Armed Forces Radiobiology Research Institute
AFRRI Triga Reactor Facility

1 January 2000 - 31 December 2000

To satisfy the requirements of
U.S. Nuclear Regulatory Commission, License No. R-84 (Docket No. 50-170),
Technical Specification 6.6.1.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
Fax: (301) 295-0735

Submission of 2000 Annual Report

Submitted by

ORIGINAL SIGNED 13 Mar 01

STEPHEN I. MILLER Date
Reactor Facility Director

Approved by

ORIGINAL SIGNED 13 Mar 01

ROBERT R. ENG Date
COL, MS, USA
Director

2000 ANNUAL REPORT

TABLE OF CONTENTS

2000 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.

Discussions continue on the feasibility of performing boron neutron capture therapy (BNCT) research and clinical trials at AFRRI. Extensive work was performed on the reactor facility relicensing package that was to be submitted to the Nuclear Regulatory Commission in November 2000. However, a request for extension of the current license submitted in February was approved in September. This extension changes the license's expiration date from 08 November 2000 to 01 August 2004 allowing the reactor staff more time to complete the relicensing documentation. This approved extension accounts for the length of the previous contested relicensing process and makes the term of the current license 20 years from the expiration of the previous license, the same as licensees who had uncontested renewals.

Two reactor facility audits were conducted during 2000. The Nuclear Regulatory Commission inspected the reactor 22-25 February. The areas inspected were reactor operations, radiation protection, environmental protection, and emergency preparedness. No deficiencies or violations were noted during the inspection. The annual reactor audit required by the reactor technical specifications was conducted by Mr. Ron Smoker in December. Mr. Smoker is a nuclear engineering consultant with several years as a licensed senior reactor operator on TRIGA reactors. As of 31 December, we had not yet received his final report, but during the audit he verbally indicated that he had not found any major discrepancies in reactor operations.

Mr. Harry Spence and ET1 Steven Pierson, USN both passed NRC licensing examinations and received their Senior Reactor Operator licenses in March 2000. Mr. Spence was then appointed Reactor Operations Supervisor (ROS) replacing Mr. Robert Marte who moved to the dosimetry division. Mr. Spence was assigned to the AFRRI reactor for two tours during his Army career and he had over 12 years experience on the AFRRI reactor prior to his appointment as ROS. There were several other personnel changes at the reactor during the year. These are detailed in the following section.

Changes were made to various procedures during 2000 in accordance with the provisions of 10 CFR 50.59. Summaries of modifications are found in Sections I and V.

Reactor staff personnel conducted a peer review of the reactor facility at Cornell University in Ithaca, NY. This assistance program is expected to continue for several more years and may expand with reactor staff members participating in inspections of military reactor facilities at Aberdeen Proving Ground, MD and White Sands Missile Range, NM.

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

6.6.1.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 2000) are as follows:

1. Director - Robert R. Eng, COL, MS, USA

   Radiation Sciences Department (RSD) Head - James W. Malinoski, CAPT, MSC, USN

   Radiation Protection Officer - Joyce M. Kraimer, MAJ, MS, USA (eff 16 June)

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

3. Reactor operations personnel:

   Reactor Operations Supervisor - Harry H. Spence (SRO) (27 March)

   SRO Training Coordinator - Harry H. Spence (SRO) (27 March)

   ERT Training Coordinator - John L. Carter, CPT, FA USA (02 October)

   Maintenance Specialist - John T. Nguyen (SRO)

   Records Administration Specialist - Samuel D. Osborne, SFC, USA (SRO)

   Senior Staff Engineer - John L. Carter, CPT, FA, USA (02 October)

4. Senior Reactor Operator - Robert G. Marte

5. Operator candidates:
   Guy Gammons (17 July)
   John L. Carter, CPT, FA, USA (02 October)
   Walter D. Tomlinson (18 December)

6. Newly licensed operator: Harry H. Spence (10 March)

7. Additions to staff during 2000:
   Guy Gammons (17 July)
   John L. Carter, CPT, FA, USA (02 October)
   Walter D. Tomlinson (18 December)

8. Departures during 2000:
   Steven W. Pierson, ET1, USN (30 August)
   William H. Baxter Jr., SFC, USA (31 October)

Kenneth L. Wrisley, MAJ, CM, USA (31 October)

9. There was one change to the Reactor and Radiation Facility Safety Committee (RRFSC) during 2000. MAJ Joyce Kraimer replaced Maj Bruce White as Radiation Protection Officer and as a regular voting member on 16 June.

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 voting members as of 31 December 2000.

Regular members are:
Radiation Protection Officer - Joyce M. Kraimer, MAJ, MS, USA
Reactor Facility Director - Stephen I. Miller
Reactor Operations Specialist - Marcus Voth
Health Physics Specialist - Joe Pawlovich

Chairman and Director's Representative - Tyrone D. Naquin, CDR, MSC, USN

Special member - James W. Malinoski, CAPT, MSC, USN

Special nonvoting member - Edward Herbert, Montgomery County Government (Environmental Protection Agency)

Recorder - Samuel D. Osborne, SFC, USA

As required by the Technical Specifications for the AFRRI Reactor Facility, four meetings of the RRFSC were conducted during 2000:

03 April, full committee meeting

26 July, full committee meeting

11 October, subcommittee meeting

08 December, subcommittee meeting

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. Revised reactor administrative and operational procedures with their 10 CFR 50.59 reviews are in the Attachment.

A. DESIGN CHANGES

There were no design changes to the facility during 2000. The final testing of the 1999 reactor console software upgrade was completed in May. Revisions to the software package were made during the testing phase to correct minor problems in the history playback and watchdog test functions. None of the problems had any effect on reactor operations or safety capabilities. (See 1999 annual report for a discussion of the software upgrade package.)

B. PERFORMANCE CHARACTERISTICS

No changes to the core occurred during 2000. All fuel, chambers, and the core experiment tube (CET) remained in place for operations throughout the year. The performance characteristics of the core did not change.

C. ADMINISTRATIVE PROCEDURES

Three modifications to the Safety Analysis Report (SAR) were incorporated when the SAR was republished in January 2000. The safety analyses for these modifications were included in the 1999 annual report.

1. The SAR was changed to remove all references to the use of thermoluminescent dosimeters (TLDs) as the perimeter monitoring method. The comply code method for reporting environmental releases is now used to determine radiation exposure to areas outside the AFRRI complex. Comply code is approved by the Nuclear Regulatory Commission and the Environmental Protection Agency for reporting environmental releases.

2. The Radiation Sources Department name changed to Radiation Sciences Department. The SAR was updated to reflect this change. References to the locations of two tables in the SAR were changed to appendices.

3. The meteorological monitoring station on the roof of AFRRI was replaced. The SAR was changed to remove the specific brand name of the existing monitoring system and replace it with a statement that a wind sensor will measure wind speed and direction. The new system performs the same functions as the previous unit.

The Routine Reactor Authorizations required by the Technical Specifications were revised and approved by the Reactor and Radiation Facility Safety Committee (RRFSC). A Special Reactor Authorization for the use of a new graphite cave apparatus in the reactor exposure rooms was also approved. These approvals are discussed fully in Section V.

D. OPERATIONAL PROCEDURES

Operational Procedure 1, Tab C was changed to state that non-monitored exposure room openings may be conducted if the exposure room CAM reads less than 2000 cpm. The previous requirement was less than 200 cpm above background. A specific point (2000 cpm) is easier to verify than a net change and the new criteria is well below any regulatory limit. The modification was approved by the AFRRI radiation protection officer before implementation.

E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS

All maintenance and surveillance tasks during 2000 were accomplished on time.

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

The Nuclear Regulatory Commission inspected the reactor 22-25 February. The areas inspected were reactor operations, radiation protection, environmental protection, and emergency preparedness. No deficiencies or violations were noted during the inspection. The inspector noted that reactor operations were conducted in accordance with all applicable regulations.

The annual reactor audit required by the reactor technical specifications was conducted by Mr. Ron Smoker in December. Mr. Smoker is a nuclear engineering consultant with several years as a licensed senior reactor operator on TRIGA reactors. As of 31 December, we had not yet received his final report, but during the audit he verbally indicated that he had not found any major discrepancies in reactor operations.

SECTION II

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

Month	Kilowatt Hours
JAN	87.7
FEB	328.8
MAR	807.0
APR	864.3
MAY	345.9
JUN	52.4
JUL	0.0
AUG	19.5
SEP	137.4
OCT	253.2
NOV	603.5
DEC	271.5
TOTAL	3,771.2

Total energy generated in 2000: 3,771.2 kWh

Total energy on fuel elements: 959,561.5 kWh

Total energy on FFCRs*: 226,763.8 kWh

Total pulses this year $\geq$ $2.00: 4

Total pulses on fuel elements $\geq$ $2.00: 4,215

Total pulses on FFCRs* $\geq$ $2.00: 103

Total pulses this year: 93

Total pulses on fuel elements: 11,657

Total pulses on FFCRs*: 1,892

*Fuel-follower control rods

SECTION III

Unscheduled Shutdowns

There was one unscheduled shutdown in 2000. During a 50 kW steady-state operation on 04 April, a database timeout scram appeared on the console. All control rods automatically inserted and all safety systems functioned normally. The console was turned off and rebooted. No obvious cause of the scram could be determined. The console was fully tested and operated normally. There was no radiation exposure or release associated with this shutdown.

SECTION IV

Safety-Related Corrective Maintenance

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

04 April 2000 - An unplanned shutdown occurred due to a spurious database timeout on the reactor console. This malfunction is fully discussed in Section III.

09 August 2000 - While performing the startup checklist, the operator noticed fluctuation of the "inlet temperature" reading on the console. When the button was pushed for the startup checklist interlock test (RWP for 60ºC water temperature), a steady reading could not be obtained. Inspection determined that the demineralizer inlet temperature relay socket in the DAC console had excessive play on the contacts. A replacement socket was ordered. Since satisfactory completion of that particular test during startup is not required by the technical specifications for operation, the operator used other means to ensure that the inlet water temperature remained below 60ºC. The new socket was installed on 11 August, and the wiring to the RWP setpoint potentiometer was tightened. The inlet temperature RWP was tested and the circuit calibration was checked. All systems operated normally.

SECTION V

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

A. ADMINISTRATIVE CHANGES TO THE SAR

Three modifications to the Safety Analysis Report (SAR) were incorporated when the SAR was republished in January 2000. The safety analyses for these modifications were included in the 1999 annual report.

1. The SAR was changed to remove all references to the use of thermoluminescent dosimeters (TLDs) as the perimeter monitoring method. An NRC/EPA-approved method for reporting environmental releases was instituted and added to the SAR.

2. The Radiation Sources Department title changed to Radiation Sciences Department. The SAR was updated to reflect this change. References to the locations of two tables in the SAR were changed to appendices.

3. A statement that a wind sensor will measure wind speed and direction, replaced the specific brand name of the wind-monitoring station listed in the SAR. The meteorological monitoring station was replaced with an equivalent system.

B. PROCEDURAL CHANGES TO THE SAR

There were no changes to procedures described in the SAR. Changes to the operational procedures are covered in Section I. The Routine Reactor Authorizations and Reactor Parameters Authorization required by the Technical Specifications were revised and approved by the current Reactor and Radiation Facility Safety Committee (RRFSC). No major changes were made to the authorizations. The revisions were appropriate since the entire membership of the committee had changed since the last revision in 1991.

C. NEW EXPERIMENTS OR TESTS

No new experiments or tests were performed during the reporting period that were not encompassed by the SAR. A Special Reactor Authorization for the use of a new graphite cave apparatus for shielding of experiments in the reactor exposure rooms was approved by the RRFSC. This new apparatus allows increased flexibility in modeling the reactor neutron-to-gamma ratio to meet experiment requirements. Before the graphite cave was placed in the exposure room, it's worth was estimated as +$0.40. After placement in Exposure Room 2, the true worth was measured as +$0.25.

The Attachment contains the safety evaluations for changes not submitted to the NRC, pursuant to the provisions of 10 CFR 50.59. Each modification was described and qualified using Administrative Procedure A3, Facility Modification. This procedure uses a step-by-step process to document that there were no unreviewed safety questions or technical specification changes required prior to implementation.

SECTION VI

Summary of Radioactive Effluent Released

A. Liquid Waste: The reactor produced no liquid waste during 2000.

B. Gaseous Waste: There were no particulate discharges in 2000.

The total activity of Ar-41 discharged in 2000 was 0.71 curies. The estimated activity from the release of Argon-41 was below the constraint limit for unrestricted areas (Table 2 of Appendix B to 10 CFR 20).

Quarterly:	Jan - Mar 2000	0.11 Ci
	Apr - Jun 2000	0.20 Ci
	Jul - Sep 2000	0.12 Ci
	Oct - Dec 2000	0.28 Ci

C. Solid Waste: All solid radioactive waste material was transferred to the AFRRI byproduct license; none was disposed of under the R-84 license.

SECTION VII

Environmental Radiological Surveys

Environmental sampling of soil and vegetation reported no radionuclide levels above the normal 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 2000, was 0.023 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 0.23% of the 10 millirem constraint limit, or 0.023 millirem for the entire year.

The reactor in-plant surveys, specified in HPP 3-2, did not exceed any of the action levels specified in HPP 0-2.

SECTION VIII

Exposures Greater than 10% of 10 CFR 20 Limits

There were no doses to reactor staff personnel or reactor visitors greater than 10% of 10 CFR 20 occupational and public radiation dose limits.

Facility Modification Work Sheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change: **UPDATE OF OPERATIONAL PROCEDURE 1, TAB A REACTOR EXPOSURE ROOM ENTRY**

Modification to: Procedure **XX** Facility____ Experiment ____

Submitted by: **Osborne** Date **28 June 2000**

Description of change:

Item 4.a.3 (non-monitored opening CAM reading), was changed from:

The ER CAM shall be observed, and its reading (net) should be less than 200 cpm above background.

to:

The ER CAM shall be observed, and its reading should be less than 2000cpm.

This modification ensures that this procedure agrees with HPP 3-1.

2. Verify that the proposed change does not involve a change to the Technical Specifications, the facility as described in the SAR, or procedures as described in the SAR, and does not produce an unresolved safety issue as defined in 10 CFR 50.59(a)(2).

Routine openings have always been allowed at a CAM reading of 2000 CPM. This count rate has been approved by SHD. This modification simply extends this count rate to non-monitored openings. It does not require changes to the SAR or technical specifications and does not produce an unresolved safety issue.

3. If change involves a facility modification, attach a drawing if appropriate. If structural facility drawings need updating, forward a copy of changes necessary to Facilities.

No facility changes

4. Determine what other procedures, logs, or training material may be affected and record below.

None identified

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

None identified

ATTACHMENT

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 **XX** Not Required _____

Reviewed and approved by RFD _____Date 6 JUNE 2000

RRFSC Notified _____Date 26 JULY 2000

REACTOR EXPOSURE ROOM ENTRY

1. REFERENCES

   a. 10 CFR 20, "Standards for Protection Against Radiation"
   b. USNRC licenses: R-84, 19-08330-02
   c. AFRRI Instruction 6055.8
   d. AFRRI Health Physics Procedure 3-1

2. GENERAL

   a. PURPOSE:
   This procedure specifies all safety and security procedures for activities involving entry into the AFRRI TRIGA Reactor exposure rooms, currently designated exposure rooms 1 and 2 (rooms 1123 and 1122).

   b. AUTHORIZED ENTRY:
   Both AFRRI picture badge and U-badge personnel, may enter a reactor exposure room under the supervision of the Reactor Facility Director (RFD) or his representative. Visiting personnel (V badge) require special authorization by both the Chairman, Safety and Health Department (SHD) and RFD to enter either exposure room. In general, permission to enter the exposure rooms will be granted to personnel whose duties require such entry; however, permission may be denied to personnel for serious or repeated safety or security violations, or for safety reasons emanating from conditions in the exposure rooms. All personnel who are granted unescorted access to the prep area or warm storage will receive a special prep area safety briefing prior to being granted access. Only personnel who have been granted permanent unescorted access will be given card access to the prep area. The RFD is responsible for maintaining a roster in the prep area for personnel who have been granted permanent unescorted access. Other personnel requiring unescorted access to the prep area or warm storage for a specific purpose or time period may be granted special access in writing by the RFD with concurrence of SHD. However, these personnel who are granted special access from the RFD will not be given card access to the prep area.

   c. ER ENTRY INSTRUCTIONS - All personnel will:

      (1) Know the Reactor staff representative is in charge of all operations in the prep area. Obtain permission to enter either exposure room from the Reactor

staff representative.

(2) Wear AFRRI TLD whole body badge and pocket dosimeter.

(3) Wear wrist or finger dosimeter if work is to be performed on an experimental array or within one meter of the core projection.

(4) Wear booties, eye protection, gloves and coat.

(5) Check and log pocket dosimeter reading on log in prep area prior to entry.

(6) Familiarize themselves with approximate radiation levels in the room, based on radiological surveys performed and data obtained by SHD.

(7) Ensure that all materials removed from the exposure room are properly labeled and entered on the exposure room entry log (AFRRI FORM 130) and the activated materials control log.

(8) Glove and lab coat requirements may be waived by the SHD monitor or reactor representative on an individual basis for personnel who will not be touching anything in the exposure room. There must be a specific reason for waiving such requirements.

d. DEPARTURE FROM REACTOR EXPOSURE ROOM ENTRY PROCEDURES: Any departure from the following procedures will require a special work permit (SWP). Exceeding any radiation dose limits will require a written justification from the supervisor of the research project which must be approved by the Head, SHD.

3. SHD EXPOSURE ROOM SURVEY

a. EXPOSURE ROOM CAM:
(1) Prior to opening either exposure room, the respective CAM must read 2000 cpm or less. If the CAM reads 2000 cpm or greater, change the filter on the CAM and put it in the radioactive materials bag in the CAM drawer. If 10 minutes or more have elapsed since the end of the reactor run, the door may be opened to the first step to facilitate radioeffluent clearing in the room. Then check the CAM after 1 minute and, if the reading has not increased by more than 100 cpm, proceed with the exposure room opening. If it has increased by more than 100 cpm, change the filter and wait two more minutes and repeat as necessary. If the CAM alarms during or immediately after a run, change the filter and reset the CAM.

(2) If either exposure room CAM or the Prep Area CAM is found malfunctioning or inoperable, notify the Reactor Representative or Reactor Operations Supervisor (ROS) and SHD immediately. No opening shall be initiated if the exposure room to be opened does not have an operable CAM.

b. DOSE RATE AT FACE OF DOOR:
If the dose rate at the face of the plug door in the direct line of sight of the reactor tank bulge reads greater than 100 mrem/hr, the door will be closed sufficiently to preclude access. The plug door will be reopened upon agreement of the SHD and RFD representatives for revaluation of radiation levels. When the dose rate at the face of the door is below 100 mrem/hr, the opening procedure may continue.

c. DOSE LEVELS IN ROOM:
Exposure rates will be measured at specific sites in the rooms. These measurements will be given to both the reactor representative and the personnel entering the room. Additionally the readings will be entered in the room entrance log (AFRRI FORM 130) and kept in the prep area. The levels will be measured at:
(1) The reactor door face in the direct line of sight of the reactor tank bulge
(2) At the contamination line in the entrance of the room
(3) The middle of the room
(4) 30 cm from the tank wall or shield
(5) Contact with the tank wall or shield
(6) The area(s) where individual(s) will be working for an extended period of time and any other place deemed necessary by the reactor representative.

d. ENTRY:
Entry is permitted only when the maximum reading in any occupiable area is 1 rem/h or less. Entry may be permitted if levels are 1-5 rem/h, but no work will be permitted in fields over 1 rem/h. If personnel are working in a specific area for an extended period of time, the dose rate in that area will be measured.

(1) Readings over 100 mrem/hr (closed window) will be specifically identified. All dose rate readings will be reported to the Reactor representative and entry personnel. When appropriate, after consultation with the SHD and Reactor representatives, stay times will be assigned for entry personnel. AFRRI limits of 100 mrem/week and 50 mrem/day are to be used as the basis of stay time determinations.

(2) All exposure room entries will be checked by the SHD monitor for compliance with radiation safety aspects of applicable Reactor Use Requests (RURs). If not, non-compliance will be reported to the RFD and to SHD.

e. FILLING OUT THE SURVEY OF EXPOSURE ROOM OPENING LOG:
The exposure room opening log sheet must be filled out completely for each opening of an exposure room. Care must be taken to fill out each blank on the entry log sheet. If a section is not applicable to the particular opening, N/A should be filled in the blank.

4. NON-MONITORED OPENING:

a. Personnel may enter the exposure rooms without a SHD monitor present if ALL the following conditions hold:
(1) The reactor has not been to power in that ER since the last survey.
(2) Survey meter readings at the door indicate safe entry conditions (should be less than 1 mrem/hr).
(3) The ER CAM shall be observed, and its reading should be less than 2000 cpm.
(4) The last survey indicates that the maximum dose rate in any area where work is to be performed did not exceed 100 mrem/hr.

b. An entry will be made in the exposure room log by a reactor staff member, with a note that the survey has been waived.

c. SHD must be notified if any radioactive materials or equipment are to be removed from the prep area.

5. PERSONNEL PROTECTION PROCEDURES

a Dosimetry and protective clothing requirements are given in paragraph 2.c, ER Entry Instructions.

b. Entry is permitted only after the SHD monitor has completed the survey and reported results to those about to enter (excluding non-monitored openings - reference Paragraph 4, above).

c. All personnel shall record initial dosimeter reading in the prep area dosimeter log prior to entering the exposure room for the first time each day. Personnel shall read dosimeters when leaving the exposure room and record a final dosimeter reading in the prep area log at completion of daily operations. Net doses over 10 mrem must be reported to the SHD Monitor.

d. Protective clothing will be removed in such a way as not to contaminate "clean" areas by items from "dirty" areas.

e. All personnel will "frisk" themselves before leaving the prep area.

6. SPECIFIC ACTIONS TO OPEN EXPOSURE ROOM DOORS

a. Turn up exposure room lights (this can be waived for experiment needs).

b. Check plug door tracks for obstructions; ensure all obstacles are clear of the door (including ropes).

c. Ensure that only authorized personnel (see 2.b.) are present in the reactor prep area during exposure room openings.

d. When facility safety interlocks and opening procedures have been satisfied, insert key into exposure room door key panel and open door. DO NOT LEAVE KEY IN LOCK UNATTENDED.

e. Open door in accordance with entry procedures. Ensure all required data is logged in entry log.

f. Ensure that individuals who will be moving lead, bismuth, or other heavy materials are wearing steel-toed shoes.

g. Limit exposure times of all personnel entering the exposure rooms based on the results of the radiation survey.

7. ACTIVATED MATERIALS

a. PLACING MATERIAL IN EXPOSURE ROOM:
Before placing any equipment or material in an exposure room for irradiation the following will be observed:

(1) Equipment tagged as AFRRI property: a memo must be sent to both the RFD and the AFRRI property officer. The memo must state that the equipment is knowingly being irradiated and therefore request that it be removed from the property books. It must also state that should the material remain byproduct material after a reasonable amount of time it will be disposed of as radioactive waste. The memo must contain all nomenclature as well as an adequate description of the equipment in order for it to be identified on the property book.

(2) Non-tagged AFRRI equipment or material (to be returned): a memo or statement on the reactor RUR must be sent to the RFD giving the kinds and amounts of byproduct material expected to be produced (that is the material that the experimenter wishes to be returned) and a copy or number of their radionuclide authorization number. The memo or RUR statement must be specific and contain an accurate description of the material being exposed (converted to byproduct). Other information will be required from personnel before any material is allowed to be removed from the prep or warm storage areas (see next section of this procedure 7.b. and 7.c.)

(3) Non-tagged equipment or material (not to be returned): A memo or statement on the RUR that the experimenter understands that byproduct material produced as a result of their irradiations will be disposed of as radioactive waste, and additionally any material not specifically requested to be held, will be disposed of as radioactive waste in the next shipment.

(4) Non-AFRRI owned equipment/material: A signed memorandum from the responsible property owner that they understand that byproduct materials generated in excess of their license will be disposed of as radioactive waste unless prior arrangements have been made with the reactor/SHD staffs for storage. Any material not removed within a reasonable amount of time will automatically be disposed of as radioactive waste.

b. SURVEY OF MATERIALS COMING OUT OF EXPOSURE ROOM

(1) All material leaving the exposure rooms must be surveyed for activation or contamination. Survey meter readings will be used to determine dose levels. Smear surveys may be used, if the SHD representative deems them necessary. All materials will be labeled appropriately in accordance with HPP 0-2 and HPP 3-1.

(2) All special equipment that has been activated such as chambers, rotators, motors, meters, etc., will be stored under the control of the reactor license or the AFRRI byproduct license in warm storage or the prep area. Removal of items from the prep area will only be allowed in accordance with HPP 3-1.

c. DISPOSITION OF ACTIVATED MATERIALS

All activated or contaminated materials will be under the control of the reactor license while such materials remain in the reactor controlled area. Removal of any radioactive materials from the reactor controlled area will be done in accordance with HPP 3-1.

8. COMPLETION OF ENTRY

a. The Reactor Staff Representative will check to see that all personnel have left the exposure room before the plug door is closed. In the event that the warning horn in either exposure room is disconnected, for testing or experiment requirements, the exposure room plug door shall not be closed until at least two (2) licensed reactor operators visually inspect the room to ensure that no personnel remain in the room. To ensure compliance with the reactor Technical Specifications, the names of these licensed operators present at the exposure room closing shall be entered into the reactor operations logbook and on AFRRI FORM 130. At the completion of the test or experiment, the warning horn shall be reconnected and tested. All actions regarding the warning horn shall in entered in GREEN ink in the reactor operations logbook.

b. The SHD monitor will not leave the area while the plug door is open without notifying the Reactor Staff Representative.

c. Lock the exposure room door control panel; reset lights, if appropriate.

d. Resecure the prep area on departure.