

March 26, 2009

Colonel Patricia Lillis-Hearne, Director  
Armed Forces Radiobiology  
Research Institute  
National Naval Medical Center  
8901 Wisconsin Avenue  
Bethesda, MD 20889-5603

SUBJECT: ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE - NRC ROUTINE,  
ANNOUNCED INSPECTION REPORT NO. 50-170/2009-201

Dear Colonel Lillis-Hearne:

On February 23-27, 2009, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an announced inspection at the Armed Forces Radiobiology Research Institute Research Reactor Facility (Inspection Report No. 50-170/2009-201. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. Based on the results of this inspection, no safety concern or noncompliance with NRC requirements was identified. However, one inspector follow-up item from a previous inspection was discussed and closed. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390 of the NRC's "Public inspections, exemptions, requests for withholding," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

P. Lillis-Hearne

- 2 -

Should you have any questions concerning this inspection, please contact Patrick J. Isaac at 301-415-1019.

Sincerely,

**/RA/**

Johnny H. Eads, Chief  
Research and Test Reactors Branch B  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-170  
License No. R-84

Enclosure:  
As stated

cc w/encl: See next page

Armed Forces Radiobiology Research Institute

Docket No. 50-170

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P. Lillis-Hearne

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U. S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-170

License No: R-84

Report No: 50-170/2009-201

Licensee: Armed Forces Radiobiology Research Institute

Facility: AFRRRI Reactor Facility

Location: Bethesda, MD

Dates: January 23-27, 2009

Inspector: Patrick J. Isaac, Lead

Accompanied by: Gregory Schoenebeck

Approved by: Johnny H. Eads, Chief  
Research and Test Reactors Branch B  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

Armed Forces Radiobiology Research Institute  
AFRRI Research Reactor Facility  
NRC Inspection Report No. 50-170/2009-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Armed Forces Radiobiology Research Institute (AFRRI, the licensee) Class II research reactor facility safety programs including procedures; experiments; Health physics; design changes; committees, audits and reviews; transportation; and follow-up on previously identified items since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

### Procedures

- The inspector found that appropriate procedures were in effect, being followed, and being updated as necessary.

### Experiments

- Conduct and control of experiments met the requirements of regulations, the AFRRI Technical Specifications (TSs), and the applicable facility procedures.

### Health Physics

- The radiation protection program was effective in minimizing radiation doses to individuals. Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory limits.

### Design Changes

- No new changes, tests, or experiments subject to Title 10 of the *Code of Federal Regulations* Part 50.59 reporting were performed since the previous inspection.

### Committees, Audits and Reviews

- The Reactor and Radiation Facilities Safety Subcommittee provided the oversight required by the TS.

### Transportation

- The program for transportation of radioactive materials satisfied NRC requirements.

### Follow-up of Previously Identified Items

- Inspector Follow-up Item 50-170/2007-201-01 (IFI) concerning the chain of command from the Radiation Protection Officer to the AFRRI Director was closed.

## REPORT DETAILS

### Summary of Facility Status

The Armed Forces Radiobiology Research Institute (AFRRI, the licensee) one megawatt Training Research Isotope Production General Atomics (TRIGA) Mark II research reactor located on the campus of the National Naval Medical Center (NNMC) is operated in support of the Institute's mission of research, experiments, education, reactor operator training and periodic equipment surveillance. During the inspection, the research and test reactor (RTR) was started up, operated, and shutdown as required and in accordance with applicable procedures to support these ongoing activities.

#### 1. Procedures

##### a. Inspection Scope (IP 69001-02.03)

The inspector reviewed the following to ensure that the requirements of TS Section 6.3, Operating Procedures, were being met concerning written procedures:

- AFRRI Operational Procedure 0, Writing and Modifying Procedures, February 11, 1999
- AFRRI Operational Procedure 1 – Conduct of Experiments, March 4, 1996
- AFRRI Operational Procedure 1, TAB A, Reactor Exposure Room Entry. June 29, 2000
- AFRRI Administrative Procedure A2, Personnel Passage Through The Prep Area, September 18, 2008
- AFRRI Administrative Procedure A3, Facility Modifications, February 26, 2001
- AFRRI Administrative Procedure A5, Evaluation and Reporting of Defects, March 4, 1994

##### b. Observations and Findings

The inspector reviewed administrative procedural changes implemented as a result of building renovations, equipment upgrades, and AFRRI policy changes. The inspector reviewed the licensee's written procedures and revisions to procedures. The Procedures Manual was organized to address the specific categories of procedures identified in Technical Specifications (TS) Section 6.3, Procedures.

The inspectors determined that written procedures were available for the activities delineated in TS Section 6.3 and were approved by the RRFSS before they were implemented. The clarity and detail in the procedures was acceptable. AFRRI Reactor Facility staff conducted TS activities in accordance with applicable procedures. A cover sheet on each procedure documented review by the

Reactor Facility Director, the Reactor and Radiation Facility Safety Committee or Subcommittee (RRFSC or RRFSS), and each licensed reactor operator on the staff at the time the procedure modification was implemented.

c. Conclusions

The inspector found that appropriate procedures were in effect, being followed, and being updated as necessary.

**2. Experiments**

a. Inspection Scope (IP 69001-02.06)

To verify compliance with the licensee's procedures, TS Sections 3.6, Limitations on Experiments, TS Section 6.4, Review and Approval of Experiments, and 10 CFR 50.59, the inspector reviewed selected aspects of:

- Routine Reactor Authorization, No. 1 through 5, dated July 2000
- Special Reactor Authorization #1, July 2000
- Reactor Logbook Number 130, November 2, 2007 to October 21, 2008
- Reactor Logbook Number 131, October 22, 2008 to present
- AFRRRI Operational Procedure 1, Conduct of Experiments, March 4, 1996
- AFRRRI Operational Procedure 1, TAB A, Reactor Exposure Room Entry, June 29, 2000
- Reactor Utilization Request # 09-01, December 31, 2008
- Reactor Utilization Request # 09-02, January 27, 2009

b. Observations and Findings

Two new experiments had been approved and were being conducted at the time of the inspection. The Reactor Utilization Request forms noted above had been completed and contained the appropriate information, hazards analyses as applicable, and had been reviewed and approved as required by TS and procedure.

Through review of the experiment procedure, the Reactor Logbook, and interviews with staff, the inspectors verified that the experiments and irradiations were installed, constrained, and conducted as outlined in the experiment authorizations and as required by the TS.

c. Conclusions

Conduct and control of experiments met the requirements of regulations, the AFRRRI TSs, and the applicable facility procedures.

### 3. Health Physics

#### a. Inspection Scope (IP 69001-02.07)

The inspectors reviewed the following to verify compliance with 10 CFR Part 20 requirements:

- NAVMED Form 6470/3A (Rev. 4/2002) for Whole Body & Extremity
- Instruction 60558.F: Radiation Protection Program
- ALARA Reports, various 2008
- Technical Specifications of AFRRRI Reactor
- Health Physics Procedures (HPP) 7-2.D: Calibration and Channel Testing of Radiation Area Monitor
- HPP 7-5: Calibration of Gas Stock Monitor
- Report of Calibration from Armed Forces Radiobiology Research Institute Calibration Lab, various 2008
- Operational Procedure: Reactor Exposure Room Entry
- Personnel dosimetry records, various 2008
- Summary of Radwaste Discharge Liquid Radioeffluent Report for 2008
- HPP 2-1.B: Environmental TLD Program and 2008 Records
- HPP 2-2.D: Environmental Monitoring Program and 2008 Records
- HPP 2-4.A: Ar-41 Stack Effluent Verification and 2008 Records

The inspectors toured the facility to interview and observe licensee personnel and practices regarding: the use of dosimetry; radiation monitoring equipment; placement of radiological signs and postings; use of protective clothing; and practices for handling and storing radioactive material or contaminated equipment.

The inspectors observed general health physics practiced by the Radiation Protection Officer (RPO) and AFRRRI staff during practical operations of experiment retrieval and setup in an exposure room. Additionally, the inspectors toured and interviewed staff at the thermoluminescent dosimetry processing station at the Naval Hospital Bethesda.

The inspectors reviewed applicable radioactive effluent monitoring and radioeffluent discharge logs and procedures.

#### b. Observations and Findings

The inspectors reviewed records of radiological surveys performed by the RPO and staff of the Health Physics Division. The radiation surveys were performed in accordance with procedures and TS. Contamination surveys have indicated activity levels to be generally consistent with background radiation.

Facility postings and observed instrument indication by the inspectors supported the survey records. No unmarked radioactive material was found in the facility. A

copy of the current NRC Form 3 notice to radiation workers required by 10 CFR Part 19 was posted at the entrance to the Control Room and Reactor Bay and other conspicuously placed areas near laboratory work stations.

Dosimetry results were reviewed by the inspectors; AFRRRI's associated exposures are in conformance with 10CFR Part 20 and administrative limits.

The calibration records of selected devices were reviewed. Calibration tags on devices found throughout the facility were verified to be current and in accordance with the calibration records that were reviewed. The AFRRRI calibration laboratory performs the calibration their portable radiological monitoring equipment onsite with frequency consistent with TS and procedures.

The RPO is responsible for the AFRRRI radiation protection program. The program contains an As Low As Reasonably Achievable (ALARA) policy and commitment. In addition to the ALARA program stipulated in Instruction 60558.F, AFRRRI policy requires individuals who need unescorted access to areas containing sources of ionizing radiation have training conducted by RSO, regarding radiation safety and emergency procedures prior to the initiation of any work. One inspector attended the training, and determined that the information contains satisfactory radiation protection and emergency guidance.

The inspectors observed practical health physics practices with an exposure room entry (2/24/09) and a sample retrieval (2/25/09). In both instances the facility performed operations in accordance with procedures. The facility showed good ALARA practices, with the incorporation of time, distance, and shielding. Specifically, during the irradiated sample removal the facility utilized a high range teletector (i.e., a radiation monitoring device with a telescopic probe) to read radiation levels as the sample passed out of the shielded exposure room wall. With high radiation levels (i.e., > 100 mrem/hr at 3 feet), the RSO had the staff put the sample back into the exposure room for a period of time that allowed the high level activity to decay in the shielded room, in accordance with procedure. After a period time, the sample was removed once more from the exposure room, surveyed with greatly reduced radiation levels. This enabled the experimenter to handle the irradiated sample with extended tongs (which incorporates the distance concept) and place it into a shielded vessel for transport to a laboratory freezer for storage.

The licensee reported the results of several thermoluminescent dosimeters (TLDs) placed around the AFRRRI facility as environmental radiation monitors. In all cases the TLDs indicated no significant difference from background radiation levels.

The review of Ar-41 discharge through the monitored exhaust stack is below the regulatory limits of concern as specified in Appendix B of 10CFR20.

Liquid radioeffluent discharge was performed in accordance with procedures and satisfied the effluent discharge criteria for 10CFR20.

c. Conclusions

The inspectors verified that the licensee's radiation protection program was effective in minimizing radiation doses to individuals through training, notices to workers, radiation monitoring and surveys, the AFRRI dosimetry program and calibrated equipment.

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory limits.

**4. Design Changes**

a. Inspection Scope (IP 69001-02.08)

To verify compliance with the licensee's procedures, TS Section 6.2.4, Review Function, and 10 CFR 50.59, the inspector reviewed selected aspects of:

- Draft Minutes of the Reactor and Radiation Facilities Safety Subcommittee Meeting of November 5, 2008
- Minutes of the Reactor and Radiation Facilities Safety Subcommittee Meeting of May 7, 2008
- NRC Notification Number 44396, July 29, 2008
- 6055.88; Reactor Facility Modifications (2008)
- Reactor Logbook Number 130, November 2, 2007 to October 21, 2008
- Reactor Logbook Number 131, October 22, 2008 to present

b. Observations and Findings

The licensee reported that since the previous inspection there were no changes made which constituted a change reportable pursuant to 10 CFR Part 50.59. One facility modification since the previous inspection, installation of a strobe light to alert the operator when the Gas Stack Monitor (GSM) pump is turned off, was evaluated per facility procedures and determined not to reach the threshold for 50.59 reporting. The inspector concurred with this finding and verified that minor procedural changes were made pursuant to findings of the design change review process. Additional training class was held for all licensed operator. In addition, a line was added to the Operational Startup Checklist to verify that the GSM pump is operating.

c. Conclusions

No new changes, tests, or experiments subject to 10 CFR Part 50.59 reporting were performed since the previous inspection.

## 5. Committees, Audits, and Reviews

### a. Inspection Scope (IP 69001-02.09)

The inspector reviewed the following to verify compliance with the requirements of TS Section 6.2, Review and Audit - The Reactor and Radiation Facility Safety Committee:

- Charter of AFRRRI Radiation Safety Committee, September 9, 2005
- Minutes of the Reactor and Radiation Facility Safety Committee Meeting of May 7, 2008
- Draft Minutes of the Reactor and Radiation Facility Safety Committee Meeting of November 5, 2008
- AFRRRI Reactor Facility Audit Report, December 16-17, 2008

### b. Observations and Findings

The inspector verified that the RRFSC composition, meeting quorums, and meeting frequency were all in accordance with TS Section 6.2, Review and Audit. Records of meeting proceedings were well-organized and included complete sets of materials distributed at meetings. The inspector verified that review functions prescribed in TS Section 6.2.4, Review Function, were all reviewed by the committee. The inspector also verified that the audit function required by TS Section 6.2.5, Audit Function, was conducted and that the audit reports were reviewed by the RRFSC.

### c. Conclusions

The Reactor and Radiation Facility Safety Committee provided the oversight required by the TS.

## 6. Transportation

### a. Inspection Scope (IP 86740)

The inspector interviewed licensee personnel and reviewed the following records to verify whether the licensee has established and is maintaining an effective management-controlled program, to ensure radiological and nuclear safety for shipping licensed radioactive material:

- DOE/NRC Form 741, Nuclear Material Transaction Report, August 18, 2008
- Reactor Logbook Number 130, November 2, 2007 to October 21, 2008
- Reactor Logbook Number 131, October 22, 2008 to present
- Control Room Reactor Fuel Inventory Map

b. Observations and Find

The licensee reported that the only material shipment made under the R-84 license in 2008 was for new fuel. Records reviews showed that the licensee had not completed any radioactive material shipments since the last inspection.

c. Conclusions

The program for transportation of radioactive materials satisfied NRC requirements.

**7. Follow-up**

a. Inspection Scope (IP 92701)

The inspector reviewed the following to verify compliance with the staffing requirements in Technical Specifications (TS) Section 6.1, Organization.

- TS for the AFRRRI Reactor Facility, Amendment No. 24, dated June 27, 2001
- Staffing and staff qualifications
- AFRRRI Reactor Facility organization

b. Observations and Findings

Inspector Open IFI 50-170/2007-201-01 was created at the inspection conducted on February 22-28 2007 to verify that, consistent with Technical Specification 6.1, a chain of command exists from the RSO to the AFRRRI Director. AFRRRI recently hired a new RSO who reports directly to the Director of AFRRRI (the licensee). The inspector reviewed the qualifications of the new RSO and determined that the revised structure is functioning effectively and meets the intent of the TS requirement; the IFI was therefore closed.

c. Conclusions

IFI 50-170/2007-201-01 concerning the chain of command from the Radiation Safety Officer to the AFRRRI Director is closed.

**8. Exit Interview**

The inspection scope and results were summarized during an exit meeting on February 27, 2009, with members of licensee management. The inspector described the areas inspected and discussed significant inspection observations. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during the routine inspection.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee

K. Baldwin, SFC, Senior Reactor Operator  
K. Connor, HM2, Radiation Health Technician  
P. Lillis-Hearne, COL, Director, AFRRRI  
C. Lissner, Deputy Scientific Director  
J. Mercier, COL, Director, Military Medical Operations  
S. Miller, Reactor Facility Director  
M. Palmer, SFC, Environmental Health and Safety, AFRRRI Division, Technical Supervisor  
T. Pellmar, Scientific Director  
H. Spence, Reactor Operations Supervisor  
A.J. Teachout, Radiation Protection Officer

### Other Personnel

A. Sucheta, Naval Hospital Bethesda Dosimetry  
F. Torres, LT Naval Hospital Bethesda Dosimetry

## **INSPECTION PROCEDURES USED**

IP 69001	Class II Research and Test Reactors
IP 86740	Transportation
IP 92701	Follow-up

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

None

### Closed

50-170/2007-201-01	IFI	Define a chain of command from the Radiation Protection Officer to the AFRRRI Director (Licensee) consistent with Technical specification 6.1
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### Discussed

None

### **PARTIAL LIST OF ACRONYMS USED**

ADAMS	Agencywide Document Access and Management System
AFRRI	Armed Forces Radiobiology Research Institute
FR	Code of Federal Regulations
IFI	Inspector Follow-up Item
IP	Inspection Procedure
LCO	Limiting Condition for Operation
NNMC	National Naval Medical Center
NRC	Nuclear Regulatory Commission
RPO	Radiation Protection Officer
RRFSC	Reactor and Radiation Facility Safety Committee
RSC	Radiation Safety Committee
SRO	Senior Reactor Operator
TS	Technical Specifications
TRIGA	Training Research Isotope Production General Atomics