ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
6801 WISCONSIN AVENUE
BETHESDA, MARYLAND 20889-5603

March 29, 2010

U.S. Nuclear Regulatory Commission
ATTN: Al Adams, NRR/DPR/PRTA
Mail Stop 12-D3
Washington, DC 20555-0001

Dear Mr. Adams:

Enclosed is the 2009 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 stated

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

A020
NRR

Armed Forces Radiobiology Research Institute
AFRRI TRIGA Reactor Facility

1 January 2009 - 31 December 2009

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
Telephone: (301) 295-1290

Submission of 2009 Annual Report

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

MAR 29 2010

STEPHEN I. MILLER
Reactor Facility Director

Date

2009 ANNUAL REPORT

TABLE OF CONTENTS

Introduction

General Information

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

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

Section III
Unscheduled Shutdowns

Section IV
Safety-Related Corrective Maintenance

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

Section VI
Summary of Radioactive Effluent Released

Section VII
Environmental Radiological Surveys

Section VIII
Exposures Greater Than 25% of 10 CFR 20 Limits

2009 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 two months during the annual reactor maintenance shutdown.

There were no major reactor modifications or projects during the year. There were no unplanned shutdowns during 2009. Reports required by the reactor technical specifications were submitted, and the details are found in Section IV.

The 2009 annual reactor audit required by the reactor technical specifications was conducted by Mr. Frank Sage in December 2009. Mr. Sage is a senior reactor leader at the U. S. Army White Sands Missile Range fast burst reactor. 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. Patrick Isaac during January 2009. While he had several recommendations for improving reactor operations, no safety concerns or noncompliance with NRC requirements were identified. Mr. Isaac also conducted a security inspection of the AFRRI reactor in September 2009 and identified no issues of noncompliance.

There were no RRFSS membership changes during the year. There were three reactor staff arrivals 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 2009) are as follows:

1. AFRRI Director - Patricia Lillis-Hearne, COL, USA

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

   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)

   ERT Training Coordinator - Kelly L. Baldwin, MSG, USA (SRO) (through 10 August)
   Michelle C. Desouza, SFC, USA (SRO) (effective 11 August)

   Maintenance Specialist - Walter D. Tomlinson (SRO)

   Records Administration Specialist - Harry H. Spence (SRO)

4. Other Senior Reactor Operators - None

5. Operator candidates:
   Ian Gifford (effective 18 May)
   Todd Hathaway, MAJ, USA (effective 08 June)
   Joseph Hughes, SFC, USA (effective 10 August)

6. Newly licensed operators:
   None

7. Additions to staff during 2009:
   Ian Gifford (effective 18 May)
   Todd Hathaway, MAJ, USA (effective 08 June)
   Joseph Hughes, SFC, USA (effective 10 August)

8. Departures during 2009:
   Kelly L. Baldwin, SFC, USA (SRO through 10 August)

9. There were no changes to the Reactor and Radiation Facilities Safety Subcommittee (RRFSS) during 2009.

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 2009.

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 2009:

15 September

08 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 was one design change to the reactor facility during 2009. The original obsolete AC motor on the transient rod drive was replaced with a DC motor having similar operational characteristics. The modification was analyzed under provisions of 10 CFR 50.59 and was found to have no safety implications.

B. PERFORMANCE CHARACTERISTICS

There were no changes to the performance characteristics of the core during 2009. All fuel, chambers, and the core experiment tube (CET) remained in place for operations throughout the year. In December, a new instrumented fuel element was placed in the F-ring, replacing a standard fuel element. The thermocouples in this new element are not being used in reactor instrumentation. The element was installed to verify both the structural integrity of the element and the correct operation of the thermocouples under operational power conditions.

C. ADMINISTRATIVE PROCEDURES

There were no changes to the Administrative Procedures during the year.

D. OPERATIONAL PROCEDURES

There were several changes to the Operational Procedures during the year involving changes to reactor Startup, Safety, and Weekly Operational Checklists. Changes were also necessary to other Calibration and Operational Procedures due to the upgrading of the reactor stack gas monitor (SGM). The specific changes are detailed in the attachment to this report.

E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS

All maintenance and surveillance tasks during 2009 were accomplished as normally scheduled during the year.

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

The 2009 annual reactor audit required by the reactor technical specifications was conducted by Mr. Frank Sage in December 2009. Mr. Sage is a senior reactor leader at the U. S. Army White Sands Missile Range fast burst reactor. 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. Patrick Isaac during January 2009. While he had several recommendations for improving reactor operations, no safety concerns or noncompliance with NRC requirements were identified. Mr. Isaac also conducted a security inspection of the AFRRI reactor in September 2009 and identified no issues of noncompliance.

SECTION II

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

Month	Kilowatt Hours
JAN	1343.5
FEB	21734.3
MAR	35946.9
APR	3237.9
MAY	147.0
JUN	107.1
JUL	128.6
AUG	33.2
SEP	150.7
OCT	25.2
NOV	550.2
DEC	1736.8
TOTAL	65141.4

Total energy generated in 2009: 65,141.4 kWh

Total energy on fuel elements: 1,081,098.6 kWh

Total energy on FFCRs*: 348,300.9 kWh

Total pulses this year ≥ $2.00: 1

Total pulses on fuel elements ≥ $2.00: 4,219

Total pulses on FFCRs* ≥ $2.00: 107

Total pulses this year: 45

Total pulses on fuel elements: 12,095

Total pulses on FFCRs*: 2,330

*Fuel-follower control rods

SECTION III

Unscheduled Shutdowns

There were no unscheduled shutdowns during 2009.

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.

16 March 2009 - During a reactor operation, the readings from fuel temperature channel #1 were fluctuating. Under direction of the RFD, the failed element was replaced with a spare instrumented element from pool storage. The incident was immediately reported to the NRC Operations Center. Upon further testing, it was determined that the channel was still able to perform its intended safety function. Nonetheless, the thermocouple was permanently taken out of service as a precautionary measure. While performing testing of the new instrumented element, the NP power-monitoring channel unit also failed and was replaced with a calibrated spare unit. All systems were tested and returned to service once their calibrations were verified.

07 August 2009 - While preparing for a pulse operation, the transient rod anvil would not raise. The cause of the malfunction could not be immediately determined. The RFD was notified and the reactor was declared non-operational pending testing and repair. During system testing, the transient rod drive motor was determined to be shorted. The AC motor was replaced with a DC motor, the system was tested, and a rod drop time test was performed. The system operated normally and the reactor was returned to service. (Section I.A. above)

09 September 2009 - The reactor and health physics staffs were unable to calibrate the stack gas monitor electronics module within the required tolerance. The RFD was notified and the reactor was declared non-operational until the SGM could be repaired. Since repair parts for the existing NMC system were no longer available, a replacement Ludlum system was procured. The new system was configured to have the same readouts and alarms as the old system. The new system was reviewed under the provisions of 10 CFR 50.59, calibrated, and tested. The reactor was then returned to service. (Section I.D. above and Attachment)

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 were no facility changes as described in the FSAR during the year. There was one facility change as described in Section I.A. above, but the motor involved is not described in the FSAR.

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 several safety evaluation for changes not submitted to the NRC, pursuant to the provisions of 10 CFR 50.59. These modifications were described and qualified using Administrative Procedure A3 - Facility Modification. This procedure uses a step-by-step process to document that the criteria in 10 CFR 50.59(c)(2) were not met and that technical specification changes were not required prior to implementation. (See Attachment)

SECTION VI

Summary of Radioactive Effluent Released

A. Liquid Waste: The reactor produced no liquid waste during 2009.

B. Gaseous Waste: There were no particulate discharges in 2009.

The total activity of Argon-41 discharged in 2009 was 49.92 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 2009	47.70 Ci
	Apr - Jun 2009	1.32 Ci
	Jul - Sep 2009	0.13 Ci
	Oct - Dec 2009	0.77 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 2009, was 1.6 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 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 16% of the 10 millirem constraint limit, or 1.6 millirem 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.

ATTACHMENT

Facility Modification Worksheet 1

10 CFR 50.59 Analysis

Proposed Change: Replacement of stack gas monitor (SGM) with an equivalent NaI scintillation detection system.

Submitted by: JAN GIFFARD Date SEP 09 2009

1. Description of change:

This modification refers to the replacement of the previous SGM NaI scintillation detection system (NMC) with a comparable NaI gamma scintillator and digital detector (Ludlum Model 44-10 and 375).

2. Reason for change:

The previous NaI scintillation detection system was no longer operational and needed to be replaced. The Ludlum 44-10 gamma scintillator provides equivalent surveillance of radiation release through the stack gas.

3. Verify that the proposed change does not involve a change to the Technical Specifications or meet any of the criteria in 10 CFR 50.59(c)(2). Attach an analysis to show this.

Analysis attached? Yes X

4. The proposed modification constitutes a change in the facility or an operational procedure as described in the FSAR. Describe which (check all that apply).

Procedure ____ Facility ____

Procedures are changed, but none described in the FSAR.

Facility Modification Worksheet 1 (cont.)

5. Specify what sections of the FSAR are applicable. In general terms describe the necessary updates to the FSAR. Note that this description need not contain the final FSAR wording.

The modification does not require a change in FSAR sections 3.6.3 or 3.6.3.2. The replacement SGM fits the description within the FSAR, including the initiation of all visual and audible alarms. The channel checks, tests, and calibrations are all performed at the same intervals outlined in the FSAR.

6. For facility modifications, specify what testing is to be performed to assure that the systems involved operate in accordance with their design intent.

The replacement NaI gamma scintillator (Ludlum 44-10 and 375) will be calibrated in accordance with Health Physics Division (HPD) procedures. All required audible and visual alarms will be tested.

Facility Modification Worksheet 1 (cont.)

7. Specify associated information.

New drawings are: Attached _____

Not required __X__

Does a drawing need to be sent to Logistics? Yes _____ No __X__

Are training materials affected? Yes __X__ No _____

Will any Logs have to be changed? Yes _____ No __X__

Are other procedures affected? Yes __X__ No _____

List of items affected:

- Calibration Procedure C006 Stack Gas Monitor Calibration
- Operational Procedure 8, TAB B Daily Operational Startup Checklist
- Operational Procedure 8, TAB B1 Daily Safety Checklist
- Operational Procedure 8, TAB H Weekly Operational Instrument Checklist
- Operational Procedure 10 Stack Gas Monitor Procedure
- Reactor staff training on all new Instruments and procedures

8. Create an Action Sheet containing a list of associated work specified in item # 7, attach a copy, and submit another to the RFD (modification of drawings must be approved by the RFD).

Action Sheet: Submitted __X__ Not Required _____

Reviewed and approved by RFD _____ Date SEP 09 2009

RRFSS Concurrence _____ Date DEC 08 2009

Technical Specifications Analysis

The relevant sections for this modification are found in section 3.5 Radiation-Monitoring System and Effluents (Limiting Conditions for Operations) and 4.5 Radiation Monitoring Sytem (Surveillance Requirements). As stated in part 3.5.1 Monitoring System, the reactor shall not be operated unless "the gas stack monitor (GSM) will sample and measure the gaseous effluent in the building exhaust system". This modification replaces the current NaI scintillation detection system with a comparable NaI gamma scintillator that measures the gaseous effluent in the building exhaust system. This new system will be in place and operational whenever the reactor is in operation and does not differ in performance from the previous setup. Section 4.5 states that a quarterly channel test, daily channel check, and annual channel calibration must be completed. These intervals will remain unchanged.

10 CFR 50.59(c)(2) Analysis

(i) The modification does not influence the frequency of an accident occurrence as evaluated in the FSAR. The SGM is used to monitor Ar-41 release from the gas stack and the Ludlum 44-10 will perform the same function as the previous scintillation detection system.

(ii) The modification has no impact on the probability of malfunction of a structure, system, or component (SSC) important to safety. The reliability of the replacement air monitor has been established.

(iii) The consequences of accidents evaluated in the FSAR are not impacted by this modification. The SGM initiates an alarm when radiation levels are high in the gas stack, which will be accomplished by the replacement detector as well.

(iv) The consequences of a malfunction of an SSC are not impacted by this modification. The consequences of malfunction of the replacement system remain unchanged.

(v) The type of accident that would result from a SGM system detector malfunction is not dependent on the system used.

(vi) This modification does not impact the evaluated results of a SSC malfunction.

(vii) The modification does not impact a design basis limit for a fission product barrier as described in the FSAR.

(viii) The modification does not result in a departure from a method of evaluation described in the FSAR used in establishing the design bases or in the safety analysis.

Action Sheet for New Stack Gas Monitor System

1. Revision of Calibration Procedure C006, Operational Procedure 10, and Operational Procedure 8, Tabs B, B1, and H ..... SEP 11 2009

2. Reactor staff training on revised Operational and Calibration Procedures ..... OCT 0 6 2009

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Change Operational Procedure 10 to check SGM pump off alarm.

Modification to: Procedure XX Facility

Submitted by: Spence Date 12 Jan 09

1.Description of change:

See attached.

2. Verify that the proposed change does not involve a change to the Technical Specifications, the facility as described in the FSAR, or procedures as described in the FSAR. See attached.

3. If change involves a facility modification, attach a drawing if appropriate. If structural facility drawings need updating, modification of drawings must be approved by RFD and forward a copy of changes necessary to Logistics.

N/A

4. Determine what other procedures, logs, or training material may be affected and record below. None

5. List of associated drawings, procedures, logs, or other materials to be changed:

None

6. Create an Action Sheet containing the list of associated work specified above, attach a copy, and submit it to the RFD.

Action Sheet: Submitted Not Required X

Reviewed and approved by RFD Date JAN 12 2009

RRFSS Notified Date SEP 15 2009

10 CFR 50.59 analysis for administrative change to Operational Procedure 10

1. Description of change:

Operational Procedures 10 is revised to add a confirmation that the "stack gas pump off alarm" is functional (Subparagraph F). This visual alarm has previously been checked monthly when the pump was turned off to check the oil level. During a review of all procedures, the staff decided that the alarm should be checked each day before operations since the Technical Specifications require the stack gas monitor (SGM) to be operational during all reactor operations.

2. Reason for change:

Update reactor procedure because of reactor staff procedure reviews.

3. Verify that the proposed changes do not involve a change to the Technical Specifications or meet any of the criteria in 10 CFR 50.59(c)(2):

This change is purely conforming in nature. It does not require any changes to the Technical Specifications. The change does not increase the likelihood or consequences of a malfunction and do not create the possibility of a malfunction or accident of a different type than previously evaluated. This SGM pump alarm change decreases the possibility that the reactor might be operated with the SGM inoperative. The proposed change also does not involve a change to either the facility or procedures described in the FSAR.