TECH SPECS
50-170, R-84

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
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March 30, 2012

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

Sir:

Enclosed is the 2011 Annual Operating Report required by the technical specifications for the Armed Forces Radiobiology Research Institute reactor (license R-84, docket 50-170).

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

STEPHEN I. MILLER
Reactor Facility Director

Enclosure:
as

cc:
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NRR

Armed Forces Radiobiology Research Institute
AFRRI TRIGA Reactor Facility

1 January 2011 - 31 December 2011

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
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Reactor Operations Supervisor

Submitted by
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Reactor Facility Director

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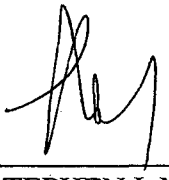
Submission of 2011 Annual Report

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



MAR 30 2012

STEPHEN I. MILLER — Date
Reactor Facility Director

2011 ANNUAL REPORT

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2011 ANNUAL REPORT

INTRODUCTION

The Armed Forces Radiobiology Research Institute (AFRRI) reactor facility was available for irradiation services for most of the year, except for several nonoperational periods totaling approximately three months during the annual reactor maintenance shutdown, repairs to the fuel temperature monitoring system, and replacement of the failed transient control rod. Each of these issues will be discussed in further detail in Section IV.

There were no major reactor modifications or projects during the year. There was one unscheduled shutdown during 2011.

The 2011 annual reactor audit required by the reactor technical specifications was conducted by Mr. Frank Sage in December 2011. Mr. Sage is a senior reactor operator at the U.S. Army White Sands Missile Range fast burst 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. Greg Schoenebeck during April 2011. While he had several recommendations for improving reactor operations, no safety concerns or noncompliance with NRC requirements were identified.

There were no RRFSS membership changes during the year. There was one reactor staff arrival and one staff departure 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 AFRRI personnel (as of 31 December 2011) are as follows:

1. AFRRI Director – Mark A. Melanson, COL, USA

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

   Radiation Safety Officer - Anna M. J. Teachout

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

3. Reactor operations personnel:

   Reactor Operations Supervisor - Harry H. Spence (SRO)

   SRO Training Coordinator - Harry H. Spence (SRO)

   Maintenance Specialist - Walter D. Tomlinson (SRO)

   Records Administration Specialist - Harry H. Spence (SRO)

4. Other Senior Reactor Operators:
   Ian Gifford (as of 15 February)
   Todd Hathaway, MAJ, USA (as of 03 February)

5. Operator candidates:
   Nichole Gillespie, SSG, USA (as of 10 June)
   Joseph Hughes, SFC, USA (through 21 October)
   Ralph Marro, CDR, USN (as of 31 October)

6. Newly licensed operators:
   Ian Gifford (as of 15 February)
   Todd Hathaway, MAJ, USA (as of 03 February)

7. Additions to staff during 2011:
   Nichole Gillespie, SSG, USA (as of 10 June)

8. Departures during 2011:
   Joseph Hughes, SFC, USA (as of 21 October)

9. There were no changes to the Reactor and Radiation Facilities Safety Subcommittee (RRFSS) during 2011.

   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 2011.

Regular members are:
Radiation Safety Officer - Anna M. J. Teachout
Reactor Facility Director and Facility Radiation Manager - Stephen I. Miller
Reactor Operations Specialist - Dr. Seymour Weiss
Health Physics Specialist - Joe Pawlovich

Chairman and Director's Representative - Dr. Christopher Lissner

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

Recorder - Harry H. Spence

Two meetings were held in 2011:

16 June

14 December

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 no design changes to the reactor facility during 2011.

B. PERFORMANCE CHARACTERISTICS

There were several changes to the performance characteristics of the core during 2011. In April, following the mechanical failure of an air-followed transient rod, that rod was replaced with a poison-followed rod. Because of the reactivity worth differences between the two rods, the core experiment tube (CET) was removed from the core and replaced by a standard fuel element. Two formerly empty fuel element positions in the F-ring were also filled with standard fuel elements. All positions in the core are now filled with fuel elements and control rods. Following these changes, the reactivity worth of all control rods was remeasured. All other fuel elements and control rods remained in place for operations throughout the year.

C. ADMINISTRATIVE PROCEDURES

There were no changes to the Administrative Procedures during 2011. The Routine Reactor Authorizations were revised and approved by the RRFSS during their June meeting.

D. OPERATIONAL PROCEDURES

There were no changes to the Operational Procedures during 2011.

E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS

All maintenance and surveillance tasks during 2011 were accomplished as normally scheduled during the year except several TS-required calibration tasks normally completed during the annual reactor maintenance shutdown. These tasks could not be completed on time because of ongoing repairs to the fuel temperature monitoring system (see Section IV). No routine reactor operations will be conducted until this issue is resolved and all required calibrations are performed.

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

The 2011 annual reactor audit required by the reactor technical specifications was conducted

by Mr. Frank Sage in December 2011. Mr. Sage is a senior reactor operator at the U.S. Army White Sands Missile Range fast burst 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. Greg Schoenebeck during April 2011. 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	340.2
FEB	455.5
MAR	8197.3
APR	2713.3
MAY	2858.8
JUN	1215.2
JUL	1462.7
AUG	217.8
SEP	125.1
OCT	226.9
NOV	0.0
DEC	0.0
TOTAL	17812.8

Total energy generated in 2011: 17,812.8 kWh

Total energy on fuel elements: 1,133,118.1 kWh

Total energy on FFCRs*: 400,320.4 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: 21

Total pulses on fuel elements: 12,157

Total pulses on FFCRs*: 2,392

*Fuel-followed control rods

SECTION III

Unscheduled Shutdowns

There was one unscheduled shutdown during 2011 associated with the ion chamber failure on 14 June.

SECTION IV

Safety-Related Corrective Maintenance

Following are excerpts from the malfunction logbook during the reporting period. The reason for the corrective actions taken, as in all cases, was to return the equipment to its proper operational status.

07 January 2011 – During annual calibration of the continuous air monitors, the hall alarm panel audible alarm did not function correctly. The visual alarm did function correctly. The "horn off" bypass switch was found to be broken and was replaced. The system was then tested and operated correctly. The bypass switch is only used during system testing, and the audible alarm would have functioned as designed during an emergency.

06 April 2011 – Symptoms: While withdrawing control rods to bring the reactor critical at a power level of 900 kW, the operator observed that the indicated power level was not increasing as expected. The console indicated that the control rods were withdrawn to positions normal for 900 kW, but the reactor period, fuel temperatures, and radiation readings did not correlate to the indicated rod positions. All power-level monitoring channels indicated a true power level less than 1 kW. The operator scrammed the reactor and notified the RFD.

Inspection of the core revealed that the bottom of the connecting rod on the transient rod drive was wedged against the top of the transient rod guide tube. The top fitting of the transient rod was attached to the connecting rod, but the transient rod itself remained fully inserted in the core. Sufficient fuel was removed to allow removal and inspection of the transient rod while maintaining the minimum $0.50 shutdown margin required by the Technical Specifications.

The transient rod drive was disassembled to remove the connecting rod and top fitting. The broken transient rod was removed from its guide tube and placed in a sealed container in the reactor pool. Both air monitors in the reactor room and reactor pool water samples showed no evidence of radioactive material release during the event. Inspection of the broken transient rod determined that a Magnaform seal had separated at the rod's top fitting. The active borated graphite control rod material was not exposed to water.

Solution: The broken air-followed transient control rod was replaced with a poison-followed rod. The replacement rod was tested in manual, automatic, and pulse modes of operation. The reactivity worths of all control rods were remeasured and other changes were made to the core loading as described in Section I.B. above. The reactor was then returned to normal operation.

14 June 2011 – Symptoms: During safety channel calibration following replacement of the transient control rod, the NPP channel (Safety 2) scrammed while indicating only 94-96% power on the console. The true power was 1.0 MW as shown on the calibrated operational channel. The RFD was notified. Testing of the channel circuitry determined that the ion channel providing input to the channel circuitry had failed. Normal operations were suspended pending installation of a new chamber.

Solution: On 28 July, following consultation with General Atomics, the failed ion chamber was replaced with a fission chamber having similar response characteristics. The NPP channel was calibrated using the same approved procedure as was formerly used for the ion chamber and the reactor was returned to regular service (see Section V.A.).

21 September 2011 – Symptoms: While performing a Weekly Operational Instrument Checklist with the reactor shutdown, the operator noticed that all fuel temperature measuring channels on the console were reading negative temperatures. The RFD was notified and all normal operations were suspended. Testing revealed that the AIO-16 signal conditioning board in the data acquisition computer system had failed.

Solution: On 29 September, a replacement AIO-16 board was installed and calibrated. All associated scram setpoints and reactor interlocks were tested and operated normally. Normal reactor operations were resumed.

08 November 2011 – Symptoms: The AIO-16 board installed on 29 September failed during calibration as part of the annual reactor maintenance shutdown. The RFD was notified and all regular operations were suspended pending installation and testing of a replacement board. The reactor remained nonoperational for the remainder of 2011 because of difficulties obtaining both the replacement parts and technical installation support necessary from General Atomics.

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

There was one facility change as described in the FSAR during the year. The failed ion chamber in Safety Channel 2 (see Section IV) was replaced by a fission chamber after a 10 CFR 50.59 analysis. This modification required a change to Section 4.11.3 of the FSAR which lists the types of detectors that may be used as part of the safety channels.

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 was one safety evaluation for changes not submitted to the NRC, pursuant to the provisions of 10 CFR 50.59 (see Section V.A. above).

SECTION VI

Summary of Radioactive Effluent Released

A. Liquid Waste: The reactor produced no liquid waste during 2011.

B. Gaseous Waste: There were no particulate discharges in 2011.

The total activity of Argon-41 discharged in 2011 was 6.21 curies. The estimated effluent concentration from the release of Argon-41 represents 2% of the constraint limit for unrestricted areas (10 CFR 20.1101(d) and Table 2, Appendix B, 10 CFR 20).

Quarterly:	Jan - Mar 2011	3.55 Ci
	Apr - Jun 2011	2.42 Ci
	Jul - Sep 2011	0.14 Ci
	Oct - Dec 2011	0.10 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 2011, was 0.2 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 0.2 millirem, or 2% 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.