

From: Edward Helvenston
Sent: Monday, November 7, 2022 6:14 PM
To: Ayman I. Hawari
Cc: Colby Sorrell; Gerald Wicks; Josh Borromeo; Justin Hudson; Duane Hardesty
Subject: NRC Discussion Items for Fueled Experiments LAR Audit
Attachments: Audit Questions.pdf

Hello Dr. Hawari,

Please see attached for discussion items and questions the NRC staff has developed for NCSU related to the license amendment request for fueled experiments. The NRC staff would like to discuss these within the scope of the audit (see audit plan dated 10/31/2022, ADAMS Accession No. ML22304A184), and I am providing in advance to facilitate discussion during audit meeting(s). We will add this e-mail and attachment to public ADAMS. If any questions, please let Justin or I know.

Thanks,
Ed

Ed Helvenston, U.S. NRC

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Proposed License Conditions

- 1) LC 2.B.(2):
 - a) The LAR requests the authority to possess “up to 20 grams of contained Plutonium-239 of any enrichment in the form of fission chambers.” However, the NRC staff notes that all plutonium is considered special nuclear material, and therefore such a possession allowance should clearly include all plutonium including isotopes other than plutonium-239.
 - b) The LAR also states this this requested plutonium is for fission chambers for upcoming planned experiments. However, it is not clear what types of experiments these fission chambers are for, whether these are commercially-manufactured fission chambers, and whether they could potentially be reactor experiments (e.g., would be evaluated as part of a reactor experiment), or would be used to monitor reactor experiments.
- 2) LC 2.B.(2):
 - a) The LAR requests the authority to possess “up to 35 grams of Uranium-235 in any enrichment excluding uranium containing U-233 and up to 5 grams of plutonium for fueled experiments.” This authority would replace the current allowance to possess “up to 2 grams of contained uranium-235 of any enrichment in the form of foils.” The NRC staff notes that the proposed revised LC would not clearly describe the uranium consistent with standard LC language. Also, the allowed form(s) of the uranium and plutonium are not clear.
 - b) In addition, the NRC staff notes that the wording “for fueled experiments” in the proposed LC could limit the allowed uses of material possessed under this portion of LC 2.B.(2), and it is not clear to the NRC staff if this is NCSU’s intent.

Proposed Technical Specifications

- 3) TS Definition of “Fueled Experiment”:
 - a) The intended meaning of definition item e. with the proposed addition of “and excludes the following” may not be fully clear.
 - b) Regarding “detectors containing fissile material” in the item e.ii. list: Could there be a case where a detector itself is an experiment?
 - c) Regarding “sealed sources” in the item e.ii. list: Is this intended to be limited to neutron sources used in reactor operations?
 - d) Regarding “naturally occurring elements” in the item e.ii. list: What does this mean? The staff notes that irradiation of, for example, uranium-containing minerals, could still potentially be a fueled experiment.
 - e) Regarding “fuel used in operation of the reactor in the item e.ii. list: Is this intended to be limited to, for example, research reactor fuel elements described in Section 5 of the PULSAR reactor TSs?
- 4) TS 3.5, “Radiation Monitoring”
 - a) Does NCSU need an allowance to have proposed TS 3.5 not apply when irradiated fuel or fueled experiments are not in e.g., “a properly sealed and approved shipping container”?

- b) Is it accurate that NCSU would never move fuel or experiments in the waste tank vault described in current TS 5.2.d being under the reactor license? (Question also applies to proposed TS 3.6.)
- c) The NRC staff notes an apparent error in proposed TS 3.5 in that “are” should be “is.”
- d) NCSU’s explanation for the changes to TS 3.5.b states “The names of the gas and particulate monitors are updated to better describe the monitors in light of potential experimental monitors which might be installed.” Can NCSU elaborate on what is meant by this? Is the intent to distinguish these monitors from gas or particulate monitors that will be part of experiments?
- e) Regarding proposed TS 3.5.d:
 - i) Does the required monitor include both gas and particulate monitoring?
 - ii) Will the required monitors isolate the experiment if setpoints exceeded? If so, is this function part of the TS?
 - iii) Will the required monitors detect if particulate activity is inadvertently released from a vented fueled experiment?
 - iv) Will the vented experiment exhaust (after passing through experiment radiation monitors) enter the main facility HVAC system upstream of the stack monitors?
- f) Following the proposed removal of “Ar-41” and “Co-60” from TS 3.5-1, how (i.e., to the airborne effluent concentration for what radionuclide(s)) would NCSU calibrate its stack monitors for alert and alarm purposes?
- g) It is not clear to the NRC staff why the proposed revision of TS 3.5, footnote (6), is necessary given that 10 CFR Part 20 dose limits only include doses from licensed operation.
- h) Regarding proposed TS 3.5, footnote (7), are vented fueled experiment radiation monitors also necessary during some period of time following experiment operation, for example, if some fission products may continue to be released from the experiment, or if the monitors are located following some holdup volume? What is meant by experiment is “in operation” or “operable”?
- i) Should TS 3.5, footnote (7), and the main text of TS 3.5, require that vented fueled experiment radiation and flow monitors be “operating” versus “operable” consistent with the PULSTAR TS definitions?
- j) The NRC staff notes that the proposed TSs do not appear to contain a TS 3.8.d.iv as referenced in TS 3.5, footnote (8). In addition, proposed TS 3.8 does not appear to contain any required radiation or flow monitor setpoints.
- k) Regarding the proposed revisions to the TS 3.5 bases, is Co-60 considered a potentially released radionuclide, or is it just used, e.g., as a convenient reference?
- l) Regarding the proposed revisions to the TS 3.5 bases, the NRC staff notes that proposed TS 3.8 does not appear to include monitoring of flow rates as referenced in the TS 3.5 bases.
- m) Regarding the proposed addition of “Radiation monitor setpoints are analyzed as described in the documentation presented in the Fueled Experiment Analysis Report for TS Amendment 19” to the TS 3.5 bases, is this referring to the vented fueled experiment radiation monitors, and is this statement accurate following the revisions to NCSU’s license amendment requirement discussed in NCSU’s supplement dated July 11, 2022 (ML22193A167)?

- 5) TS 3.6, "Confinement and Main HVAC Systems"
 - a) Does NCSU need an allowance to have proposed TS 3.6 not apply when irradiated fuel or fueled experiments are not in e.g., "a properly sealed and approved shipping container"? (See also ANSI/ANS-15.1-2007, Section 3.4.1, item (2).)

- 6) TS 3.8, "Operations with Fueled Experiments"
 - a) Proposed TS 3.8.a states that "mass and fission rate for fueled experiments are limited", but the NRC staff notes that proposed TS 3.8.a only appears to include a fission rate limit.
 - b) The NRC staff notes that proposed TS 3.8.b appears to be redundant to TSs 3.5 and 3.6. Proposed TS 3.8.b also appears to use different wording than proposed TSs 3.5 and 3.6 such that the requirements may not be clear.
 - c) The NRC staff notes that proposed TS 3.8.c appears to be redundant to TS 3.2.
 - d) Regarding proposed TS 3.8.d:
 - i) Will vented fueled experiments still be non-corrosive for consistency with the intent of TS 3.7.a?
 - ii) How will NCSU ensure that having liquids in vented (unencapsulated) fueled experiments will not cause any undesirable interactions with reactor components or pool water and that the liquids are appropriately contained?
 - iii) Proposed TS 3.8.d specifies that "vented experiments" do not need encapsulation, but should this state "vented fueled experiments"?
 - iv) NCSU's discussion of TS 3.8.d changes stated that vented experiments are restricted to not allow particulate releases, but the NRC staff notes that it is not clear whether "airborne activity" clearly excludes particulates.
 - e) The NRC staff notes that proposed TS 3.8.e appears to be redundant to TSs 6.2.3 and 6.5.
 - f) The NRC staff notes that it is not clear if the list in proposed TS 3.8 beginning with "Each type of fueled experiment shall meet the following items..." is part of TS 3.8.e, or should be a separately-numbered TS e.g. 3.8.[X].
 - g) Regarding proposed item ii. in the list in proposed TS 3.8 beginning with "Each type of fueled experiment shall meet the following items...", how will NCSU ensure that experiment materials in powder form are appropriately contained?
 - h) Regarding proposed item iii. (as numbered on page 27 of the proposed TS change pages submitted in NCSU's supplement dated July 11, 2022) in the list in proposed TS 3.8 beginning with "Each type of fueled experiment shall meet the following items...", will NCSU still perform appropriate analyses for experiments located outside the pool water to ensure that thermal power is limited to prevent experiment failure?
 - i) Regarding proposed item iv. in the list in proposed TS 3.8 beginning with "Each type of fueled experiment shall meet the following items...", what locations for monitors would be considered "at the exhaust of vented fueled experiments"?
 - j) Although NCSU did not propose to revise item v. in the list in proposed TS 3.8 beginning with "Each type of fueled experiment shall meet the following items...", the NRC staff notes that the wording of item v. does not appear to be clear in the context of the revised list in proposed TS 3.8. In addition, the NRC staff notes that item v. appears to be redundant to proposed TSs 3.8.c and 3.8.d.
 - k) Regarding proposed TS 3.8.f, the basis for the addition of "total site" is not clear to the NRC staff, and it also would appear to make TS 3.8.f inconsistent with the wording of

existing TS 3.7.f. In addition, the NRC staff would like to verify that proposed TS 3.8.f would be consistent with a bounding calculation of dose from credible failure of a fueled experiment allowed by the proposed TSs.

- l) The NRC staff notes that proposed TS 3.8.g appears to be redundant to TS 5.3.
- 7) TS 4.4, "Radiation Monitoring Equipment"
- a) Should proposed TS 4.4.a additionally require channel calibration following replacement of, or changes to, the stack monitoring systems?
 - b) Should proposed TS 4.4 require channel testing (e.g., daily) of the stack monitoring systems?
 - c) Regarding proposed TS 4.4.c, it is not clear what is meant by the wording "for as long as the experiment is in operation."
 - d) Should proposed TS 4.4 require channel testing of the vented fueled experiment radiation and flow monitors?
- 8) General
- a) The NRC staff notes that, in issuing amendments to licenses, the amendment number and date is typically only updated on TS and license pages that include TS or license changes as part of the amendment.
 - b) The NRC staff notes that the calculations provided by NCSU in its supplement dated July 11, 2022, appear to be example calculations of proposed experiments, rather than bounding calculations involving the maximum TS allowed time or fission rate. The NRC staff would like to confirm that NCSU calculations of experiments based on TS limits continue to result in acceptable doses.