UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 30, 2021

Mr. John P. Foster, Director
of Reactor Operations
Nuclear Reactor Laboratory
Massachusetts Institute of Technology
138 Albany Street, MS NW12-116B
Cambridge, MA 02139

SUBJECT: MASSACHUSETTS INSTITUTE OF TECHNOLOGY – ISSUANCE OF AMENDMENT NO. 46 TO RENEWED FACILITY OPERATING LICENSE NO. R-37 FOR THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR FACILITY RE: EMERGENCY POWER SYSTEM BATTERY REPLACEMENT (EPID NO. L-2021-NFA-0000)

Dear Mr. Foster:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 46 to Renewed Facility Operating License No. R-37 for the Massachusetts Institute of Technology Reactor Facility. The amendment consists of change to the technical specification (TS) in response to your application, dated March 3, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21070A185), as supplemented by letters dated March 24, 2021, and May 17, 2021 (ADAMS Accession No. ML21091A207 and ML21140A362, respectively).

Specifically, the amendment approves the safety analysis report and TS revisions that allows installation of the valve-regulated lead-acid batteries in the emergency power system, replacement of the battery charger, and the addition of a battery monitoring system. The amendment also revises TS 4.6 “Emergency Electrical Power Systems” surveillance requirements to assure the quality of the new batteries.

A copy of the NRC staff's safety evaluation is also enclosed. If you have any questions, please contact me at (301) 415-3936, or by electronic mail at Patrick.Boyle@nrc.gov.

Sincerely,

Patrick L Boyle Signed by Boyle, Patrick on 08/30/21

Patrick Boyle, Project Manager
Non-Power Production and Utilization Facility Licensing Branch
Division of Advanced Reactors and Non-Power Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 50-020
License No. R-37

Enclosures:
1. Amendment No. 46 to Renewed Facility Operating License No. R-37
2. Safety Evaluation

cc w/enclosures: See next page

cc:

City Manager
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Department of Environmental Protection
One Winter Street
Boston, MA 02108

Mr. Jack Priest, Director
Radiation Control Program
Department of Public Health
529 Main Street
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Ms. Samantha Phillips, Director
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Test, Research and Training
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Attention: Ms. Amber Johnson
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College Park, MD 20742-2115

Mr. Marshall B. Wade
Reactor Superintendent
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Nuclear Reactor Laboratory
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138 Albany Street, MS NW12-116B
Cambridge, MA 02139

SUBJECT: MASSACHUSETTS INSTITUTE OF TECHNOLOGY – ISSUANCE OF AMENDMENT NO. 46 TO RENEWED FACILITY OPERATING LICENSE NO. R 37 FOR THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR FACILITY RE: EMERGENCY POWER SYSTEM BATTERY REPLACEMENT (EPID NO. L-2021-NFA-0000) DATED: AUGUST 30, 2021

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ADAMS Accession No.: ML21174A309 **NRR-058**

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NAME	SRay	JBorromeo	PBoyle
DATE	8/27/2021	8/30/2021	8/30/2021

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

DOCKET NO. 50-020

MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR FACILITY

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 46
License No. R-37

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to Renewed Facility Operating License No. R-37, filed by the Massachusetts Institute of Technology dated March 2, 2021, as supplemented by letters dated March 24, 2021 and May 17, 2021, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;

   E. The issuance of this amendment is in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," of the Commission's regulations and all applicable requirements have been satisfied; and

   F. Prior notice of this amendment was not required by 10 CFR 2.105, "Notice of proposed action," and publication of notice of this amendment is not required by 10 CFR 2.106, "Notice of issuance."

2. Accordingly, the license is amended as described in Attachment 1 to this license amendment and by changes to the Technical Specifications as indicated in Attachment 2. Paragraph 2.C.(2) of Renewed Facility Operating License No. R-37 to read as follows:

   2. Technical Specifications

      The Technical Specifications contained in Appendix A, as revised through Amendment 46, are hereby incorporated in the license. The Massachusetts Institute of Technology shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 180 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Joshua M. Borromeo

Digitally signed by Joshua M. Borromeo

Joshua Borromeo, Chief
Non-Power Production and Utilization Facility Licensing Branch
Division of Advanced Reactors and Non-Power Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Attachments:
1. Changes to Renewed Facility Operating License R-37
2. Changes to Appendix A, “Technical Specifications”

Date of Issuance: August 30, 2021

ATTACHMENT TO LICENSE AMENDMENT NO. 46

RENEWED FACILITY OPERATING LICENSE NO. R-37

DOCKET NO. 50-020

Replace the following page of the Renewed Facility Operating License No. R-37 with the revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Renewed Facility Operating License

Remove	Insert
3	3

3. Pursuant to the Act and 10 CFR Part 30, to receive, possess, and use:

   a. a 150-curie antimony-beryllium sealed neutron source in connection with operation of the facility;

   b. such byproduct material as may be produced by operation of the facility, which, except for byproduct material produced in non-fueled experiments, shall not be separated; and

   c. byproduct materials activated in reactors other than the MIT reactor (for use in the reactor hot cells) that are in solid form and have atomic numbers 3 through 83. The total inventory of this byproduct material shall not exceed 100,000 curies at any one time. This material may be irradiated in the reactor.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in Parts 20, "Standards for Protection against Radiation," 30, 50, 51, 55, "Operators' Licenses," 70, and 73, "Physical Protection of Plants and Materials," of the Commission's regulations; is subject to all applicable provisions of the Act and the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified below:

Maximum Power Level

1. The licensee is authorized to operate the reactor at steady-state power levels not to exceed 6.0 megawatts (thermal).

Technical Specifications

2. The Technical Specifications contained in Appendix A, as revised through Amendment 46, are hereby incorporated in the license. The Massachusetts Institute of Technology shall operate the facility in accordance with the Technical Specifications.

Additional Conditions

3. The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security plan, including amendments and changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The approved physical security plan consists of a Massachusetts Institute of Technology Nuclear Reactor Laboratory document, withheld from public disclosure pursuant to 10 CFR 73.21, entitled, "Physical Security Plan for the M.I.T. Research Reactor Facility," dated July 22, 2013, as revised.

ATTACHMENT TO LICENSE AMENDMENT NO. 45

RENEWED FACILITY OPERATING LICENSE NO. R-37

DOCKET NO. 50-20

Replace the following pages of Appendix A, “Technical Specifications,” with the revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Technical Specifications

Remove	Insert
4-18	4-18
4-19	4-19

4.6 Emergency Electrical Power Systems

Applicability

This specification applies to the surveillance of the emergency electrical power supply.

Objective

To ensure the reliability of the reactor control and safety systems.

Specification

1. The temperature of the negative terminal on each battery cell shall be measured quarterly.

2. The voltage of each battery cell shall be measured semi-annually.

3. The connector resistance at each battery cell shall be measured annually.

4. A discharge test shall be performed once every two years

5. Operability of the inverter motor-generator set and associated switches shall be verified annually. Performance of a discharge test satisfies this requirement.

Basis

The emergency electrical power system consists of batteries, an inverter motor-generator set, and the switches necessary to tie into the normal electrical distribution system.

Voltage measurements of individual battery cells are the accepted method of ensuring that the batteries are in satisfactory condition. In addition, periodic discharge tests are performed to detect deterioration of cells. To ensure the operability of the inverter motor-generator set, the generator and associated switches will be operationally tested.

The frequency of these component tests is based on manufacturer recommendations and on standard practice as recommended in ANSI/ANS-15.1-2007. Specific gravity measurements are not needed for lead-acid battery cells that use no free-flowing electrolyte. The discharge test frequency is biennial rather than every five years.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALU ATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 46

RENEWED FACILITY OPERATING LICENSE NO. R-37

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR

DOCKET NO. 50-020

1.0 INTRODUCTION

By letter dated March 3, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21070A185), as supplemented on March 24, 2021 (ADAMS Accession No. ML21091A207), and May 17, 2021 (ADAMS Accession No. ML21140A362), Massachusetts Institute of Technology (MIT, the licensee), submitted a license amendment request (LAR) to revise the technical specifications (TSs) and safety analysis report (SAR) that allows replacement of the existing batteries in the MIT reactor (MITR-II) emergency electrical power system from flooded (vented) lead-acid to absorbent glass mat (AGM) valve-regulated lead-acid (VRLA) batteries. The replacement of the batteries would include installation of a new charger and battery monitoring system.

The letters submitted by MIT on March 24, 2021 and May 17, 2021 were in response to the U.S. Nuclear Regulatory Commission (NRC) staff request for additional information (RAI) sent by letter dated March 18, 2021 (ADAMS Accession No. ML21076A023).

2.0 REGULATORY EVALUATION

2.1 Proposed Changes

In the LAR, as supplemented, MIT provided modified sections of the MITR-II's SAR (ADAMS Accession No. ML21091A217), and TSs (ADAMS Accession No. ML21070A185), that included details of the proposed batteries, battery charger, and battery-monitoring system.

The licensee proposes to 1) replace the existing batteries with a bank of 60 VRLA batteries, rated for 840 amp-hours (Ah) at an 8-hour discharge rate to 1.75 Volts direct current (Vdc) per cell, 2) add a temperature-compensating battery charger, and 3) add a battery monitoring system.

The MITR-II TSs define specific features, characteristics, and conditions governing the operation of the facility. Since the replacement batteries are physically different from the batteries being replaced, the licensee proposed changes to the MITR-II SAR and TS surveillance requirements. The licensee proposed changes to TS 4.6, "Emergency Electrical

Power Systems" because the AGM cell packs are sealed and the electrolyte is gelatinous and is intended to have a stable and consistent specific gravity; therefore, periodic measurement of the batteries' specific gravity is not possible because the electrolyte is not accessible and will not demonstrate the quality of the battery.

2.2 Regulatory Evaluation

The NRC staff reviewed the LAR, as supplemented, to ensure that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) activities proposed will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. The NRC staff considered the following regulations during its review of the proposed changes:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," which provides the regulatory requirements for licensing of non-power reactors, and Section 50.36, "Technical specifications," which requires TSs to be included in utilization facility licenses.

- Section 50.34(b)(2) of 10 CFR, which requires a description and analysis of the system, structures, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefore, upon which such requirements have been established, and the evaluations required to show that safety functions will be accomplished. The description shall be sufficient to permit understanding of the system designs and their relationship to safety evaluations (SEs).

- Section 50.34(b)(2)(i) of 10 CFR, which requires such items as the "electrical systems" be discussed insofar as they are pertinent.

- Section 50.34(b)(4) of 10 CFR, which requires a final analysis and evaluation of the design and performance of SSCs with the objective stated in 50.34(a)(4), which requires analysis and evaluation of the design and performance of SSCs including determination margin of safety, that considers any pertinent information developed since the submittal of the preliminary SAR.

- Section 50.36(a)(1) of 10 CFR, which requires that each applicant for a license authorizing operation of a production or utilization facility include in its application proposed TSs. This regulation also requires applicants to submit a summary statement of the bases or reasons for such TSs, other than those covering administrative controls, that shall not become part of the TSs.

- Section 50.36(b) of 10 CFR, which requires that the TSs be derived from the analyses and evaluation included in the SAR.

- Section 50.36(c)(3) of 10 CFR, which requires that TSs include surveillance requirements (SRs) relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation (LCOs) will be met.

- Section 51.22, “Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review,” of 10 CFR, identifies licensing, regulatory, and administrative actions eligible for categorical exclusion from the requirement to prepare an environmental assessment or environmental impact statement.

- NUREG-1537, Part 1, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content,” Appendix 14.1, “Format and Content of Technical Specifications for Non-Power Reactors” (ADAMS Accession No. ML042430055), provides guidance to applicants and licensees on preparing research reactor license applications and TSs. Appendix 14.1 of NUREG-1537, Part 1, Section 4 “Surveillance Requirements” provides guidance related to surveillance requirements.

- NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria,” Chapter 14, “Technical Specifications,” (ADAMS Accession No. ML042430048), provides guidance for reviewing and evaluating the TSs submitted to the NRC by applicants for research reactor licenses and accepts the guidance in American National Standards Institute/American Nuclear Society (ANSI/ANS)-15.1-1990, “The Development of Technical Specifications for Research Reactors.”

- ANSI/ANS-15.1-2007, “The Development of Technical Specifications for Research Reactors,” Section 4, “Surveillance Requirements,” provides guidance used by the NRC staff, applicants, and licensees, for TS surveillance requirements. The 2007 version is a revision of the ANSI/ANS-15.1-1990 standard cited in NUREG-1537. Both versions of ANSI/ANS-15.1 state in Section 4.6.2 “Emergency batteries,” that a TS surveillance include testing of the battery voltage and that a discharge test should be performed. Both versions are acceptable for use by the NRC staff.

3.0 TECHNICAL EVALUATION

This section of the SE documents the NRC staff review and evaluation of the design basis of the battery replacement, battery charger replacement, and addition of a battery monitoring system against the design acceptance criteria in Section 8.2 of NUREG-1537, Part 2. TS 3.6.1 requires that, when the reactor is operating, emergency electrical power be available to operate the equipment listed in Table 3.6-1 “Minimum Equipment to be Supplied by Emergency Electrical Power,” for at least one hour following the loss of normal electrical power to the facility. Table 3.6-1 includes the following equipment: 1) one neutron flux level channel; 2) the core tank level indicator; 3) the primary coolant outlet temperature indication; 4) radiation monitors required by TS 3.7; 5) the containment intercom system (or, alternatively, telephones), 6) the primary coolant auxiliary pump; and 7) lighting as required for personnel safety (or, alternatively, battery operated lights). TS 4.6 “Emergency Electrical Power Systems,” contains SRs applicable to the emergency electrical power system. Sections 3.2 and 3.3 of this SE discuss the NRC staff evaluation of the adequacy of the design bases and design criteria of the emergency electrical power systems (i.e., the batteries) to verify that the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety provide reasonable assurance that the MITR-II can be operated without undue risk to the health and safety of the public.

3.1 MITR-II Detailed Emergency Electrical Power System Batteries Description

For the reactor emergency power system, MIT proposed to replace their existing flooded (vented) lead-acid batteries with AGM VRLA batteries. The proposed battery cells are C&D Technologies, "msEndur II" series, model AT-15P, standard version with 2 Volts direct current per cell, as stated in the LAR. Further, MIT's RAI response #4 dated March 24, 2021, indicated that the supporting equipment for the new batteries included the HindlePower "AT30 Series Microprocessor Controlled Float Battery Charger." MIT's RAI response #3, dated March 24, 2021, stated that a Phoenix Broadband Technologies SC4 battery monitoring unit capable of monitoring battery voltages, internal resistance, and operating temperatures, and capable of providing data storage and alarms will be installed. MIT also indicated that the information provided by the battery monitor will be measured by handheld instruments should the monitor not be available.

In its LAR, MIT states that the proposed battery cells are constructed with lead-calcium alloy grids, using sulfuric acid as electrolyte in AGM form, and enclosed in a flame-retardant thermoplastic container. Each of the 60 battery cells is rated at 840 Ah for an 8-hour discharge; thus, each cell can provide a constant discharge current of 105 amps (A) for 8 hours.

3.2 Emergency Power System Design Basis and Design Criteria

This section of the SE documents the NRC staff's evaluation of the proposed upgrade to perform safety functions as specified by 10 CFR 50.34(b) design requirements. The NRC staff used the design acceptance criteria in Section 8.2 of NUREG-1537, Part 2, which, in part, states:

> The source of electrical power (generator, batteries, etc.) should be capable of supplying power for the duration required by the SAR analysis.
>
> ...
>
> Technical specifications should be based on the accident analyses, should include surveillance and testing, and should provide reasonable assurance of emergency electrical power system operability. The discussions in the SAR should identify the minimum design requirements, the minimum equipment required, and the power and duration of operation required.

3.2.1 Service Life & Replacement

Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 1188-2005, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications," provides guidance to determine when batteries should be replaced. While this standard post-date NUREG-1537, the NRC staff used this consensus standard to assess the proposed maintenance, testing, and replacement criteria in the LAR.

The licensee stated in its RAI response that the expected service life of the VRLA batteries is 20 years. Guidance in IEEE Std. 1188-2005, Section 8, "Battery replacement criteria," states that the recommended practice is to replace a cell/unit or the battery if its capacity is below 80 percent of the manufacturer's rating. In its supplement, MIT confirmed the use of the battery replacement criteria per IEEE Std.1188-2005, Section 8, of capacity falling below 80 percent of

the manufacturer's rating. In addition, MIT also stated that the following factors or indicators, per IEEE Std. 1188-2005, Section 8, would be taken into consideration for battery or cell replacement: abnormally high cell operating temperatures, unsatisfactory performance test results, and a low cell voltage that fails to respond to corrective action. Because the battery replacement criteria follow IEEE Std. 1188-2005, which is adequate to ensure the quality and reliability of the VRLA batteries, the NRC staff finds the battery replacement criteria acceptable. The replacement frequency will ensure that the battery remains capable of supplying power for the one-hour duration required by the SAR Section 8.2.1, which allows the operator sufficient time to monitor reactor shutdown following a loss of power, and can support the projected service life.

3.2.2 Battery Reliability

In the LAR supplement, MIT stated that "A bank of the proposed type of batteries (C&D AT-15P, 120 cells) has been in operation at the MIT Cogeneration Plant since 2016. The batteries have provided reliable, failure-free performance since the time they were installed, supported by a similar type of charging unit and the same type of monitoring unit that the MIT Reactor will use." In addition, MIT stated in the supplement that "the AT-15P batteries delivered to the MIT Reactor passed the manufacturer's IEEE Std. 1188-2005 testing." Enclosure S3 of the LAR supplement dated May 17, 2021, presented the results manufacturer testing of the battery cells fabricated for MIT and stated that each of the (60) cells of model AT-15P meets and exceeds C&D Technologies' published rate of 225.3 A for 3 hours. Based on its review of the Cogeneration Plant operating history of batteries of a similar type and the manufacturer test results provided in the LAR, as supplemented, the NRC staff finds that the MIT demonstrated the reliability of batteries for time period for emergency power required by TS 3.6.1.

3.2.3 Capacity – Battery Sizing

In the LAR, MIT proposed replacing the existing battery with 60 AGM battery cells, which will provide a constant discharge current of 105 A for 8 hours or a 1-hour discharge of 454 A, to 1.75 Vdc per cell.

TS 3.6.1, "Emergency Power," requires emergency electrical power with the capacity to operate the equipment listed in Table 3.6-1 to be available when the reactor is operating and to be capable of operation for at least 1 hour following a loss of normal electrical power to the facility. In the LAR, MIT indicated that the total load on the battery is 50-60 A. In response to the NRC staff RAI asking whether other equipment is powered by the batteries, MIT identified that the "equipment on reactor emergency power consists entirely of continuous loads, feeding the equipment listed in TS Table 3.6-1 [ ]. Other equipment besides these items includes extra facility lighting, redundant neutron flux level channels, redundant core tank coolant level indicators, redundant primary coolant outlet temperature indicators, and redundant radiation monitors." Based on the NRC staff review of MIT's supplement, the NRC staff concludes that the loads are all continuous loads with a constant current load of 57 A. The load is an input into the sizing calculation to ensure the battery is sized appropriately and can perform its safety function, per TS 3.6.1.

In its RAI response, MIT stated that the manufacturer utilized the sizing methodology in IEEE Std. 485-2020, "Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications." The NRC staff endorsed IEEE Std. 485-2010 in RG 1.212, "Sizing of Large Lead-Acid Storage Batteries," as an acceptable methodology for sizing lead-acid batteries. The

NRC staff compared IEEE Std. 485-2010 and IEEE Std. 485-2020 and found no significant changes in the 2020 version that impact the sizing methodology.

Per IEEE Std. 485-2020 and IEEE Std. 485-2010, the temperature correction factor, design margin, and aging factor should be considered in the sizing. The NRC staff verified the use of these factors in Enclosure 2 of MIT's RAI response. Specifically, the battery sizing utilizes a temperature correction factor of 1.00 for 77 degrees Fahrenheit, a design margin of 110 percent, and an aging factor of 125 percent. The NRC staff verified the factors are in accordance with both IEEE Std. 485-2020 and IEEE Std. 485-2010. Thus, the NRC staff finds that the battery sizing is acceptable, as it conforms to industry consensus standards and that the battery can perform the function as outlined in Section 3.6 of the SAR.

3.2.4 Battery Installation and Monitoring

There are unique hazards associated with VRLA batteries, and therefore, proper precautions should be considered in handling and installation of these type of batteries. Guidance in IEEE Std. 1187-2013, "IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications," outlines proper installation and design guidelines for VRLA batteries. While the NRC has not endorsed this standard, the NRC staff used this consensus standard for assessing the proposed installation design and installation for this LAR.

In its RAI #3 response, dated March 24, 2021, MIT indicated that the manufacturer's guidelines will be followed for installation design and actual installation and that the manufacturer's guidelines follow IEEE Std. 1187-2013. The NRC staff compared the manufacturer's guidelines to those in IEEE Std. 1187-2013. For storage, IEEE Std. 1187-2103, Section 6.1.3, "Storage," recommends that cells should be stored indoors in a clean, level, dry, ventilated, and cool location; provides details on the storage duration and temperature; and includes information on applying a freshening charge. The NRC staff verified that the manufacturer's guidelines in Sections 5.1, "Storage Conditions," and 5.2, "Storage Temperature and Duration," address storage environmental conditions, including cool, well-ventilated, clean, and dry; specific storage temperature range and recommended storage duration, and specifications for freshening charges, if needed, in accordance with IEEE Std. 1187-2013. Because MIT will follow the recommendations in IEEE Std. 1187-2013 for storage to ensure the battery remains capable of supplying power for the duration required by the SAR analysis, the NRC staff finds MIT's plans for the installation design and physical installation acceptable.

Regarding ventilation, IEEE Std. 1187-2013, Sections 5.4.1, "Ventilation for temperature control," and 5.4.2, "Ventilation for hydrogen control," address ventilation to ensure adequate air flow around eNIh cell/module for proper cooling and prevent the possible accumulation of hydrogen (i.e. concentration maintained below combustible limits). In the LAR, MIT stated that the battery racks will be installed in the reactor's Utility room, where the ambient temperature is maintained within the recommended operating temperature of 77 ± 10 degrees Fahrenheit, measured at the negative terminal of a cell. MIT also stated that the Utility room is heated and vented to maintain a constant ambient temperature, with a ceiling vent and continuous exhaust fan. IEEE Std. 1187-2013, Section 5.4.1, recommends an operating temperature of 68-77 degrees Fahrenheit, as measured at the negative terminal post and adequate air flow. Based on the LAR, as supplemented, the NRC staff finds that the operating temperature and ventilation for temperature control of the Utility room containing the batteries, charger, and monitor is in accordance with IEEE Std. 1187-2013.

The NRC staff also evaluated MIT's plans to control hydrogen accumulation in the area where the batteries and charger are to be located. IEEE Std. 1187-2013, Section 5.4.2 recommends limiting hydrogen accumulation to less than 2 percent of the total volume of the battery area/cabinet in order to prevent hydrogen from concentrating in explosive quantities (the combustibility limit of hydrogen is 4 percent concentration). In its RAI response, dated May 17, 2021, MIT indicated that the Utility Room has adequate ventilation with a continuously operating exhaust fan such that hydrogen monitoring is not necessary. Also, Enclosure 3a of the MIT's RAI response states that the manufacturer recommends not allowing hydrogen gasses of greater than two (2 percent) percent by volume to accumulate. Based on the information provided regarding the room ventilation, the IEEE Std, and the manufacturer's recommendations, the NRC staff finds MIT's reliance on room ventilation to control hydrogen to less than 2 percent, is consistent with the manufacturer's recommendation, and is in accordance with IEEE Std. 1187-2013. Thus, the NRC staff finds that MIT hydrogen control is acceptable to prevent combustion and ensure the batteries remain capable of supplying power for the duration required by the SAR analysis.

Guidance in IEEE Std. 1187-2013 addresses mounting and installation in Sections 5.1.1.1, "Rack-mounted or stackable installations," 5.1.1.2.2, "Cabinet installation," and 5.2, "Mounting." In Enclosure 3a of the RAI response, the manufacturer specifically states that the battery systems are shipped with the cells pre-installed into the modules and addresses installation and mounting in Sections 6.5.1,"Installation of Modules and Cells Together," 6.5.2, "Installation of Modules and Cells Separately," 6.6, "Electrical Connections," 6.7, "Terminal Plates," 6.9, "Interconnection," and 6.10, "Tap Connections." The NRC staff's review of the manufacturer's Installation and Operating Manual (Enclosure 3a of the MIT's RAI response) and IEEE Std 1187-2013 also identified that the manufacturer's specifications provide details on mounting and installation that are specific to this battery model. The NRC staff finds that MIT provided information that is acceptable to address mounting and installation in accordance with IEEE Std. 1187-2013 to ensure the battery remains capable of supplying power for the one-hour duration in the SAR Section 8.2.1 "Design Basis."

Although all batteries are susceptible to thermal runaway, which could potentially damage batteries or shorten battery life, VRLA cells are more sensitive to the conditions that lead to thermal runaway. Annex B, "Thermal Runaway," of IEEE Std. 1187-2013 states, "The possibility of thermal runaway may be minimized by use of appropriate ventilation between and around the cells and by limiting the charger output current and voltage such as by using temperature-compensated chargers." As noted above, the NRC finds that the LAR provided information that is acceptable to address ventilation aspects. Further, MIT stated a supplemental response, that (1) a temperature-compensated charger is utilized and float current is monitored and (2) that continuous monitoring of battery parameters will provide early warning if the battery bank or any individual cells are developing a problem and require corrective action or replacement.

Because MIT provided information that addresses ventilation, utilizes a temperature-compensated charger, and monitors float current, the NRC staff finds that the MIT approach to minimizing the possibility of thermal runaway is acceptable to ensure the battery system remains capable of supplying power for the duration required by the SAR analysis.

For battery protection, IEEE Std. 1187-2013 Section 5.8.1, "General," discusses protective devices and schemes. In a supplement, MIT stated that "the battery bank is connected to the emergency power system through a 2-pole, 200-amp fused disconnect switch. Immediately downstream from the fused switch, it connects to a 2-pole, 100-amp switch at the

motor-generator set, and to a 2-pole, 100-amp circuit breaker at the emergency lighting panel." The NRC staff reviewed SAR Figure 8-1 and verified that the proposed design has protective devices to protect the battery, including fused disconnect switch, switch, and circuit breaker. In a supplement, MIT stated that the existing batteries have a maximum short-circuit current of 7,407 A, and the new batteries have a maximum short-circuit current of 6,038 A. The NRC staff finds that the new batteries have a smaller short-circuit current, and thus, the existing protective devices are adequate for overcurrent protection. Based on its review, the NRC staff finds that the protective devices should ensure that the emergency power system does not interfere with or prevent reactor operation or prevent safe facility shutdown. The NRC staff also finds that any non-safety-related uses of the emergency electrical power system should not interfere with performance of safety-related functions.

Guidance in IEEE Std. 1187-2013 Section 5.5, "Instrumentation, controls, and alarms," provides recommendations for instrumentation, controls, and alarms to ensure the battery remains capable during its service life. In a supplement, MIT described the design and features of the Phoenix Broadband Technologies SC4 battery monitoring unit and battery charger that it plans to install. The unit is capable of monitoring battery voltages, internal resistance, and operating temperatures, and capable of providing data storage and alarms. The battery monitoring system monitors the string voltage, float current, ripple current, battery voltage delta, discharge status, discharge/load current, cell terminal post DC voltage, cell terminal post temperature, and battery and cell admittance. The battery charger has alarms for alternating current (ac) input failure, DC output failure, high voltage, low voltage, and positive and negative ground faults. The LAR, as supplemented, also indicated that the ground fault detection is accomplished in the battery charger instead of the battery monitoring system. Based on its review, the NRC staff finds the instrumentation, controls, and alarms provided by the battery monitor and charger are consistent with IEEE Std. 1187-2013 to ensure that the battery remains capable during its service life in accordance with and is therefore acceptable.

The NRC staff verified that the manufacturer's guidelines adequately address installation topics such as storage, location, mounting, temperature-compensated charging, initial and freshening charges, in accordance with IEEE Std. 1187-2013. Therefore, the NRC staff finds that the licensee has demonstrated that battery system installation and monitoring is acceptable.

3.2.5 Battery Maintenance and Testing

Guidance in IEEE Std. 1188-2005, provides guidance on maintenance, test schedules, and testing procedures that can be used to optimize the life and performance of VRLA batteries.

In a LAR supplement, MIT stated that it intends to follow the manufacturer's recommendations for surveillance and performance test recommendations, and IEEE Std. 1188-2005. Proposed TS 4.3.2 would decrease the required frequency of cell voltage measurements from quarterly to semi-annually based on the manufacturer's recommendations. Guidance in IEEE Std. 1188-2005, Section 5.2.2, "Quarterly," however, recommends that the voltage of each cell be measured quarterly in order to assure that the battery is capable of satisfying its design requirements and prolong the life of the battery. Based on this, the NRC staff requested additional information on MIT's conformance to IEEE Std. 1188. In its response, MIT stated that the manufacturer's recommendation as well as operating experience on VRLA batteries supports the proposed TS 4.3.2 semi-annual surveillance frequency. The NRC staff finds a frequency of measuring the individual cell voltages from quarterly to semi-annually acceptable since it is based on the manufacturer's recommendations and operating experience.

In a supplement, MIT stated that IEEE Std. 1188-2005 will be followed to perform other maintenance and testing. As to monthly inspections, MIT stated that the "total system [overall] float voltage, charger output current and voltage, ambient temperature, condition of ventilation and monitoring equipment, etc., will be checked and recorded." Guidance in IEEE Std. 1188-2005, Section 5.2.1, "Monthly," indicates that monthly inspections should be performed on: a) overall float voltage, b) charger output current and voltage, c) ambient temperature, d) condition of ventilation and monitoring equipment, e) visual individual cell/unit condition, f) excessive jar/cover distortion, and g) DC float current. MIT also indicated that the items listed in IEEE Std. 1188-2005, Section 5.2.1, will be checked monthly per operating procedures. Because MIT's proposed monthly inspection activities are consistent with the guidance in IEEE Std. 1188-2005, the NRC staff finds that the proposed monthly inspections acceptable.

For quarterly inspections, proposed revisions to TS 4.6.1 would require measurement of the temperature of the negative terminal of each cell quarterly. Guidance in IEEE Std 1188-2005, Section 5.2.2, "Quarterly," states that quarterly inspections should include cell/unit ohmic values, temperature of the negative terminal of each cell/unit of the battery, and voltage of each cell/unit. As the NRC staff noted above, the NRC finds acceptable to measure each cell voltage semi-annually. Because MIT plans to measure the cell/unit ohmic values and temperature of the negative terminal are consistent with IEEE Std. 1188-2005, the NRC staff finds these quarterly inspections acceptable to maintain battery quality.

For yearly inspections, MIT proposed to add a new TS 4.6.3, which would require measurement of connector resistances. In addition to the TS required measurement, MIT plans to revise its maintenance procedures to include measurement of ac ripple current and/or applied voltage as recommended by the manufacturer. Guidance in IEEE Std. 1188-2005, Section 5.2.3 recommends measuring cell-to-cell and terminal connection detail resistance and ac ripple current and/or voltage yearly. The NRC staff finds that MIT's proposal to conduct yearly inspections based on the manufacturer recommendation which varies slightly from some of the guidance document but is otherwise consistent with IEEE Std. 1188-2005 and is therefore acceptable.

Guidance in IEEE Std. 1188-2005, Section 5.3, "Corrective Actions," outlines immediate and routine corrective actions when test results are not within acceptable limits and indicates areas where manufacturer recommendations should be followed. In a supplement, MIT stated, "If test results are not within the acceptance limits, corrective actions will be taken as per the manufacturer's instructions. Otherwise, IEEE Std. 1188 Section 5.3 corrective actions, immediate and routine, will be followed." The NRC staff finds that MIT's corrective actions are acceptable, as they are in accordance with IEEE Std. 1188-2005 and the manufacturer's recommendations.

Proposed TS 4.6.4 would require that a discharge test be performed once every 2 years. In its supplement, MIT explained. "The biennial discharge test is a modified performance test, combining a performance test (for battery capacity) and a service test of the emergency power supply system equipment. The discharge test is performed at constant load for one hour, verifying battery capacity while also demonstrating system capability." In Section 3.1, "Definitions," of both IEEE Std. 485-2020 and IEEE Std. 485-2010, a modified performance test is defined as "[a] test, in the 'as found' condition, of battery capacity and the ability of the battery to satisfy the duty cycle." Section 6.5, "Modified Performance Test," of both IEEE Std. 485-2020 and IEEE Std. 485-2010 states the following: 1) "A modified performance test is a test of battery capacity using a constant current modified by increasing the current to bound the

currents in the duty cycle;" 2) "A modified performance test can be used in lieu of a service test and/or a performance test at any time;" and 3) "the battery is acceptable if it delivers a tested capacity of 80% or greater." MIT provided SAR Section 8.2 markups delineating that "[a] biennial discharge test, with one-hour duration at constant load, verifies battery capacity while also demonstrating system capability. The discharge test is a modified performance test, meaning it envelops both a performance test for capacity and a service test for capability." The NRC staff finds the results of the modified performance discharge test can be used to trend the health and capacity of the battery and used to determine when the battery should be replaced. Since the modified performance test envelops both a performance test (i.e., for capacity) and service test (i.e., for capability) and is consistent with IEEE Std. 485-2020 and IEEE Std. 485-2010, the NRC staff finds the proposed two-year interval acceptable to maintain battery quality.

3.2.6 Battery Charger

In its LAR, as supplemented, MIT stated that "the charging device will be a HindlePower model AT30, floor mount, 480-volt 3-phase, 30-amp, temperature-compensated charger." Enclosure 4, "HindlePower 'AT30 Series Microprocessor Controlled Float Battery Charger [product literature],'" of the RAI response states that the charger meets National Electrical Manufacturers Association (NEMA) PE 5-1996 and PE 5-1997(R2003).

MIT also stated that the charger sizing includes a 1.1 design margin for efficiency, with a 456 Amp-hour battery load, and the resulting charger minimum capacity is 21 A to recharge the batteries within 24 hours following a full-load discharge of 8 hours. MIT also stated that the charger is rated for 30 A output. The NRC staff finds that the charger is sized with sufficient design margin and has enough capacity to recharge the batteries while maintaining the batteries on float charge.

In addition, MIT stated that the charger has the following alarms: AC Input Failure, DC Output Failure, high voltage, low voltage, and positive and negative ground faults. The NRC staff also notes that the existing overcurrent and short-circuit protection for the battery (e.g., circuit breaker and fused disconnect switch) identified in Section 3.2.4 of this SE, also protects the battery charger. Based on its review, the NRC staff finds that the protective devices should ensure that the emergency power system does not interfere with or prevent reactor operation or prevent safe facility shutdown.

Therefore, since the battery charger is sized adequately, has overcurrent and short-circuit protection, and meets NEMA PE-5, the NRC staff finds the battery charger can recharge the battery and maintain the battery on float charge.

3.2.7 Conclusion and Evaluation of Design Basis and Design Criteria

The NRC staff reviewed the proposed MIT modification to the emergency power system with respect to 10 CFR 50.34(b) design requirements using the applicable guidance in Chapter 8 of NUREG-1537, Part 2. The NRC staff also reviewed the safety analyses submitted, which included the description of the design, testing, and operation of the proposed emergency power system. The NRC staff finds that the proposed revisions to Chapter 8 of the SAR reflect the new battery system and the licensee may incorporate the revisions in its SAR.

The NRC staff concludes that the licensee appropriately justified the technical bases for the proposed modifications to the emergency power system and that the design is derived from the MITR-II's design basis and design criteria. SAR Section 8.2.1 states that the emergency power system provides power to the equipment listed in TS 3.6, Table 3.6-1 for at least one hour, which will allow the MITR-II to safely operate as analyzed in the LAR, as supplemented.

On this basis, the NRC staff concludes that:

- The battery and charger sizing are acceptable, as they conform to industry consensus standards. The MIT battery, charger, and monitoring system design and installation criteria related to installation, including storage, location, mounting, temperature-compensated charging, initial and freshening charges, ventilation, and protection are acceptable because they meet the IEEE Std. 1187-2013. The battery maintenance, inspection, and corrective actions are sufficient to ensure that the battery can perform its function. The design includes instrumentation, controls, and alarms to ensure safe and effective operation of the emergency power system. MIT demonstrated that the battery and charger are capable of supplying power for the duration required by the SAR analysis.

- The protection devices in the emergency power system will ensure that (1) non-safety-related uses of an emergency electrical power system do not interfere with performance of its safety-related functions and (2) the emergency power system does not interfere with or prevent reactor operation or prevent safe facility shutdown. Also, the emergency power system design is sufficient to provide for isolation and independence from other reactor subsystems required by SAR analyses to avoid malfunctions or failures caused by the other systems.

- The emergency power system design reasonably ensures that the design bases can be achieved, the emergency power system will be tested and maintained in the designed operating condition. The design and operating characteristics of the source of emergency electrical power are basic and reliable, ensuring availability.

3.3 Evaluation of Technical Specifications

The MITR-II TSs provide the definitions, safety limits, limiting safety system settings (LSSSs), LCO, SRs, design features, and administrative controls required to operate the facility. As part of the LAR, as supplemented, MIT proposed changes to the MITR-II TSs due to the design and operational changes resulting from the replacement of the batteries.

The NRC staff reviewed the format and content of the proposed TSs for consistency with the guidance in NUREG-1537, Part 1, Chapter 14, and Appendix 14.1, and ANSI/ANS-15.1-2007. Consistent with NUREG-1537, Part 2, Chapter 14 (ADAMS Accession No. ML042430048), acceptance criteria, the NRC staff also evaluated the proposed TS revisions to determine if the proposed MIT TSs meet the requirements in 10 CFR 50.36.

3.3.1 Proposed Changes to TS 4.6 Emergency Electrical Power Systems

TS 4.6, "Emergency Electrical Power Systems," sets forth surveillance requirements to maintain and test the emergency electrical power supply in accordance with accepted standards to ensure the reliability the reactor control and safety systems.

To support the battery replacement, MIT proposed the following changes:

- Modify TS 4.6.1 to remove the required voltage and specific gravity measurements and to require that the temperature of the negative terminal be measured quarterly
- Modify TS 4.6.2 to remove the biennial specific gravity measurement requirement and to require measurement of the voltage of each battery cell semi-annually
- Add a new TS 4.6.3 to require measurement of the connector resistance at each battery cell annually
- Renumber existing TSs 4.6.3 and 4.6.4 as TSs 4.6.4 and 4.6.5, respectively

The proposed TS changes set forth below are denoted using **bold** to indicate addition and ~~strikethrough~~ to indicate deletion.

Specification:

1. The ~~voltage and specific gravity of the pilot~~ **temperature of the negative terminal on each battery** cell shall be measured quarterly.

2. The ~~specific gravity~~ **voltage** of ~~all batteries~~ **each battery cell** shall be measured **semi-annually** ~~at any time that a significant change is noted in the pilot cell and at least every two years~~.

3. **The connector resistance at each battery cell shall be measured annually.**

~~3~~**4**. A discharge test shall be performed once every two years.

4**5**. Operability of the inverter motor-generator set and associated switches shall be verified annually. Performance of a discharge test satisfies this requirement.

Battery Cell Negative Terminal Temperature

MIT proposed modifying TS 4.6.1 to require the measurement of the temperature of the negative terminal on each battery cell quarterly and to remove the requirement for specific gravity and voltage measurements. In the LAR, MIT explained that specific gravity measurements are not considered for AGM cells, as they are sealed, and the electrolyte is gelatinous. The LAR also stated that measuring the temperature of the negative terminal of each battery cell quarterly in lieu of measuring individual cell voltages is per the manufacturer's recommendations because of operating experience. In addition, the manufacturers recommendation to measure the temperature of the negative terminal of each battery cell quarterly is in accordance with IEEE Std. 1188-2005, Section 5.2.2, "Quarterly," to assure that the battery can satisfy its design requirements. The NRC staff finds the proposed modification to TS 4.6.1 consistent with the guidance in NUREG-1537, Chapter 14, Appendix 14.1, and ANSI/ANS-15.1-2007 to ensure operability of the emergency power system because the surveillance testing and frequency are consistent with the industry standard and the manufacturer recommendations related to battery monitoring. Accordingly, the NRC staff concludes that the changes to TS 4.6.1 are acceptable and adequate to maintain battery quality.

Battery Cell Voltage

MIT proposed modifying TS 4.6.2 to require the measurement of the voltage of each battery cell semi-annually and to remove the requirement to specific gravity measurements. In the LAR, MIT noted that specific gravity measurements are not considered for AGM cells, as they are sealed, and the electrolyte is gelatinous. In addition, MIT proposed that the frequency of the measuring individual cell voltages be changed from quarterly to semi-annually per the manufacturer's recommendations. The guidance in IEEE Std. 1188-2005, Section 5.2.2 however, recommends that the voltage of each cell be measured quarterly to assure that the battery can satisfy its design requirements. In response to an NRC RAI on MIT's conformance to IEEE Std. 1188, MIT indicated that the manufacturer's recommendation was based on the manufacturer's experience. The NRC staff finds the proposed modification to TS 4.6.2 is consistent with the guidance in NUREG-1537, Chapter 14, Appendix 14.1, and ANSI/ANS-15.1-2007 to ensure operability of the emergency power system because (1) the individual cell voltages are measured semi-annually per manufacturer's recommendations and operating experience and (2) specific gravity measurements cannot be taken on VRLA batteries. Accordingly, the NRC staff concludes that the proposed changes to TS 4.6.2 ensure battery system quality is maintained and are acceptable.

Connector Resistance

MIT proposed adding TS 4.6.3 to require the measurement of the connector resistance at each battery cell annually and stated that this interval is recommended by the manufacturer. The NRC staff reviewed the proposed maintenance of measuring connector resistance at each battery cell annually and finds it to be consistent with IEEE Std. 1188-2005, Section 5.2.3, "Yearly and initial," for recommended maintenance to assure that the battery can satisfy its design requirements. The NRC staff finds the proposed addition of TS 4.6.3 is consistent with the voltage measurement guidance in NUREG-1537, Chapter 14, Appendix 14.1, and ANSI/ANS-15.1-2007 to ensure operability of the emergency power system. The NRC staff also finds that measurement of the connector resistance will maintain battery system quality. Accordingly, the NRC staff concludes that the addition of TS 4.6.3 is acceptable.

Renumbered Items

MIT proposed renumbering TS 4.6.3 and TS 4.6.4 as TS 4.6.4 and TS 4.6.5, respectively. No other changes were proposed to these TSs. The NRC staff finds that the proposed change is editorial in nature to reflect the addition of the new TS 4.6.3 requirement to measure connector resistance and does not substantively alter the technical content of these SRs. Therefore, the NRC staff finds the proposed changes acceptable.

3.4 Proposed Changes to TS Bases

The regulation, 10 CFR 50.36(a)(1), states that a summary statement of the bases or reasons for such specifications, other than those covering administrative controls, shall be included in the application for a license, but shall not become part of the TSs. Consistent with 10 CFR 50.36(a)(1), the licensee submitted changes to TS 4.6 Bases as part of the LAR, that provide the reasons for the proposed TS changes.

3.5 Conclusion on TS Changes

The NRC staff reviewed MIT's proposed TS SR revisions that describe the testing of the replacement emergency power system batteries and reviewed the SAR Section 8.2 revisions that reflect the design of the emergency power system replacement batteries. Based on its review, the NRC staff finds that the TS 4.6 changes are based on the system description and performance requirements in the SAR, as revised by the LAR, and are consistent with the guidance in Section 4.6 of NUREG-1537, Part 1, Appendix 14.1, that if emergency power is required, an SR should assure the quality of the system or component. Also, the proposed TS revisions are consistent with the surveillances recommended in IEEE Std. 1188-2005 or the manufacturer's recommendation. Based on its evaluation of the information presented above, the NRC staff concludes:

- The licensee provided TSs, as required by 10 CFR 50.36(a), and, consistent with 10 CFR 50.36(b), the TSs are derived from the SAR analyses as revised by the LAR, as supplemented.

- The proposed TS SRs assure that the necessary quality of system components is maintained that facility operation will be within the safety limits, and that the LCOs will be met as required by 10 CFR 50.36(c)(3).

Therefore, the NRC staff concludes that the proposed changes to TS 4.6, provide reasonable assurance that the MITR-II will be operated as analyzed in the LAR, as supplemented, in a manner that protects the health and safety of the public. Accordingly, the NRC staff concludes that the proposed changes to the TSs are acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

The NRC regulation, 10 CFR 51.22(b), states that no environmental assessment or environmental impact statement is required for any action within the category of actions listed in 10 CFR 51.22(c), for which the Commission declared to be a categorical exclusion by finding that the action does not individually or cumulatively have a significant effect on the human environment.

The regulation,10 CFR 51.22(c)(9), states, in part, that issuance of an amendment that changes a requirement with respect to use of a facility component located within the restricted area, as defined in Part 20 of this chapter, or that changes a surveillance requirement is an action that is subject to categorical exclusion, provided that each of 10 CFR 51.22(c)(9) criteria listed below are met:

(i) *The amendment or exemption involves no significant hazards consideration;* [10 CFR 51.22(c)(9)(i)]

Pursuant to 10 CFR 50.92, "Issuance of amendment" paragraph (c), the Commission may make a final determination that a license amendment involves no significant hazards consideration if operation of the facility, in accordance with the proposed amendment, would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated [10 CFR 50.92(c)(1)]; or

The proposed license amendment would approve SAR revisions that allow the licensee to replace the emergency power system flooded lead-acid batteries with similar capacity AGM VRLA batteries, to replace the battery charger, to install a battery monitoring system, and to revise emergency power system revise TS SRs to assure the quality of the AGM VRLA batteries is maintained. The licensee indicated that the replacement batteries are more reliable and present a reduced non-radiological hazard due to the deletion of the battery acid specific gravity measurement. The License Renewal safety evaluation report (SER) (ADAMS Accession No. ML102320082), Section 8.2, "Emergency Electrical Power System," states that the emergency electrical power system is designed to provide power to lighting, communication, reactor monitoring, and decay heat removal systems for at least 1 hour. The License Renewal SER Section 13.7, "Loss of Normal Electrical Power," states that the emergency power system provides backup power to monitoring systems but is not required to maintain the safe shutdown of the reactor. In Section 13.1, "Maximum Hypothetical Accident," of the renewal SE, the NRC staff concluded that the calculated doses of the maximum hypothetical accident (MHA), which bounds all accidents at the facility, would remain below the limits in 10 CFR 20.1201, "Occupational dose limits for adults," and 10 CFR 20.1301, "Dose limits for individual members of the public." The proposed changes do not alter any of the assumptions or limits used in postulating or evaluating the MHA because the MHA does not rely on mitigation from the components powered by the emergency power system.

In addition, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated because no changes are being proposed to reactor design or hardware, or to structures, systems, and components that are relied upon for accident detection, mitigation, or response. The emergency power system will continue to provide power to the core and radiation monitoring systems (as required by TS 3.6.1, Table 3.6-1) during the loss of offsite power with the new batteries. The revised surveillances will continue to ensure the quality of the batteries supplying power to the emergency power system. Further, the proposed amendment does not change the licensed power level of the reactor, fission product inventory, and or change any potential release paths from the facility. Therefore, the proposed amendment does not involve a significant increase in the probability or consequence of an accident previously evaluated.

(2) *Create the possibility of a new of different kind of accident from any accident previously evaluated* [10 CFR 50.92(c)(2)]; or

The proposed license amendment would allow the installation of a replacement emergency power battery system, battery charger, and battery monitoring system that will continue to provide power to TS required equipment during a loss of normal power. In addition, the revised surveillance requirements would maintain the quality of the new battery system. The proposed changes do not create a new or different kind of accident from any accident previously evaluated because there are no changes to any equipment that is relied upon for accident detection, mitigation, or response to an accident. In addition, the changes would not introduce any new accident scenarios, transient precursors, failure mechanisms, or limiting single failures, and there would be no adverse effect or challenges to any systems important to safety as a result of the proposed amendment. The proposed changes do not authorize any changes in the hardware, design, function, or operation of any equipment important to safety, or in the authorized reactor power level. Further, the proposed changes do not alter or decrease the functional capability of any equipment used for defense in depth or create any new radiological

accident release pathways. Therefore, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) *Involve a significant reduction in a margin of safety* [10 CFR 50.92(c)(3)]

The proposed license amendment would allow replacement of the emergency power battery system that will continue to provide power to TS required equipment during a loss of power. The proposed amendment also revises the TS surveillance requirements to maintain the quality of the new battery system. The proposed changes do not authorize any changes in the design, function, or operation of any equipment important to safety, or in the authorized reactor power level. The proposed changes do not alter how SLs, LSSSs, or LCO are determined and do not adversely affect existing facility safety margins or the reliability of equipment assumed to mitigate accidents in the facility. Additionally, the proposed changes do not alter or decrease the functional capability of any equipment used for defense in depth. Therefore, the proposed amendment does not involve a significant reduction in the margin of safety.

(ii) *There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and [10 CFR 51.22(c)(9)(ii)].*

The proposed changes do not change the types of effluents that may be released offsite or cause any significant increase in the amount of radioactive material that could be released offsite because the existing requirements for monitoring and release of radioactive effluents are unchanged. TS 3.7, “Radiation Monitoring Systems, Effluents, Hot Cells, and Byproduct Material,” continues to require “[a]t least one environmental monitor at the site and one within one quarter mile of the site shall be used to verify compliance with environmental dose limits.” Annual releases from the facility must be controlled such that radiation dose (to a member of the public) will not exceed the dose limits in 10 CFR 20.1101, (10 millirem) and 10 CFR 20.1301, (100 millirem). The proposed amendment does not alter TS 4.7, “Radiation Monitoring Systems and Effluents,” which requires periodic channel checks, tests, and calibrations of the radiation monitors. In addition, the reactor power level, the amount of radioactive material used, and the design of equipment important to safety are not changed. Therefore, there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

(iii) *There is no significant increase individual or cumulative occupational radiation exposure.* [10 CFR 51.22(c)(9)(iii)]

The proposed changes do not alter any technical or safety requirements for radiation monitoring at the facility or affect occupational radiation exposure. The reactor power level, the amount of radioactive material used, and the design of equipment important to the safety of the reactor are not changed. In addition, TS 7.3 “Radiation Safety,” requires that the licensee Radiation Protection Program be designed to achieve the requirements of 10 CFR Part 20, including maintaining exposures as low as is reasonably achievable. Therefore, there is no significant increase in individual or cumulative occupational radiation exposure.

In summary, the NRC staff determined that the amendment involves no significant hazards consideration. There is no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and no significant increases in individual or

cumulative occupational radiation exposure. Based on the discussion above, the NRC staff concludes that the amendment meets the eligibility criteria for categorical exclusions set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of the amendment.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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