November 1, 2017

Mr. Matt Sanford, Interim Reactor Facility Director
University of Missouri-Columbia
Research Reactor Center
1513 Research Park Drive
Columbia, MO 65211

SUBJECT: UNIVERSITY OF MISSOURI AT COLUMBIA - REQUEST FOR ADDITIONAL INFORMATION RE: LICENSE AMENDMENT REQUEST TO IMPLEMENT SELECTIVE GAS EXTRACTION TARGET EXPERIMENTAL FACILITY AT THE UNIVERSITY OF MISSOURI RESEARCH REACTOR (CAC A11010/05000186/L-2017-LLA-0227)

Dear Mr. Sanford:

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of your license amendment request (LAR) to produce molybdenum-99 using the General Atomics, Selective Gas Extraction process, provided by letter dated May 3, 2017 (redacted versions of the application are available on the NRC's public web site at www.nrc.gov under Agencywide Documents Access and Management System Accession Package No. ML17132A252).

The NRC staff has reviewed your proposed LAR and identified the items in the attached enclosure, which need additional information or clarification. We request that you provide responses within 30 days from the date of this letter.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.30(b), "Oath or affirmation," 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." Any information related to security should be submitted in accordance with 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements." Following receipt of the additional information, we will continue our evaluation of your LAR.

If you need additional time to complete this request, or have any questions regarding this review, please contact me at (301) 415-0893, or by electronic mail at Geoffrey.Wertz@nrc.gov.

Sincerely,

/RA/

Geoffrey A. Wertz, Project Manager
Research and Test Reactors Licensing Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 50-186
License No. R-103

Enclosure:
As stated

cc: See next page

cc:

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SUBJECT: UNIVERSITY OF MISSOURI AT COLUMBIA - REQUEST FOR ADDITIONAL INFORMATION RE: LICENSE AMENDMENT REQUEST TO IMPLEMENT SELECTIVE GAS EXTRACTION TARGET EXPERIMENTAL FACILITY AT THE UNIVERSITY OF MISSOURI RESEARCH REACTOR (CAC A11010/05000186/L-2017-LLA-0227) DATED: NOVEMBER 1, 2017

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REQUEST FOR ADDITIONAL INFORMATION

FOR THE LICENSE AMENDMENT REQUEST TO IMPLEMENT THE SELECTIVE GAS

EXTRACTION TARGET EXPERIMENTAL FACILITY AT

THE UNIVERSITY OF MISSOURI-COLUMBIA RESEARCH REACTOR

LICENSE NO. R-103; DOCKET NO. 50-186

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of the University of Missouri-Columbia Research Reactor (MURR) license amendment request (LAR) to conduct an experiment that would produce molybdenum-99 using the General Atomics, Selective Gas Extraction (SGE) process, provided by letter dated May 3, 2017 (a redacted version of the application is available on the NRC's public web site at www.nrc.gov under Agencywide Documents Access and Management System (ADAMS) Accession Package No. ML17132A252). The LAR is Part 1 of 2, and consists of the changes needed to perform irradiation of the target material. The NRC staff has reviewed your proposed LAR, Part 1, and identified the items in the attached enclosure, which need additional information or clarification. We request that you provide responses within 30 days from the date of this letter.

These requests for additional information have been developed based on the following requirements and guidance applicable to your LAR:

- The regulations in Title 10 of the *Code of Federal Regulations* (10 CFR).

- The regulations in 10 CFR Part 20, "Standards for Protection against Radiation," require that radiation doses to workers and members of the public be limited. To support meeting the public dose limits, 10 CFR Part 20, also limits the release of radioactive materials from the licensed facility to the environment (e.g., 10 CFR Part 20, Appendix B, Table 3).

- 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 regulations in 10 CFR 50.36, "Technical specifications [TSs]," require each applicant to propose TSs. Additionally, 10 CFR 50.36(c) provides requirements to include safety limits, limiting safety system settings, limiting conditions for operation, surveillance requirements, design features, and administrative controls. These TSs are derived from the analyses and evaluation included in the safety analysis report (SAR) and submitted pursuant to 10 CFR 50.34. Furthermore, American National Standards Institute/American Nuclear Society-15.1-2007, "The Development of Technical Specifications for Research Reactors," as discussed in NUREG-1537 Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Format and Content," Chapter 14, "Technical Specifications," provides guidance acceptable to the NRC staff, and, unless acceptable alternatives are justified by the licensee, should be utilized whenever appropriate.

- The regulations in 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications.

- NUREG-1537, Part 1 and Part 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Format and Content," issued February 1996 (ADAMS Accession Nos. ML042430055 and ML042430048, respectively).

  Note: the RAI numbering below follows sequentially from the previous NRC RAI letter dated September 7, 2017 (ADAMS Accession No. ML17234A733).

LAR Attachment 1

39. LAR, Attachment 1, Section 3.4.3, "Structural Performance During a Seismic Event," provides analyses of the target experimental facility (TEF) response to two seismic events. The results of the analyses imply that the integrity of the TEF piping and components will be maintained during the analyzed seismic events. However, the description of the analyses does not provide an overall conclusion as to the operability of the TEF to a seismic event, or the consequences of any accident from a seismic event. Furthermore, the NRC staff did not find any discussion of any other external events which could impact the operation of the TEF, such as fire, floods, high winds, or human-created events such as toxic releases or explosions.

    The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, NUREG-1537, Part 1, Chapter 3.4, "Seismic Damage," provides guidance that the applicant should provide reasonable assurance that the reactor, and TEF, can be shutdown, and maintained in a safe condition, and that all potential consequences from a seismic event are bounded by the results of the safety analysis or within NRC limits. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 13, "Accident Analyses," states that the facility design should be able to accommodate any postulated external events.

    39.1. Provide a description indicating that the seismic design of the TEF can provide reasonable assurance that both the reactor and TEF can be shutdown and remain in a safe condition, or justify why no additional information is needed.

    39.2. Provide a description that the potential consequences from a seismic event have been analyzed and the consequences are bound by the SAR, or within NRC limits, or justify why no additional information is needed.

    39.3. Provide the evaluation of any external events (other than seismic, such as fire, floods, high winds, or human-created events such as toxic releases or explosions.) which could impact the TEF operation. If not evaluated, provide a justification why no additional information is needed.

40. LAR, Attachment 1, Section 3.4.9, "Electrical Power System Supporting the TCS [Target Cooling System]," provides information on the electrical power distribution to the TCS. However, the NRC staff did not find any information describing any other auxiliary systems needed to support the TEF operation, changes to existing auxiliary systems needed to

support the TEF operation, or if the installation or operation of the TEF affected auxiliary systems needed to operate the reactor.

The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. Furthermore, NUREG-1537, Part 1, Chapter 9, "Auxiliary Systems," provides guidance that the LAR should provide information on auxiliary systems that are important to the safe operation and shutdown of the reactor and to the protection of the health and safety of the public, the facility staff, and the environment.

40.1. Discuss or describe any auxiliary systems that are needed to support the operation of the TEF, or justify why no additional information is needed.

40.2. Discuss changes to any other auxiliary systems than the electrical system, needed to support the TEF operation, or justify why no additional information is needed.

40.3. Discuss if the installation of the TEF impacts any of the auxiliary systems needed to support the operation of the reactor, or justify why no additional information is needed.

41. LAR, Attachment 1, Section 7, "In-Pool Target Transfer System," presents a description of the equipment and process to move target rods from/to the target storage and to/from the target cartridge at the cartridge loading/unloading station. However, the NRC staff review identified the need for additional information as listed below.

The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. The regulations in 10 CFR Part 20 require that doses to workers and members of the public be limited. Furthermore, NUREG-1537, Part 1, Chapter 9.2, "Handling and Storage of Reactor Fuel," provides guidance that the LAR should provide information on how subcriticality is ensured under all conditions of fuel handling and storage, and descriptions of procedures and systems for the storage and handling of irradiated fuel, including shielding, protection from physical damage, physical control, and cooling to prevent overheating, and surface corrosion.

41.1. Provide the detailed calculations that support the analyses for the k-effective values provided in the LAR, Section 7.1.1, "Cartridge Loading/Unloading Station Description," and the results of analyses for any other k-effective values reported in the LAR, or justify why no additional information is needed.

41.2. Provide a description of any accident scenarios involving physical damage to the target assemblies (TAs) during the in-pool transport process, possibility of a mishandled TA or cartridge, or justify why no additional information is needed.

41.3. Provide the dose assessment performed to indicate that the irradiated TAs in the cartridge loading/unloading station have adequate biological shielding (concrete wall) to protect the workers, or justify why no additional information is needed.

41.4. Provide a description of the proximity of the TEF Cartridge Loading/Unloading Station to the reactor fuel in-pool storage locations, if any storage locations are the same for the reactor fuel and TAs, and if any potential for a dropped TEF TA or

cartridge could adversely impact stored reactor fuel, or justify why no additional information is needed.

41.5. Provide a description of the tools needed for handling the target rods and cartridges, and the TAs (e.g., are the tools identical to the current fuel handling tools), or justify why no additional information is needed.

42. LAR Attachment 1, Section 7.1.1, "Cartridge Loading/Unloading Station Description," states that no more than 22 target rods will be either in a cartridge or in target storage at the cartridge loading/unloading station during normal operations. Furthermore, of those 22 target rods, only 11 of them will be fresh (unirradiated). LAR Section 1.2, "Normal Operation," states that during normal operation, one (1) or two (2) target cartridge(s) are loaded with fresh (unirradiated) target rods in the loading station. The NRC staff is not clear if the LAR is limiting the irradiation to only 11 fresh (unirradiated) target rods or 22 fresh (unirradiated) target rods.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. Furthermore, the guidance in NUREG-1537, Part 1, Chapter 4, Section 4.5, "Nuclear Design," provides guidance that the LAR should include all necessary information on the nuclear parameters and characteristics of the reactor core.

    Provide a description of the fresh (unirradiated) target rods (11 or 22) which may be irradiated in the reactor, and if a limit is imposed on the irradiation of fresh (unirradiated) target rods, if a corresponding TS is required, or justify why no additional information is needed.

43. LAR, Attachment 1, Section 7.1.2, "Cartridge Loading/Unloading Station Operation," and Section 7.2.2, "Cartridge Installation and Removal into/From the Target Housing Operation," provide a description of the operational sequence for each specified activity. However, the NRC staff is not completely clear as to the overall process for loading, unloading, installation, storage, and removal of the TA cartridges. The NRC staff needs additional description, detail, drawings, illustrations, etc., to ensure a comprehensive understanding of the process.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, NUREG-1537, Part 1, Chapter 9, "Auxiliary Systems," provides guidance for the handling and storage of reactor fuel, which would include the TEF TAs.

    Provide additional description, detail, drawings, illustrations, etc., of the TA cartridge loading and unloading station operation, and the cartridge installation and removal into and from the target housing, and storage, or justify why no additional information is needed.

44. LAR, Attachment 1, Section 8.2, "Liquid Sources," states, in part, that "By utilizing existing reactor-related cooling and decay systems for the reduction of N-16, the addition of any N-16 produced by the TAs will not add any appreciable source term to the overall inventory of N-16 that must be decayed and/or shielded in order to protect reactor staff." However,

the NRC staff is not clear as to the expected dose rates and worker doses due to the Target Cooling System piping when the TEF is in operation.

The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. The regulations in 10 CFR Part 20 require that doses to workers and members of the public be limited. Furthermore, NUREG-1537, Part 1, Section 11.1, "Radiation Protection," provides guidance that the applicant should describe the radiological consequence of normal operation of the facility.

Provide a description of the expected dose rates and worker doses from the Target Cooling System piping to the workers in the vicinity, or justify why no additional information is needed.

45. LAR, Attachment 1, Section 8.3, "Solid Sources," provides general information on the solid radioactive sources expected from the proposed LAR. However, the NRC staff is interested in the potential for the activation and generation of additional solid radioactive sources from the operation of the TEF, such as cobalt-60.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. Furthermore, the guidance in NUREG-1537, Part 1, Chapter 11, "Radiation Protection Program and Radioactive and Waste Management," Section 11.1.1.3, "Solid Radioactive Sources," provides guidance that the LAR should identify all expected solid radioactive sources.

    Provide a description of the potential for the activation and generation of solid radioactive sources, including cobalt-60, as a result of the operation of the TEF, or justify why no additional information is needed.

46. LAR, Attachment 1, Section 8.4, "Radioactive Waste Management Program," indicates that no changes are needed to the MURR Health Physics (HP) monitoring and surveying program as a result of the TEF. Furthermore, the LAR states, in part, that "Little additional equipment is anticipated to be needed in order to support the addition and operation of the SGE TEF." The NRC staff is not clear as to the extent of any additional equipment needed to provide HP monitoring and surveying to ensure that the worker's radiation exposures are maintained below the limits in 10 CFR 20.

    Additionally, the NRC staff finds that the MURR SAR, Chapter 11, "Radiation Protection Program and Waste Management," (ADAMS Accession No. ML092110597), provides a description of the radiation protection programs at the MURR facility, including the MURR Radioactive Waste Management Program, ALARA Program, Radiation Monitoring and Surveying, the Radiation Exposure Control and Dosimetry, Contamination Control, and Environmental Monitoring. The NRC staff is not clear if any changes to these programs are required to ensure effective HP monitoring of the TEF operation, or if any changes to the quantity or type of radioactive waste is expected as a result of the TEF operation.

    Note: Attachment 1, Section 8.3, Table 35, Column titled "Wt% Uranium," does not appear to correct based on the information provided. The NRC staff finds that the table column would more appropriately titled "U-235 Enrichment."

The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. The regulations in 10 CFR Part 20 require that doses to workers and members of the public be limited. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 11, "Radiation Protection Program and Waste Management," indicates that the LAR should provide information on radiation protection and waste management.

46.1. Provide a description of any changes to the HP monitoring and surveying equipment needed to support the operation of the TEF, or justify why no additional information is needed.

46.2. Provide a description of any changes to the:

46.2.1. Radiation Protection Program,

46.2.2. Radioactive Waste Management Program,

46.2.3. ALARA Program,

46.2.4. HP Radiation Monitoring and Surveying Program,

46.2.5. Radiation Exposure Control and Dosimetry Program,

46.2.6. Contamination Control Program, and

46.2.7. Environmental Monitoring Program, needed to support the operation of the TEF, or justify why no additional information is needed.

46.3. Provide a description of any changes to the quantity or type of radioactive waste as a result of the TEF operation, or justify why no additional information is needed.

47. LAR Attachment 1, Section 9.3, "Material Control & Accounting," states, in part, that "Irradiated target rod material control will be discussed in the Part 2 License Amendment application." However, LAR Section 1.1, "Proposed Experiment Description," states that the target material will be irradiated in the graphite reflector region of the reactor. The NRC staff is not clear why the control of target material would not apply to material irradiated in the LAR Part 1.

The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, the regulations in 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material, require licensees of special nuclear material to establish controls, as applicable.

Provide a description of the material controls required for the irradiated targets as described within the scope of the activities proposed in the LAR, Part 1, or justify why no additional information is needed.

48. LAR, Attachment 1, Section 10, "Target Experimental Facility Accident Analysis," provides accident analyses for various accidents associated with the TEF. However, the NRC staff

review did not find an accident analysis for 1) a potential flow blockage of the TA; or 2), a potential loss of secondary cooling.

The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 13, indicates that the LAR should also describe how equipment will work when needed in accident situations.

48.1. Provide an analysis for the potential flow blockage of the TA assembly accident, or justify why no additional information is needed.

48.2. Provide an analysis for the potential loss of secondary cooling accident, or justify why no additional information is needed.

49. LAR, Attachment 1, Section 10, "Target Experimental Facility Accident Analysis," provides accident analyses for various accidents associated with the TEF. However, the NRC staff is not clear if other experiments will be performed concurrent with TEF TA irradiation. If multiple experiments are performed concurrent with TA irradiation, the LAR does not appear to discuss any accident scenarios involving multiple experiments, or the impact of other experiments on the TA in the reactor or stored in the reactor pool.

The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 13, indicates that the LAR should also describe how equipment will work when needed in accident situations.

Provide an analysis or description of any accident scenarios which involve concurrent or multiple experiment failures occurring during TA irradiation, or while TAs are stored in the reactor pool, or justify why no additional information is needed.

50. LAR, Attachment 1, Section 10.1, "Target Experimental Facility Maximum Hypothetical Accident," provides a description of the maximum hypothetical accident (MHA) associated with the TEF (known as the TEF MHA versus the SAR MHA which results from the Failed Fueled Experiment accident). The NRC staff review of the TEF MHA did not identify any discussion as to the adequacy of the existing engineered safety features (ESFs), or whether additional ESFs were needed for the operation of the TEF MHA, in order to ensure that radiation doses to the workers and public remain below the limit in 10 CFR Part 20. Additionally, the NRC staff didn't find any discussion describing which MHA was considered the bounding MHA (Failed Fueled Experiment MHA or TEF MHA).

The regulations in 10 CFR Part 20 require that doses to workers and members of the public be limited. Furthermore, NUREG-1537, Part 1, Chapter 6, "Engineered Safety Features," Section 6.1, "Summary Description," provides guidance that the applicant should describe all the ESFs in the facility design and summarize the postulated accidents whose consequences could be unacceptable without mitigation.

50.1. Provide a description of the adequacy of the existing ESFs, and whether additional ESFs were needed for the operation of the TEF MHA, in order to ensure that

radiation doses to the workers and public remain below the limit in 10 CFR Part 20, or justify why no additional information is needed.

50.2. Provide a description of which MHA provides the bounding analysis for MURR, or justify why no additional information is needed.

51. LAR, Attachment 1, Section 10.2.1, "Rapid Insertion of Positive Reactivity," states, in part that "The target rod analysis for the positive reactivity step insertion examines the maximum powered target rod at the beginning and end of a three-week irradiation." The NRC staff review noted that LAR, Attachment 1, Section 6.1.4, "Target Assembly Steady-State Operation," states the minimum loaded TA (3 target rods) results in the most severe target rod operating conditions. The NRC staff review also finds that the assessment of the Rapid Insertion of Positive Reactivity emphasizes the calculated maximum fuel temperatures and acceptance criteria to fuel melt. The NRC staff assumes that the calculated target rod transient fuel temperature is maximized when the target rod initial fuel temperature is maximized. The NRC staff review further notes that both Attachment 1, Section 6.1.4, "Target Assembly Steady-State Operations," Table 30, "Predicted Thermal Performance for 11 Active Target Rods, 11.5 MWt Reactor Power, 85% Flow," and Table 32, "Predicted Thermal Performance for 3 Active Target Rods, 11.5 MWt Reactor Power, 85% Flow," provide an initial target rod fuel centerline temperature of 2,204.7 degrees Celsius.

The NRC staff is not clear if the analysis described in Section 10.2.1, is initiated from the maximum powered target rod assuming a TA loaded with 3 target rods, or from the maximum powered target rod assuming a complete TA of 11 target rods. Additionally, the NRC staff is not clear if sensitivity analyses were done using a combination of target rods (1 through 11) which demonstrate the limiting TA composition associated with the Rapid Insertion of Positive Reactivity transient analysis.

The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 13, indicates that the LAR should also describe how equipment will work when needed in accident situations.

51.1. Provide a description of the TA composition (i.e., number of target rods in the TA) used in the analysis in Section 10.2.1, and which composition of target rods is considered the limiting TA configuration, or justify why no additional information is needed.

51.2. Provide the results of the sensitivity study performed to establish the limiting TA composition, or justify why no additional information is needed.

52. LAR, Attachment 1, Section 10.2.1, "Rapid Insertion of Positive Reactivity," states, in part, "The target rod analysis for the positive reactivity step insertion examined the maximum powered target rod at the beginning and end of a three week irradiation." LAR, Attachment 6, Section 2.1, "Design Requirements," states that the number of hours of irradiation in a 1 week irradiation cycle is 152 consecutive hours. Furthermore, LAR, Attachment 2, Section 3.11, "Selective Gas Extraction Target Experimental Facility," proposed TS, Specification d., states, each SGE target rod shall not be irradiated for greater than 480 hours at 10 megawatts, and the TS bases states the thermal steady-state and transient analyses are based on an SGE target rod being irradiated for no greater than

480 hours at 10 megawatts. However, the NRC staff review did not find the analyzed target rod irradiation time.

The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 13, indicates that the LAR should also describe how equipment will work when needed in accident situations.

Provide the maximum target rod irradiation time in hours used in the rapid insertion of positive reactivity analysis, or justify why no additional information is needed.

53. The NRC staff review did not identify any changes proposed to the MURR Organization as a result of the proposed LAR.

    The regulations in 10 CFR 50.90 require that the applicant submit an application fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. Furthermore, the guidance in NUREG-1537, Part 2, Chapter 12.1, "Organization," states that the organization should be specified.

    Provide a description of any organization changes at MURR as a result of the proposed LAR, or justify why no additional information is needed.

LAR Attachment 2

54. LAR Attachment 2, proposed TS 3.8, Specifications f, n, r, and t, describe exceptions for the SGE target rods. The NRC staff noted that the corresponding TS bases for TS 3.8, Specifications f, n, r, and t, generally provided a reference to the applicable SAR section. However, the NRC staff could not find a justification which explained the reason for each TS exception.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. NUREG-1537, Part 2, Chapter 14, provides guidance that the TSs should be supported by their respective safety analysis.

    Provided justification which explains the reason for each exception listed in TS 3.8, Specifications f, n, r, and t, or justify why no additional information is needed.

55. LAR Attachment 2, proposed TS 3.11, "Selective Gas Extraction Target Experimental Facility," Specification c, states "Each SGE target cartridge shall contain eleven (11) SGE target rods." Furthermore, proposed TS 4.11, "Selective Gas Extraction Target Experimental Facility," Specification a, states "Each SGE target cartridge shall be verified to consist of eleven (11) SGE target rods…." However, LAR Attachment 1, Section 2.1.4, "Target Cartridge," states, in part, that "During commissioning operations, it will be necessary to load fewer than 11 [uranium dioxide] UO_2 filled target rods in a cartridge." The NRC staff is not clear how the proposed TS 3.11.c and TS 4.11.a, support operation with less than 11 UO_2 target rods.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. NUREG-1537, Part 2,

Chapter 14, provides guidance that the TSs should be supported by their respective safety analysis.

Provide a safety analysis for operation with less than 11 UO_2 target rods and revise proposed TS 3.11.c and TS 4.11.a accordingly, or justify why no additional information is needed.

56. In the NRC staff-issued SER for license renewal (ADAMS Accession No. ML16124A887), TS 5.3, "Reactor Core and Fuel," Specification I, describes the experimental facilities. Although TS 5.3, Specification I.3, describes a portion of the graphite reflector, the NRC staff noted that the TEF was not listed in TS 5.3.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. NUREG-1537, Part 2, Chapter 14, Section 3.8, "Experiments," provides guidance that the experimental facilities should be described in TS Section 5, "Design Features."

    Provide a description of the TEF in TS 5.3, or justify why no additional information is needed.

LAR Attachment 3

57. LAR Attachment 3, Section 3.1.1, "Selective Gas Extraction Target Experimental Facility QAL 1 Components," states that, "As the result of the engineering determination and assessment to identify all of the equipment required for the SGE TEF, the following components are considered to meet the QAL 1 designation: the target rods' cladding, endcaps (upper and lower) and welding of the endcaps; the target pellets; the flow meters in the target cooling system; and the temperature sensor downstream of the heat exchanger in the target cooling system, including its signal conditioner." However, the NRC staff is not clear if these constitute SGE TEF system, structures or components (SSCs), or if they are considered ESFs.

    The regulations in 10 CFR 50.9 require that information provided to the Commission by a licensee shall be complete and accurate in all material respects. Furthermore, the guidance in NUREG-1537, Part 1, Chapter 3, "Design of Structures, Systems, and Components," states that the licensee should discuss the SSCs required to ensure reactor facility safety and protection of the public, and Chapter 6, "Engineered Safety Features," states that the license should discuss ESFs.

    Provide a description of any SGE TEF SSCs or ESFs needed as a result of this LAR, or justify why no additional information is needed.