



**ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE**  
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July 13, 2017

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555-0001

Sir:

The 2016 Annual Operating Report required by the technical specifications for the Armed Forces Radiobiology Research Institute reactor (license R-84, docket 50-170) was originally submitted on March 17, 2017. Since then, we have discovered several minor Ar-41 effluent release calculation errors in Sections VI and VII of the report. Please withdraw the report dated March 17, 2017 and replace it with the attached revised copy.

Should you need any further information, please contact me at (301) 295-9245.

STEPHEN J. MILLER  
Reactor Facility Director

Enclosure:  
as

cc:  
U.S. Nuclear Regulatory Commission  
ATTN: Al Adams, NRR/DPR/PRLB  
Mail Stop 12-D20  
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A020  
NRR

Armed Forces Radiobiology Research Institute  
AFRI TRIGA Reactor Facility

1 January 2016 - 31 December 2016

To satisfy the requirements of  
U.S. Nuclear Regulatory Commission License No. R-84 (Docket No. 50-170),  
Technical Specification 6.6.a.

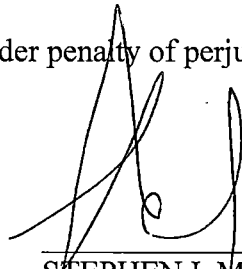
Prepared by  
Harry H. Spence  
Reactor Staff

Submitted by  
Stephen I. Miller  
Reactor Facility Director

Armed Forces Radiobiology Research Institute  
8901 Wisconsin Avenue  
Bethesda, MD 20889-5603

# Submission of 2016 Annual Report

I declare under penalty of perjury that this report is true and correct.



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STEPHEN I. MILLER  
Reactor Facility Director

**JUL 13 2017**

Date

# 2016 ANNUAL REPORT

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# 2016 ANNUAL REPORT

## INTRODUCTION

The Armed Forces Radiobiology Research Institute (AFRRI) reactor facility was available for irradiation services for the entire year until December 7 when it was shutdown to prepare for the installation of a new instrumentation and control system by contractors from General Atomics, scheduled to begin in January 2017. The reactor license renewal application, submitted in June 2004, was approved by the NRC with the issuance of a new 20-year operating license on November 30, 2016. Numerous revisions to both the Technical Specifications and the Safety Analysis Report were submitted as part of the relicensing process and were approved by the NRC.

There were no major reactor modifications or projects during the year except preparation for installation of the new reactor console after December 7. There were no unscheduled shutdowns during 2016.

The 2016 annual reactor audit required by the reactor technical specifications was conducted by Mr. Bob Woodruff in January 2017. Mr. Woodruff is a health physicist in the Military Medical Operations Division. During the audit he verbally indicated that he had not found any major discrepancies in reactor operations and those conclusions are reflected in his written report.

A comprehensive NRC inspection of reactor facility operations and security was conducted by Mr. Johnny Eads during January 2016. While he had several recommendations for improving reactor operations, no safety concerns or noncompliance with NRC requirements were identified.

There were two RRFSS membership changes during the year. There were two reactor staff arrivals and three staff departures during the year.

The remainder of this report is written in the format designated in the Technical Specifications for the AFRRI TRIGA Reactor Facility. Items not specifically required are presented in the General Information section. The following sections correspond to the required items listed in Section 6.6.b. of the Technical Specifications.

# GENERAL INFORMATION

All personnel held the listed positions throughout the year unless otherwise specified.

Key AFRRRI personnel (as of 31 December 2016) are as follows:

1. AFRRRI Director – L. Andrew Huff, Col, USAF  
Radiation Sciences Department (RSD) Head - Stephen I. Miller (SRO)  
Radiation Safety Officer – Daniel Shaw (as of 06 September)
  2. Reactor Facility Director and Facility Radiation Manager - Stephen I. Miller (SRO)
  3. Reactor operations personnel:  
Reactor Operations Supervisor – Walter D. Tomlinson (SRO) (as of 23 March)  
SRO Training Coordinator – Walter D. Tomlinson (SRO) (as of 23 March)  
Maintenance Specialist - Walter D. Tomlinson (SRO)  
Records Administration Specialist - Harry H. Spence (as of 02 February)
  4. Other Senior Reactor Operators:  
Jason Jacot, SFC, USA (through 23 March)
  5. Operator candidates:  
Sacha T. Moore, SFC, USA (as of 26 July)  
David D. Manzanares, SFC, USA (through 05 August)  
Robert E. McMahon, MAJ, USA (through 21 November)
  6. Newly licensed operators:  
None
  7. Additions to staff during 2016:  
Sacha T. Moore, SFC, USA (as of 26 July)  
Harry H. Spence (as of 02 February)
- NOTE: Mr. Spence formerly held a SRO license at the AFRRRI reactor and retired in June 2013. He returned as an unlicensed part-time staff member in February 2016.
8. Departures during 2016:  
Jason Jacot (SRO), SFC, USA (as of 23 March)  
David D. Manzanares, SFC, USA (as of 05 August)  
Robert E. McMahon, MAJ, USA (as of 21 November)

9. There were two change to the Reactor and Radiation Facilities Safety Subcommittee (RRFSS) during 2016. Dr. David Lesser replaced LTC Clayton Carr, USA on 06 September and Mr. Daniel Shaw replaced CDR Marie Parry, USN also on 06 September.

In accordance with the requirements set forth in Section 6.2.1.1. of the Technical Specifications for the AFRRI TRIGA Reactor Facility, the RRFSS consisted of the following members as of 31 December 2016.

Regular members are:

Radiation Safety Officer: - Daniel Shaw

Reactor Facility Director and Facility Radiation Manager - Stephen I. Miller

Reactor Operations Specialist – Vincent Adams

Health Physics Specialist - Joe Pawlovich

Chairman and Director's Representative – Dr. David Lesser

Special nonvoting member - David Lake, Montgomery County Government (Department of Environmental Protection)

Recorder - Harry H. Spence

Two meetings were held in 2016:

14 July

17 November

# SECTION I

## **Changes in the Facility Design, Performance Characteristics, Administrative Procedures, Operational Procedures, Results of Surveillance Tests and Inspections**

A summary of changes to the facility design, performance characteristics, administrative procedures, and operational procedures as well as the results of surveillance testing are provided in this section.

### **A. DESIGN CHANGES**

There were two design changes to the reactor facility during 2016 that were reviewed and approved under provisions of 10 CFR 50.59:

23 February -- Addition of incandescent lamps to visually check the status of the transient rod up and down limit switches.

19 May -- Removal and replacement of the automatic secondary water treatment system. This involved the upgrading of a former cooling tower water treatment system that was installed in September 2004 after 10 CFR 50.59 approval.

Revisions were also made to Chapter 7, Instrumentation and Control Systems, of the FSAR to complete the relicensing package and to prepare for the installation of the new reactor console in 2017 (see Section V).

### **B. PERFORMANCE CHARACTERISTICS**

There were no changes to the performance characteristics of the core during 2016. All fuel elements and control rods remained in place for operations throughout the year until December 7 as noted in the Introduction.

### **C. ADMINISTRATIVE PROCEDURES**

There were no changes to the Administrative Procedures during 2016.

### **D. OPERATIONAL PROCEDURES**

There were no changes to the Operational Procedures during 2016.

### **E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS**

All maintenance and surveillance tasks during 2016 were accomplished as normally scheduled during the year.

There were no reactor malfunctions during 2016.



The 2016 annual reactor audit required by the reactor technical specifications was conducted by Mr. Bob Woodruff in January 2017. Mr. Woodruff is a health physicist in the Military Medical Operations Division. During the audit he verbally indicated that he had not found any major discrepancies in reactor operations and those conclusions are reflected in his written report.

A comprehensive NRC inspection of reactor facility operations and security was conducted by Mr. Johnny Eads during January 2016. While he had several recommendations for improving reactor operations, no safety concerns or noncompliance with NRC requirements were identified.

## SECTION II

### Energy Generated by the Reactor Core and the Number of Pulses \$2.00 or Larger

Month	Kilowatt Hours
JAN	937.5
FEB	1199.7
MAR	312.1
APR	308.8
MAY	111.8
JUN	339.6
JUL	389.4
AUG	0.0
SEP	0.0
OCT	0.0
NOV	43.0
DEC	<u>88.2</u>
TOTAL	3730.0

Total energy generated in 2016: 3,730.1 kWh

Total energy on fuel elements: 1,156,793.7 kWh

Total energy on FFCRs\*: 423,996.0 kWh

Total pulses this year  $\geq$  \$2.00: 0

Total pulses on fuel elements  $\geq$  \$2.00: 4,219

Total pulses on FFCRs\*  $\geq$  \$2.00: 107

Total pulses this year: 18

Total pulses on fuel elements: 12,189

Total pulses on FFCRs\*: 2,424

\*Fuel-followed control rods

## SECTION III

### **Unscheduled Shutdowns**

There were no unscheduled shutdowns during 2016.

## SECTION IV

### **Safety-Related Corrective Maintenance**

There were no reactor malfunctions during 2016.

## SECTION V

### **Facility and Procedure Changes as Described in the Final Safety Analysis Report (FSAR), New Experiments or Tests Performed During the Year**

#### A. FACILITY CHANGES AS DESCRIBED IN THE FSAR

Chapter 7, Instrumentation and Control Systems and Chapter 13, Accident Analysis of the FSAR were extensively revised during the reactor relicensing process and were approved by the NRC when the license was renewed on November 30.

#### B. PROCEDURE CHANGES AS DESCRIBED IN THE FSAR

There were no changes to procedures as described in the FSAR.

#### C. NEW EXPERIMENTS OR TESTS

No new experiments or tests were performed during the reporting period that were not encompassed by the FSAR.

There were two safety evaluations for changes not submitted to the NRC, pursuant to the provisions of 10 CFR 50.59 (see Section I.D. above).

## SECTION VI

### Summary of Radioactive Effluent Released

A. Liquid Waste: The reactor produced no liquid waste during 2016.

B. Gaseous Waste: There were no particulate discharges in 2016.

The total activity of Argon-41 discharged in 2016 was 1.22 curies. The estimated effluent concentration from the release of Argon-41 represents under 1% of the constraint limit for unrestricted areas (10 CFR 20.1101(d) and Table 2, Appendix B, 10 CFR 20).

Quarterly:	Jan - Mar 2016	0.70 Ci
	Apr - Jun 2016	0.32 Ci
	Jul - Sep 2016	0.15 Ci
	Oct - Dec 2016	0.05 Ci

C. Solid Waste: All solid radioactive waste material was transferred to the AFRRI byproduct license; none was disposed of under the R-84 reactor license.

## SECTION VII

### Environmental Radiological Surveys

All environmental sampling of soil and vegetation yielded radionuclide levels within the background range. The radionuclides that were detected were those expected from natural background and from long-term fallout from nuclear weapons testing.

The calculated annual dose, due to Argon-41 release to the environment for 2016, was 0.04 mRem at the location of maximum public exposure. The maximum exposure is calculated at a location 91 meters from the release point as described in the FSAR. Exposure to the general population at the boundary of the Naval Support Activity Bethesda is significantly less due to the diffusion of Argon-41 in the atmosphere. The constraint limit for exposure to the public established under 10 CFR 20.1101(d) is 10 millirem per year. The exposure dose was calculated using COMPLY code, level 2, which is the most conservative level of COMPLY. Emissions due to reactor operations were 0.04 millirem, or less than 1% of the 10 millirem constraint limit, for the entire year.

The reactor in-plant surveys, specified in Health Physics Procedure (HPP) 3-2, all resulted in readings that were less than the action levels specified in HPP 0-2.

## SECTION VIII

### **Exposures Greater than 25% of 10 CFR 20 Limits**

There were no doses to reactor staff personnel or reactor visitors greater than 25% of 10 CFR 20 occupational and public radiation dose limits.