

**Armed Forces Radiobiology Research Institute  
Reactor Facility**

# **Reactor Operator Requalification Program**

**July 2004**

**Docket 50-170  
License R-84**

**Armed Forces Radiobiology Research Institute  
Bethesda, Maryland**

REACTOR OPERATOR REQUALIFICATION PROGRAM  
FOR THE  
ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE  
TRIGA REACTOR FACILITY

I. PURPOSE

This document sets forth the requirements for the Reactor Operator (RO) and Senior Reactor Operator (SRO) Requalification Program for the Armed Forces Radiobiology Research Institute (AFRRI) TRIGA reactor facility in accordance with the Code of Federal Regulations, Title 10, Part 50.54, Conditions of Licenses, and Part 55.59, Requalification.

II. RESPONSIBILITY

The Reactor Facility Director (RFD) is ultimately responsible for certifying that each RO and SRO has met the requalification criteria outlined by this document. The RFD shall appoint, in writing, a Training Coordinator responsible for administration of the requalification program at AFRRI. However, each licensed operator is ultimately responsible for ensuring that he or she meets all the requirements as outlined in this document.

III. SCHEDULE

The Operator Requalification Program cycle will last a period of two years beginning in the first quarter of the even-numbered year. Each licensed operator will enter the requalification program on the date the U.S. Nuclear Regulatory Commission issues him/her a license and will continue in the program until either the expiration date of the current license or the date at which the current license is terminated. Training will be scheduled such that, regardless of when the licensed operator enters the requalification program, he/she will complete all requirements within a two-year period. At the end of the requalification program cycle, the RFD must certify in writing that the operator has completed the requalification program.

IV. REFERENCES

- A. Reactor License R-84
- B. Technical Specifications
- C. Reactor Operational & Administrative Procedures
- D. 10 CFR - Parts 19, 20, 50, 55, 70, and 73
- E. AFRRI Reactor Facility Emergency Plan
- F. Safety Analysis Report
- G. AFRRI Reactor Facility Physical Security Plan
- H. AFRRI Safety and Health Manual
- I. Facility Design Files and As-Built Drawings.

## V. REQUALIFICATION PROGRAM

As required by 10 CFR 55.59, all licensed operators will participate in the Operator Requalification Program. The requalification program will include the following:

- A. Preplanned lecture series
- B. On-the-job training
- C. Periodic evaluation
- D. Supervisor evaluation
- E. Medical evaluation

### A. PREPLANNED LECTURE SERIES

The preplanned lecture series will be conducted on a continuing basis throughout the requalification cycle and will include the following subjects:

- 1. Nuclear and radiation physics theory and principles of operation
- 2. General and specific plant operating characteristics
- 3. Plant instrumentation, control, and engineered safety systems
- 4. Plant protection systems and facility interlocks
- 5. Plant physical security systems
- 6. Modifications, malfunctions, and changes to facility design and procedures
- 7. Normal, abnormal, and emergency operating procedures
- 8. Radiation control and safety
- 9. Technical Specifications
- 10. Applicable portions of Title 10 CFR

Individual study, training aids (audio-visual) or other forms of study may be employed; however, they shall not be substituted for the lecture series.

Lectures may be videotaped with these tapes being used to conduct make-up classes for licensed operators who missed the original lecture. A minimum of one lecture in each of these ten areas will be given during the requalification cycle.

### B. ON-THE-JOB TRAINING

Each licensed operator will manipulate the controls of the AFRRRI TRIGA reactor such that reactivity changes are made in the performance of the following operations on a least 10 different occasions during the requalification period. Any combination of operations is acceptable for a total of 10; however, at least one from each category is required.

- 1. Square wave or steady state operation
- 2. Pulsing operation
- 3. Excess reactivity measurement

In addition, each licensed operator will participate in the following reactor checkout operations on different occasions during the requalification period. Any combination of operations is acceptable for a total of 18; however, at least one from each category is required.

1. Daily operational startup or safety checklist
2. Daily operational shutdown checklist
3. Weekly operational instrument checklist

Each licensed operator shall participate in the annual AFRRI TRIGA reactor maintenance shutdown program at least once during the requalification period. This participation will include activities such as:

1. Control rod worth measurements
2. Fuel measurement and inspection
3. Fuel temperature measurement system calibration
4. Reactor thermal power calibration
5. High flux safety channel calibration

Each licensed operator shall perform duties at the AFRRI TRIGA reactor facility, including the frequent operation and maintenance of the AFRRI TRIGA reactor facility, that ensure familiarization and retraining on a continuous basis.

Each SRO shall perform or directly supervise the performance of the above activities with the same frequency required of a RO.

The Training Coordinator will track individual progress to ensure that each licensed operator actively performs the functions of a licensed operator as defined in 10 CFR 55.4 for at least four hours per calendar quarter. This is the minimum acceptable criteria. In addition, the Training Coordinator is responsible for notifying the RFD if any licensed operators have less than the required four hours at least two weeks prior to the end of the calendar quarter.

If the operator does not satisfactorily complete these on-the-job training requirements, to include a minimum of four hours per calendar quarter active performance of the functions of an operator or senior operator, then the operator will not resume the functions authorized by his/her license until the Reactor Facility Director or Reactor Operations Supervisor (ROS) certifies in writing that all of the following conditions have been met:

1. The qualifications and status of the licensee are current and valid.
2. The licensee has completed a minimum of six hours of shift functions, under the direction of a licensed operator or senior operator as appropriate, in the position to which the individual will be assigned.
3. The six hours have included a complete tour of the facility and all required startup and shutdown procedures.

The above-mentioned on-the-job training consists of activities required of ROs and SROs as outlined in 10 CFR 55.59(c)(3)(i) that are applicable to the AFRRI TRIGA reactor facility in accordance with 10 CFR 55.59(c)(7).

### C. PERIODIC EVALUATION

The evaluation of each licensed operator's knowledge and performance of the requirements set forth in the requalification program will be accomplished by a written examination and operating test, including a demonstration at the reactor console. These evaluations will be prepared in accordance with 10 CFR Parts 55.41, 55.43, 55.45, and 55.59. The operating test shall be administered annually, not to exceed 15 months, to each licensed operator except the RFD. Two operating tests shall be administered during each 24-month requalification cycle. A written examination shall be administered once near the end of each 24-month requalification cycle to each licensed operator except the RFD. All evaluations will be prepared and graded by the RFD, except as noted below for the administration of operating tests.

The operating test shall be prepared in accordance with 10 CFR 55.59(a)(2)(ii). In addition, only sections of 10 CFR 55.45(a) that are applicable to the AFRRI TRIGA reactor facility shall be used to develop the test. This test will require the operator to demonstrate an understanding of and the ability to perform the actions necessary to accomplish a representative sample from among the following eight items (derived from 10 CFR 55.45(a)):

1. Manipulate the console controls as required to safely operate the facility.
2. Identify annunciators and condition-indicating signals and perform appropriate remedial actions if necessary.
3. Identify the reactor instrumentation systems and significance of their readings.
4. Perform control manipulations required to obtain desired operating results during normal, abnormal, and emergency situations.
5. Demonstrate or describe the use and function of the facility's radiation monitors and alarms and portable survey instruments.
6. Demonstrate knowledge of significant radiation hazards and techniques for reducing personnel exposure.
7. Demonstrate knowledge of the emergency plan for the facility including when the plan should be executed and the operator's duties under the plan.
8. Demonstrate knowledge of the operational procedures and facility license ensuring that the operational procedures are adhered to and that the limitations in the license and amendments are not violated.

The written examination for each licensed operator shall be prepared in accordance with 10 CFR 55.59(a)(2)(i). In addition, only sections of 10 CFR 55.41 and 10 CFR 55.43 that are applicable to the AFRRRI TRIGA reactor facility shall be used to develop the examination. This examination will include a representative sample from among the following 12 items (derived from 10 CFR 55.41 and 55.43):

1. Conditions and limitations in the facility license.
2. Facility operating limitations in the Technical Specifications.
3. Fundamentals of reactor theory, including the fission process, neutron multiplication, source effects, control rod effects, criticality indications, reactivity coefficients, and poison effects.
4. General design features of the core, including core structure, fuel elements, control rods, and core instrumentation.
5. Mechanical components and design features of the reactor cooling system.
6. Reactor operating characteristics during all modes of operation.
7. Design, components, and functions of control and safety systems, including instrumentation, interlocks, and automatic and manual features.
8. Administrative, operational, and emergency procedures for the facility including assessment of facility conditions and appropriate actions during abnormal and emergency situations.
9. Purpose and operation of radiation monitoring systems, including alarms and survey equipment.
10. Radiological safety principles and procedures.
11. Radiation hazards that may arise during normal and abnormal situations.
12. Procedures for handling and disposal of radioactive material.

If an individual receives a grade of less than 70% on any section of the written examination, he/she will enter an accelerated requalification program with training emphasis placed on identified weaknesses.

An unsatisfactory evaluation on the annual operating test will require that discussions of deficiencies take place between that licensed operator and the RFD or ROS. A second operating test will then be administered. If performance is again unsatisfactory, the licensed operator will be temporarily suspended from licensed duties and placed into an accelerated requalification program.

The Training Coordinator will be responsible to the RFD for all training schedules, materials, and documentation associated with these evaluations. The RFD is the senior technical manager and, as such, shall oversee the administration of written examinations. Additionally, he will give senior staff members operating tests. These senior staff members may then administer the remaining operating tests. As the senior supervisor in charge, the RFD shall not be required to take written examinations or operating tests.

#### D. SUPERVISOR EVALUATION

Each licensed operator of the AFRRI TRIGA reactor will be periodically evaluated for performance and competency by the RFD or his designee in accordance with 10 CFR 55.59(c)(4)(iii). These evaluations will include performance and actions taken or to be taken during actual or simulated abnormal or emergency conditions.

#### E. MEDICAL EVALUATION

All licensed operators will undergo a medical evaluation at least once during the requalification period (every two years) by a physician in accordance with 10 CFR 55.21, 55.23, and 55.33(a)(1). The Training Coordinator is responsible for scheduling medical examinations for each licensed operator and ensuring that a record of this medical evaluation is maintained in the operator's training file in accordance with 10 CFR 55.27.

### VI. ACCELERATED REQUALIFICATION PROGRAM

The additional training that an operator may require (as indicated by his/her examinations) may consist of additional lectures and study assignments, as the Training Coordinator deems necessary, written examinations, and console performance operating tests. The additional training and the evaluation that the operator receives will depend upon the weaknesses exhibited on previous evaluations. Either the RFD or his designee will determine the number of lectures and evaluations that an operator will receive. The operator must obtain an overall rating of at least 80% on the reevaluation in order to be removed from the accelerated requalification program. Any operator who was temporarily suspended from licensed duties must be recertified by the RFD prior to having the temporary license suspension lifted. The Training Coordinator will be responsible to the RFD for directing all accelerated training efforts to include preparation of evaluations, training schedules, materials and documentation associated with accelerated requalification requirements.

### VII. RECORDS

The following records will be maintained for each licensed operator and retained until the individual license is either renewed or terminated:

A. Current copy of either the operator's Reactor Operator or Senior Reactor Operator license

B. A graded copy of the licensed operator's most recently administered written requalification examination

C. Results of supervisor evaluations and documentation of all operating tests administered during the cycle

D. The licensed operator's Requalification Program Checklist

E. The licensed operator's Requalification Memorandum for Record

F. The summary of training received by a licensed operator in the accelerated requalification program documented in a memorandum for record and any additional documentation that is pertinent to additional training received by that licensed operator

G. The licensed operator's medical evaluation record

H. All training records associated with each licensed operator's last completed two-year requalification cycle

The Training Coordinator will be responsible to the RFD for maintenance of all records associated with this requalification program.

Financial Qualifications and Decommissioning Information  
for the  
AFRRI TRIGA Reactor Facility  
Docket 50-170  
July 2004

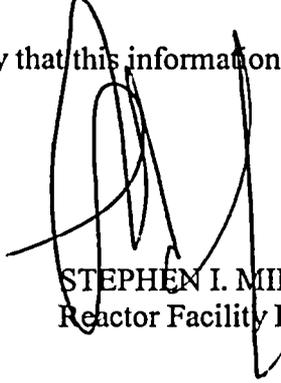
This information is submitted as required by 10 CFR 50.33(f) in conjunction with the relicensing application for the AFRRI TRIGA reactor facility.

The Armed Forces Radiobiology Research Institute is a U.S. government entity within the Department of Defense. Normal yearly funding to cover operational costs for the AFRRI reactor come through the normal Congressional appropriations process as further delegated within the Department of Defense. The appropriations process in past years has always provided sufficient funds to operate the reactor in a safe manner. Adequate Congressional funding is expected to continue throughout the requested 20-year relicensing period.

The estimated annual cost to operate the reactor facility for the first five years of the requested renewal period is detailed in Attachment 1 along with the underlying assumptions and bases.

The source of funding to cover decommissioning of the reactor would be a supplemental Congressional appropriation requested when necessary. The amount of this request would be approximately \$13,300,000 in 2004 dollars. This estimate assumes that DOE will maintain sufficient storage capacity to accept the AFRRI fuel in a timely manner. If the fuel must be stored at the AFRRI site for a lengthy period, the decommissioning estimates will increase both due to inflation and the normal expenditures discussed in Attachment 1. The estimated decommissioning costs are fully discussed in Attachment 2 and are based on actual costs incurred at several recently decommissioned research reactors. The type of decommissioning contemplated would be to release the site for unrestricted use.

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



STEPHEN I. MILLER  
Reactor Facility Director

**Annual Cost Estimates to Maintain  
The AFRRJ Reactor in an Operational  
Status (Minimum Staff Required)**

<b>Total Cost</b>	<b>\$589K – 654K/year</b>
<b>with:</b>	
<b>Utilities</b>	<b>\$89K</b>
<b>Staff (6) + Security</b>	<b>\$466K</b>
<b>Supply</b>	<b>\$34K</b>
<b>NRC Licensing Fee</b>	<b>\$65K</b>

## COST ESTIMATES TO MAINTAIN THE AFRRI REACTOR IN AN OPERATIONAL STATUS

The following cost estimates are the absolute minimum costs to maintain the AFRRI TRIGA reactor in an operational status. Minimum staffing would allow for minimal operations.

UTILITIES	89K
STAFFING: (RFD, ROS, RPO, HP, STAFF ENG, TECH, SECURITY)	*466K
SUPPLY	34K
ANNUAL NRC LICENSING FEE	*65K

\*Salary and benefits

\*\*Categorized as part of a university, AFRRI is exempt from the annual licensing fee.  
Otherwise \$65K.

As a U.S. Government entity, AFRRI is also exempt from various other NRC fees under 10 CFR 170.11(a)(5).

**COST OF UTILITIES**

The cost of utilities for the AFRRRI complex for one year are as follows:

User	Electricity	Water	Sewage	Chilled Water	Steam	Total
AFRRRI	900K	26K	36K	502K	330K	1794K
Reactor 5%	46K	2K	2K	23K	16K	89K

**MINIMUM PERSONNEL COSTS FOR THE AFRRRI TRIGA REACTOR**

Staffing Requirements	Base Pay w/benefits	% Time for NRC Compliance
Reactor Facility Director (GS-14)	100K	40%
Reactor Operations Supervisor (GS-12)	70K	30%
Engineer (GS-12)	59K	40%
Technician (GS-11)	49K	20%
Radiation Protection Officer 50% time	38K	40%
Health Physicist 100% time	50K	30%
Security Contract	100K	
<b>Total Personnel Costs</b>	<b>466K</b>	

Cost of staffing would allow for minimal operating capability. The above staffing requirements were derived from the AFRRRI TRIGA Reactor Technical Specifications and operational requirements.

**REGULATORY REQUIREMENTS**

Annual Requirements	Staff-Hours/year
Reports	1500
Inspections	900
Training/Licensing	1650
Emergency Response Team/HAZMAT	1000
<b>One-time Requirement</b>	<b>Total Staff-Hours</b>
Reactor Relicensing (begin FY00)	8500

**MINIMUM SUPPLY AND EQUIPMENT COSTS FOR AFRI TRIGA REACTOR**  
 (per year)

		**
Water makeup system still demineralizers	\$ 1,500	\$ 1,500
Water purification system demineralizers	\$ 1,500	\$ 1,500
Water purification CUNO filters	\$ 50	\$ 50
Absolute filters for exhaust ventilation	\$ 1,900	\$ 1,900
Chart paper and pens for various recorders	\$ 500	\$ 500
Annual NRC Indemnity fee	\$ 100	\$ 100
Annual NRC licensing fee	\$ 0	\$65,000
RRFSC consultant	\$3,000	\$ 3,000
Compressor oil	\$ 200	\$ 200
Office supplies, Repair parts, Equipment	\$25,000	\$25,000
<b>Total Supply and Equipment Costs</b>	<b>\$33,750</b>	<b>\$98,750</b>

**\*\* Categorized as part of a university, AFRI is exempt from the annual licensing fee. Otherwise the fee is \$65K.**

**Decommissioning Cost Estimates  
For the AFRRR TRIGA Reactor-  
Fuel Returned to DOE**

06/14/04		DECOMMISSIONING -- RETURN TO DOE					
		2004	2005	2006	2007	2008	2009
1	Return Fuel to DOE	////					
2	Statement of Work	//// A					
3	Write Plan	//// B					
4	Contract(Decommission)	////		\$750K			
5	Possession-Only Lic	////	\$15K				
6	Fuel Decay	////		\$585K			
7	Remove Non-Rad Equip	////		\$1.0M			
8	Acquire Fuel Transport	////			C		
9	Ship Fuel	////			D		
10	Remove Facility	////				\$7.2M	
11	Rad Waste Shipment	////				E	
12	Decon Acceptance	////					F
13	Final Report	////					G
14	Unrestricted Use	////					END

Fuel shipped to DOE: This involves shipping the fuel to one of the DOE disposal sites. Currently, Idaho National Engineering Laboratory (INEL) is not accepting TRIGA reactor fuel due to Idaho state laws. The shipments would be made to the Savannah River, SC site.

NOTE: Assuming fuel will be accepted by one of the major DOE disposal sites. If not, then storage at AFRI would be considered.

A = \$0; B = \$250K; C = \$50K; D = \$170K; E = \$2.0M; F = \$1.0M; G = \$250K

Fuel Shipped to DOE: This involves shipping the fuel to one of the DOE disposal sites. Currently, Idaho National Engineering Laboratory (INEL) is not accepting TRIGA reactor fuel due to Idaho state laws. Fuel shipments would be made to the Savannah River, SC site.

0 to 1 months (1 month)	
Statement of Work	
0 to 3 months (3 months)	
Write Plan	\$250 K
4 to 21 months (18 months)	
Let Contract	\$750K
Fuel Decay	\$585K
4 to 9 months	
Possession-Only Status	\$ 15 K
4 to 37 months (34 months)	\$ 1.0 M
Remove Non-Radiation Equipment	
Console/Electrical	
22 to 25 months (4 months)	
Acquire fuel transport	
Consultants/Support	\$ 50 K
Ship Fuel (3 trips) to INEL or SRNL	
Rent cask	\$100 K
Transport fuel	\$ 70 K
26 to 37 months (12 months)	
Reactor Facility Removal	\$ 7.2M
Core/Exposure Rooms	
38 to 39 months (2 months)	
Decontamination Shipment	\$ 2.0M
40 to 41 months (2 months)	
Decontamination Acceptance	\$ 1.0M
42 to 44 months	
Final Report	\$ 250K
Unrestricted Use	

NOTE: Assuming fuel will be accepted by one of the major DOE disposal sites. If not, then storage at AFRRRI would be considered.

TOTAL COSTS: \$13.3M

## JULY 2004 CHANGES

### Docket 50-170

#### **Technical Specifications –**

- a. On page 30, Figure 1 in Section 3.1.1 is changed to agree with Section 1.4 of the reactor Emergency Plan that was implemented in December 2003.
- b. On page 33, Section 6.2.1.1.c is changed so that nonvoting members are invited by the AFRRI Director rather than by the RRFSC Chairman. This is consistent with the AFRRI Director appointing all other committee members.

**Emergency Plan –** The submitted plan is identical to the current plan except the date is changed from December 2003 to July 2004.

#### **Physical Security Plan –**

- a. In paragraph 5.b., rooms 1118 and 2164A are removed from the list of Reactor Control Area rooms. Other references to these rooms are removed throughout the plan. These rooms no longer contain reactor-related equipment.
- b. In paragraph 10.h., the access time for the CAA is changed to 0530 instead of 0545 to accommodate early-arriving staff members.
- c. Throughout the plan, the term Security Operations Sergeant is changed to Security Noncommissioned Officer.
- d. In Appendix 1, key identification is changed from a R-series system to a Letter-series system. The doors opened by each equivalent key remains the same as before.

#### **Operator Requalification Program –**

- a. The first paragraph in Section V.C. is revised to clarify the timing of written examinations and operating tests. This change ensures compliance with NRC RIS 2003-10.
- b. In Section V.C., the next-to-last paragraph on page 5 is revised to delete the reference to an 80% overall grade on the written examination. Operators will now be entered into an accelerated requalification program only upon scoring less than 70% on an individual section. This is consistent with NRC scoring of initial licensing examinations.