Armed Forces Radiobiology Research Institute
AFRRI TRIGA Reactor Facility

1 January 2004 - 31 December 2004

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

Prepared by
Harry H. Spence
Reactor Operations Supervisor

Submitted by
Stephen I. Miller
Reactor Facility Director

Armed Forces Radiobiology Research Institute
8901 Wisconsin Avenue
Bethesda, MD 20889-5603
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Submission of 2004 Annual Report

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

28 MAR 05

STEPHEN I. MILLER Date
Reactor Facility Director

2004 ANNUAL REPORT

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2004 ANNUAL REPORT

INTRODUCTION

The Armed Forces Radiobiology Research Institute (AFRRI) reactor facility was available for irradiation services throughout the year except for one nonoperational period of approximately one month during the annual reactor maintenance shutdown.

There were no major reactor modifications or projects during the year. One minor facility modification was made during 2004 in accordance with the provisions of 10 CFR 50.59. A summary of that modification is found in Sections I and V. There was also one reportable occurrence during 2004. Reports required by the reactor technical specifications were submitted, and the details are found in Section IV.

The 2004 annual reactor audit required by the reactor technical specifications was conducted by Mr. Terry Flinchbaugh in November 2004. Mr. Flinchbaugh is a senior reactor operator and Associate Director for Operations at the Pennsylvania State University reactor facility. 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 was conducted by Mr. Craig Bassett during March 2004. No safety concerns or noncompliance with NRC requirements were identified.

There were several RRFSC membership changes during the year. These are detailed in the following section. Also, one reactor operator candidate received her Senior Reactor Operator license during the year.

Reactor staff members participated in an inspection of the military reactor facility at White Sands Missile Range, NM conducted by the U.S. Army Test and Evaluation Command during April 2004.

In June 2004, the reactor staff submitted an application to renew the reactor operating license for an additional twenty years. Since the application was submitted at least thirty days before the expiration date of the current license, the reactor may continue to operate until the relicensing evaluation is complete.

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 specifications.

GENERAL INFORMATION

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

Key AFRRI personnel (as of 31 December 2004) are as follows:

1. AFRRI Director - David Jarrett, COL, MC, USA

   Radiation Sciences Department (RSD) Head - Stephen I. Miller

   Radiation Protection Officer - Daniel Simpson, LCDR, USN (29 March)

2. Reactor Facility Director - Stephen I. Miller (SRO)

3. Reactor operations personnel:

   Reactor Operations Supervisor - Harry H. Spence (SRO)

   SRO Training Coordinator - John T. Nguyen (SRO)

   ERT Training Coordinator - Stephanie Vaughn, MAJ, CM USA (SRO 15 Dec)

   Maintenance Specialist - John T. Nguyen (SRO)

   Records Administration Specialist - Harry H. Spence (SRO)

   Senior Staff Engineer - Stephanie Vaughn, MAJ, CM, USA (SRO 15 Dec)

4. Senior Reactor Operators - Christopher Whicker, SSG, USA
   Stephanie Vaughn, MAJ, CM, USA (15 Dec)

5. Operator candidates:
   Walter D. Tomlinson
   Joneil Ribaya, SFC, USA

6. Newly licensed operators:
   Stephanie Vaughn, MAJ, CM, USA (15 Dec)

7. Additions to staff during 2004:
   None

8. Departures during 2004:
   None

9. There were two changes to the Reactor and Radiation Facility Safety Committee (RRFSC) during 2004. LCDR Daniel Simpson replaced Dr. David McKown as the Radiation Protection Officer on 29 March and Mr. David Lake replaced Mr. David Rotolone as the Montgomery

County nonvoting member on 29 March.

In accordance with the requirements set forth in Section 6.2.1.1. of the Technical Specifications for the AFRRI Triga Reactor Facility, the RRFSC consisted of the following members as of 31 December 2004.

Regular members are:
Radiation Protection Officer - Daniel Simpson, LCDR, USN
Reactor Facility Director - Stephen I. Miller
Reactor Operations Specialist - Seymour Weiss
Health Physics Specialist - Joe Pawlovich

Chairman and Director's Representative - Mark Gee

Special nonvoting member - David Lake, Montgomery County Government (Environmental Policy and Compliance Office)

Recorder - Harry H. Spence

Two meetings were held in 2004. All meetings are full committee meetings; subcommittees were eliminated in 2001:

14 April

21 June

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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. Design change documentation with its 10 CFR 50.59 review is in the Attachments.

A. DESIGN CHANGES

There was one design change to the facility during 2004. An automatic secondary water monitoring and treatment system was installed to eliminate the monthly requirement to manually drain, clean, and refill the reactor cooling tower. This installation also eliminates the need to manually add algicide to the tower as the automated system will automatically control both algae growth and "hard water" scale mineral formation. A complete description of this change is included at Attachment 1.

B. PERFORMANCE CHARACTERISTICS

There were no changes to the performance characteristics of the core during 2004. All fuel, chambers, and the core experiment tube (CET) remained in place for operations throughout the year.

C. ADMINISTRATIVE PROCEDURES

There were no changes to Administrative Procedures during the year.

D. OPERATIONAL PROCEDURES

Operational Procedure 8, Tab H - Weekly Operational Instrument Checklist, was changed to add a requirement to check the new monitoring and treatment system for malfunctions in conjunction with the design change discussed above.

E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS

All maintenance and surveillance tasks during 2004 were accomplished on time.

Malfunctions are detailed in Section IV, Safety-Related Corrective Maintenance.

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SECTION II

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

Month	Kilowatt Hours
JAN	37.5
FEB	2.0
MAR	486.1
APR	309.8
MAY	672.7
JUN	374.5
JUL	14.0
AUG	1508.4
SEP	415.9
OCT	442.7
NOV	71.5
DEC	636.9
TOTAL	4972.0

Total energy generated in 2004: 4,972.0 kWh

Total energy on fuel elements: 997,825.9 kWh

Total energy on FFCRs*: 265,028.2 kWh

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

Total pulses on fuel elements $\geq$ $2.00: 4,216

Total pulses on FFCRs* $\geq$ $2.00: 104

Total pulses this year: 68

Total pulses on fuel elements: 11,896

Total pulses on FFCRs*: 2,131

*Fuel-follower control rods

SECTION VI

Summary of Radioactive Effluent Released

A. Liquid Waste: The reactor produced no liquid waste during 2004.

B. Gaseous Waste: There were no particulate discharges in 2004.

The total activity of Argon-41 discharged in 2004 was 0.59 curies. The estimated effluent concentration from the release of Argon-41 was below the constraint limit for unrestricted areas (Table 2 of Appendix B of 10 CFR 20).

Quarterly:	Jan - Mar 2004	0.011 Ci
	Apr - Jun 2004	0.339 Ci
	Jul - Sep 2004	0.157 Ci
	Oct - Dec 2004	0.081 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 reported 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 2004, was 0.02 mRem at the location of maximum public exposure. The maximum exposure is calculated at a location 91 meters from the release point. Exposure to the general population at the boundary of the National Naval Medical Center 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 0.2% of the 10 millirem constraint limit, or 0.02 millirem for the entire year.

The reactor in-plant surveys, specified in HPP 3-2, were less than the action levels specified in HPP 0-2.

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
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January 3, 2005

U.S. Nuclear Regulatory Commission
ATTN: Pat Isaac, NRR/DRIP/RNRP
Mail Stop 12-G13
Washington, DC 20555-0001

Sir:

On December 14, 2004, an instrument malfunction occurred at the AFRRI reactor (License R-84, Docket 50-170) that is reportable under Sections 1.21.b and 6.5.2 of the reactor Technical Specifications and 10 CFR 50.72. This malfunction has previously been reported to you telephonically as required by Section 6.5.2 of the Technical Specifications.

On that date, an operator trainee was operating the reactor console as part of a licensing examination being administered by an NRC examiner. A licensed senior reactor operator was present in the control room at the same time. The trainee performed several power level changes and made appropriate entries in the reactor operations logbook. After the examination ended, the licensed SRO who had been in the control room reviewed the logbook for completeness. During that review, he noticed that the recorded readings for fuel temperature safety channel #1 were significantly lower than expected for the power levels involved. The Reactor Facility Director was informed and the reactor was declared non-operational until the cause of the low fuel temperatures could be determined. The recorded readings for fuel temperature safety channel #2 and a third instrumented element providing a signal to a chart recorder were as expected at the 900 KW power level. The required electronic checks of the fuel temperature scrams (TS Section 4.2.3.a) and the required weekly fuel temperature channel test (TS Section 4.2.3.c) had been successfully performed shortly before the console examination.

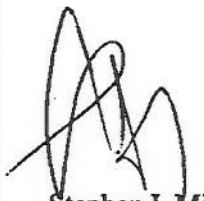
The next day, fuel temperature safety channel #1 was again electronically checked. This check involved all channel components from the reactor core support carriage through the reactor console, excluding the thermocouple. All electronic and wiring components functioned normally. The channel scram function and set point were tested and found to be operational and correctly calibrated. This testing indicated that the problem was most likely caused by a failed thermocouple within the B-ring instrumented fuel element. That element was replaced by an element from storage. The reactor was then stabilized at several different power levels, through 900 KW, and the temperature readings were correct at all tested power levels. At that point, the Reactor Facility Director agreed that both fuel temperature safety channels were functioning correctly, and the reactor was returned to operational status.

During some part of the trainee's licensing examination, the reactor was apparently operated with only one operable fuel temperature safety channel. This is a violation of Technical Specifications Section 3.2.1 that requires two operable fuel temperature safety channels for operations. The 600°C scram set point on both fuel temperature channels remained operational, so there was no violation of TS Section 3.2.2. During the incident, the reactor power never exceeded the demand power of 900 KW. At that power level, based on over 40 years of operational records, fuel temperature in both channels remains less than 400°C. During the run in question, this was confirmed by both the C-ring instrumented fuel element (safety channel #2) and by a third instrumented element providing a signal to a chart recorder that provides a written record. There is no possibility that fuel temperature anywhere in the core exceeded either the 600°C Limiting Safety System Setting (TS Section 2.2) or the 1000°C Safety Limit (TS Section 2.1).

To prevent any future use of the defective instrumented fuel element, the thermocouple connectors have been removed and the inventory record for that element has been annotated to highlight the inoperable thermocouple.

The point of contact concerning this incident is the undersigned at (301) 295-9245 or 1290.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 3, 2005.



Stephen I. Miller
Reactor Facility Director