U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket/Report No. 50-170/88-04

License No. R-84

Licensee: Armed Forces Radiobiology Research Institute
Bethesda, Maryland 20014

Facility Name: Armed Forces Radiobiology Research Institute

Inspection at: Bethesda, Maryland

Dates: October 26 - 28 and November 7, 1988

Inspectors: J. H. Williams, Project Engineer
J. Gadzala, Reactor Engineer
D. T. Wallace, Operations Engineer

Reviewed by: for J. H. Williams, Project Engineer — 11/22/88 date

Approved by: J. C. Linville, Chief, Reactor Projects Section 2A, Division of Reactor Projects — 11/23/88 date

Summary Inspection on October 26-28 and November 7, 1988

Areas Inspected: Routine, unannounced inspection by three region-based inspectors (66 hours) of facility operations, organization, reviews and audits, operator requalification training, surveillance activities and allegation followup.

Results: Four apparent violations were identified associated with; (1) failure to perform safety reviews (see Sections 3.3 and 6.2), (2) inadequacy of and failure to follow procedures (see Section 5), (3) failure to monitor effluent releases (see Section 3.4), and (4) failure to adhere to the requalification training program (see Section 7). Three unresolved items are discussed related to (1) assignment of responsibilities in the absence of the Reactor Facility Director (see Section 6.3), (2) the impact of omitting information on license renewals (see Section 7), and (3) NRC review of the reactor console safety evaluation (see Section 8). Weaknesses were noted in documenting operations in enough detail to allow the reconstruction of events at a later date and timeliness of safety reviews. Operator professionalism was considered a strength as was the questioning attitude displayed by the Safety Committee

DETAILS

1. Persons Contacted

Col G. W. Irving, III	Director, AFRRI
* M. L. Moore	Chairman, Radiation Sources Department
* Maj J. R. Felty	Reactor Operations Supervisor
* Maj L. A. Alt	Radiation Sources Program Manager
* SFC W. W. Reed	Senior Reactor Operator
SFC P. Cartwright	Senior Reactor Operator
* SFC G. F. Talkington	Senior Reactor Operator
* T. J. O'Brien	Radiation Protection Officer, SHD
A. Munno	Senior Reactor Operator
W. Ting	Senior Reactor Operator
* Lt Col A. A. Elliott, Jr.	Air Force Observer
* CMSGT D. J. Bragg, Jr.	Air Force Observer

Interviews and discussions were conducted with other members of licensee staff as necessary to support inspection activity.

* Attended the exit interview on October 28, 1988.

2. Followup on Outstanding Items

2.1 (Closed) Emergency Training Program (84-01-04)

The licensee was to consider strengthening the Emergency Training Program by implementing eight suggestions. Review of this item revealed that the eight suggestions have been considered, and have been incorporated into the Emergency Training Program.

2.2 (Closed) Review and Tracking of As-Built Drawings (86-01-02)

Operators were unable to locate up to date, as-built drawings of the facility. Review of this item revealed that drawings of the facility are available to the operators. Efforts have been made by the facility to acquire more recent drawings, however these efforts have not yet resulted in a complete set of detailed and current as-built drawings.

Although drawings are available to the operators, management is expected to take the necessary steps to acquire detailed as-built drawings. This effort is being tracked under Unresolved Item 87-01-02.

2.3 (Open) Up to Date As-Built Drawings (87-01-02)

As discussed in paragraph 2.2 above, detailed current as-built drawings are not available to operators. Although several requests have been made to the site unit assigned to provide such drawings, these requests have not been answered with delivery of the requested drawings.

3. Operations Review (NRC Inspection Manual Module 40750)

3.1 Facility Tour

The inspectors examined the facility by having an operator walk through the "Daily Operational Start-up Checklist." The operator demonstrated a good knowledge of the facility. Areas were generally clean and well maintained although some debris was observed from construction activities. The inspectors examined the preventive maintenance program by checking the work done on the air compressor. Licensee records indicated that PM was performed twice in 1987 and three times in 1988. Equipment appeared to be well maintained and clearly labeled. No leaks or abnormal operation were observed. Postings as required by 10 CFR 19 were observed. No deficiencies were identified.

3.2 Reactor Operators

The inspectors observed several Reactor Operators during the course of reactor startups and pulse operations. The operators demonstrated proper control room decorum and formality. A positive attitude was conveyed. Operator professionalism is considered a strength.

3.3 Logs and Records

The following records were reviewed to evaluate operations:

Reactor Operator Log (1986 - present)
Malfunction Log (1985 - present)
Gas Stack Monitor Historical Log (1987 - present)
Reactor Console Strip Chart Record (March 1986)
Meter calibration records

A general weakness was noted in recording adequate details for non-routine events to allow reconstruction of the events. An example was the March 6, 1986 failure of the linear channel pen during a reactor startup. When this event was discussed, the licensee stated that during this startup, a digital voltmeter was used in the neutron monitoring circuit in lieu of the failed pen. The inspector found that a safety evaluation had not been performed to analyze the use of this digital voltmeter in the linear channel. This is an apparent violation of 10 CFR 50.59 (88-04-01). The digital voltmeter, which appears to be commonly used, was also found to be out of calibration since August 30, 1988.

Additional examples of inadequate documentation include the various Gas Stack Monitor failures described in sections 3.4 and 5, Operator Log entries for installation of the various neutron detectors, and placing equipment required by Technical Specifications to be operating, out of service (section 5).

3.4 Effluent Monitoring

During a review of the Gas Stack Monitor (GSM) Historical Log, the inspector noted that there was no hourly report printout from the GSM for August 1, 1988, to document effluent samples for that day's operations. The morning checklist which directs checking the GSM was completed at 6:36 a.m., but the morning 1 minute printout from the GSM is dated 01/01/061 at 02:02 which indicates a malfunction. The Operator's Log showed that nine reactor operations occurred that day during the period from 6:46 a.m. to 3:20 p.m.

Cognizant operators stated that upon completing operations, the GSM electronics were found to have malfunctioned, neither measuring nor storing effluent data. No log entry or other record was made to note this. This is an apparent violation of Technical Specification 3.5.1 (b) which requires that gaseous effluents be sampled and measured during reactor operations (88-04-02). In addition Technical Specification 1.21 (b) requires that any violation of a Limiting Condition for Operation (LCO) be reported to the NRC and this was not done. Section 5 contains additional information regarding this event.

Although environmental monitoring dosimeters had not yet been read following this event, a backup system to the GSM was in operation during this period. That system, the Reactor Deck Continuous Air Monitor System, is also required by Technical Specifications and would have provided a warning of any unusual effluent releases.

4. Surveillance Activities

The following surveillance requirements were selected from the Technical Specifications for review:

Description	Frequency
Control rod worth (4.1)	Annual
Control rod visual inspection (4.1)	Annual
Clean/inspect pulse rod drive (4.1)	Semiannual
Measure delta k/k at 100 kW and 1 MW (4.1)	Annual
Measure control rod drop time (4.2.1)	Semiannual
Power level channel calibration (4.2.2)	Annual
Fuel temperature channel calibration (4.2.3)	Annual
Shield door/plug/dolly interlock check (4.2.4)	Annual
Fuel element inspection (4.2.5)	Annual/500 pulses
Measure water conductivity (4.3)	Weekly
Check ventilation damper mecharism (4.4)	Monthly
Channel test radiation monitoring system (4.5)	Quarterly
Calibrate radiation monitoring system (4.5)	Annual

The inspector verified that the selected surveillance items had been completed as required. The licensee uses a compact folder containing index cards to document surveillance items and specify procedures to be used. The file cards have clearly labeled tabs and are cross referenced for ease of access.

No deficiencies were identified.

5. Procedures

The inspector reviewed Reactor Operations Procedures I through VIII. Deficiencies were identified in the adminstration of procedures and sufficient instances of failure to follow procedures were found to indicate an underlying sense of complacency towards procedural compliance. Specific examples of the deficiencies include:

-- GSM malfunctions on 7/26/88 and again on 8/1/88 were not recorded in the Malfunction Log as required by Procedure III.

-- There was no record of the GSM hourly printout for 8/1/88 in the GSM Historical Log as required by Tabs I and K of Reactor Operations Procedure VIII.

-- Procedure I, Conduct of Experiments, requires completion of a Reactor Use Request (RUR) prior to irradiation of materials. After review of the reactor log, a Memorandum for the Record dated 6/21/88 and interviews it was concluded that an experiment was conducted on 10/9/85 without completion of an RUR.

-- The GSM pump was turned off on 6/3/87 due to apparent malfunction (smell of smoke) without being recorded in the Malfunction Log (Procedure III).

-- Operator's Log #78 (3/10/87 - 6/17/87) and the Activated Materials Log were not reviewed by the Reactor Facility Director as required by TAB A of procedure VIII and TAB A of procedure I respectively.

Interviews with the staff revealed that equipment required during reactor operations is occasionally taken out of service without any formal method to alert the operator of this fact. An example occurred when the Gas Stack Monitor pump was turned off on June 3, 1987, between a series of reactor operations. This practice has the effect of invalidating the startup checklist which is performed to ensure that required equipment is in service prior to reactor operations. It illustrates an inadequacy in procedural control that increases the potential for reactor operation outside the bounds required in the Technical Specifications.

This inadequacy in procedural control and the previous examples of procedural non compliance have been classed as a single apparent violation of Technical Specification 6.3 which requires the licensee to have (and comply with) written procedures adequate for safe operation (88-04-03).

Issuance, approval, and operator notification of procedures appears weak. A specific example is the Pulse Operation procedure using the Cerenkov detector. The procedure was not issued until a month after the April 1988 installation of the detector. Operator review of the procedure is dated October 1988, and the preimplementation Reactor and Radiation Facility Safety Committee (RRFSC) review is still pending.

During a tour of the facility on October 26, 1988 the inspector noted that the procedure for gas stack monitor operations posted at the monitor had no information on it to identify the revision number, date, or any other markings to ascertain it was the current procedure. This concern was discussed with the licensee and actions were taken to correct the problem.

6. Organization and Administration

6.1 Reactor and Radiation Facility Safety Committee (RRFSC)

The composition, qualifications, functions and authority of the RRFSC are defined in section 6.2 of the Technical Specifications. The inspector reviewed the minutes for meetings conducted in 1986 through 1988 as well as annual audit reports for this period. In all cases the requirements associated with quorum and frequency were met. The RRFSC meeting minutes documented the review of audit reports, procedure changes, and safety reviews. The supporting documentation of the RRFSC meeting was noted to have improved in 1988.

No deficiencies were identified.

6.2 Safety Reviews

Based upon discussions with licensee personnel it was determined that when the new reactor console was installed in a monitoring only mode of operation in early April, 1988, the licensee exchanged the pulse ion chamber in Safety Channel Number 2 with a Cerenkov detector. This review by the inspector was prompted by an allegation indicating a failure to perform a safety evaluation prior to use of the Cerenkov detector.

The inspector examined current and early versions of the Safety Analysis Report (SAR), the 10 CFR 50.59 evaluation for the new reactor console, and other reports provided by the licensee to determine if use of a Cerenkov detector was described or evaluated from a safety standpoint. One early version of the SAR indicated the Cerenkov detector would be evaluated during initial startup. No information was available on these startup tests. The licensee had a drawing showing the Cerenkov detector in the nuclear instrumentation system but this was not part of the SAR, nor was there any information provided to indicate that a safety evaluation was made.

The licensee stated they had used the Cerenkov detector in the past and believed it to be described in the SAR. However, the 50.59 evaluation dated May 11, 1988, for the new reactor console states with respect to SAR changes; "the phrase 'three ion chambers' has been changed to 'two ion chambers and a pulse detector' to allow a Cerenkov detector or an ion chamber to be used for pulse operation." It was also noted that the SAR described a scram input from the pulse ion chamber which was not described in the Technical Specifications and had been eliminated from use apparently without a safety evaluation. The elimination of the pulse ion chamber scram input is another example of an apparent violation of 10 CFR 50.59 (88-04-01).

The capability and adequacy of the Cerenkov detector and the effects of various parameters on its performance could not be determined based upon the information available to the inspector. No written safety evaluations exist to document the suitability of the Cerenkov detector. This is yet another example of an apparent violation of 10 CFR 50.59 which requires a written safety evaluation to provide the basis for a determination that a change to the facility does not involve an unreviewed safety question (88-04-01).

Additionally, some other safety evaluations did not appear to be performed in a timely manner. For example the safety evaluation for the new reactor console was not submitted to the RRFSC until the console was already in place, and it did not address the additional nuclear instruments prior to their installation. It is recognized that the console and additional instrumentation was not used to operate the reactor.

6.3 Organizational Structure

The inspectors reviewed the AFRRI organizational changes relating to the reactor facility and compared these changes to technical specification requirements. The creation of the Radiation Sources Department headed by the Reactor Facility Director (RFD) enabled the Department Chairman to be responsible for both the administrative and technical aspects of reactor operations. The Reactor Division is within the Radiation Sources Department.

The inspector noted that the organizational changes were approved by the RRFSC on August 14, 1987 and after further changes, again on December 18, 1987. Minutes of the December 18, 1987 RRFSC meeting indicate that the Reactor Operations Supervisor (ROS) and Reactor Division Chief should be two separate positions and that changes in the organization should be made in the SAR and technical specifications. The annual report for 1987 discusses these changes. The annual report states that a dual chain now exists under the Department Head, with the ROS reporting to the Department Head/RFD on matters that pertain to reactor operations, and the Reactor Division Chief reporting to the Department Head/RFD on administrative matters.

Technical Specification 6.1.1 states that organizational changes can be made as long as the RFD has direct responsibility to the Director of AFRRI for operation, safety and emergency control. There is no Technical Specification requirement that the Reactor Division Chief and the ROS be two separate positions, although the RRFSC recommended this arrangement.

As a result of an allegation that the designation of the Acting RFD was not in accordance with technical specification requirements, the inspector examined licensee practice in this area. Technical Specification 6.1.2 states that the RFD shall be responsible for administration and operation of the Reactor Facility and for determination of applicability of procedures, experiment authorization, and maintenance operations. During the absence of the RFD, the ROS shall have these responsibilities.

Documentation in certain memoranda, organizational charts, the Safety Analysis Report and Annual Reports indicate a definite awareness of the requirements in technical specification 6.1.2. However, discussions and memoranda indicate that in many cases during the absence of the RFD, his responsibility was assigned to the senior person in the department or division. This item is considered unresolved pending licensee clarification of the responsibilities of the ROS in the absence of the RFD (88-04-05).

6.4 Reporting

The inspector discussed with the licensee an internal memo describing an event of March 23, 1988 should be reported and addressed to NRC as required by the technical specifications. A copy of the memo was provided to NRC.

It was noted that Annual Reports to the NRC for 1985, 1986 and 1987 all stated that liquid radioactive effluents released were estimated on a quarterly basis to be less than 25% of the allowable amounts under 10 CFR 20. The inspectors asked to see the basis for the estimate and was told that there are no liquid releases from the AFRRI reactor facility and therefore no data.

Section 3.4 of this inspection report discusses a failure to report an LCO violation.

7. Operator Training

A review of licensed operator training (requalification training) was conducted in order to determine whether the facility has successfully implemented its NRC approved requalification program.

Improvements to the requalification program are currently being implemented by the Training Coordinator. These improvements are intended to strengthen the requalification program by improving scheduling control, tracking of attendance, and establishing "performance based training". Because these measures have not been fully implemented, the effectiveness of the measures cannot be verified. However, the measures are recognized as being positive factors intended to improve requalification program quality.

The inspector verified that all licensed operators have been administered the annual written, oral and operating exams required by 10 CFR 55.59 (a)(2). Documentation of the annual oral and operating examinations included only a signed statement that these examinations had been performed. No clarifying information such as examination coverage, strengths or weaknesses was available for any operator. Such clarifying information is needed to identify strengths and weaknesses that are an important source of data that can be used to improve the requalification program. Although adequate documentation of these examinations existed in the operator files, the thoroughness of the operating and oral examination documentation is a program weakness.

A review of lecture training revealed that between 1986 and 1988, approximately twenty-two of thirty-nine scheduled lectures were cancelled by management and not rescheduled, resulting in a substantial amount of the requalification lecture material not being covered as required. Examples of training lectures that were cancelled by management and not performed at a later date include:

* "Calibration Procedures,"
* "Plant Instrumentation and Control Systems,"
* "Plant Protection Systems and Physical Security,"
* "Preview of Annual Shutdown"
* "Reactor Facility Update,"
* "Nuclear Reactor Kinetics,"
* "Biological Effects of Radiation," and
* "Operating Procedures."

In addition, of those requalification lectures that were performed, attendance by the operators was poor, resulting in every licensed operator missing between two and seventeen of the lectures during the 1986-1988 cycle. No makeup of the missed lecture material was performed as required by the AFRRI Requalification Program. Members of management apparently condoned laxity regarding the requalification training program since all licensed operators, including management, missed a substantial amount of the training. Apparently, other concerns outweighed management's commitment to the requalification program, resulting in scheduled lectures frequently being cancelled.

Management stated that a review would be performed to determine those operators who are deficient in requalification training and that remedial training would be performed. The improved scheduling method was a means through which management stated that full compliance with the requirements could be achieved.

Failure to perform requalification training lectures and ensure proper attendance is an apparent Violation of 10 CFR 55.59(c) (88-04-06).

In addition, the uncompleted requalification training was not noted on the NRC Form 398's which were submitted during 1988 for five licensed operators applying for license renewals. Facility management must certify on the Personal Qualifications Statement (NRC Form 398) that the licensed operator has met all the requirements of the requalification program. The impact of these omissions on the license renewal applications is an Unresolved Item (88-04-07).

8. Modifications

Modifications to the AFRRI facility were reviewed by the inspector in order to determine if the Reactor and Radiation Facility Safety Committee (RRFSC) had reviewed each modification, and whether an adequate Safety Analysis had been conducted.

Safety Evaluations for the following modifications were reviewed:

*Control Room Windows
*Reactor Building Roof
*Overpressure Relief Valve
*Reactor Cooling Tower
*Primary Water Makeup System
*Radiation Area Monitor Readouts
*Gas Stack Monitor
*Air Supply For Dampers
*Exposure Room Monitoring
*Reactor Control Room Air Conditioner

Each of the above modifications was verified to have been approved by the RRFSC. A brief review of the Safety Evaluations indicated that indepth analyses had been conducted for each modification.

A brief review was conducted on the new reactor control console. A Safety Evaluation for the console, dated May 11, 1988, describes the instrumentation and control of the system as well as features expected to improve the overall operability of the reactor.

The facility contracted ORI Inc. of Alexandria, Virginia, to conduct an independent review of the new console Safety Evaluation. ORI agreed that no unreviewed safety questions existed for the new panel.

Facility management stated that a plausible five dollar ramp accident over a two second interval was evaluated by General Atomics with the conclusion that this scenario is encompassed in the existing safety analysis for the facility.

The adequacy and the appropriateness of the 50.59 safety evaluation of the new reactor control console is unresolved pending an NRC review (88-04-04).

9. Allegation Followup (RI-88-A-0102)

Background

The inspectors investigated several allegations regarding technical specification violations, including failure to follow procedures, and violations of regulations.

Allegation

The Reactor Division Chief and Reactor Operations Supervisor are two positions being filled by the same person; The designation of Acting RFD is not per Technical Specification 6.1.2. (See section 6.3)

Allegation

The linear channel was not operable during reactor operation in violation of Technical Specification 3.2.1. (See section 3.3)

Allegation

The GSM was not operable on June 3, 1987, during reactor operations when the pump was turned off in the morning. NRC inspectors then onsite were told it was turned off in the afternoon after completion of reactor operations due to the smell of smoke.

Interviews with staff and operators indicated that the Reactor Operations Supervisor secured the noisy GSM pump at about 9:00 a.m. on July 7, 1987, to facilitate a meeting on the reactor deck. He wrote himself a reminder in his personal notebook and turned the pump back on after the meeting (about 10:30 a.m.). A log review indicates that reactor operations were conducted from 7:33 - 7:57 a.m., then again from 10:43 a.m. - 1:21 p.m. The second period consisted of two 5 minute runs at 2 kW, followed by a twenty minute run at 960 kW which ended at 1:21 p.m.

The GSM Historical Log indicates that the GSM was not properly sampling during the final run, since the count rate only increased from 1.592+01 cpm at 1:00 p.m. to 2.228+01 cpm at 2:00 p.m. This small increase appears inconsistant with the high power run. The expected increase is more aptly shown in a June 8, 1988 GSM Historical Log entry for a similar 100% power, 20 minute run from 11:01 to 11:21 a.m. The count rate increased more than ten times from 1.482+01 at 11:00 a.m. to 1.636+02 at 12:00 p.m.

NRC inspectors then onsite, state that they noted the secured pump on the GSM at about 2:30 p.m. The Reactor Facility Director (RFD) told them it was secured about half an hour earlier due to the smell of smoke. The pump was subsequently restarted.

The RFD had difficulty recalling this event and it is not documented in licensee records. An investigation to obtain the additional information necessary to conclusively substantiate a violation of Technical Specifications is not warranted since the weaknesses associated with these events are identified in section 5 and a response discussing corrective actions is being requested from the licensee. Environmental dosimetry records indicate normal effluent discharges during this period.

Allegation

The GSM was not operable during reactor operations on July 25 and August 1, 1988. The July 25 malfunction is not recorded in the Malfunction Log as required by local procedures.

A review of logs and interviews with operators indicates that storm induced electrical surges caused an intermittent memory loss, not a malfuction in the GSM, prior to operations on July 25. The GSM did malfunction on July 26 and August 1, neither of which are recorded in the Malfunction Log. This is discussed further in section 5. The July 26 malfunction occurred prior to 6:54 a.m. and not during reactor operations. The August 1 malfunction is an apparent violation as discussed in section 3.4.

Allegation

Radiation exposure to dosimetry personnel was higher than average. Experiments are run with insufficient consideration to ALARA.

The inspector reviewed exposures of the personnel in question and examined Reactor Use Reports from the standpoint of the ALARA requirement in Technical Specification 3.8. The requirement is that consideration be given to alternative operational profiles that might reduce exposures. The inspector found that ALARA was being considered in running experiments and that exposures were being adequately controlled.

Allegation

An experiment was conducted on October 9, 1985 without proper approval. (See section 5)

Allegation

The Activated Materials Log was not reviewed annually as required. (See section 5)

Allegation

No procedure was written for pulse operation with Cerenkov detector. (See section 5)

Allegation

No safety analysis was performed on replacement of Pulse Ion Chamber with Cerenkov detector nor on parallel nuclear instrumentation installed in conjunction with a new reactor control console. (See section 6.2)

Allegation

The alleger was concerned about licensing a Senior Reactor Operator due to that operator's hearing impediment. The alleger does not feel this person meets the requirements of the ANS standard for medical certification.

The operator in question holds a license which contains restrictions that require the wearing of a hearing aid when performing licensed duties and prohibit assuming the SRO position of Commander, Emergency Response Team. The operator was given an Operational Hearing Evaluation, an Audiological Evaluation and a standard license related medical examination. Results of the Operational Hearing Evaluation indicated that the operator is able to recognize an abnormal condition indicated by an alarm on either the remote area monitor or the reactor continuous air monitor with the same adeptness that any other operator would exhibit.

Section 5.4.4 of ANSI/ANS-3.4 1983 entitled Medical Certification and Monitoring Personnel Requiring Operator Licenses for Nuclear Power Plants, states that: "If audiometric scores are unacceptable, qualification may be based upon onsite demonstration to the satisfaction of the facility operator of the examinee's ability to safely detect, interpret, and respond to speech and other auditory signals." The operator's ability to perform these tasks was verified by the Operational Hearing Evaluation.

These factors were all considered during the licensing process and the NRC subsequently issued a restricted license on August 23, 1988. A review of the issue maintained the original NRC position.

Allegation

Snail shells irradiated on May 12, 1988 were not recorded in the control room core experiment log.

A review of the core experiment log shows several May 12 entries appearing in proper chronological order, one of which contains the description "Snail Shells". This entry is consistent with other entries in the log and appropriately completed. The entry is cross referenced to RUR 88-38. A review of that form also showed no irregularities.

10. Unresolved Items

Unresolved items are items about which more information is required to ascertain whether they are acceptable, a violation, or deviation. Unresolved Items are discussed in sections 2.2, 6.3, 7, and 8.

11. Exit Meeting (30703)

The scope and findings of this inspection were duscussed with licensee representatives on October 28, 1988. No written inspection material was provided to the licensee during the inspection.