



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

June 27, 2022

Mr. Andrew Cook
Interim Reactor Facility Director
Radiation Sciences Department
Armed Forces Radiobiology Research Institute
4301 Jones Bridge Road, Building 42
Bethesda, MD 20889-5648

SUBJECT: ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE – ISSUANCE OF AMENDMENT NO. 26 TO RENEWED FACILITY OPERATING LICENSE NO. R-84, FOR THE ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE TRIGA-MARK F TANK-TYPE NUCLEAR REACTOR FACILITY TO UPGRADE THE DIGITAL INSTRUMENTATION AND CONTROL SYSTEM (EPID L-2020-NFA-0012)

Dear Mr. Cook:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 26 to Armed Forces Radiobiology Research Institute (AFRRI) for the Armed Forces Radiobiology Research Institute TRIGA-Mark F tank-type nuclear reactor facility. This amendment authorizes AFRRI to upgrade the digital instrumentation and control systems for the AFRRI TRIGA reactor and authorizes changes to the renewed facility operating license and technical specifications.

This amendment is issued in response to the application for an amendment to Facility Operating License No. R-84 for the AFRRI TRIGA-Mark F reactor facility, filed by letter dated November 10, 2020 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML20318A338), as supplemented by letters dated February 5, 2021 (ADAMS Accession No. ML21036A297), February 11, 2021 (ADAMS Accession No. ML21042B841), October 28, 2021 (ADAMS Accession No. ML21302A096), November 8, 2021 (ADAMS Accession No. ML21316A032), January 7, 2022 (ADAMS Accession No. ML22007A263), April 4, 2022 (ADAMS Accession No. ML22096A279), and April 28, 2022 (ADAMS Accession No. ML22118A867).

A copy of the NRC staff's safety evaluation is also enclosed. If you have any questions, please contact me at (301) 415-3398 or by electronic mail at Cindy.Montgomery@nrc.gov.

Sincerely,



Boyle, Patrick signing on behalf
of Montgomery, Cynthia
on 06/27/22

Cindy Montgomery, 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. 50-170
License No. R-84

Enclosures:

1. Amendment No. 26 to
Facility Operating License No. R-84
2. Safety Evaluation Report

cc w/enclosures: See next page

Armed Forces Radiobiology Research Institute

Docket No 50-170

cc:

Director, Maryland Office of Planning
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Baltimore, MD 21201

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Colonel Mohammad Naeem, Director
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Test, Research and Training
Reactor Newsletter
Attention: Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Park, MD 20742-2115

SUBJECT: ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE – ISSUANCE OF AMENDMENT NO. 26 TO RENEWED FACILITY OPERATING LICENSE NO. R-84, FOR THE ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE TRIGA-MARK F TANK-TYPE NUCLEAR REACTOR FACILITY TO UPGRADE THE DIGITAL INSTRUMENTATION AND CONTROL SYSTEM (EPID L-2020-NFA-0012) DATED: JUNE 27, 2022

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ADAMS Accession No.: ML22131A373**NRR-058**

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

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE

DOCKET NO 50-170

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE TRIGA-MARK F TANK-TYPE

NUCLEAR REACTOR FACILITY

AMENDMENT TO FACILITY OPERATING LICENSE NO. R-84

Amendment No. 26
License No. R-84

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for an amendment to Facility Operating License No. R-84, filed by the Armed Forces Radiobiology Research Institute on November 10, 2020, as supplemented by letters dated February 5, 2021, February 11, 2021, October 28, 2021, November 8, 2021, January 7, 2022, April 4, 2022, and April 28, 2022, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations 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 that (i) the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) 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 a notice of issuance for 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 Facility Operating License No. R-84 is hereby amended to read as follows:

2. Technical Specifications

The Technical Specifications contained in Appendix A, as revised by Amendment No. 26 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Joshua M. 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 Facility Operating License No. R-84
2. Changes to Appendix A, "Technical Specifications"

Date of Issuance: June 27, 2022

ATTACHMENT TO LICENSE AMENDMENT NO. 26

FACILITY OPERATING LICENSE NO. R-84

DOCKET NO 50-170

Replace the following page of Facility Operating License No. R-84 with the attached revised page. The revised page is identified by amendment number and contains lines in the margin indicating the areas of change.

Facility Operating License No. R-84

Remove

3

Insert

3

- b. to receive, possess, and use, but not separate, in connection with the operation of the facility, up to 100 grams total of special nuclear material, of any enrichment, in the form of detectors, fission plates, foils, and solutions; and
 - c. to receive, possess, and use, but not separate, in connection with the operation of the facility, such special nuclear material as may be produced by the operation of the facility.
 - 3. Pursuant to the Act and 10 CFR Part 30, the following activities are included:
 - a. to receive, possess, and use, in connection with the operation of the facility, a sealed 3-curie americium-beryllium neutron source; and,
 - b. to receive, possess, and use, in connection with operation of the facility, such byproduct material as may be produced by operation of the reactor, which cannot be separated except for byproduct material produced in non-fueled reactor experiments.
 - 4. Pursuant to the Act and 10 CFR Part 40, "Domestic Licensing of Source Material," to receive, possess, and use, in connection with the operation of the facility, not more than 5.0 kilograms of source material.
- C. This license shall be deemed to contain, and is subject to the conditions specified 10 CFR Parts 20, 30, 40, 50, 51, 55, 70, and 73 of the Commission's regulations; is subject to all provisions of the Act, and to the rules, regulations and orders of the Commission now or hereafter in effect, and is subject to the additional conditions specified or incorporated below:
 - 1. Maximum Power Level

The licensee is authorized to operate the reactor at a steady-state power level up to a maximum of 1.1 megawatts (thermal) and to pulse the reactor in accordance with the limitations in the Technical Specifications.
 - 2. Technical Specifications

The Technical Specifications contained in Appendix A, as revised by Amendment No. 26 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

ATTACHMENT TO LICENSE AMENDMENT NO. 26

FACILITY OPERATING LICENSE NO. R-84

DOCKET NO 50-170

Replace the following pages of Appendix A, "Technical Specifications," with the attached revised pages. The revised pages is identified by amendment number and contains vertical lines in the margin to indicate the areas of change.

Technical Specifications

<u>Remove</u>	<u>Insert</u>
14	14
15	15
28	28
30	30

Table 2. Minimum Reactor Safety System Scrams

Channel	Maximum Set Point	Effective Mode	
		Steady State	Pulse
Fuel Temperature	600°C	2	2
Percent Power, High Flux	1.1 MW	2	0
Console Manual Scram Button	Closure switch	1	1
High Voltage Loss to Safety Channel	20% Loss	2	1
Pulse Time	15 seconds	0	1
Emergency Stop	Closure switch	3	3
(1 in each exposure room, 1 on console)			
Pool Water Level	14 feet from the top of the core	1	1
Watchdogs (UIT and CCS)	15 seconds	2	2
AC Power Loss	15 seconds	1	1

Bases

The fuel temperature and power level scrams provide protection to ensure that the reactor can be shut down before the fuel temperature safety limit is exceeded. The manual scram allows the operator to shut down the system at any time if an unsafe or abnormal condition occurs. In the event of failure of the power supply for the safety channels, operation of the reactor without adequate instrumentation is prevented. The preset pulse timer ensures that the reactor power level will return to a low level after pulsing. The emergency stop allows personnel trapped in a potentially hazardous exposure room, or the reactor operator, to scram the reactor through the facility interlock system. The pool water level ensures that a loss of biological shielding would result in a reactor scram. The watchdog scram ensures reliable communication between the User Interface Terminal (UIT) and the Console Computer System (CCS). The AC power loss scram ensures that a loss of AC power to the uninterruptible power supply (UPS) for the reactor control console will result in a scram.

Table 3. Minimum Reactor Safety System Interlocks

Action Prevented	Effective Mode	
	Steady State	Pulse
Pulse initiation at power levels greater than 1 kW		X
Withdrawal of any control rod except transient		X
Any rod withdrawal with power level below 1×10^{-5} watts as measured by the Linear Power Channel (NMP-1100)	X	X
Simultaneous manual withdrawal of two standard rods	X	
Any rod withdrawal if high voltage is lost to the Log Power Channel (NLW-1000)	X	X
Withdrawal of any control rod if reactor period is less than 3 seconds	X	
Application of air if the transient rod drive is not fully down. This interlock is not required in square wave mode.	X	

* Reactor safety system interlocks shall be tested daily whenever operations involving these functions are planned

Bases

The interlock preventing the initiation of a pulse at a power level above 1 kW ensures that the pulse magnitude will not allow the fuel element temperature to exceed the safety limit. The interlock that prevents movement of standard control rods in pulse mode will prevent the inadvertent increase in steady state reactor power prior to initiation of a pulse. Requiring a minimum power level to be measured by the Linear Power Channel ensures sufficient source neutrons to bring the reactor critical under controlled conditions. The interlock that prevents the simultaneous manual withdrawal of two standard control rods limits the amount of reactivity added per unit time. Correct high voltage to the Log Power Channel ensures accurate power indications. Preventing the withdrawal of any control rod if the period is less than 3 seconds minimizes the possibility of exceeding the maximum permissible power level or the fuel temperature safety limit.

4.2.2. REACTOR SAFETY SYSTEMS

Applicability

These specifications apply to the surveillance requirements for measurement, test, and calibration of the reactor safety systems.

Objective

The objective is to verify the performance and operability of the systems and components that are directly related to reactor safety.

Specifications

- a. A channel test of the scram function of the high-flux safety channels shall be made each day that reactor operations are planned.
- b. A channel test of each of the reactor safety system channels in Table 2 and Table 3 with the exception of the exposure room emergency stop and AC power loss scrams for the intended mode of operation shall be performed weekly, whenever operations are planned.
- c. Channel calibration, including verification of the setpoints for the high voltage loss to safety channel scrams, shall be made of the NP, NPP, NLW, NMP or any other console instrumentation designated to provide direct power level information to the operator, annually not to exceed 15 months.
- d. A thermal power calibration shall be completed annually not to exceed 15 months.
- e. The exposure room emergency stop and AC Power Loss scrams shall be tested annually, not to exceed 15 months.
- f. The low pool water scram shall be tested weekly not to exceed 10 days whenever operations are planned.
- g. The console manual scram button shall be tested weekly not to exceed 10 days whenever operations are planned.

Bases

TRIGA system components have proven operational reliability. Daily tests ensure reliable scram functions and ensure the detection of channel drift or other possible deterioration of operating characteristics. The channel checks ensure that the safety system channel scrams are operable on a daily basis or prior to an extended run. The power level channel calibration will ensure that the reactor is operated within the authorized power levels.

4.2.4. FACILITY INTERLOCK SYSTEM

Applicability

This specification applies to the surveillance requirements that ensure the integrity of the facility interlock system.

Objective

The objective is to ensure performance and operability of the facility interlock system.

Specifications

Functional checks shall be made annually, not to exceed 15 months, to ensure the following:

- a. With the lead shield doors open, neither exposure room plug door can be electrically opened.
- b. The core dolly cannot be moved in region 2 with the lead shield doors closed except during the use of the core dolly interlock override switch.
- c. The lead shield doors cannot be opened to allow movement into the exposure room projection unless a warning horn has sounded in that exposure room, or unless two licensed reactor operators have visually inspected the room to ensure that no personnel remain in the room prior to securing the plug door.

Bases

These functional checks will verify operation of the interlock system. Experience at AFRR1 indicates that this is adequate to ensure operability.