TREAT AS

SENSITIVE

INFORMATION

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
8901 WISCONSIN AVENUE
BETHESDA, MARYLAND 20889-5603

March 29, 2007

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
ATTN: Al Adams, NRR/ADRA/DPR/PRT
Mail Stop 12-G13
Washington, DC 20555-0001

Dear Mr. Adams:

Enclosed is the 2006 Annual Operating Report required by the technical specifications for the Armed Forces Radiobiology Research Institute reactor (license R-84, docket 50-170).

Should you need any further information, please contact me at (301) 295-9245.

Enclosure:
as stated

STEPHEN I. MILLER
Reactor Facility Director

A020

Armed Forces Radiobiology Research Institute
AFRRI TRIGA Reactor Facility

1 January 2006 - 31 December 2006

To satisfy the requirements of
U.S. Nuclear Regulatory Commission License No. R-84 (Docket No. 50-170),
Technical Specification 6.6.b.

Prepared by
Harry H. Spence
Reactor Operations Supervisor

Submitted by
Stephen I. Miller
Reactor Facility Director

Armed Forces Radiobiology Research Institute
8901 Wisconsin Avenue
Bethesda, MD 20889-5603
Telephone: (301) 295-1290
Fax: (301) 295-0735

Submission of 2006 Annual Report

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

27 March 07

STEPHEN I. MILLER Date
Reactor Facility Director

2006 ANNUAL REPORT

TABLE OF CONTENTS

Introduction

General Information

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

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

Section III
Unscheduled Shutdowns

Section IV
Safety-Related Corrective Maintenance

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

Section VI
Summary of Radioactive Effluent Released

Section VII
Environmental Radiological Surveys

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

Attachment
Facility Modification Worksheet for ARM Replacement

2006 ANNUAL REPORT

INTRODUCTION

The Armed Forces Radiobiology Research Institute (AFRRI) reactor facility was available for irradiation services throughout the year except for one nonoperational period of approximately two months during the annual reactor maintenance shutdown.

There were no major reactor modifications or projects during the year. One minor facility modification was made during 2006 in accordance with the provisions of 10 CFR 50.59 and is detailed at the Attachment. There were no unplanned shutdowns during 2006. Reports required by the reactor technical specifications were submitted, and the details are found in Section IV.

The 2006 annual reactor audit required by the reactor technical specifications was conducted by Dr. William Vernetson in January 2007. Dr. Vernetson is a professor of nuclear engineering and Director of the University of Florida reactor facility. During the audit he verbally indicated that he had not found any major discrepancies in reactor operations and those conclusions are reflected in his written report.

A comprehensive NRC inspection of reactor facility operations was conducted by Mr. Kevin Witt and Dr. Marcus Voth during July 2006. No safety concerns or noncompliance with NRC requirements were identified.

There were several RRFSS membership changes during the year. These are detailed in the following section. One reactor operator candidate who had been removed from the training program during 2005 was returned to the program in 2006. There were also several reactor staff arrivals and departures during the year.

The remainder of this report is written in the format designated in the Technical Specifications for the AFRRI TRIGA Reactor Facility. Items not specifically required are presented in the General Information section. The following sections correspond to the required items listed in Section 6.6.b. of the specifications.

GENERAL INFORMATION

All personnel held the listed positions throughout the year unless otherwise specified.

Key AFRRI personnel (as of 31 December 2006) are as follows:

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

   Radiation Sciences Department (RSD) Head - William Adams, Jr., CAPT, USN

   Radiation Safety Officer - Daniel Hamilton, LTC, USA

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

3. Reactor operations personnel:

   Reactor Operations Supervisor - Harry H. Spence (SRO)

   SRO Training Coordinator - Kenneth Allen, MAJ, USA

   ERT Training Coordinator - Michael J. Belson, CPT, USA

   Maintenance Specialist - Walter D. Tomlinson

   Records Administration Specialist - Harry H. Spence (SRO)

   Senior Staff Engineer - Kenneth Allen, MAJ, USA

4. Other Senior Reactor Operators - None

5. Operator candidates:
   Kenneth Allen, MAJ, USA (effective 14 August)
   Kelly L. Baldwin, SFC, USA (effective 13 July)
   Michael J. Belson, CPT, USA (effective 16 February)
   Michele C. Desouza, SSG, USA (effective 05 May)
   Walter D. Tomlinson (effective 01 October) (Mr. Tomlinson was previously an operator candidate from December 2000 to May 2005)

6. Newly licensed operators:
   Joneil T. Ribaya, SFC, USA (SRO - 07 March)

7. Additions to staff during 2006:
   Kenneth Allen, MAJ, USA
   Kelly L. Baldwin, SFC, USA
   Michael J. Belson, CPT, USA

Michele C. Desouza, SSG, USA

8. Departures during 2006:
John T. Nguyen (SRO) (11 December)
Joneil T. Ribaya, SFC, USA (SRO) (23 June)
Stephanie Vaughn, MAJ, USA (SRO) (23 June)
Christopher S. Whicker, SSG, USA (SRO) (28 April)

9. There were several changes to the Reactor and Radiation Facilities Safety Subcommittee (RRFSS) during 2006. Dr. Christopher Lissner replaced Dr. Richard Lofts as the Chairman and Director's Representative on 01 November. SFC Regina Miller replaced LCDR Daniel Simpson as the Radiation Safety Officer on 01 February and LTC Daniel Hamilton replaced SFC Miller on 18 November.

In accordance with the requirements set forth in Section 6.2.1.1. of the Technical Specifications for the AFRRI TRIGA Reactor Facility, the RRFSS consisted of the following members as of 31 December 2006.

Regular members are:
Radiation Safety Officer - Daniel Hamilton, LTC, USA
Reactor Facility Director and Facility Radiation Manager - Stephen I. Miller
Reactor Operations Specialist - Dr. Seymour Weiss
Health Physics Specialist - Joe Pawlovich

Chairman and Director's Representative - Dr. Christopher Lissner

Special nonvoting member - David Lake, Montgomery County Government (Department of Environmental Protection)

Recorder - Harry H. Spence

Two meetings were held in 2006:

02 May

16 November

SECTION I

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

A summary of changes to the facility design, performance characteristics, administrative procedures, and operational procedures as well as the results of surveillance testing are provided in this section.

A. DESIGN CHANGES

In November 2006, the obsolete scintillation area radiation-monitoring (ARM) system was replaced with a new microprocessor-based halogen-quenched G-M system. The modification was analyzed against the criteria of 10 CFR 50.59 and reactor Administrative Procedure A3 to verify that no license amendment was required. The details of the analysis are attached to this report. The new ARM system was installed by representatives of the manufacturer. The system was then tested and its calibration verified by AFRRI reactor, radiation safety, and calibration personnel. Operational checklists and maintenance procedures have been updated as detailed in the analysis. The analysis will be submitted to the RRFSS for concurrence at the next scheduled subcommittee meeting.

B. PERFORMANCE CHARACTERISTICS

There were no changes to the performance characteristics of the core during 2006. All fuel, chambers, and the core experiment tube (CET) remained in place for operations throughout the year.

C. ADMINISTRATIVE PROCEDURES

There were no changes to Administrative Procedures during the year.

D. OPERATIONAL PROCEDURES

There were several changes to Operational Procedures during the year in conjunction with the installation of the new ARM system detailed in Section I.A. above:

Operational Procedure 8, Tab B - Daily Operational Startup Checklist
Operational Procedure 8, Tab B1 - Daily Safety Checklist
Operational Procedure 8, Tab H - Weekly Operational Instrument Checklist
Operational Procedure 8, Tab I - Daily Operational Shutdown Checklist

E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS

All maintenance and surveillance tasks during 2006 were accomplished as normally scheduled during the year.

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

The 2006 annual reactor audit required by the reactor technical specifications was conducted by Dr. William Vernetson in January 2007. Dr. Vernetson is a professor of nuclear engineering and Director of the University of Florida reactor facility. During the audit he verbally indicated that he had not found any major discrepancies in reactor operations and those conclusions are reflected in his written report.

A comprehensive NRC inspection of reactor facility operations was conducted by Mr. Kevin Witt and Dr. Marcus Voth during July 2006. No safety concerns or noncompliance with NRC requirements were identified.

SECTION II

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

Month	Kilowatt Hours
JAN	0.0
FEB	0.0
MAR	1678.8
APR	8.4
MAY	181.7
JUN	520.8
JUL	1.9
AUG	41.4
SEP	50.2
OCT	351.9
NOV	489.5
DEC	480.9
TOTAL	3805.5

Total energy generated in 2005: 3,805.5 kWh

Total energy on fuel elements: 1,004,479.2 kWh

Total energy on FFCRs*: 271,681.5 kWh

Total pulses this year $\geq$ $2.00: 0

Total pulses on fuel elements $\geq$ $2.00: 4,216

Total pulses on FFCRs* $\geq$ $2.00: 104

Total pulses this year: 28

Total pulses on fuel elements: 11,973

Total pulses on FFCRs*: 2,208

*Fuel-follower control rods

SECTION III

Unscheduled Shutdowns

There were no unscheduled shutdowns during 2006. On 08 June, a new larger uninterruptible power supply (UPS) was installed in the air particulate monitor (CAM) circuit to prevent any recurrence of the 12 October 2005 unscheduled shutdown that was described in the 2005 annual report.

SECTION IV

Safety-Related Corrective Maintenance

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

06 November 2006 - While performing the Daily Operational Startup Checklist, the operator discovered that the pump on the primary air particulate monitor (CAM) was not operating due to a blown fuse. A new fuse was installed and immediately failed. The RFD was notified and, with his approval, operations were allowed to continue. The alarm functions on the primary CAM were bypassed and the alarm functions on the secondary CAM continued to fulfill all requirements of the reactor Technical Specifications, Section 3.5.1. The pump was repaired and returned to service later that day. The primary CAM, including its alarm functions, was tested and operated normally.

CORRECTION: Section IV of the 2005 annual report described a malfunction in the water purification system that occurred on 14 January 2005. The items involved were described as "conductivity" probes with associated indicator modules. That description was incorrect. The probes and indicator modules actually give readings in units of "resistivity" rather than "conductivity." This note is to clarify that 2005 annual report section.

SECTION V

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

A. FACILITY CHANGES AS DESCRIBED IN THE FSAR

In November 2006, the obsolete scintillation area radiation-monitoring (ARM) system was replaced with a new microprocessor-based halogen-quenched G-M system. The modification was analyzed against the criteria of 10 CFR 50.59 and reactor Administrative Procedure A3 to verify that no license amendment was required. The details of the analysis are attached to this report. The new ARM system was installed by representatives of the manufacturer. The system was then tested and its calibration verified by AFRRI reactor, radiation safety, and calibration personnel. Operational checklists and maintenance procedures have been updated as detailed in the analysis. The analysis will be submitted to the RRFSS for concurrence at the next scheduled subcommittee meeting. Changes to applicable FSAR sections will be incorporated into the FSAR revision being completed as part of the ongoing reactor relicensing effort.

B. PROCEDURE CHANGES AS DESCRIBED IN THE FSAR

There were no changes to procedures as described in the FSAR. Changes to the administrative and operational procedures are covered in Section I.

C. NEW EXPERIMENTS OR TESTS

No new experiments or tests were performed during the reporting period that were not encompassed by the FSAR.

There was one safety evaluation for changes not submitted to the NRC, pursuant to the provisions of 10 CFR 50.59. The modification was described and qualified using Administrative Procedure A3 - Facility Modification. This procedure uses a step-by-step process to document that the criteria in 10 CFR 50.59(c)(2) were not met and that technical specification changes were not required prior to implementation. That safety evaluation is included as an attachment to this report.

SECTION VI

Summary of Radioactive Effluent Released

A. Liquid Waste: The reactor produced no liquid waste during 2006.

B. Gaseous Waste: There were no particulate discharges in 2006.

The total activity of Argon-41 discharged in 2006 was 2.24 curies. The estimated effluent concentration from the release of Argon-41 was below the constraint limit for unrestricted areas (Table 2 of Appendix B of 10 CFR 20).

Quarterly:	Jan - Mar 2006	0.697 Ci
	Apr - Jun 2006	1.230 Ci
	Jul - Sep 2006	0.030 Ci
	Oct - Dec 2006	0.280 Ci

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

SECTION VII

Environmental Radiological Surveys

All environmental sampling of soil and vegetation yielded radionuclide levels within the background range. The radionuclides that were detected were those expected from natural background and from long-term fallout from nuclear weapons testing.

The calculated annual dose, due to Argon-41 release to the environment for 2006, was 0.07 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 0.7% of the 10 millirem constraint limit, or 0.07 millirem for the entire year.

The reactor in-plant surveys, specified in Health Physics Procedure (HPP) 3-2, all resulted in readings that were less than the action levels specified in HPP 0-2.

SECTION VIII

Exposures Greater than 25% of 10 CFR 20 Limits

There were no doses to reactor staff personnel or reactor visitors greater than 25% of 10 CFR 20 occupational and public radiation dose limits.

ATTACHMENT

Facility Modification Worksheet 1

10 CFR 50.59 Analysis

Proposed Change Replacement of area radiation-monitoring (ARM) system.
(See attached answers for all questions)

Submitted by: Spence Date 06 Nov 06

1. Description of change:

2. Reason for change:

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

Analysis attached? Yes ✓

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

Procedure ____ Facility ✓

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

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

Facility Modification Worksheet 1 (cont.)

7. Specify associated information.

New drawings are: Attached ____

Not required ✓

Does a drawing need to be sent to Logistics? Yes ____ No ✓

Are training materials effected? Yes ✓ No ____

Will any Logs have to be changed? Yes ____ No ✓

Are other procedures effected? Yes ✓ No ____

List of items affected:

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

Action Sheet: Submitted ✓ Not Required ____

Reviewed and approved by RFD _____ Date 8 NOV 06

RRFSS Concurrence _____ Date _____

Facility Modification Worksheet 1

10 CFR 50.59 Analysis

1. Replace obsolete NMC scintillation area radiation-monitoring (ARM) system with new microprocessor-based Ludlum halogen-quenched G-M system (Model 375).

2. Nuclear Measurements Corporation no longer makes repair parts for the current system. The system has reached the end of its life expectancy and is becoming increasingly difficult to calibrate to acceptable tolerances.

3. The proposed change does not involve a change to the Technical Specifications. The new system will continue to have detectors, alarms, and readouts in the same locations as the current system (TS Section 3.5.1 and Table 4). The correct operation of the new system will be verified using the same surveillance requirements and intervals as the current system (TS Section 4.5). The proposed change does not meet any of the criteria in 10 CFR 50.59(c)(2):

a. The change will not result in any increase in the frequency or occurrence of an accident. The ARM system is a passive independent system that serves only to alert the staff to the occurrence and magnitude of an accident. The system does not insert reactivity, move fuel, and is not in any way connected to other reactor safety systems, SCRAMS, or alarms.

b. The change will not result in any increase in the likelihood of occurrence of a malfunction of a SSC important to safety for the same reasons discussed in (a) above. The modification will actually decrease the likelihood of a malfunction in the ARM system by upgrading the system hardware.

c. The change will not result in more than a minimal increase in the consequences of an accident previously evaluated in the FSAR. The ARM system is not connected to the CAM alarm system that would isolate the reactor room in case of a cladding failure. The ARM system is not related to the absolute air filters or any other component of the reactor ventilation system.

The control room readout meters for the current system show an upper limit of 100 R/hr. The meters for the new system have an upper limit of 10 R/hr. However, as clearly described in the FSAR, the maximum dose rates expected in the reactor room during accident conditions would be 300 mR/hr during a loss-of-coolant accident (FSAR Section 6.3.3) and 200 mR/hr during a fuel cladding accident (FSAR Section 6.3.2.2). The operator in the control room will still have access to other instrumentation capable of measuring radiation levels up to 1000R/hr.

d. The change will not result in any increase in the consequences of a malfunction of the system. As with the current system, a system failure or malfunction will illuminate a visual alarm both at the detector location and in the control room. Since the ARM system is required by the Technical Specifications to be functional during reactor operations, the operator will still SCRAM the reactor as required by reactor procedures. The new system will be connected to the building emergency power generator as is the current system. See also (c) above.

e. The change will not create the possibility for an accident of a different type than any previously evaluated in the FSAR for the various reasons described above.

f. The change will not create the possibility for a malfunction of an SSC with a different result than any previously evaluated in the FSAR. See the analyses for (a), (c), and (d) above.

g. The change will not result in the design basis limit for a fission product barrier as described in the FSAR being exceeded or altered. As described above, the ARM system can have no effect on reactor room containment, the reactor ventilation system, or the 1000°C fuel temperature safety limit.

h. The change does not result in a departure from a method of evaluation described in the FSAR used in establishing the design bases or in the safety analysis. As described above for the Technical Specifications, the locations, alarms, and readouts for the new system will be in the same locations as the current system (FSAR Section 3.6, Table 3.1, and Figures 3-11 to 3-13). FSAR Section 3.6.1 will be updated to reflect the characteristics of the new system.

4. Facility – Yes

Procedure – Procedures will be changed, but not those described in the FSAR

5. Applicable sections are Section 3.6, Table 3.1, and Figures 3-11 to 3-13. Only Section 3.6.1 will need to be changed to reflect the characteristics of the new system such as range, accuracy, and response time.

6. Manufacturer's representatives will install and test the new system. The detector modules will be calibrated at the factory prior to installation, and that calibration will be confirmed on-site by manufacturer's representatives and AFRRI calibration technicians using both pulse generators and Cs-137 sources. Alarm setpoints will be identical to the current system. All required audible and visual alarms and readouts will be verified by reactor staff members using a Cs-137 source before any reactor operations.

7. New drawings – No

Training materials or logs – Reactor staff members will be verbally trained on the correct completion of new daily and weekly checklists.

Other procedures – Yes

List of items affected:

a. Calibration Procedure C014
b. Maintenance Procedure M010
c. Surveillance Procedure S001
d. Daily Operational Startup Checklist
e. Daily Safety Checklist
f. Daily Operational Shutdown Checklist
g. Weekly Operational Instrument Checklist

8. Action Sheet attached.

Action Sheet for New ARM System

1. Revision of FSAR Section 3.6.1 – Will be included in complete FSAR revision during current reactor relicensing effort.

2. Revision of procedures C014, M010, and S001..... NOV 17 2006

3. Staff training and implementation of revised Startup, Safety, Shutdown, and Weekly checklists..... NOV 22 2006

DAILY OPERATIONAL STARTUP CHECKLIST

Checklist No. _____ Date _____
Time Completed _____ Supervised by _____
Assisted by _____

I. EQUIPMENT ROOM 3152

1. Air compressor pressure (80 - 120 psig) ..... _____*
2. Air dryer operating ..... _____
3. Doors 231, 231A, and roof hatch SECURED ..... _____

II. EQUIPMENT ROOM 2158

1. Prefilter differential pressure (< 8 psid) ..... _____*
2. Primary discharge pressure (11 - 20 psig) ..... _____*
3. Demineralizer flow rates set to 6 gpm (5.5 - 6.5 gpm) ..... _____*
4. Water Resistivity readings
   (a) Water monitor box resistivity (>0.2 Mohm-cm) ..... _____*
   (b) DM1 resistivity (>0.5 Mohm-cm) ..... _____*
   (c) DM2 resistivity (>0.5 Mohm-cm) ..... _____*
5. Stack roughing filter (notify supervisor if > 1.0" of water) ..... _____*
6. Stack absolute filter (notify supervisor if > 1.35" of water) ..... _____*
7. Visual inspection of area ..... _____
8. Door 2158 SECURED ..... _____

III. REACTOR ROOM 3161

1. Transient rod air pressure (78 - 82 psig) ..... _____*
2. Shield door bearing air pressure (8.5 - 11 psig) ..... _____*
3. Visual inspection of core and tank ..... _____
4. Number of fuel elements and control rods in tank storage — Fuel elements _____* Control rods _____*
5. Air particulate monitor (CAM)
   (a) Primary operating and tracing ..... _____
   (b) Backup operating ..... _____
   (c) Channel test completed, damper closure verified ..... _____
6. Channel test completed on SGM ..... _____
7. Radiation monitors

Monitor	Source check	Failure mode lights off & status light on
(a) R-1	_____	_____
(b) R-2	_____	_____
(c) R-3	_____	_____
(d) R-5	_____	_____

8. Door 3162 SECURED ..... _____

*Numerical Entry

IV. LOBBY AREA

Lobby alarm turned off ..... _____

V. PREPARATION AREA

1. Visual inspection of area ..... _____
2. Radiation monitors

Monitor	Source check	Failure mode lights off & status light on
(a) E-3	_____	_____
(b) E-6	_____	_____

VI. REACTOR CONTROL ROOM 3160

1. Emergency air dampers reset ..... _____
2. Console recorders dated ..... _____
3. Stack flow and fuel temperature recorders dated ..... _____
4. Logbook dated and reviewed ..... _____
5. Water monitor box background activity (10 - 60 cpm) ..... _____*
6. Stack gas flow rate (15 - 35 Kcfm) ..... _____*
7. Stack linear flow rate (1.0 - 2.0 Kft/min) ..... _____*
8. Gas stack monitor
   - (a) Background (2 - 20 cpm) ..... _____*
   - (b) SGM High Indicator Check ..... _____
   - (c) High alarm point set to 3.2 E-5 microCi/cc at stack top ..... _____
9. Radiation monitors
   - (a) All AUDIO & RELAY switches set to the ENABLE position ..... _____
   - (b) Green OK light on and all red ALARM and FAIL lights off ..... _____
10. CAM high level audible alarm check ..... _____
11. Demineralizer inlet temperature (5 - 35 °C) ..... _____*
12. Water level log completed ..... _____
13. Console lamp test completed ..... _____
14. Source level power greater than/equal to 0.5 cps ..... _____
15. Prestart operability checks performed ..... _____
16. Time delay operative ..... _____
17. Interlock Tests

(a) Rod raising, SS mode	_____	(e) 1 kW/Pulse mode	_____
(b) Rod raising, Pulse mode	_____	(f) NM-1000 HV	_____
(c) Source RWP	_____	(g) Inlet Temp (pool)	_____
(d) Period RWP	_____		

18. SCRAM checks (at least one per rod)

(a) % Power 1	_____	(h) Reactor key	_____
(b) % Power 2	_____	(i) Manual	_____
(c) Fuel temp 1	_____	(j) Timer	_____
(d) Fuel temp 2	_____	(k) DAC Watchdog	_____
(e) HV loss 1	_____	(l) CSC Watchdog	_____
(f) HV loss 2	_____	(m) Emergency Stop	_____
(g) Pool level	_____		

19. Zero power pulse ..... _____

*Numerical Entry

DAILY SAFETY CHECKLIST

Checklist No. _____ Date _____
Time Completed _____ Supervised by _____
Assisted by _____

I. EQUIPMENT ROOM 3152

1. Air compressor pressure (80 - 120 psig) ..... _____*
2. Air dryer operating ..... _____
3. Doors 231, 231A, and roof hatch SECURED ..... _____

II. EQUIPMENT ROOM 2158

1. Prefilter differential pressure (< 8 psid) ..... _____*
2. Primary discharge pressure (11 - 20 psig) ..... _____*
3. Demineralizer flow rates set to 6 gpm (5.5 - 6.5 gpm) ..... _____*
4. Water Resistivity readings
   (a) Water monitor box resistivity (>0.2 Mohm-cm) ..... _____*
   (b) DM1 resistivity (>0.5 Mohm-cm) ..... _____*
   (c) DM2 resistivity (>0.5 Mohm-cm) ..... _____*
5. Stack roughing filter (notify supervisor if > 1.0" of water) ..... _____*
6. Stack absolute filter (notify supervisor if > 1.35" of water) ..... _____*
7. Visual inspection of area ..... _____
8. Door 2158 SECURED ..... _____

III. REACTOR ROOM 3161

1. Transient rod air pressure (78 - 82 psig) ..... _____*
2. Shield door bearing air pressure (8.5 - 11 psig) ..... _____*
3. Visual inspection of core and tank ..... _____
4. Number of fuel elements and control rods in tank storage — Fuel elements _____* Control rods _____*
5. Air particulate monitor (CAM)
   (a) Primary operating and tracing ..... _____
   (b) Backup operating ..... _____
   (c) Channel test completed, damper closure verified ..... _____
6. Channel test completed on SGM ..... _____
7. Radiation monitors

Monitor	Source check	Failure mode lights off & status light on
(a) R-1	_____	_____
(b) R-2	_____	_____
(c) R-3	_____	_____
(d) R-5	_____	_____

8. Door 3162 SECURED ..... _____

*Numerical Entry

IV. LOBBY AREA

Lobby alarm turned off ..... _____

V. PREPARATION AREA

1. Visual inspection of area ..... _____
2. Radiation monitors

Monitor	Source check	Failure mode lights off & status light on
(a) E-3	_____	_____
(b) E-6	_____	_____

VI. REACTOR CONTROL ROOM 3160

1. Emergency air dampers reset ..... _____
2. Console recorders dated ..... _____
3. Stack flow and fuel temperature recorders dated ..... _____
4. Logbook dated and reviewed ..... _____
5. Water monitor box background activity (10 - 60 cpm) ..... _____*
6. Stack gas flow rate (15 - 35 Kcfm) ..... _____*
7. Stack linear flow rate (1.0 - 2.0 Kft/min) ..... _____*
8. Gas stack monitor
   (a) Background (2 - 20 cpm) ..... _____*
   (b) SGM High Indicator Check ..... _____
   (c) High alarm point set to 3.2 E-5 microCi/cc at stack top ..... _____
9. Radiation monitors
   (a) All AUDIO & RELAY switches set to the ENABLE position ..... _____
   (b) Green OK light on and all red ALARM and FAIL lights off ..... _____
10. CAM high level audible alarm check ..... _____
11. Demineralizer inlet temperature (5 - 35 °C) ..... _____*
12. Water level log completed ..... _____
13. Console lamp test completed ..... _____
14. Source level power greater than/equal to 0.5 cps ..... _____

*Numerical Entry

WEEKLY OPERATIONAL INSTRUMENT CHECKLIST

CHECKLIST # _____ DATE_____
SUPERVISED BY _____
ASSISTED BY _____ REVIEWED BY _____

I. WATER LEVEL INDICATOR

A. In pool, east side, depress float on water level indicator ..... _____
B. Observe scram on console ..... _____

II. WATER RESISTIVITY

List resistivity readings for previous calendar week from daily startup checklists. Determine the average at each point is >0.5 Mohm-cm.

	MON	TUE	WED	THU	FRI	AVG
Monitor Box	_____	_____	_____	_____	_____	_____
DM1	_____	_____	_____	_____	_____	_____
DM2	_____	_____	_____	_____	_____	_____

III. RADIATION ALARMS

A. Test alarm functions for high level and failure

Monitor	Failure alarm functional	HIGH Level alarm functional
Reactor Room CAM	_____	_____
Stack Gas Monitor	_____	_____

B. Reset alarms..... _____

C. Radiation monitors

(a) All AUDIO & RELAY switches set to the ENABLE position (3160) ..... _____
(b) Green OK light on and all red ALARM and FAIL lights off (3160) ..... _____

Monitor	Source check	Failure mode lights off & status light on
(a) R-1	_____	_____
(b) R-2	_____	_____
(c) R-3	_____	_____
(d) R-5	_____	_____
(e) E-3	_____	_____
(f) E-6	_____	_____

IV. OTHER

A. Top lock key seals at Security Desk and at LOG verified intact ..... _____
B. Change Filter in the Stack Gas Monitor ..... _____
C. Fill Multichannel Analyzer Liquid Nitrogen Dewer ..... _____
D. Check for Alarm on Cooling Tower Monitor in Room 2158 ..... _____

DAILY OPERATIONAL SHUTDOWN CHECKLIST

Checklist No. _____ Date _____
Time Completed _____ Supervised by _____
Assisted by _____
_____

I. REACTOR ROOM 3161

1. All rod drives DOWN ..... _____
2. Carriage lights OFF ..... _____
3. Door 3162 SECURED ..... _____
4. Both CAMs operating and tracing ..... _____
5. Radiation monitors

Monitor	Green status light on	Red failure mode lights off
(a) R-1	_____	_____
(b) R-2	_____	_____
(c) R-3	_____	_____
(d) R-5	_____	_____

6. Door 3161 locked with key ..... _____

II. EQUIPMENT ROOM 3152

1. Distillation unit discharge valve CLOSED ..... _____
2. Air dryer OPERATIONAL ..... _____
3. Doors 231, 231A, and roof hatch SECURED ..... _____

III. LOBBY ALARM

Lobby alarm audio ON ..... _____

IV. EQUIPMENT ROOM 2158

1. Primary discharge pressure (11 - 20 psig) ..... _____*
2. Demineralizer flow rates set to 6 gpm (5.5 - 6.5 gpm) ..... _____*
3. Visual inspection for leaks ..... _____
4. Doors 2158 and 2164 SECURED ..... _____

V. PREPARATION AREA

1. ER2 plug door CONTROL LOCKED ..... _____
   Door closed; and handdwheel PADLOCKED ..... _____
2. ER2 lights ON and rheostat at 10% ..... _____
3. ER1 plug door CONTROL LOCKED ..... _____
   Door closed; and handwheel PADLOCKED ..... _____
4. ER1 lights ON and rheostat at 10% ..... _____
5. Visual inspection of area ..... _____
6. Warm storage doors closed ..... _____
7. Radiation monitors

Monitor	Green status light on	Red failure mode lights off
(a) E-3	_____	_____
(b) E-6	_____	_____

VI. REACTOR CONTROL ROOM 3160

1. Reactor tank lights OFF ..... _____
2. Console chart recorder pens raised ..... _____
3. Console LOCKED, and all required keys returned to lock box ..... _____
4. Diffuser pumps OFF ..... _____
5. Purification, secondary and primary pumps ON ..... _____
6. Reactor monthly usage summary completed ..... _____
7. Auxiliary chart recorders operating and tracing ..... _____

* Numerical Entry