs of the facility license.

9. Provide a marked up copy of the current license and TSs indicating the proposed changes.
10. Provide a clean copy of the current license and TSs incorporating the proposed changes.