UNIVERSITY *of* MISSOURI

RESEARCH REACTOR CENTER

February 19, 2016

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

REFERENCE: Docket 50-186
University of Missouri-Columbia Research Reactor
Amended Facility License No. R-103

SUBJECT: Written communication as specified by 10 CFR 50.4(b)(1) regarding responses to the "University of Missouri at Columbia - Request for Additional Information Regarding the License Amendment Request to Modify the Technical Specifications to Produce Radiochemical Sodium Iodine at the University of Missouri at Columbia Research Reactor (TAC No. MF6514)," dated November 19, 2015

By letter dated July 20, 2015, the University of Missouri-Columbia Research Reactor (MURR) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) to amend the Technical Specifications (TSs), which are appended to Amended Facility License No. R-103, in order to produce the radiochemical sodium iodide (I-131).

There are currently no competing modalities for its use as a therapy for thyroid dysfunctions and no current supplier within the U.S. This license amendment would allow MURR to continue to perform a key role in the supply of critical medical radioisotopes, both domestically and internationally.

By letter dated November 19, 2015, the NRC requested additional information and clarification regarding the proposed license amendment request in the form of fourteen (14) questions. By letter dated December 30, 2015, MURR responded to those questions.

On January 7, 2016, via a conference call between MURR and NRC staff, the NRC requested additional information/clarification on three (3) of the responses, specifically Questions 5.a, 9 and 10. By letter dated January 8, 2016, MURR provided the additional information/clarification.

On February 19, 2016, via a conference call between MURR and NRC staff, the NRC requested additional information/clarification on proposed TS 3.6.c, 3.6.p and 5.7.e. Below is the additional information/clarification.

A0ZD
NRR

1513 Research Park Drive Columbia, MO 65211 Phone: 573-882-4211 Fax: 573-882-6360 Web: www.murr.missouri.edu

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If there are questions regarding this response, please contact me at (573) 882-5319. I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

For John L. Fruits
Reactor Manager

ENDORSEMENT:
Reviewed and Approved

Ralph A. Butler, P.E.
Director

xc: Reactor Advisory Committee
Reactor Safety Subcommittee
Dr. Garnett S. Stokes, Provost
Dr. Mark McIntosh, Vice Chancellor for Research, Graduate Studies and Economic Development
Mr. Alexander Adams Jr., U.S. Nuclear Regulatory Commission
Mr. Geoffrey A. Wertz, U.S. Nuclear Regulatory Commission
Mr. Johnny Eads, U.S. Nuclear Regulatory Commission

References:

1. U.S. Nuclear Regulatory Commission Regulatory Guide 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants" (September 2012, Rev. 4)
2. U.S. Nuclear Regulatory Commission Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmospheric Systems in Light-Water-Cooled Nuclear Power Plants" (June 2001, Rev. 2)

Attachments:

1. Newly Proposed and Revised Technical Specification Pages

State of Missouri
County of Boone
Subscribed and sworn to before me this 19 day of February, 2014
Jacqueline L. Bohm
Jacqueline L. Bohm, Notary Public
My Commission Expires: March 26, 2019

JACQUELINE L. BOHM
Notary Public-Notary Seal
STATE OF MISSOURI
Commissioned for Howard County
My Commission Expires: March 26, 2019
Commission # 15634308

1. ***Additional information/clarification regarding Technical Specification 3.6.c:***

Proposed Technical Specification 3.6.c has been revised as follows: "*Where the possibility exists that the failure of an experiment could release radioactive gases or aerosols to the reactor bay or atmosphere, the experiment shall be limited to that amount of material such that the airborne concentration of radioactivity averaged over a year will not exceed the limits of Appendix B, Table I of 10 CFR Part 20. Exception: Fueled experiments that produce Iodine 131 through 135 and non-fueled experiments that are intended to produce Iodine 131 (See Specifications 3.6.a and 3.6.p).*"

As discussed during the conference call, the words "are intended to" have been added to the specification. Also, the letter "I" has been capitalized in the word "iodine."

2. ***Additional information/clarification regarding Technical Specification 3.6.p:***

Proposed Technical Specification 3.6.p has been revised as follows: "*Each non-fueled experiment that is intended to produce Iodine 131 shall be limited such that the inventory of Iodine 131 is not greater than 150 Curies.*"

As discussed during the conference call, the words "that is intended to produce Iodine 131" have been added to the specification.

3. ***Additional information/clarification regarding Technical Specification 5.7.e:***

Proposed Technical Specification 5.7.e states: "*The efficiency of the Iodine 131 processing hot cells charcoal filter banks shall be verified biennially or following major maintenance. It shall be verified that the charcoal filter banks have a removal efficiency of 99% or greater for iodine.*"

Regarding the wording "*or following major maintenance*" in TS 5.7.e, MURR will follow the guidance of U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants" (September 2012, Rev. 4) (Ref. 1) and NRC Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmospheric Systems in Light-Water-Cooled Nuclear Power Plants" (June 2001, Rev. 2) (Ref. 2) when performing major maintenance on the Iodine 131 processing hot cells charcoal filter banks. Section 6, "In-Place Testing Criteria," of both documents lists activities that would require testing, such as weld repairs; filter adjustments; painting, fire, or chemical release in any ventilation zone communicating with the system; and following the detection of, or evidence of, penetration or intrusion of water or other material that may have an adverse effect on the functional capability of the system. This is just a partial list that provides examples of not only major maintenance activities but also other abnormal

events that would warrant efficiency testing. MURR will perform efficiency testing following all of the activities listed in Section 6 of both references.

ATTACHMENT 1

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ATTACHMENT 1

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TECHNICAL SPECIFICATION

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SUBJECT: Experiments (continued)

airborne concentration of radioactivity averaged over a year will not exceed the limits of Appendix B, Table I of 10 CFR Part 20. Exception: Fueled experiments that produce Iodine 131 through 135 and non-fueled experiments that are intended to produce Iodine 131 (See Specifications 3.6.a and 3.6.p).

d. Explosive materials shall not be irradiated or allowed to generate in any experiment in quantities over 25 milligrams.

e. Only movable experiments in the center test hole shall be removed or installed with the reactor operating. All other experiments in the center test hole shall be removed or installed only with the reactor shut down. Secured experiments shall be rigidly held in place during reactor operation.

f. Experiments shall be designed and operated so that identifiable accidents such as loss of reactor coolant flow, loss of experiment cooling, etc., will not result in a release of fission products or radioactive materials from the experiment.

g. Experiments shall be designed such that a failure of an experiment will not lead to a direct failure of other experiments, a failure of reactor fuel elements, or to interference with the action of the reactor control elements or other operating components.

h. Cooling shall be provided to prevent the surface temperature of a submerged irradiated experiment from exceeding the saturation temperature of the cooling medium.

TECHNICAL SPECIFICATION

UNIVERSITY OF MISSOURI RESEARCH REACTOR FACILITY

SUBJECT: Experiments (continued)

o. Fueled experiments containing inventories of Iodine 131 through 135 greater than 1.5 Curies or Strontium 90 greater than 5 millicuries shall be in irradiation containers that satisfy the requirements of specification 3.6.i or be vented to the exhaust stack system through HEPA and charcoal filters which are continuously monitored for an increase in radiation levels.

p. Each non-fueled experiment that is intended to produce Iodine 131 shall be limited such that the inventory of Iodine 131 is not greater than 150 Curies.

q. Non-fueled experiments that are intended to produce Iodine 131 shall be processed in hot cells that are vented to the exhaust stack system through charcoal filters which are continuously monitored for an increase in radiation levels.

Bases

a. Specification 3.6.a restricts the generation of hazardous materials to levels that can be handled safely and easily. Analysis of fueled experiments containing a greater inventory of fission products has not been completed, and therefore their use is not permitted.

b. Specification 3.6.b is intended to reduce the likelihood of accidental voiding in the core or water annulus surrounding the center test hole by restricting materials which could generate or accumulate gases or vapors.

c. The limitation on experiment materials imposed by specification 3.6.c assures that the limits of Appendix B of 10 CFR 20 are not exceeded in the event of an experiment failure.

d. Specification 3.6.d is intended to reduce the likelihood of damage to reactor or pool components resulting from detonation of explosive materials.

e. Specification 3.6.e is intended to limit the experiments that can be moved in the center test hole while the reactor is operating, to those that will not introduce reactivity transients more severe than one that can be controlled without initiating safety system action (Ref. Add. 5 to HSR).

TECHNICAL SPECIFICATION

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SUBJECT: Experiments (continued)

f. Specifications 3.6.f and 3.6.g provide guidance for experiment safety analysis to assure that anticipated transients will not result in radioactivity release and that experiments will not jeopardize the safe operation of the reactor.

g. Specification 3.6.h is intended to reduce the likelihood of reactivity transients due to accidental voiding in the reactor or the failure of an experiment from internal or external heat generation.

h. Specification 3.6.i is intended to reduce the likelihood of damage to the reactor and/or radioactivity releases from experiment failure.

i. Specification 3.6.j provides assurance that no chemical reaction will take place to adversely affect the reactor or its components.

j. Specification 3.6.k provides assurance that the integrity of the beamports will be maintained for all loop-type experiments.

k. Specification 3.6.l assures that corrosive materials which are chemically incompatible with reactor components, highly flammable materials and toxic materials are adequately controlled and that this information is disseminated to all reactor users.

l. The extremely low temperatures of the cryogenic liquids present structural problems which enhance the potential of an experiment failure. Specification 3.6.m provides for the proper review of proposed experiments containing or using cryogenic materials.

m. Specifications 3.6.p and 3.6.q provide assurance that the processing of Iodine 131 can be performed safely and that equipment necessary for accident mitigation has been installed.

ATTACHMENT 1

TECHNICAL SPECIFICATION

UNIVERSITY OF MISSOURI
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Number 3.11

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Date

Amendment No.

SUBJECT: Iodine 131 Processing Hot Cells

Applicability

This specification shall apply to the limiting conditions of operation on the equipment needed to safely process Iodine 131.

Objective

The objective of this specification is to reasonably assure that the health and safety of the staff and public is not endangered as a result of processing Iodine 131.

Specification

a. The facility ventilation exhaust system shall be operable when processing Iodine 131 in the Iodine 131 processing hot cells.

b. The facility ventilation exhaust system shall maintain the Iodine 131 processing hot cells at a negative pressure with respect to the surrounding areas when processing Iodine 131.

c. Processing of Iodine 131 shall not be performed in the Iodine 131 processing hot cells unless the following minimum number of radiation monitoring channels are operable.

	Radiation Monitoring Channel	Number
1.	Stack Radiation Monitor	1
2.	Iodine-131 Processing Hot Cells Radiation Monitor	1

Exception: When the required radiation monitoring channel becomes inoperable, then portable instruments may be substituted for the normally installed monitor in specification 3.11.c.2 within one (1) hour of discovery for a period not to exceed one (1) week.

TECHNICAL SPECIFICATION

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SUBJECT: Iodine 131 Processing Hot Cells (continued)

d. At least three (3) charcoal filter banks each having an efficiency of 99% or greater shall be operable when processing Iodine 131 in the Iodine 131 processing hot cells.

Bases

a. Operation of the facility ventilation exhaust system when processing Iodine 131 in the Iodine 131 processing hot cells ensures proper dilution of effluents to prevent exceeding the limits of 10 CFR 20 Appendix B.

b. Maintaining the Iodine 131 processing hot cells at a negative pressure with respect to the surrounding areas ensures safety for the facility staff.

c. The radiation monitors provide information to operating personnel regarding routine release of radioactivity and any impending or existing danger from radiation. Their operation will provide sufficient time to take the necessary steps to prevent the spread of radioactivity to the surroundings. The Stack Radiation Monitor continuously monitors the air exiting the facility through the exhaust stack for airborne radioactivity. The Iodine-131 Processing Hot Cells Radiation Monitor is a six (6) detector system; two (2) detectors serving each one of the three (3) hot cells. For each hot cell, one (1) detector is located at the processor's work area where the hot cell manipulators are installed and the other is located in the bay above the hot cell next to the exhaust charcoal filters.

d. The potential radiation dose to staff and individuals at the Emergency Planning Zone boundary and beyond have been calculated following an accidental release of Iodine 131 activity. These calculations are based on the facility ventilation exhaust system directing all Iodine 131 processing hot cell effluents through charcoal filtration with an efficiency of 99% or greater prior to being released through the facility exhaust stack.

ATTACHMENT 1

TECHNICAL SPECIFICATION

UNIVERSITY OF MISSOURI
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Number 5.7

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Date

Amendment No.

SUBJECT: Iodine 131 Processing Hot Cells

Applicability

This specification shall apply to the surveillance of the equipment needed to safely process Iodine 131.

Objective

The objective of this specification is to reasonably assure proper operation of the equipment needed to safely process Iodine 131.

Specification

a. An operability test of the facility ventilation exhaust system shall be performed monthly.

b. The operability of the facility ventilation exhaust system to maintain the Iodine 131 processing hot cells at a negative pressure with respect to the surrounding areas shall be verified daily prior to any process (channel check).

c. The radiation monitors as required by specification 3.11.c shall be calibrated on a semi-annual basis.

d. The radiation monitors as required by specification 3.11.c shall be checked for operability with a radiation source at monthly intervals.

e. The efficiency of the Iodine 131 processing hot cells charcoal filter banks shall be verified biennially or following major maintenance. It shall be verified that the charcoal filter banks have a removal efficiency of 99% or greater for iodine.

Bases

a. Experience has shown that monthly tests of the facility ventilation exhaust system are sufficient to assure proper operation.

TECHNICAL SPECIFICATION

UNIVERSITY OF MISSOURI
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SUBJECT: Iodine 131 Processing Hot Cells (continued)

b. Verifying that the Iodine 131 processing hot cells are at negative pressure with respect to the surrounding areas prior to use ensures personnel safety.

c. Semiannual channel calibration of the radiation monitoring instrumentation will assure that long-term drift of the channels will be corrected.

d. Experience has shown that monthly verification of operability of the radiation monitoring instrumentation is adequate assurance of proper operation over a long time period.

e. Biennial verification of filter banks ensures that the filters will perform as analyzed.