TECH SPECS
DOCKET 50-170

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

RSDR

30 MAR 1994

SUBJECT: Submission of Annual Report

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Dir Sir:

Attached please find the 1993 Annual Report for the AFRRI TRIGA reactor facility, submitted as required by license R-84, facility docket 50-170.

Should you need any further information, please contact the undersigned at (301) 295-1290.

Mark Moore

Attachment
as stated

MARK MOORE
Reactor Facility Director

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King of Prussia, PA. 19406

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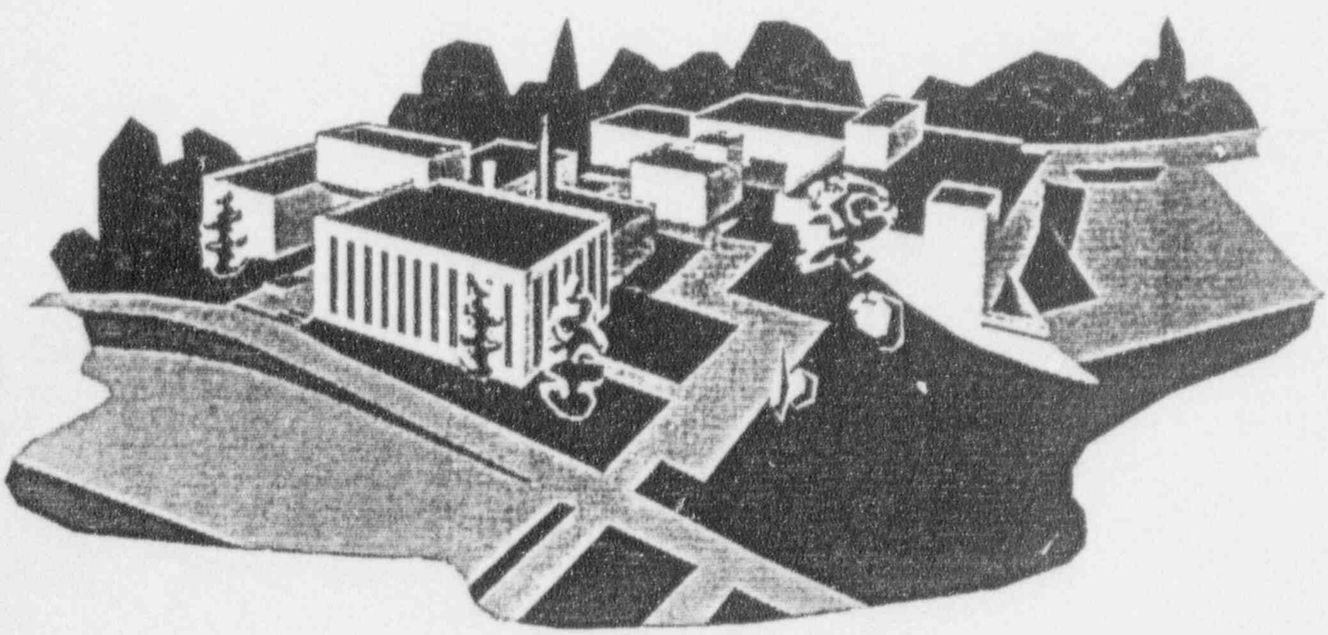
1993 Annual Report of the AFRRI TRIGA Reactor

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
DEPARTMENT OF DEFENSE



1993 ANNUAL REPORT
OF THE AFRRI TRIGA REACTOR

Submitted by

Mark Moore 29 March 94
MARK L. MOORE Date
Reactor Facility Director

Approved

Robert L. Bumgarner
ROBERT L. BUMGARNER Date
Captain, MC, USN 29 March 94
Director

1993 ANNUAL REPORT
OF THE
AFRRI TRIGA REACTOR

Docket 50-170

Edited By

Mr. Robert George ROS

SGM Harry Spence

License R-84

Submitted By

Mark L. Moore

Reactor Facility Director

INTRODUCTION

1993 ANNUAL REPORT

INTRODUCTION

In 1993, the AFRRI reactor facility continued to provide reliable irradiation services to nineteen investigators including both AFRRI staff scientists and an outside investigator at the University of Maryland, Baltimore. The number of non-AFRRI investigator⁻ declined from previous years, but the resulting available irradiation times were productively used by in-house investigators performing significant radioprotectant and functional degradation reduction studies. On 1 Oct 93, administrative control of AFRRI was transferred from the Defense Nuclear Agency (DNA) to the Uniformed Services University of the Health Sciences (USUHS) (see Section V). The reactor staff anticipates a significant number of requests for irradiation support from USUHS scientists as they become aware of the reactor's capabilities to support their radiobiological work. Activation analysis support for the Federal Bureau of Investigation is also expected to resume in early 1994. The reactor irradiation workload was reduced during the second half of the year in preparation for the exposure room ventilation repair contract (Sections I & V). This action was necessary to allow for decay of any residual radioactivity in the exposure rooms and to minimize any possible radiation exposure to ventilation contract workers.

The microprocessor-based instrumentation and control console, fully installed in 1990 after a two year test period, completed its third year of successful operation as the primary console. The console operated throughout the year with only minimal malfunctions (Section IV). There were no unplanned shutdowns during 1993.

The excavation created during the ventilation duct repair work outside the reactor building filled with water during a heavy rainstorm in late November. This caused approximately 7000 gallons of muddy water to flow into exposure room #1 (ER1) through the exposed, deteriorated air ducts. From ER1, the water flowed through the hot drain system into the hot waste holding tanks. Samples of both the water in the holding tanks and the mud reside in ER1 were counted in the radioanalysis laboratory and no radioactivity above background was detected. The water was then released to the sewer and the mud was cleaned from ER1. No damage to reactor systems or equipment resulted except for the wood floor which is being replaced in ER1. The wood replacement project will continue into 1994.

Radiological monitoring performed during the previously mentioned excavation work detected very low-level contamination in soil adjacent to the lower end of the ER1 exhaust duct. A request was submitted to the NRC to rebury this soil in its original location upon completion of the repair project (Attachment E).

There were two Licensee Event Reports submitted during the year. On 4 Mar 93 the senior reactor operator on console left the reactor control room with the key still in the console. The reactor was in a shutdown configuration at the time. This event is more fully described at Attachment C. The second Licensee Event Report, of 5 Nov 93, is detailed in both Sections I & IV and Attachment C. There were also several additional malfunctions that are discussed in Section IV.

The reactor facility was inspected by Nuclear Regulatory Commission (NRC) personnel from Region I on 20-22 Jul 93. No safety concerns or violations were observed during this inspection.

A reactor pool water quality testing program was initiated with a monthly test for nitrogen present in the form of ammonia. The results have ranged from 0.01 mg/L to 0.04 mg/L. This level is not considered to pose any hazard to the reactor pool structure. Tests for other possible impurities will be conducted on a yearly basis.

The reactor Physical Security Plan was updated and approved by the NRC during 1993. Changes were also made, without prior NRC approval, to the Reactor Facility Emergency Plan. Changes were requested to the Reactor Operator Requalification Program but have not yet been approved by the NRC. These various changes will be discussed fully in Section I.

Reactor staff changes included the departure of MAJ Christopher Owens and Mr. Gilbert Waldman. Added to the staff were LTC Leonard Alt and Tricia Gurley, who transferred within AFRRI. LTC Alt had previously been a licensed reactor operator at AFRRI for over four years. LTC Alt was added to the reactor operator training program and will take the SRO exam in early 1994, along with Capt Daniel Robbins who has been in the reactor operator training program throughout the year. Two former trainees received their operator licenses during 1993.

Changes were made to the procedures and facilities during 1993. These changes were supported by an extensive safety review process in accordance with the provisions of 10 CFR 50.59. These various changes will be discussed fully in Sections I & V.

The reactor staff was tasked with providing personnel to assist in conducting inspections of the Fast Burst Reactor facilities at Aberdeen Proving Ground, Maryland and White Sands Missile Range, New Mexico. At the request of Cornell University, an operations audit of their reactor facility was conducted.

The remainder of this report is written in a format to include information items required by the AFRRI TRIGA Reactor Technical Specifications. Items not specifically required but of general informational value are presented in the General Information section. Each section following the General Information corresponds to the required items as listed in Section 6.6.1.b of the AFRRI TRIGA Reactor Technical Specifications.

1993 ANNUAL REPORT

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Request for approval of slightly radioactive material disposal procedures

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Reactor Operator Requalification Program for the AFRRI TRIGA Reactor Facility

Attachment G

Changes to the AFRRI TRIGA Reactor Emergency Plan

GENERAL INFORMATION

Key Personnel

Reactor and Radiation Facility Safety Committee

GENERAL

GENERAL INFORMATION

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

1. Current key AFRRI personnel (as of 31 Dec 93) are as follows:

Director - CAPT Robert L. Bumgarner, USN

Chairman, Radiation Sources Department - CAPT C. B. Galley, USN

AFRRI Radiation Protection Officer - Mr. Thomas J. O'Brien

2. Reactor Facility Director - Mr. Mark Moore (SRO)

3. Current key Reactor Operations Personnel:

Deputy Reactor Facility Director - Mr. Stephen Miller (SRO) (Effective 2 Jun 93)

Reactor Operations Supervisor - Mr. Robert George (SRO) (Effective 2 Jun 93)

Training Coordinator - Mr. Stephen Miller (SRO) (Effective 1 Jul 93)

Maintenance - SFC Michael Laughery (SRO)

Administration - SGM Harry Spence (SRO)

Other Senior Reactor Operators - Mr. John Nguyen (SRO)

4. Operator Candidates: Capt Daniel Robbins (Full Year)
LTC Leonard Alt (Effective 1 Sep 93)

5. Newly Licensed Operators:
Mr. Stephen Miller (SRO Effective 19 Mar 93)
Mr. Gilbert Waldman (RO Effective 19 Mar 93)

6. Departures during 1993:
MAJ Christopher Owens (SRO License Terminated 1 Jul 93)
Mr. Gilbert Waldman (RO License Terminated 24 Sep 93)

7. There were two changes to the RRFSC during 1993. Effective 29 Jun 93, Col John R. Sheehan replaced Col Nicholas Manderfield as chairman due to the retirement of Col Manderfield from the Air Force. Capt Daniel Robbins replaced Ms. Carol King as the Recorder on 11 May 93. The various changes are shown at Attachment D.

The 1993 RRFSC consisted of the following membership in accordance with AFRRI Reactor Technical Specifications. (as of 31 Dec 93):

Chairman: Col John R. Sheehan, USAF, MSC (Director's Representative) (Effective 29 Jun 93)

Regular Members:

Mr. Thomas O'Brien (AFRRI Radiation Protection Officer)
Mr. Mark Moore (Reactor Facility Director, AFRRI)
Dr. Marcus Voth (Director, Breazeale Reactor and Professor of Nuclear Engineering, Pennsylvania State University)
Mr. Ron Luersen (Safety Directorate, Naval Research Laboratory)

Special Members:

CAPT Charles B. Galley, USN (Chairman, Radiation Sources Dept., AFRRI) (Certified HP)

Non-voting members:

Mr. James Caldwell (EPA, Montgomery County, MD)
LTC Eric Daxon (Radiation Biophysics Department, AFRRI)

Non-Voting Recorder:
Capt Daniel J. Robbins (Effective 11 May 93)

As required by the reactor Technical Specifications, four meetings of the RRFSC were held. All of the meetings held this year were full committee meetings.

22 March 1993

29 June 1993

29 September 1993

15 December 1993

SECTION I

Changes to the Facility Design,
Performance Characteristics
and Operational Procedures.
Results of Surveillance Tests
and Inspections.

SECTION I

Changes to the facility design, performance characteristics, operational procedures, and results from surveillance testing are contained in this section. The revised procedures can be found at Attachment A, while the 50.59 reviews can be found at Attachment B for all of the following changes.

A. DESIGN CHANGES:

1. The CAM-activated damper closure system was modified to allow the dampers to be opened during times when one of the CAMs is down for maintenance or repair. There are two CAMs, either of which can close the dampers. Only one CAM is required for safe operation. During extended periods of maintenance or down time for one of the CAMs, the ventilation dampers could not be opened. The modification will allow either of the CAMs to be bypassed so that the ventilation dampers can be opened during such periods. Red warning lights indicate that part of the closure system has been bypassed.

2. An audible alarm was added to the bulk water conductivity monitor. A 12 Vdc Sonalert buzzer was attached to the conductivity monitor in the control room so that, if the Technical Specifications limit of 0.2 megohm-cm is reached, the alarm sounds in the control room.

3. Reactor facility ventilation repair work was initiated in October and continued through the end of the year. Work on the project is expected to be completed during Apr 94. The repair work entailed excavating the back of the reactor building to expose the air duct system which supplies and exhausts ER1, ER2 and the Linac; removing the old ducts; installing new ducts; rustproofing the ducts; and sealing the back of the building with a waterproofing material. The new ducts are a direct replacement for the existing 30-year-old system which has begun to show signs of deterioration. The new system will be tested and balanced to ensure that the flow characteristics conform to the Safety Analysis Report.

4. A 4" sample port was placed in the wall between the upper equipment room (3152) and the reactor room (3160). The sample port will allow air samples to be retrieved from the reactor room without personal entry into the room. When not in use, the sample port has a screw-on plug with a rubber seal to maintain the reactor room air barrier.

5. The core position switch RP2-1/RP2-3 (position 500 switch) was removed and replaced by two relays and a manual momentary switch to perform the same functions as switch RP2-1/RP2-3 (see Section IV). Switch RP2-1\RP2-3 prevented movement of the core from either region 1 or 3 into region 2 with the lead shield doors closed. It also allowed movement of the core within region 1 toward ER1 or within region 3 toward ER2. The new relays, located in the reactor room motor control center,

control the movement of the core in regions 1 and 3 toward the exposure rooms and, in conjunction with the manual momentary switch, prevent core movement into region 2 with the doors closed. Should the core be driven into the boundary between region 2 and either region 1 or 3, and thus stopped by the interlock system, simultaneous activation of the manual momentary switch in the motor control center and the console core movement switch or foot pedal is necessary to return the core to region 1 or 3. This change is further discussed in Section IV and Attachment C.

B. PERFORMANCE CHARACTERISTICS:

The performance characteristics of the reactor did not change during the year. The core configuration remained the same throughout the year.

C. ADMINISTRATIVE PROCEDURES:

1. Procedure A3, FACILITY MODIFICATION:

Paragraph 3 on page 6 and paragraph 8 on page 5 were changed to state that "modification of drawings must be approved by the RFD." The RFD will thus see the modified drawings and be able to ensure as-built drawing updates.

2. CHANGES TO THE SAR FOR THE TRANSFER TO USUHS AND THE REMOVAL OF THE THERATRON:

a. On 1 Oct 93, administrative control of AFRRI was changed from the Defense Nuclear Agency (DNA) to the Uniformed Services University of the Health Sciences (USUHS). All references in the SAR to DNA were changed to USUHS and all references to the Director, DNA were changed to the President, USUHS. The DNA mission statement was changed to the USUHS mission statement. A new AFRRI organization chart also was added. These changes have no effect on the reactor facility operations.

b. All references to the theratron facility were removed from the SAR. The theratron had reached the end of its useful life and was removed from AFRRI. The theratron was not part of the reactor facility but was mentioned in the SAR as an additional AFRRI source.

3. THE AFRRI TRIGA FACILITY PHYSICAL SECURITY PLAN UPDATE:

Wording in the physical security plan was changed in numerous places to clarify the intent and meaning of many passages. Personal titles were changed to reflect the currant titles being used in AFRRI. The changes to the plan in no way decrease the effectiveness of the plan. The revised plan was approved by the NRC on 27 Sep 93 and is withheld from public disclosure under 10 CFR 2.790.

4. CHANGES TO THE EMERGENCY PLAN:

a. Numerous changes made to the Reactor Facility Emergency Plan are detailed at Attachment G.

b. These changes were made without prior NRC approval as permitted by 10 CFR 50.54(q) and do not decrease the effectiveness of the plan.

5. REACTOR OPERATOR REQUALIFICATION PROGRAM CHANGES:

a. A lecture on "Plant Protection Systems and Facility Interlocks" was added in section V.A.

b. A new paragraph was added in Section V.B. to detail the recovery program required to reinstate an operator who has not satisfactorily completed on-the-job training requirements.

c. The list of references on pages 1 and 2 was updated to conform to the current titles of internal AFRRI documents.

d. The requirement for performing 8 startup, 8 shutdown, and 2 weekly checklists was changed to allow any combination for a total of 18 checklists as long as one of each type is performed during the requalification cycle.

e. The wording "training program" was changed to "requalification program" in one place to agree with the rest of the plan.

These requested changes were submitted to the NRC on 6 Aug 93 but have not yet been approved. A copy of the proposed revision is at Attachment F.

D. OPERATIONAL PROCEDURES:

1. Procedure 0: PROCEDURE CHANGES:

a. The wording "operational procedures" was expanded to include administrative procedures in the general section of the procedure.

b. Temporary changes are to be made on a separate sheet of paper rather than a pen and ink change directly on the current procedure. This eliminates any possibility of confusion when the temporary change expires. The temporary change can then be detached and filed with a clean copy of the basic procedure remaining.

c. All references to the Chairman, Safety and Health Department were changed to AFRRI Radiation Protection Officer to agree with the Technical Specifications.

2. Procedure 4: PERSONNEL RADIATION PROTECTION (ALARA):

a. The title was updated to specifically mention ALARA, clarifying the purpose of the procedure.

b. A list of references were added at the beginning of the procedure for easier referencing of standards.

c. Section 2 is expanded to specifically reference HPP 0-2 dealing with dose action limits and to detail the specific factors included in the phrase "ALARA principles."

d. In section 3a(2), a sentence concerning access inside the chained area around the reactor pool above 100 Kw was added to reinforce the statement in section 3.4.1.1 of the Safety Analysis Report intended to minimize radiation exposure to personnel around the reactor pool.

e. Section 3f (1) was modified to indicate that non-staff personnel allowed to work in the upper and lower equipment rooms will receive a safety briefing concerning reactor-related equipment and hazards in those rooms.

f. Section 3g was added to give specific details of the requirement, from AFRRI Instruction 6055.8, that the RFD will monitor & control radiation exposures for personnel using the reactor facilities. The list of current health physics references was also updated in section 3g.

3. Procedure 8: REACTOR OPERATIONS:

Specific #4 was changed to require that the names of the person-in-charge (PIC) at the reactor and HP on-call be listed at the top of each logbook page. Previously the PIC was listed only at the start of the day and the HP on-call was not listed at all.

4. Procedure 8: Tab B: DAILY OPERATIONAL STARTUP CHECKLIST:

On the Startup Checklist, the unnecessary list of operators was deleted from the top of the form and section V, #5 was changed to require that channel tests be performed by the revised Operational Procedure 11 on both reactor room CAMs. This increases the probability of early detection of CAM malfunctions.

5. Procedure 8: Tab B1: DAILY SAFETY CHECKLIST:

On the Daily Safety Checklist, the unnecessary list of operators was deleted from the top of the form and section V, #5 was changed to require that channel tests be performed by the revised Operational Procedure 11 on both reactor room CAMs. This increases the probability of early detection of CAM malfunctions.

6. Procedure 8: Tab F1: SQUARE WAVE OPERATION (Subcritical):

This procedure is revised in Specific #2 to clarify the specific insertion values necessary to ensure that reactor power reaches the demand setting within the time allowed by the DAC/CSC logic circuits. The insertion is kept to a minimum consistent with achieving the demand power.

7. Procedure 8, Tab F2: SQUARE WAVE OPERATION (Critical):

This procedure is revised in Specific #4 & #5 making the same changes as in Procedure 8, Tab F1.

8. Procedure 8, Tab G2: PULSE OPERATION (Subcritical):

This procedure was revised in Specific #3 to be consistent with the steady-state and square wave procedures by requiring that all rods to be servoed be raised at least 5% before entering automatic mode.

9. Procedure 8, Tab I: DAILY OPERATIONAL SHUTDOWN CHECKLIST:

a. The Daily Shutdown Checklist was revised to change the requirement for turning off the TV monitors to turning off the steady-state timer (sect VI, #3). Often staff members are in the reactor area after a shutdown is complete. Since there is no reason to turn the monitors off, they will be left on until the reactor room lights are turned out.

b. Section VI, #5 & #6 were changed to leave the secondary pump on during non-duty hours. With the installation of the new cooling tower, there is no danger of the tower freezing so the secondary system can be left on to cool the pool more quickly after high power runs.

c. Section I, #5 was added to implement the new afternoon channel test on both reactor room CAMs as required by the revised Operational Procedure.

d. The old Section VI, #8 in which the exposure room camera power supply was turned off is deleted. This is not a required system and the current power supply remains on at all times.

10. Procedure 11: AIR PARTICULATE MONITOR (CAM) PROCEDURE:

This procedure was revised to require a full channel test rather than just an alarm test in the morning and a newly required abbreviated channel test during shutdown. Also, the testing was expanded to both reactor room CAMs, not just the primary CAM. The General and Specific #1 sections are expanded.

E. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS:

All required maintenance and surveillance items were accomplished as originally scheduled except for the following three items:

1. The load testing of the reactor hoist is required either annually, if in regular service, or before the hoist is used if it is not used for several years. This year the contractor inspecting the hoist determined that the cable for the hoist needed to be replaced. The load testing of the hoist has been delayed until a new cable can be installed in early 1994. This delay is acceptable since the hoist is not in regular service.

2. The annual reactor facility audit, due on 27 Oct 93, was delayed due to the transfer of AFRRI to USUHS and difficulties in selecting a qualified auditor. The audit was scheduled for 13-14 Jan 94 and will be performed by Dr. Vernetson from the University of Florida and Dr. Mulder from the University of Virginia. The Technical Specifications requirement for the annual audit allows the audit to take place during a 15 month window, therefore the audit will still occur during the allowable time period.

3. The NNMC security and fire personnel training required by the Emergency Plan was delayed until early January because of difficulty in scheduling the training around the holiday vacations of the non-AFRRI personnel involved. This training is an annual orientation and familiarization of NNMC fire and security personnel with the AFRRI complex. Many of the personnel involved in the training are in AFRRI on a regular basis, so a brief delay of this training will not effect emergency response at AFRRI. This training is still within the allowable time period.

Malfunctions discovered are detailed in Section IV.

SECTION II

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

SECTION II

SECTION II

Energy generated by the reactor core:

Month	Kw-Hrs	
JAN	689.6	
FEB	5405.8	
MAR	680.1	
APR	1902.7	
MAY	4398.3	
JUN	4314.5	
JUL	3031.5	
AUG	9918.8	
SEP	273.2	*
OCT	1201.3	
NOV	281.4	*
DEC	0.2	*
TOTAL	32097.4	

Total energy generated this year:	32097.4 Kw-hrs
Total energy on fuel elements:	810814.5 Kw-hrs
Total energy on FFCRs:	78016.4 Kw-hrs
Total pulses this year ≥ $2.00:	4
Total pulses on fuel element ≥ $2.00:	4157
Total pulses on FFCRs ≥ $2.00:	45
Total pulses this year:	304
Total pulses on fuel elements:	10419
Total pulses on FFCRs:	654

* The low power generated during September was due to the annual shutdown maintenance period. Most operations were also curtailed during November and December for the ventilation system repair work.

SECTION III

Unscheduled Shutdowns

SECTION III

Unscheduled Shutdowns:

There were no unscheduled shutdowns during this reporting period.

SECTION IV

Safety-Related Corrective Maintenance

SECTION IV

SECTION IV

Safety-Related Corrective Maintenance.

The 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.

11 Feb 93 Problem: A failure of the reactor room primary CAM was discovered during the daily shutdown procedure. The failure occurred after reactor operations for the day had been completed. The reactor staff noted in the logbook that the primary CAM was out of service. The RFD and radiation safety were notified.

Solution: A repair contractor was called to repair the problem which was diagnosed as a bad GM tube. The CAM was calibrated upon replacement of the GM tube and the CAM was returned to service on 12 Feb 93.

12 Feb 93 Problem: The secondary reactor room CAM failed during the daily shutdown procedure. The reactor staff noted in the logbook that the secondary CAM was out of service and notified the RFD and radiation safety.

Solution: The repair contractor was called to repair the problem which was diagnosed as a bad power supply. Upon replacing the power supply, a short in the low level alarm bell wiring was discovered to have caused the power supply failure. The alarm bell wiring and bell were replaced, and the CAM was calibrated and returned to service on 16 Feb 93. While the secondary CAM was out of service during 12-16 Feb, reactor operations continued using the primary CAM and all required safety systems remained operational.

21 Feb 93 Problem: A reactor staff member was working in the facility on a Sunday afternoon when the stack gas monitor (SGM) high-level alarm sounded. No reactor operations were being performed. After investigating the problem he determined that the SGM setpoints had been erased.

Solution: The SGM was shut off for the night and an entry was placed in the operations logbook that the SGM had failed. Monday morning (22 Feb 93), the SGM was powered up and the set points and alarm points were reset. The SGM calibration was source tested and performed satisfactorily. The SGM was returned to service. The cause of the problem was determined to be a noise spike in the AC power line which erased the calibration set points on the SGM. No operations were performed with the SGM out of service.

23 Aug 93 Problem: An operator preparing to fire a pulse pressed the enter key when queried whether he desired a high or low resolution pulse. The computer then did not ask for the pulse ID number but rather went into pulse ready mode.

The pulse was fired and no data was collected by the computer.

Solution: There were no other signs of any malfunction so the pulse system was tested by firing several zero power and regular power pulses to try to duplicate the problem. The system operated normally in each instance and would not malfunction a second time. The problem did not reoccur during the rest of 1993.

27 Aug 93 Problem: During a 190 minute extractor irradiation at 515 Kw, three of the four borated-poly neutron absorbing blocks surrounding the ER1 extractor tube irradiation location fell off the table and onto the floor. Because the falling panels did not interfere with the extractor setup and because no reactivity change occurred, the operation was allowed to continue. No damage occurred to any reactor equipment and the experiment was being observed at all times during irradiation.

Solution: Review of console computer data verified that there was no distinguishable change in reactivity associated with the malfunction. The borated-poly panels were examined and showed no defects which would have caused them to fall. Subsequent reactor staff discussions emphasized the need to ensure experimental setup stability.

21 Sep 93 Problem: Radiation Area Monitor R-1 alarmed by going full scale while the reactor was secure. A check of the other RAMs and of the CAMs indicated normal conditions in the reactor room.

Solution: SHD was immediately notified and responded with a teletector to verify that there was no radiation present. Readout unit R-1 was replaced with readout unit R-3 (the R-3 unit is not required to be on line) and the new unit alarmed as well. Detector R-1 was replaced by detector R-3 (R-3 detector also not required) and the replacement system operated normally. SHD then calibrated the new R-1 system. The old R-3 units were correctly relabeled as the new R-1 units. The failed detector and the accompanying readout unit were taken for repair. A new calibrated readout unit and detector were installed for the R-3 system on 23 Sep 93.

05 Nov 93 Problem: The reactor core was moved from Region 1 into Region 2 with the lead shield doors closed. The interlock system, which is designed to prevent the core from moving into region 2, failed to stop the core at the region 1 - region 2 crossover point (position 300). No damage occurred to any reactor equipment and no safety hazard was created. The NRC was immediately notified through a Licensee Event Report (LER).

Solution: The core was moved back into region 1 and a diagnosis of the core position switches found that the position 500 switch, located on the flat core dolly track, was pointed in the wrong direction. This switch error allowed the core to move into region 2. The cause of the error was determined to be a slight misalignment of the switch, allowing the core to travel past the switch but not trip it. The switch was immediately realigned; the system was tested several times and functioned normally. Subsequent analysis resulted in a decision to remove the position 500 switch and replace it with two relays and a manual toggle switch under a 10 CFR 50.59 review. The replacement system performs the same function as the position 500 switch and eliminates any possibility of the event reoccurring. See Section I and Attachment B for the 10 CFR 50.59 review and Attachment C for the LER submitted to the NRC (see Section I A.5.).

03 Dec 93 Problem: While operators were performing the daily startup checklist, the console went into Scram mode 2 to 3 seconds after the console key was turned to reset and the "CSC Watchdog Timer" message appeared on the reactor status CRT screen. When the CSC Watchdog Timer test pushbutton was depressed, the console began the "Prestart Checks" sequence. After Prestart Checks ended, the Acknowledge button was pressed to clear the scram messages that had been generated and the Prestart Checks unexpectedly began again. The console was then shut down and rebooted in an attempt to isolate the problem.

Solution: Symptoms indicated that the CSC DIS064 was sending improper messages to the CSC computer, so special DIS064 trouble shooting software was activated to study the operation of the DIS064. The display indicated that several various inputs were activated upon pressing any particular switch on the console. This indicated that the DIS064 was malfunctioning. The staff began to replace the DIS064 when an operator noticed that a capacitor on the RIM808 board, mounted below the diode matrix & termination board, was contacting the solder joints on the bottom of the diode matrix & termination board. These two boards, making up the DIS064, were separated, the capacitor was insulated, and the boards were reconnected. All of the inputs to the DIS064 were tested and found to operate normally. The DIS064 was reinstalled, the startup checklist was completed, and the reactor was returned to operational status.

SECTION V

Changes to the facility and procedures as described in the Safety Analysis Report (SAR) and new experiments or tests performed during the year are contained in this section.

A. An audible alarm was added to the bulk water conductivity monitor. A 12 Vdc Sonalert buzzer was attached to the conductivity monitor in the control room so that, if the Technical Specifications limit of 0.2 megohm-cm is reached, the alarm sounds in the control room.

B. On 1 Oct 93, administrative control of AFRRI was changed from the Defense Nuclear Agency (DNA) to the Uniformed Services University of the Health Sciences (USUHS). All references in the SAR to DNA were changed to USUHS and all references to the Director, DNA were changed to the President, USUHS. The DNA mission statement was changed to the USUHS mission statement. A new AFRRI organization chart also was added. These changes have no effect on the reactor facility operations.

C. All references to the theratron facility were removed from the SAR. The theratron had reached the end of its useful life and was removed from AFRRI. The theratron was not part of the reactor facility but was mentioned in the SAR as an additional AFRRI source.

D. Reactor facility ventilation repair work was initiated in October and continued through the end of the year. Work on the project is expected to be completed during April 1994. The repair work entailed excavating the back of the reactor building to expose the air duct system which supplies and exhausts ER1, ER2 and the Linac; removing the old ducts; installing new ducts; rustproofing the ducts and sealing the back of the building with a waterproofing material. The new ducts are a direct replacement for the existing 30-year-old system which has begun to show signs of deterioration. The new system will be tested and balanced to ensure that the flow characteristics conform to the Safety Analysis Report.

E. There were no new experiments or tests performed during the reporting period that are not encompassed in the Safety Analysis Report.

Attachment B contains the safety evaluations made 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 utilizes a step-by-step process to document that there were no unreviewed safety questions and no changes required to the Technical Specifications.

SECTION V

Facility Changes and Changes to Procedures as Described in the Safety Analysis Report. New Experiments or Tests During the Year.

SECTION V

SECTION VI

Summary of Radioactive Effluent Released:

A. Liquid Waste: The reactor produced no liquid waste during 1993 except for the 7000 gallons of muddy rain water discussed in the Introduction section.

B. Gaseous Waste: There were no particulate discharges in 1993.

The total amount of Ar-41 discharges in 1993 was 14.11 Curies. The estimated average release after dilution or diffusion was less than 25% of the concentration allowed.

Quarterly:	Jan - Mar 1993	1.758 Ci
	Apr - Jun 1993	6.350 Ci
	Jul - Sep 1993	6.000 Ci
	Oct - Dec 1993	0.005 Ci

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

SECTION VII

Environmental Radiological Surveys:

A. The normal environmental sampling of soil, water, and plant growth reported radionuclide levels that were not above the normal range. The radionuclides that were detected were those normally expected from natural background and from long-term fallout.

Special sampling of the soil from the ventilation construction showed slight contamination of the soil immediately surrounding the lower end of the ER1 exhaust duct. The report to the NRC detailing the contamination and AFRRI's request for disposition of the soil by reburial in the original location is in Attachment E.

B. The environmental monitoring (dosimetry) program reported the following results for 1993:

1. The annual average background of 19 thermoluminescent dosimeters (TLD) located outside a 15 mile radius from the AFRRI site was determined to be 81.70 $\pm$ 4.30 millirem.

2. The average reading of approximately 30 environmental stations located on the NNMC grounds was determined to be 7.8 $\pm$ 3.6 millirem above background.

3. The single highest environmental station reading was 9.0 $\pm$ 2.1 millirem above background. This station is located approximately 560 feet from the AFRRI reactor stack and ten feet north of Building 23, which is the recreation building and club.

4. The above results are expressed at a 95% confidence level.

C. The in-plant surveys, including analysis of effluent filters, showed no measurable activity (except as reported in this section) in all areas outside the restricted access areas.

D. There was one special environmental study conducted during the year. This study was undertaken to investigate any possible radiological hazard to the workers on the ventilation contract. During this study extremely low level contamination was found in the soil directly adjacent to the exposure room 1 exhaust duct (See A. above).

SECTION VIII

Exposures Greater than 25% of 10 CFR 20 Limits:

There were no exposures to reactor staff personnel or reactor visitors greater than 25% of 10 CFR 20 limits.

SECTIONS VI through VIII

Summary of Radioactive Effluent Released.

Summary of Radiological Surveys.

Exposures Greater Than 25% of 10 CFR Limits

ATTACHMENT A

Revised Reactor Administrative and Operational Procedures

Facility Modification, Procedure A3

Procedure Changes, Procedure 0

Personnel radiation Protection-ALARA, Procedure 4

Reactor Operations, Procedure 8

Daily Startup Checklist, Procedure 8, TAB B

Daily Safety Checklist, Procedure 8, TAB B1

Square Wave Operation (Subcritical), Procedure 8, TAB F1

Square Wave Operation (Critical), Procedure 8, TAB F2

Pulse Operation (Subcritical) Procedure 8, TAB G2

Daily Operational Shutdown Checklist Procedure 8, TAB I

Air Particulate Monitor (CAM) Procedure, Procedure 11

FACILITY MODIFICATION

Procedure A3

FACILITY MODIFICATION

GENERAL

Changes to the Reactor Facility and operational procedures must comply with requirements specified in the Reactor License, and 10 CFR 50.59. It is required that modifications to the facility or procedures as described in the Safety Analysis Report (SAR) be documented with a written safety analysis. Under 10 CFR 50.59, a licensee may make changes to the facility provided there are no changes made to the Technical Specifications, there are no unreviewed safety questions, and that a proper safety analysis is carried out, documented, and reviewed.

Applicability:

- The Facility Modification Procedure applies to proposed facility changes or changes in the operating procedures.
- The referenced procedure will not cover routine replacement of parts or components with equivalent parts or components.

DESCRIPTION

This administrative procedure consists of these instructions, the Facility Modification Worksheet Guide, and two worksheets to facilitate a 10 CFR 50.59 review of modifications and to determine if a detailed safety analysis is necessary. The instructions in the Facility Modification Worksheet Guide are used to determine which worksheet must be completed for the modification. One of three conclusions regarding the proposed facility modification will be reached:

1. The modification requires prior approval or a license amendment from the USNRC,

2. The modification may be made according to the provisions of 10 CFR 50.59(a)(1) (Facility Modification Worksheet # 1), or

3. The modification does not require a 10 CFR 50.59 safety analysis (Facility Modification Worksheet # 2).

Facility Modification Worksheet Guide

1. Technical Specification Change: If the proposed modification requires a change in the Technical Specifications, a license amendment is required prior to making the change. NRC approval is required; do not implement the change without this approval.

2. Unreviewed Safety Question: If an unreviewed safety question is created by the proposed change as defined in 10 CFR 50.59(a)(2) such that the change increases the probability of occurrence or severity of an accident described in the SAR, can malfunction in a manner that can cause an accident of a different type than described in the SAR or can decrease safety margins as defined in Technical Specifications, then NRC approval is required. Do not implement the change without this approval.

2. If the proposed modification makes a change in the facility as described in the SAR or changes a procedure as described in the SAR, the change can be performed under a 10 CFR 50.59 analysis with a safety review, if there are no unreviewed safety issues (10 CFR 50.59(a)(2)). The change may be made following a review by the RRFSC. Go to Facility Modification Worksheet # 1.

3. If the proposed modification does not make a change to the facility as described in the SAR or to a procedure as described in the SAR and does not pose an unreviewed safety issue, a 10 CFR 50.59 analysis is not required. Go to Facility Modification Worksheet # 2.

Facility Modification Worksheet 1

10 CFR 50.59 Analysis

Proposed Change ____

____

Submitted by: ________________________________ Date ______________

1. Description of change:

2. Reason for change:

3. Verify that the proposed change does not involve a change to the Technical Specifications or produce an unresolved safety issue as specified in 10 CFR 50.59(a)(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 SAR. Describe which (check all that apply).

Procedure ____ Facility ____ Experiment ____

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

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 __________

RRFSC Concurrence ________________________ Date __________

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change ____

____

Modification to: Procedure ____ Facility ____ Experiment ____

Submitted by: ______________________________ Date __________

1.Description of change:

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 question as defined in 10 CFR 50.59(a)(2).

3. If change involves a facility modification, attach a drawing if appropriate. If structural facility drawings need updating, modification of drawings must be approved by RFD and forward a copy of changes necessary to Logistics.

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

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

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 ____ Not Required ____

Reviewed and approved by RFD ____________________ Date ____________

RRFSC Notified ______________________________ Date ____________

PROCEDURE CHANGES

Procedure 0

PROCEDURE CHANGES

GENERAL

This establishes procedures for permanently or temporarily changing reactor operational or administrative procedures.

SPECIFIC

1. Permanent changes are made by revising the entire procedure. The revised procedures will be approved by the Reactor Facility Director (RFD) and reviewed by the Reactor and Radiation Facility Safety Committee (RRFSC).

2. Temporary changes will be documented on a separate sheet attached to the current procedure and implemented when initialed by the RFD or Reactor Operations Supervisor (ROS). These changes must be approved by the RFD and reviewed by the RRFSC at the next scheduled meeting.

3. Temporary procedures may be established by the RFD for a specific situation.

4. All procedures and changes (temporary or permanent) will have a signature block for all operators and reactor staff members. Operators will review new or modified procedures and sign the signature block prior to operating the reactor console. When the block is completed, the procedure will be place.: ı the Reactor Procedures binder and kept available for review in the control room.

5. All changes will be accomplished under the following guidelines:
   a. The change will result in no decrease in the safety of the actions being addressed.
   b. The change will result in no decrease in the efficiency of procedure performance.
   c. The change will not affect the ability of the procedure to perform its intended function.

6. All changes will be staffed to the following:
   a. AFRRI Radiation Protection Officer (RPO)*
   b. Reactor and Radiation Facility Safety Committee (RRFSC)
   c. AFRRI TRIGA Reactor Facility staff

Procedures that may affect other areas such as building changes, security, etc., will be staffed to the appropriate office(s) prior to routing to the RPO.

* NOTE: Procedural changes that do not deal specifically with health physics procedures or radiation safety issues need not be staffed through the RPO.

PERSONNEL RADIATION PROTECTION - ALARA

Procedure 4

PERSONNEL RADIATION PROTECTION - ALARA

1. REFERENCES

a. ANSI/ANS Standard 15.11, Radiation Protection at Research Reactor Facilities

b. NRC Regulatory Guide 8.10

c. AFRRI Instruction 6055.8, Occupational Radiation Protection Program

d. HPP 0-2, 1-2, 1-4, 3-1, and 3-2

2. GENERAL

All activities performed in areas of potential personnel radiation exposure will be done in accordance with ALARA principles. These areas are the reactor room, upper equipment room (3152), lower equipment room (2158), warm storage, prep area, exposure room 1, exposure room 2, and the hot lab/cell. AFRRI Instruction 6055.8, Occupational Radiation Protection Program, is the radiation protection program followed by RSDR.

That Instruction mandates ALARA consideration in all operations involving radiation and radioactive materials at AFRRI. HPP 0-2 provides specific Personnel Dose Action Limits, requirements for investigating exposures exceeding the Action Limits, and procedures for obtaining special permission to exceed the Limits.

In the implementation of ALARA principles, the following methods and factors should be considered to the extent applicable for the control of radiation exposure, contamination, and radioactive effluents during reactor operations (ANSI/ANS-15.11):

a. Assessments of radiation, contamination, airborne radioactivity and mechanical difficulties which might be encountered in performing the operation.

b. Consideration of radioactive decay time.

c. Assessment of the feasibility of reducing the existing radiation levels by draining, flushing, or other decontamination methods, or by removing and transporting the component to a lower radiation area.

d. Consideration of personnel ingress and egress to work areas.

e. Assessment of the response capability for coping with abnormal operational occurrences.

f. Providing portable or temporary shielding.

g. Providing portable or temporary ventilation systems, or temporary enclosures and covering, or both to minimize spread of contamination.

h. Providing for personnel preoperational briefing for those assigned to perform tasks in high radiation areas.

i. Performing "dry runs" or mock-up equipment to train personnel and identify problems that may be encountered in the actual situation, and to select special tools and procedures.

j. Providing special communication systems.

k. Providing radiation monitoring instruments in adequate numbers to permit accurate measurements and rapid evaluations of the radiation and contamination levels encountered.

l. Limiting the amount of time spent in radiation areas or airborne radioactivity areas.

m. Maintaining as much distance as possible between the worker and sources of radiation.

No written record of ALARA consideration for a specific experiment is required except as indicated by the signature in section II of the RUR.

3. SPECIFIC

a. Reactor Room:

(1). CET Operations: See Procedure 1-Tab B.

(2). Chained area around pool: The reactor operator on the console shall be responsible for controlling entry into the chained area during operations. Need for access will be evaluated on a case by case basis particularly during operations above 100 KW to minimize radiation exposure.

b. Warm Storage: See HPP 3-1.

c. Prep Area: See Prep Area Briefing.

d. Exposure Rooms: See HPP 3-1 and Procedure 1-Tab A.

e. Hot Lab/Cell: Procedure 1-Tab D.

f. Upper and Lower Equipment Rooms:

(1). No written radiation protection procedures are required for entry into these rooms, however, personnel authorized access to these areas will receive safety briefings appropriate to their work.

(2). Access to these areas is controlled by the AFRRI Triga Facility Physical Security Plan.

g. As required by AFRRI Instruction 6055.8, the RFD will monitor and control radiation exposures for reactor staff members and all other personnel using the reactor facilities. To accomplish this, the Radioanalysis and Dosimetry Division (SHDD) will provide to the RFD a copy of the dosimetry records for all reactor staff member, SHD personnel involved in reactor operations, and any other personnel identified by the RFD. The listing will include both the dose for that specific dosimetry period and the total year-to-date dose and shall be given to the RFD within two weeks of SHDD receipt of the results from the TLD contractor.

After review by the RFD, the list will be retained in the reactor files. High doses and doses not consistent with the individual's job category will be investigated jointly by the RFD and RPO utilizing HPP 0-2. Details of other aspects of personnel dosimetry and monitoring are also given in HPP 1-2, HPP 1-4, HPP 3-1, HPP 3-2, and the Prep Area Briefing.

REACTOR OPERATIONS

Procedure 8

REACTOR OPERATIONS

GENERAL

Logbook entries will be made in accordance with the Logbook Entry Checklist (Tab A).

SPECIFIC

1. The names of the individuals who supervised and performed the daily and weekly checklists will be shown at the top of the checklist. Checkmarks or numbers, as appropriate, will then be entered on each checklist line as that item is performed.

2. Perform reactor Daily Operational Startup Checklist (Tab B), utilizing appropriate nuclear instrumentation set points (Tab C). In the case of no planned operations, a Daily Safety Checklist (Tab B1) may be performed.

3. Record at the beginning of each day in the reactor operations logbook the SRO on-call for that date.

4. At the top of each logbook page also record the name of the senior person in charge, noted as physicist in charge (PIC), present in the reactor facility and the name of the HP on-call. If the PIC, SRO on-call, or HP on-call changes during the day, an updated entry will be made in the body of the logbook at the time of occurrence.

5. Perform K-excess measurement (Tab D).

6. Perform operations in accordance with the following:

   a. Steady state operation (Tab E).

   b. Square wave operation (Tab F).

   c. Pulse operation (Tab G).

   d. CET operations (Procedure 1, Tab B).

   e. Pneumatic Transfer System (Procedure 1, Tab D).

   f. In-pool/in-core experiment (Procedure 1, Tab E)

7. Perform Weekly Operational Instrument Checklist once during each calendar week (Tab H).

8. At the end of each day in which a Daily Operational Startup Checklist or Daily Safety Checklist has been completed, perform a Daily Operational Shutdown Checklist (Tab I).

9. Complete the monthly summary.

10. Respirator equipment will not be used on a routine basis. Respirator equipment is provided for use during emergency conditions only.

DAILY OPERATIONAL STARTUP CHECKLIST

Procedure 8, TAB B

DAILY OPERATIONAL STARTUP CHECKLIST

Checklist number ____________ Date ____________
Time completed ____________ Supervised by____________
Assisted by____________
____

I. EQUIPMENT ROOM (Room 3152)

1. Air compressor pressure (psi) .... ________
2. Water drained from air compressor .... ________
3. Air dryer operating .... ________
4. Doors 231,231A, 3152, and roof hatch SECURED .... ________

II. LOBBY AREA

Lobby audio alarm turned off .... ________

III. EQUIPMENT ROOM (Room 2158)

1. Prefilter differential pressure .... ________
2. Primary discharge pressure (psi) .... ________
3. Demineralizer flow rates set to 6 gpm .... ________
4. Stack roughing filter (inches of water) .... ________
5. Stack absolute filter (inches of water) .... ________
6. Visual inspection of area .... ________
7. Door 2158 SECURED .... ________

IV. PREPARATION AREA

Visual inspection of area .... ________

V. REACTOR ROOM (Room 3161)

1. Transient rod air pressure (psi) .... ________
2. Shielding doors bearing air pressure (psi) .... ________
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 monitors (CAM) (Primary and Backup)
   (a) Operating and tracing .... ________
   (b) Channel test completed, damper closure verified .... ________
6. Door 3162 SECURED .... ________
7. Stack gas monitor quality assurance checked .... ________

VI. REACTOR CONTROL ROOM (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 (resistivity must be >0.5 Mohm-cm)
   (a) Background activity(cpm) .... ____________
   (b) Water monitor box resistivity [Mohm-cm] .... ____________
   (c) DM1 resistivity [Mohm-cm] .... ____________
   (d) DM2 resistivity [Mohm-cm] .... ____________
6. Stack gas flow rate [Kcfm] .... ____________
7. Stack air flow rate (Kft/min) .... ____________
8. Gas stack monitor
   (a) Background (cpm) .... ____________
   (b) Alarm check .... ____________
   (c) High alarm set to 3.2E-5 microCi/cc at stack top .... ____________
9. Radiation monitors

Monitor	Alarm Point Functional	Reading (mRem/hr)		Alarm Setting (mRem/hr)
(a) R-1	____________	____________	____________	500
(b) R-2	____________	____________		10
(c) R-3	____________	____________		10
(d) R-5	____________	____________	____________	100
(e) E-3	____________	____________		10
(f) E-6	____________	____________		10

10. TV monitors on .... ____________
11. CAM high level audible alarm check .... ____________
12. Water temperature (inlet) .... ____________
13. Water level log completed .... ____________
14. Console lamp test completed .... ____________
15. Time delay operative .... ____________
16. Source level power greater/equal to 0.5 cps. .... ____________
17. Prestart operability checks performed .... ____________
18. Interlock Tests
   (a) Rod raising, SS mode ____________
   (b) Rod raising, Pulse mode ____________
   (c) Source RWP ____________
   (d) Period RWP ____________
   (e) 1 kW/Pulse mode ____________
   (f) NM-1000 HV ____________
   (g) Inlet Temp ____________
19. SCRAM checks (at least one per rod)
   (a) % Power 1 ____________
   (b) % Power 2 ____________
   (c) Fuel temp 1 ____________
   (d) Fuel temp 2 ____________
   (e) HV loss 1 ____________
   (f) HV loss 2 ____________
   (g) Pool level ____________
   (h) Reactor key ____________
   (i) Manual ____________
   (j) Emergency Stop ____________
   (k) Timer ____________
   (l) CSC Watchdog ____________
   (m) DAC Watchdog ____________
20. Zero power pulse .... ____________

DAILY SAFETY CHECKLIST

Procedure 8, TAB B1

DAILY SAFETY CHECKLIST

Checklist number ____________________ Date ____________________
Time completed ____________________ Supervised by ____________________
Assisted by ____________________
____

I. EQUIPMENT ROOM (Room 3152)

1. Air compressor pressure (psi) .... ________
2. Water drained from air compressor .... ________
3. Air dryer operating .... ________
4. Doors 231,231A, 3152, and roof hatch SECURED .... ________

II. EQUIPMENT ROOM (Room 2158)

1. Prefilter differential pressure .... ________
2. Primary discharge pressure (psi) .... ________
3. Demineralizer flow rates set to 6 gpm .... ________
4. Stack roughing filter (inches of water) .... ________
5. Stack absolute filter (inches of water) .... ________
6. Visual inspection of area .... ________
7. Door 2158 SECURED .... ________

III. PREPARATION AREA

Visual inspection of area .... ________

IV. REACTOR ROOM (Room 3161)

1. Transient rod air pressure (psi) .... ________
2. Shielding doors bearing air pressure (psi) .... ________
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 monitors (CAM) (Primary and Backup)
   (a) Operating and tracing .... ________
   (b) Channel test completed, damper closure verified................... ________
6. Door 3162 SECURED .... ________
7. Stack gas monitor quality assurance checked .... ________

V. LOBBY AREA

Lobby audio alarm turned off	____________

VI. REACTOR CONTROL ROOM (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 (resistivity must be >0.5 Mohm-cm)
   (a) Background activity(cpm) .... ____________
   (b) Water monitor box resistivity [Mohm-cm] .... ____________
   (c) DM1 resistivity [Mohm-cm] .... ____________
   (d) DM2 resistivity [Mohm-cm] .... ____________
6. Stack gas flow rate [Kcfm] .... ____________
7. Stack linear flow rate (Kft/min) .... ____________
8. Gas stack monitor
   (a) Background (cpm) .... ____________
   (b) Alarm check .... ____________
   (c) High alarm set to 3.2E-5 microCi/cc at stack top .... ____________
9. Radiation monitors

Monitor	Alarm Point Functional	Reading (mRem/hr)		Alarm Setting (mRem/hr)
(a) R-1	____________	____________	____________	20
(b) R-2	____________	____________		10
(c) R-3	____________	____________		10
(d) R-5	____________	____________	____________	20
(e) E-3	____________	____________		10
(f) E-6	____________	____________		10

10. TV monitors on .... ____________
11. CAM high level audible alarm check .... ____________
12. Water temperature (inlet) .... ____________
13. Water level log completed .... ____________
14. Source level power greater/equal to 0.5 cps. .... ____________

SQUARE WAVE OPERATION (Subcritical)

Procedure 8, TAB F1

SQUARE WAVE OPERATION (Subcritical)

GENERAL

The square wave mode will not be used above a demand power of 250 KW.

SPECIFIC

1. Set R1 and R5 to full scale

2. Determine he transient rod critical position using the core position, the final transient rod position, the rod curves and the equation below. Note that a square wave insertion can not exceed 75 cents.

CRITICAL)SITION($) = FINAL POSITION($) - INSERTION ($)

- For demand powers up to 25 KW, insert $0.70
- For demand powers greater than 25 KW, insert $0.75

3. Apply air to the transient rod and raise the anvil to the critical position that was calculated above.

4. Bring the reactor cold critical using the three standard control rods; use a rod configuration commensurate with the core position and experimental requirements.
   If Auto Mode is used, select the rods to be used. Ensure that these rods have been raised at least 5% before entering Auto Mode. Set the cold critical power level on the Power Demand thumb wheels and enter Auto Mode.

5. Stabilize the reactor in Manual Mode.

6. Set Power Demand thumb wheels to desired power level.

7. Select the standard control rods to be servoed. Make sure that all control rods to be servoed have been raised at least 5%.

8. Scram the transient rod.

9. Raise the anvil to the desired final position.

10. Allow the power level to fall below 1 watt.

11. Switch into Square Wave mode.

12. Depress Fire button.

13. As the power level approaches the power demand level, the console will switch into Auto Mode. If power can not reach the demand power, it will automatically change to manual mode. At this time, either switch to Auto Mode or bring the reactor to the desired power level manually.

14. Scram the reactor at the end of the run using the manual or timer scram.

15. Ensure all pertinent information has been entered in the reactor operations logbook.

16. If no further steady state runs, square waves or pulses are anticipated, adjust R-1 and R-5 alarm points to their normal settings.

SQUARE WAVE OPERATION (Critical)

Procedure 8, TAB F2

SQUARE WAVE OPERATION (Critical)

GENERAL

The square wave mode will not be used above a demand power of 250 KW.

SPECIFIC

1. Set R-1 and R-5 to full scale.

2. Bring the reactor cold critical using the three standard control rods.

   Use a rod configuration commensurate with the core position and experimental requirements.

   If Auto Mode is used, select the rods to be used, ensure that all rods to be servoed have been raised at least 5% before entering Auto Mode, set the cold critical power level on the Power Demand thumb wheels, and enter Auto Mode.

3. Stabilize the reactor in Manual Mode.

4. Determine TRANS rod anvil setting for desired insertion.

   Insert 70 cents for demand powers up to 25 KW. Insert 75 cents for demand powers greater than 25 KW.

5. Raise the anvil to the appropriate setting corresponding to these values using the transient rod calibration curve corresponding to current core position.

6. Set Power Demand thumb wheels to desired power level.

7. Select the standard control rods to be servoed.

   Make sure that all control rods to be servoed have been raised at least 5%.

8. Switch into Square Wave mode.

9. Depress Fire button.

   As the power level approaches the power demand level, the console will switch into Auto Mode. If power can not reach the demand power, it will automatically change to Manual Mode. At this time, either switch to Auto Mode or bring the reactor to the desired power level manually.

10. Scram the reactor at the end of the run using the manual or timer scram.

11. Ensure all pertinent information has been entered in the reactor operations logbook.

12. If no further steady state runs, square waves, or pulses are anticipated, adjust R-1 and R-5 alarm points to their normal settings.

PULSE OPERATION (Subcritical)

Procedure 8, TAB G2

PULSE OPERATION (SUBCRITICAL)

GENERAL

Pulses above $2.00 must be approved by the RFD (prior to pulse initiation). Specification on the RUR may be used to meet this requirement.

SPECIFIC

1. Set the alarm points on R-1 and R-5 (criticality monitor) to full scale.

2. Given a core position, set the transient rod at a position corresponding to the dollar value determined by the following equation:

$ Value = Total worth ($) Transient rod (to 100% or mechanical stop) - Desired pulse ($) Value

3. Bring the reactor cold critical using the three standard control rods; use a rod configuration commensurate with core position and experimental requirements.
   Do not use automatic mode until the three standard rods have been raised at least 5%.
   Note: A series of repetitive pulses may be fired using the same rod positions on the same day as long as the reactor power is not increasing and is less than 1 kW.

4. Stabilize in the manual mode.

5. Select the proper pulse detector according to the table below. **If the Cerenkov detector is selected, turn off the reactor room and tank lights.**

Detector 1 = Pulse Ion	(Maximum insertion = $2.00)
Detector 2 = Cerenkov	(Maximum insertion = $4.00)

6. Adjust Pulse Mode Scram Timer if necessary.

7. Scram the Transient rod.

8. Raise the Transient rod anvil to 100% or the mechanical stop if installed.

9. Let the power decay to approximately 1 watt or less.

10. Enter Pulse Mode and select high or low resolution pulse display. High resolution displays 1200 MW full scale and should be used for pulses of $2.00 or smaller. Enter the pulse number at the next prompt.

11. Fire the pulse by depressing the "Fire" button on the reactor console.

12. RecorJ the appropriate data in the reactor operations logbook from the pulse display.

13. Reset R-1 and R-5 to their normal alarm points when pulsing, square wave, or steady state operations are complete.

DAILY OPERATIONAL SHUTDOWN CHECKLIST

Procedure 8, TAB I

DAILY OPERATIONAL SHUTDOWN CHECKLIST

Checklist No. ______________ Date ________________________

Time Completed ____________ Supervised by ________________

Assisted by __________________

____

I. REACTOR ROOM (Room 3161)

1. All rod drives DOWN .... ________
2. Carriage lights OFF .... ________
3. Door 3162 SECURED .... ________
4. Door 3161 locked with key .... ________
5. Channel test completed on both CAMs .... ________

II. EQUIPMENT ROOM (Room 3152)

1. Distillation unit discharge valve CLOSED .... ________
2. Air dryer OPERATIONAL .... ________
3. Doors 231, 231A, 3152 and Roof hatch SECURED .... ________

III. EQUIPMENT ROOM (Room 2158)

1. Primary discharge pressure (PSI) .... ________
2. Demineralizer flow rates set to 6 GPM .... ________
3. Visual inspection for leaks .... ________
4. Door 2158 SECURED .... ________

IV. PREPARATION AREA

1. ER 2 plug door CONTROL LOCKED;
   Door closed; and handwheel PADLOCKED .... ________
2. ER 2 lights ON and rheostat at 10% .... ________
3. ER 1 plug door CONTROL LOCKED .... ________
   Door closed; and handwheel PADLOCKED .... ________
4. ER 1 lights ON and rheostat at 10% .... ________
5. Visual inspection of area .... ________

V. LOBBY ALARM

Lobby alarm audio ON .... ________

VI. REACTOR CONTROL ROOM (Room 3160)

1. Reactor tank lights OFF .... ________
2. Console chart recorder pens raised .... ________
3. T\` monitors OFF .... ________
4. C\` \`ole LOCKED, and all required keys returned to lock box .... ________
5. Diffuser pumps OFF .... ________
6. Purification, secondary and primary pumps ON .... ________
7. Reactor monthly usage summary completed .... ________
8. Radiation monitors .... ________

MONITOR	READING	HIGH LEVEL ALARM SETTING (mRem/hr)
a. R-1	______	20 ______
b. R-2	______	N/A
c. R-3	______	N/A
d. R-5	______	20 ______
e. E-3	______	N/A
f. E-6	______	N/A
g. R-6	______	N/A

AIR PARTICULATE MONITOR (CAM) PROCEDURE

Procedure 11

AIR PARTICULATE MONITOR (CAM) PROCEDURE

GENERAL

This procedure specifies how to test the CAM to ensure proper operation of this monitoring device. A channel test will be performed on both reactor room CAMs at the beginning and end of each day.

SPECIFIC

1. OPERATING and TRACING

Check that the CAM is operating and tracing with the correct time indicated on the chart. Ensure the flow rate is > 6 cfm and not off scale.

2. CHANNEL TEST WITH SOURCE

a. Place the switch on the front of the CAM to "test" and verify a reading of 3600 CPM +/- 20% on the chart. Reset the switch.

b. Open shield door and change the detector filter if the filter appears excessively dirty or the flow rate has dropped below 6 cfm. Place the used filter in the radioactive waste box in each CAM drawer.

c. Slowly bring a radioactive source near the detector. Observe the meter on the front of the CAM. The yellow light will activate at approximately 4,000 counts per minute. The red light will activate at approximately 10,000 counts per minute; the alarm will sound and the dampers will close. Reset the alarm, close the chamber door and return the source to the CAM drawer.

d. Annotate completion of the channel test on chart paper with initials and date performed.

3. TEST FREQUENCY

This entire procedure will be performed in conjuction with the daily startup or safety checklist. Items 1 and 2a will be performed again as part of the daily shutdown checklist.

ATTACHMENT B

10 CFR 50.59 Safety Evaluations of Modifications, Changes, and Enhancements to Procedures or Facilities

Bypass Switches Added to Damper Closure Circuit

Addition of Pool Water Conductivity Monitor Audible Alarm

Repair of Underground Ventilation Ducts

Installation of a 4" Sample Port in Reactor Room Wall

Core Position Switch RP2 Replacement

Add new Phrase to Facility Modification Procedure

Changes to SAR for Transfer to USUHS and Removal of Theratron

Update of the AFRRI TRIGA Facility Physical Security Plan

Minor Revisions to AFRRI Form 62 (R)- Shutdown Checklist

Revise Several Operational Procedures

Changes to Various Procedures for HP On-Call and New CAM Channel Test

Add New Section to ALARA Procedure (Procedure 4)

50.59

Bypass Switches Added to Damper Closure Circuit

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Bypass switches added to damper closure Circuit

Modification to: Procedure ___ Facility X Experiment ___

Submitted by: George Date 16 Feb 93

1.Description of change:

Switches Added will allow the dampers to be opened if either the primary or secondary cam fails. This will allow air flow during Repair times into the Reactor Room. A Light will indicate that a cam is bypassed.

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 question as defined in 10 CFR 50.59(a)(2). ✓

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 Logistics. ✓

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

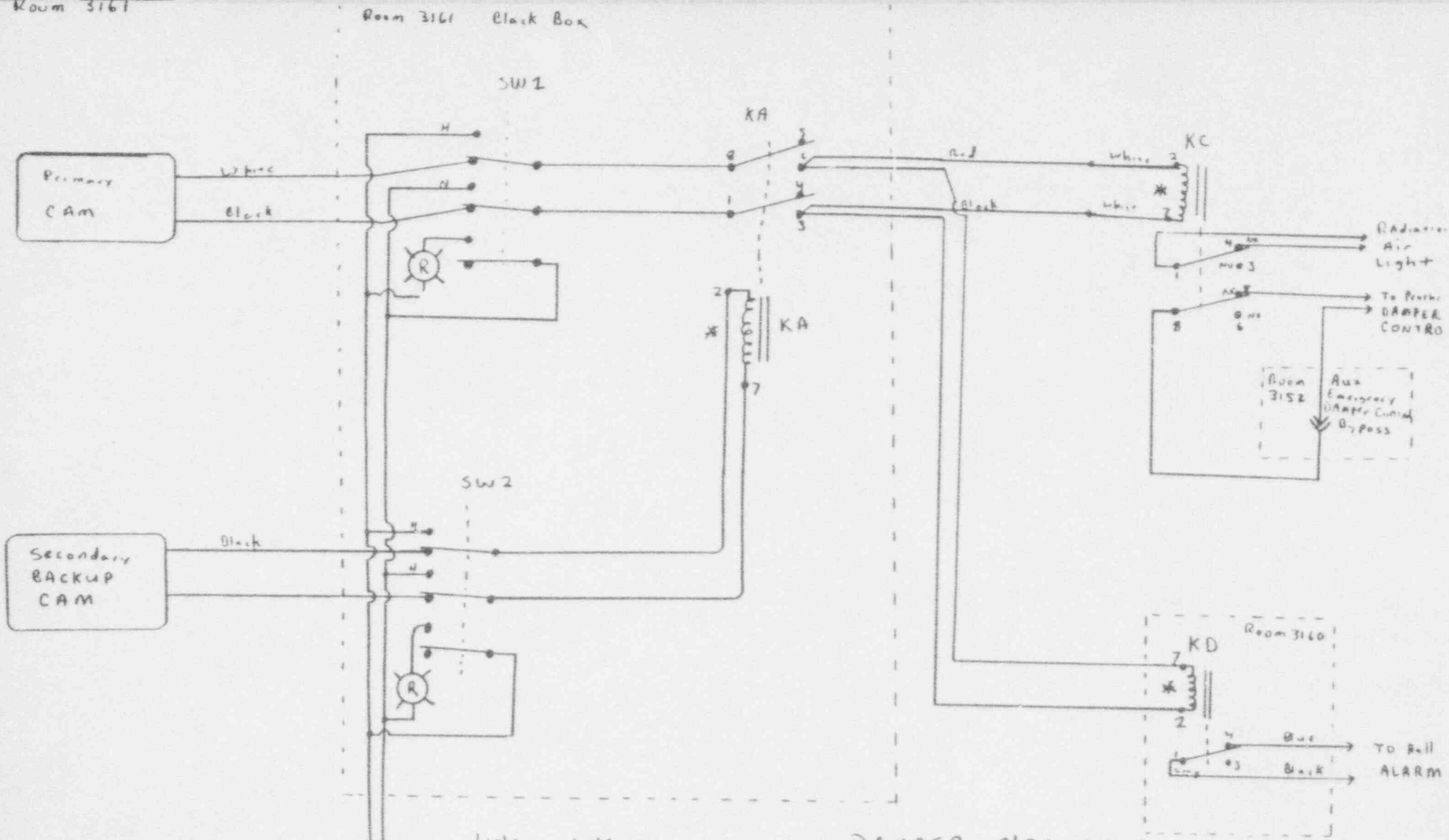
5. List of associated drawings, procedures, logs, or other materials to be changed: Drawing Attached and old versions updated

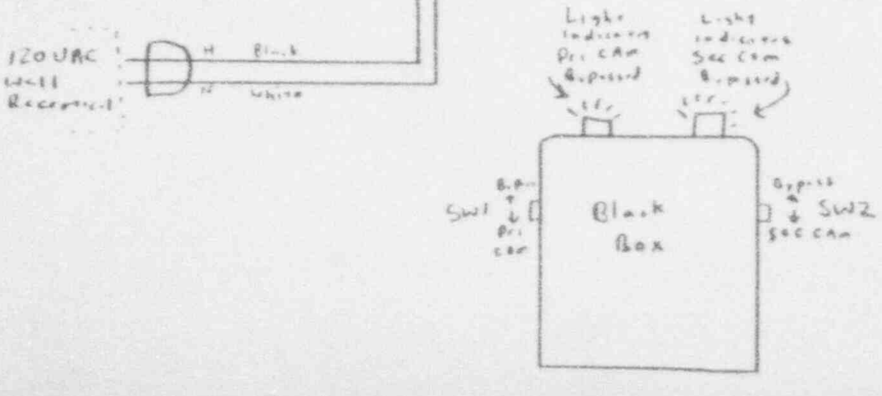
6. Create an Action Sheet containing the list of associated work specified above, attach a copy, and submit it to the RFD.

Action Sheet: Submitted ___ Not Required X

Reviewed and approved by RFD [signature] Date 17 Feb 93

RRFSC Notified ______ Date 22 MAR 1993





DAMPER CLOSURE SYSTEM 16 Feb 93

* Relays shown Deenergized

EACH CAM Supplies 120VAC when Not alarming
Secondary cam operates Relay KA which allows
120 VAC to pass to Relays KC and KD.
KC operates the Radiation air light and the Damper Control
to the penthouse
KD Operates the bell alarm panel.

50.59

Addition of Pool Water Conductivity Monitor Audible Alarm

Facility Modification Worksheet 2

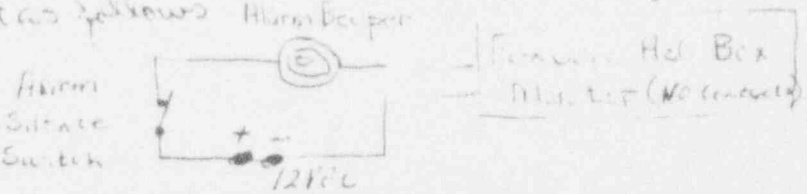
No 10 CFR 50.59 Analysis Required

Proposed Change Addition of an audible alarm to the Pool water conductivity monitor

Modification to: Procedure ____ Facility x ____ Experiment ____

Submitted by: SFC [illegible] Date 16 April 93

1.Description of change: A audible alarm (12Vdc Sonalert) and one alarm silence switch will be added to the [illegible] conductivity monitor. Alarm will use existing relay in HCl box monitor. Circuit as follows



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 question as defined in 10 CFR 50.59(a)(2).

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 Logistics.

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

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

Add Terminal Board connections

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 ____ Not Required ____

Reviewed and approved by RFD [signature] Date 16 April 93

RRFSC Notified ____________ Date 29 JUN 1993

REFERENCE: ADMINISTRATIVE PROCEDURE I, FACILITY MODIFICATIONS

ANALYSIS OF PROPOSED MODIFICATION

Modification Nomenclature: **AUDIBLE ALARM FOR THE WATER CONDUCTIVITY MONITORING SYSTEM**

Analysis: **SFC LAUGHERY** Date: **16 April 1993**

SECTION A

1. Document analysis to determine if a change to the Technical Specifications is required. Include 10 CFR and/or Technical Specification references as applicable.

   NO CHANGE TO THE TECHNICAL SPECIFICATION IS REQUIRED

2. If your analysis determines that a Technical Specification change is required, go to SECTION B.

3. If a Technical Specification change is not required, document an analysis to determine if the proposed modification would constitute a change to the facility as described in the SAR. Include 10 CFR and/or SAR references as applicable.

   NO CHANGE TO THE FACILITY AS DESCRIBED IN THE SAR IS REQUIRED. The proposed modification is the addition of an audible alarm to augment the visual alarm (Flashing LED Display) of the Water Conductivity Monitoring System. This modification will alert personnel in the reactor office area (Rm 3155 - Rm 3159) to a change in reactor pool water condition. The current visual alarm can only be seen in the reactor control room (Rm 3160).

4. Document an analysis to determine if the proposed modification would constitute a change in a procedure as described in the SAR. References as applicable.

   PROPOSED MODIFICATION DOES NOT CONSTITUTE A CHANGE IN A PROCEDURE AS DESCRIBED IN THE SAR.

5. Document an analysis to determine if the proposed modification would constitute a change in the tests or experiments as described in the SAR. Include license and/or SAR references as applicable.

   PROPOSED MODIFICATION DOES NOT CONSTITUTE A CHANGE IN THE TESTS OR EXPERIMENTS AS DESCRIBED IN THE SAR.

6. If the modification does not constitute a change to the facility, procedures, tests or experiments as described in the SAR (Answer to SECTIONS A.3, A.4 and A.5 is "NO" in all cases). Go to SECTION C.

SECTION C

1. No 10 CFR 50.59 is required. The analysis in SECTIONS A.3, A.4 and A.5 provides the bases for this determination that:

   a. no change in the Technical Specification is required.

   b. no change in the facility as described in the current SAR is proposed.

   c. no change in the procedures as described in the current SAR is proposed, and

   d. the proposed test or experiment:

      (1) coincides with those described in the current SAR;

      (2) is permitted by the Technical Specifications, and

      (3) has been previously reviewed and conducted.

2. This modification has been reviewed in accordance with ALARA principles. Comments (if necessary) are as follows:

3. Reviewed and approved by ROS [signature] Date 16 Apr 93

4. Reviewed and approved by RFD [signature] Date 16 Apr 93

5. RRFSC Concurrence ______________________ Date _____

12 April 93

Water Box Gamma Monitor - Audible Alarm

Relay/Recorde Connection

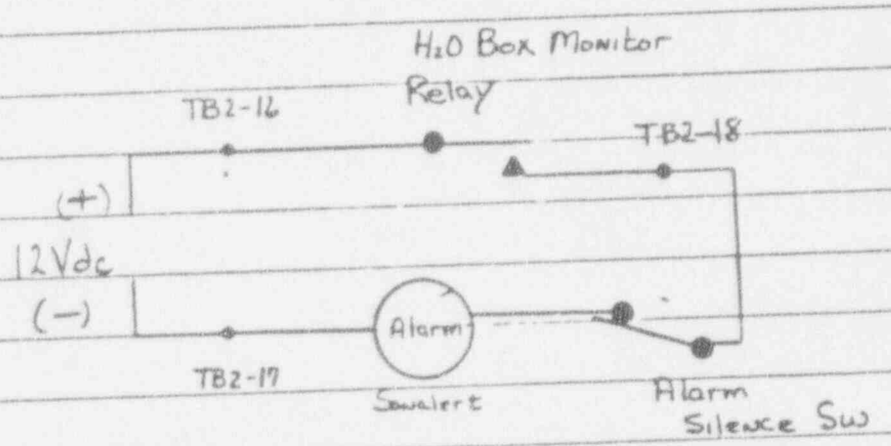
Pin #	Color	Signal
1	Orange	Relay - Common
2	White	Relay - NO
3	Red	Relay - NC
4	Brown	Recorder - (+)
5	Blue	Recorder - (-)
6	Black	Spare

Chartrecorder Console

+12Vdc — TB2-16 — Relay/Common

GND — TB2-17 — Sonalert (-)

White Relay/NO - TB2-18 - Alarm Silence Sw



50.59

Repair of Underground Ventilation Ducts

Facility Modification Work Sheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change **Repair of Underground Ventilation Ducts**

Modification to: Procedure ___ Facility _X_ Experiment ___

Submitted by: **SFC Michael Laughery Date 1 June 1993**

1. Description of change: **Replace the existing underground portion of the supply and exhaust ventilation ducts for the radiation exposure rooms.**
Refer to CONTRACT N62477-91-D-0012 for a detailed description of repair work.

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 question as defined in 10 CFR 50.59(a)(2). **No change to the Technical Specifications, the facility as described in the SAR, or procedures as described in the SAR is required. The proposed change does not produce an unresolved safety question as defined in 10 CFR 50.59(a)(2). The repair work will consist of replacing the existing underground portion of the ventilation system ducts with new duct work meeting the design performance and functional characteristics of the existing duct system.**

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 Logistics.

   There are abandoned underground utility conduits which will be removed during excavation and some utilities will be rerouted. On completion of construction facility drawings will require updating.

4. Determine what other procedures, logs, or training materials may be affected and record below. **None**

5. List of associated drawings, procedures, logs, or other materials to be changed: **See item 3 above.**

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 _X_ Not Required ____

Reviewed and approved by RFD [signature] Date 8 June 93

RRFSC Notified Notified at 29 June 93 meeting Date 29 Jun 93

VENTILATION CONTRACT ACTION SHEET

DATE	ACTION
	1. Notification by Contractor that work is to start in 30 days.
	2. Place notice in AFRRI bulletin and notify all experimenters, who use the reactor.
	3. Exposure Room 1
20 Sept 93	(a) Remove all experimental equipment and store in Rm 1121 (Warm Storage).
22,23,24 Sept 93	(b) Coordinate with SHD to make swipes in the exhaust duct to determine if contaminated.
22 Sept 93	(c) Thoroughly clean accessible portion of exhaust duct and install metal security cover over vent opening.
20-24 Sept 93	(d) Remove portion of wall and ceiling required to access the supply duct.
	(e) Coordinate with SHD to make swipes in the supply duct to determine if contaminated.
	(f) Seal supply duct opening with plastic cover to prevent entry of dust during construction.
	(g) Thoroughly clean the exposure room and install a microwave intrusion detection device.
	(h) When construction is completed, replace portion of wall and ceiling removed for access, remove security plate and intrusion detector, replace the plastic floor covering, and replace the experimental equipment.

DATE ACTION

4. Exposure Room 2

   (a) Remove all experimental equipment.

   (b) Coordinate with SHD to swipe supply and exhaust ducts.

2'
23Nov93 (c) Seal both ducts to prevent entry of dust during construction.

   (d) Thoroughly clean exposure room.

24Nov93 (e) Install supply and exhaust duct shielding on elevated stands.

5. Area outside reactor room

   (a) Insure the fire exit from reactor room (RM3161) is maintained at all times.

   (b) Coordinate with SHD on sampling for contamination during construction.

   (c) Determine radiation levels at outside of building after each 5 foot of excavation.

6. Equipment Room (2158)

12Nov93 (a) Close damper and louvers in supply duct going to ducts being replaced.

12Nov93 (b) Seal exhaust duct at entry to filter bank to prevent dust from construction entering filters.

7. Consult with SHD concerning sampling and survey requirements during construction.

8. Update all As-Built and Facility drawings affected, when construction is completed.

50.59

Installation of a 4" Sample Port in Reactor Room Wall

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Install a Air Sample Port in Reactor Room wall

Modification to: Procedure ___ Facility X Experiment ___

Submitted by: R George Date 14 Jul 93

1.Description of change:

Drill/Cut a Hole In the wall Between the Reactor Room and the equipment Room (3152). Install a Iron or PVC Pipe in the Hole and seal the pipe in place. The pipe will be threaded on the Equipment Room side and a cap will be screwed on to seal the opening. The Hole (4.5" ID pipe) will be used during emergencies to sample Reactor Room air with a Staplex Air Sampler.

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 question as defined in 10 CFR 50.59(a)(2).

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 Logistics. None

4. Determine what other procedures, logs, or training material may be affected and record below. None. Notify staff to New Sample Port

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

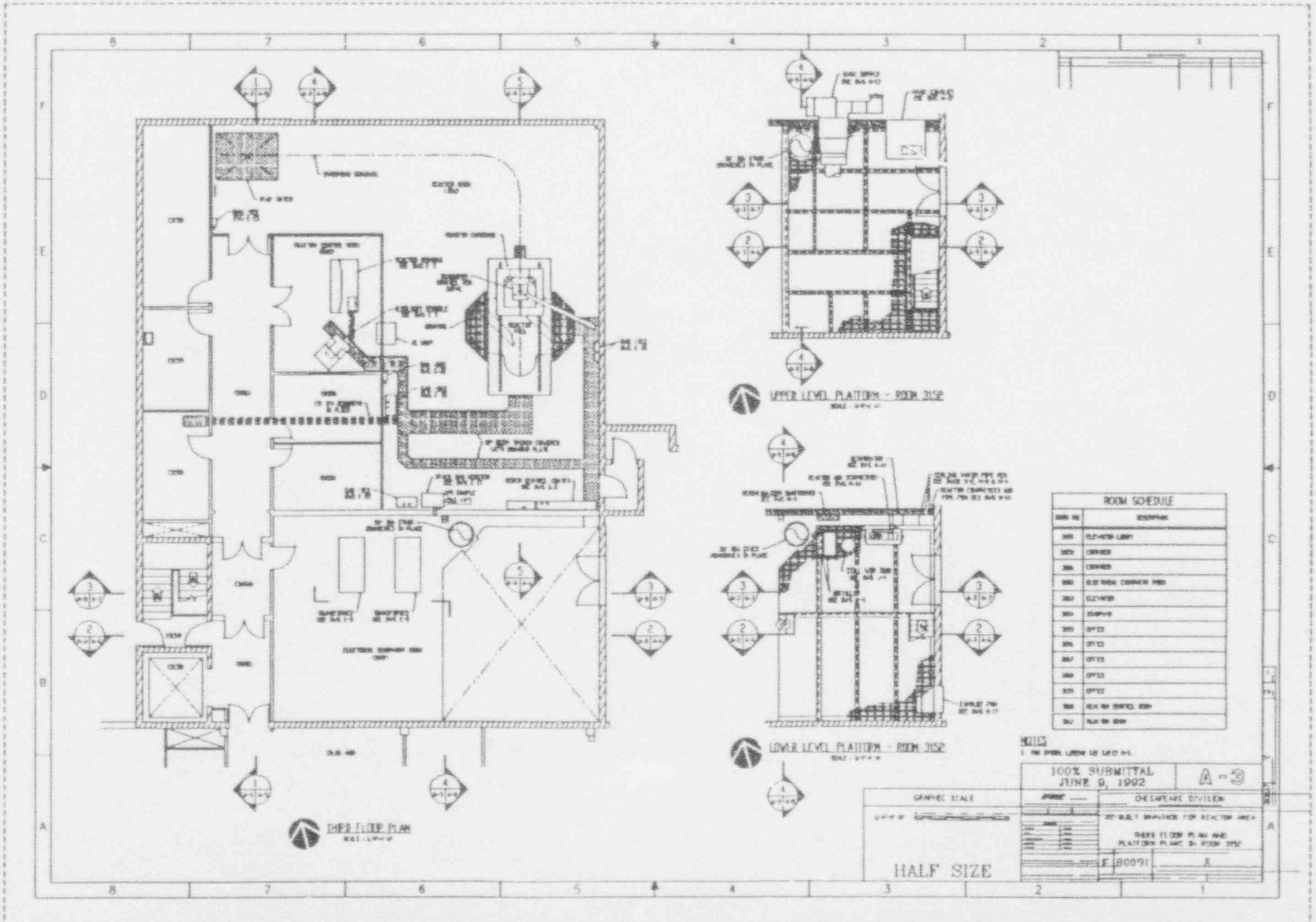
6. Create an Action Sheet containing the list of associated work specified above, attach a copy, and submit it to the RFD.

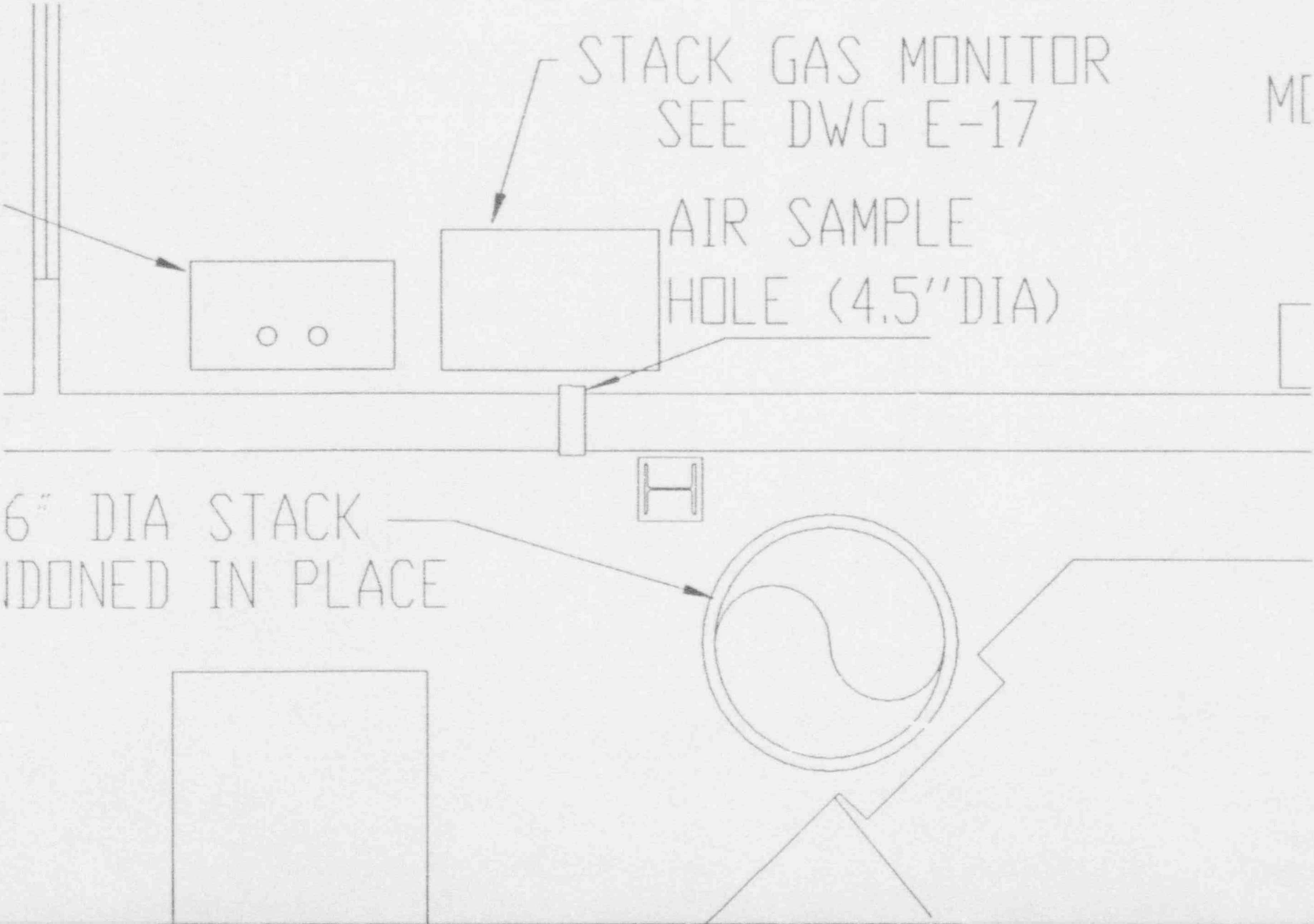
Action Sheet: Submitted ___ Not Required X

Reviewed and approved by RFD [signature] Date 22 July 93

RRFSC Notified ______ Date 2? SEP 1993

A3REV901.DWG




STACK GAS MONITOR
SEE DWG E-17
AIR SAMPLE
HOLE (4.5''DIA)
6" DIA STACK
IDONED IN PLACE
MI

50.59

Core Position Switch RP2 Replacement

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Replacement of switch RP2 with relays RP1AXC and RP3AXC

Modification to: Procedure ___ Facility XX Experiment ___

Submitted by: Stephen Miller Date 24NOV1993

1. Description of change:

Switch RP1 will be removed, and its function replaced by two relays, RP1AXC and RP3AXC

See attached drawings

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 question as defined in 10 CFR 50.59(a)(2). No unresolved safety question exists

3. If change involves a facility modification, attach a drawing if appropriate. If structural facility drawings need updating, modification of drawings must be approved by RFD and forward a copy of changes necessary to Logistics.

Drawing Attached

4. Determine what other procedures, logs, or training material may be affected and record below. A training class will be given describing the proposed change to all reactor staff members

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

The facility interlock drawings will be modified to reflect the wiring changes described on the attached drawing

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 [signature] Date 24Nov1993

RRFSC Notified ______ Date 15 DEC 1993

5059 analysis of design change to facility interlock system

Proposed Change Removal of the center interlock switch

Modification to Facility

Submitted By: Stephen Miller

1. Description of change: Switch RP1 will be removed, and its function replaced by two relays, RP1AXC and RP3AXC. (See Attached Drawings)

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

3. The proposed change will eliminate the possibility for the core direction switch (RP2) to become misaligned and fail to function as required. Currently, if the core dolly is driven into region 2 with the lead shield doors closed, interlock logic will allow the core to be driven back out of region 2 with no further operator action. The recent reportable occurrance highlighted the consequences of failure of switch RP2. By removing switch RP2, violation of the interlock will cut off all power to the carriage drive motor, stopping the operator from driving the carriage into the lead shield doors. According to the proposed change, restoring power to the drive mechanism will require to persons, and both must be in agreement as to the proper direction to drive the core. This change will eliminate operator dependenace on the correct operation of switch RP2, and will demand proper analysis of the situation and the proper corrective action by two people in order to return the reactor core to an operational status.

4. A class will be given describing the changes to the facility interlock system, and the proper corrective action should the carriage be driven into interlock status..

5. The facility interlock drawings will be modified as appropriate to reflect the wiring changes described on the attached drawing.

6. Actions to be performed:

   a. perform necessary wiring to interlock system

   b. pei 'orm thourough test of interlock system

   c. document changes in drawings

   d. give class to staff outlining changes made to system

With proposed modifications

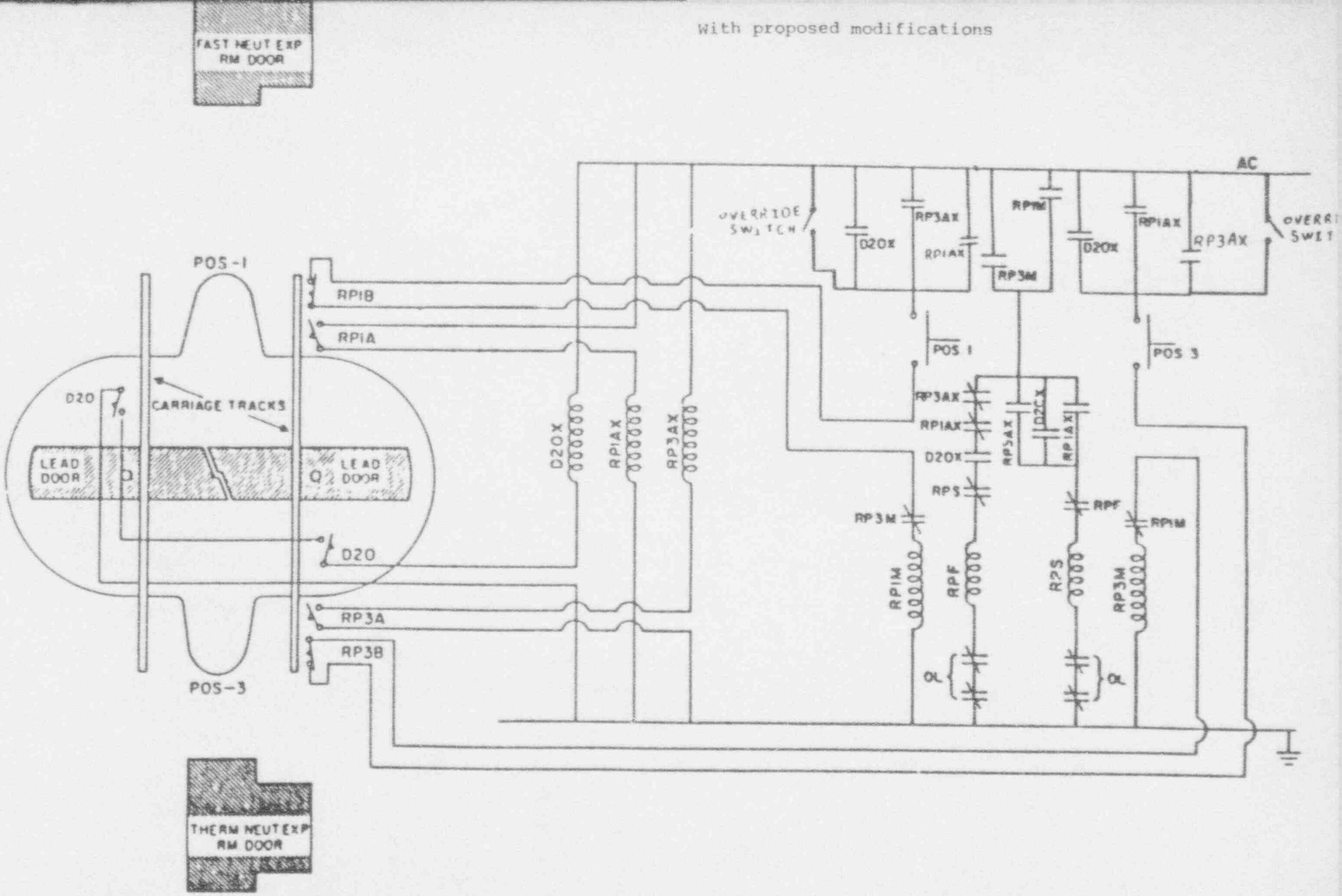


Figure 2.15--Core Support Carriage Interlocks

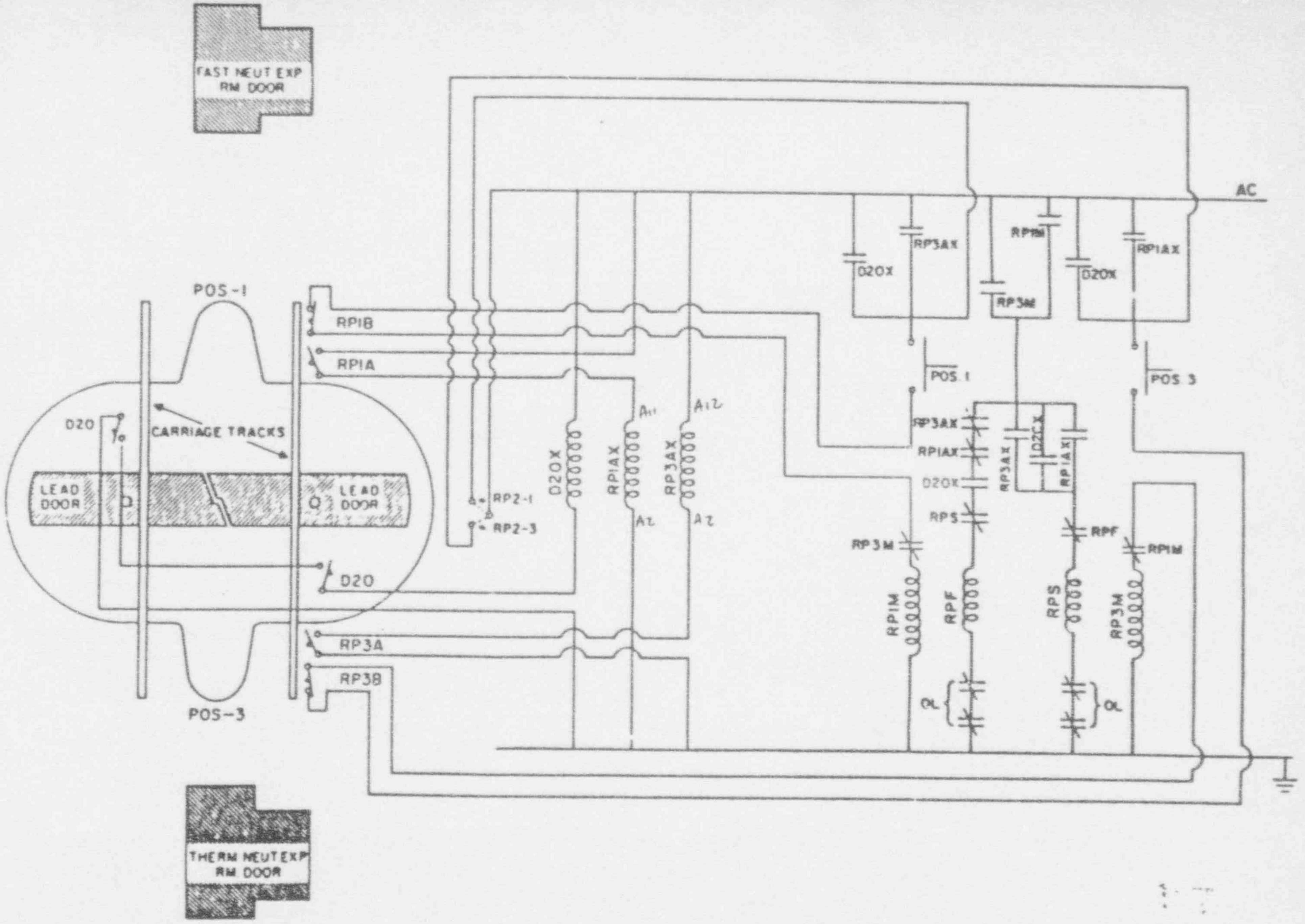


Figure 2.15--Core Support Carriage Interlocks

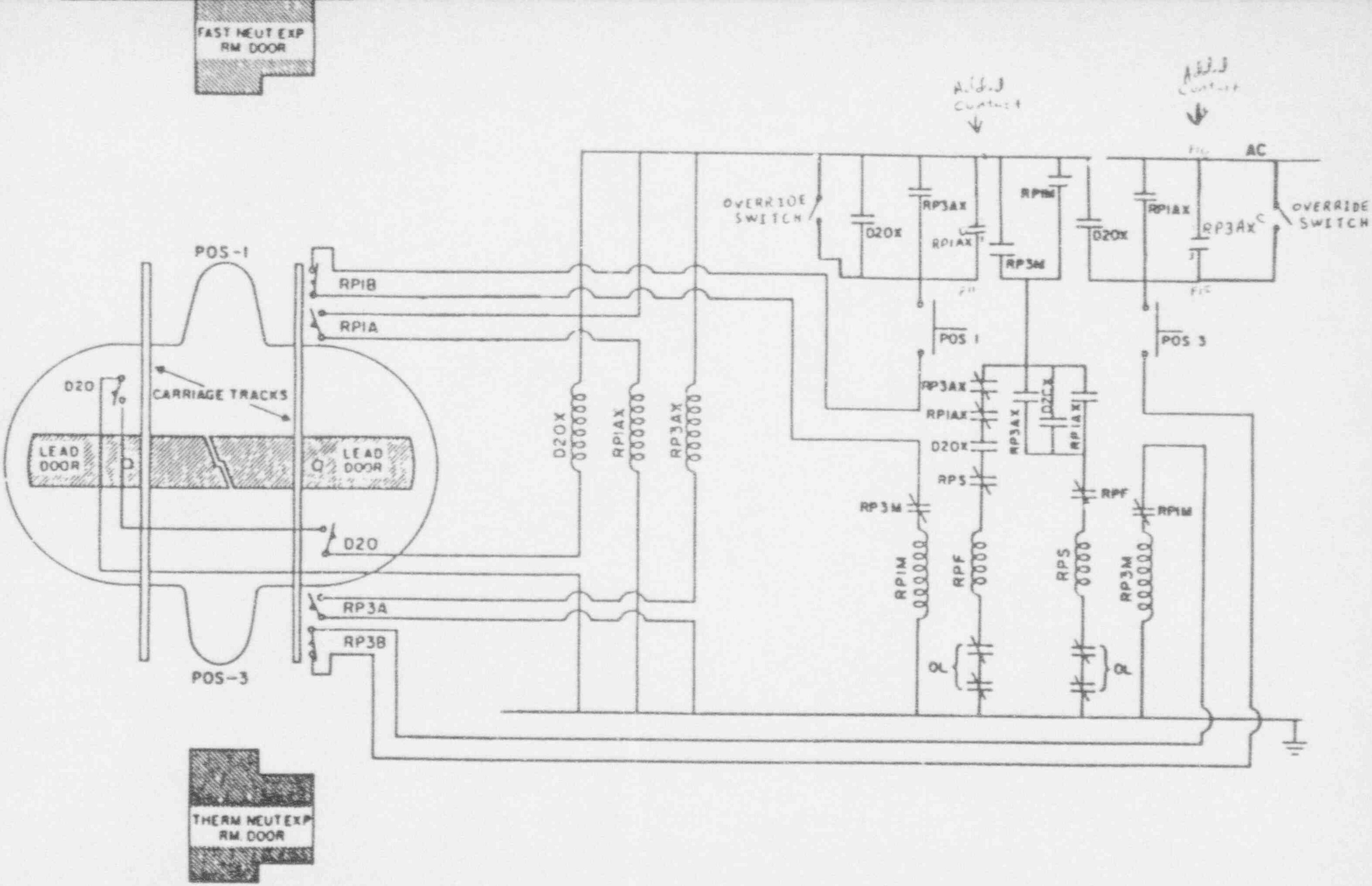


Figure 2.15--Core Support Carriage Interlocks

50.59

Add new Phrase to Facility Modification Procedure

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change: Add new phrase to facility modification procedure (Operational Procedure A3)

Modification to: Procedure x Facility ___ Experiment ___

Submitted by: Nguyen, Spence Date 27 May 93

1. Description of change:

On page 6, paragraph 3 and page 5 paragraph 8, a phrase " modification of drawings must be approved by the RFD" is added so that the RFD will inform and control changes of current drawings.

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 question as defined in 10 CFR 50.59(a)(2). N/A

3. If change involves a facility modification, attach a drawing if appropriate. If structural facility drawings need updating, modification of drawings must be approved by RFD and forward a copy of changes necessary to Logistics. N/A

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

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

None

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 ___ Not Required x

Reviewed and approved by RFD [signature] Date 3 June 93

RRFSC Notified ___ Date 29 JUN 1993

FACILITY MODIFICATION

GENERAL

Changes to the Reactor Facility and operational procedures must comply with requirements specified in the Reactor License and 10 CFR 50.59. It is required that modifications to the facility or procedures as described in the Safety Analysis Report (SAR) be documented with a written safety analysis. Under 10 CFR 50.59, a licensee may make changes to the facility provided there are no changes made to the Technical Specifications, there are no unreviewed safety questions, and that a proper safety analysis is carried out, documented, and reviewed.

Applicability:

- The Facility Modification Procedure applies to proposed facility changes or changes in the operating procedures.
- The referenced procedure will not cover routine replacement of parts or components with equivalent parts or components.

DESCRIPTION

This administrative procedure consists of these instructions, the Facility Modification Worksheet Guide, and two worksheets to facilitate a 10 CFR 50.59 review of modifications and to determine if a detailed safety analysis is necessary. The instructions in the Facility Modification Worksheet Guide are used to determine which worksheet must be completed for the modification. One of three conclusions regarding the proposed facility modification will be reached:

1. The modification requires prior approval or a license amendment from the USNRC,

2. The modification may be made according to the provisions of 10 CFR 50.59(a)(1) (Facility Modification Worksheet # 1), or

3. The modification does not require a 10 CFR 50.59 safety analysis (Facility Modification Worksheet # 2).

Facility Modification Worksheet Guide

1. Technical Specification Change: If the proposed modification requires a change in the Technical Specifications, a license amendment is required prior to making the change. NRC approval is required; do not implement the change without this approval.

2. Unreviewed Safety Question: If an unreviewed safety question is created by the proposed change as defined in 10 CFR 50.59(a)(2) such that the change increases the probability of occurrence or severity of an accident described in the SAR, can malfunction in a manner that can cause an accident of a different type than described in the SAR or can decrease safety margins as defined in Technical Specifications, then NRC approval is required. Do not implement the change without this approval.

3. If the proposed modification makes a change in the facility as described in the SAR or changes a procedure as described in the SAR, the change can be performed under a 10 CFR 50.59 analysis with a safety review, if there are no unreviewed safety issues (10 CFR 50.59(a)(2)). The change may be made following a review by the RRFSC. Go to Facility Modification Worksheet # 1.

4. If the proposed modification does not make a change to the facility as described in the SAR or to a procedure as described in the SAR and does not pose an unreviewed safety issue, a 10 CFR 50.59 analysis is not required. Go to Facility Modification Worksheet # 2.

Facility Modification Worksheet 1

10 CFR 50.59 Analysis

Proposed Change ____

____

Submitted by: ______________________________ Date ______________

1. Description of change:

2. Reason for change:

3. Verify that the proposed change does not involve a change to the Technical Specifications or produce an unresolved safety issue as specified in 10 CFR 50.59(a)(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 SAR. Describe which (check all that apply).

Procedure ____ Facility ____ Experiment ____

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

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 __________

RRFSC Concurrence ________________________________ Date __________

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change ____

____

Modification to: Procedure ____ Facility ____ Experiment ____

Submitted by: ________________________________ Date __________

1. Description of change:

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 question as defined in 10 CFR 50.59(a)(2).

3. If change involves a facility modification, attach a drawing if appropriate. If structural facility drawings need updating, modification of drawings must be approved by RFD and forward a copy of changes necessary to Logistics.

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

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

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 ____ Not Required ____

Reviewed and approved by RFD ______________________ Date ____________

RRFSC Notified ____ ______________________________ Date ____________

50.59

Changes to SAR for Transfer to USUHS and Removal of Theratron

Facility Modification Worksheet 1

10 CFR 50.59 Analysis

Proposed Change Changes to SAR for transfer to USUHS and removal of Theratron

Submitted by: Spence Date 05 Oct 93

1. Description of change: See attached summary.

2. Reason for change: AFRRI transfered from control of DNA to USUHS. Theratron unit removed from AFRRI due to end of useful source life.

3. Verify that the proposed change does not involve a change to the Technical Specifications or produce an unresolved safety issue as specified in 10 CFR 50.59(a)(2). Attach an analysis to show this. No nucleonic or reactor operational issues invloved. Theratron not discussed in reactor Tech Specs.

Analysis attached? ~~Yes~~ ___ Not needed.

4. The proposed modification constitutes a changes in the facility or an operational procedure as described in the SAR. Describe which (check all that apply). Change to administrative sections of SAR-neither experiment nor procedure.

Procedure ___ Facility ___ Experiment ___

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

See attached summary.

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

N/A

Facility Modification Worksheet 1

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: None

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 [signature] Date 5Oct93

RRFSC Concurrence ______________ Date 15 DEC 1993

01 OCT 1993

SUMMARY OF CHANGES TO SAFETY ANALYSIS REPORT

PAGES	CHANGES
1-1/3-1/7-4	Delete references to Theratron facility.
1-1/7-1,2,9	Change all references to Defense Nuclear Agency to read Uniformed Services University of the Health Sciences and change Director, DNA to President, USUHS. On page 7-1, change the DNA mission statement to the USUHS mission statement. These changes have no effect on reactor facility operations.
7-3	New organization chart to reflect change to USUHS.

1.0 INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

This Safety Analysis Report is an update of the Final Safeguards Report (dated March 1962, with subsequent revisions). This report is submitted as part of the license renewal process for Facility License No. R-84 for the Armed Forces Radiobiology Research Institute (AFRRI) TRIGA Mark-F reactor in accordance with 10 CFR 50.

1.2 AFRRI

The Armed Forces Radiobiology Research Institute is located on the grounds of the National Naval Medical Center (NNMC), Bethesda, Maryland. AFRRI is a tri-service military organization under the Uniformed Services University of the Health Sciences. The mission of AFRRI is to conduct scientific research in the field of radiobiology and related matters essential to the support of the Department of Defense. To carry out this mission, AFRRI supports and utilizes the TRIGA Mark-F reactor, research laboratories, a 50-MeV electron linear accelerator, a hot cell, office space, an animal research facility, and a 500 KCi Cobalt-60 facility, all of which are contained in the AFRRI complex.

1.3 AFRRI-TRIGA REACTOR

The AFRRI-TRIGA Mark-F reactor was originally developed and installed by the General Atomics Division of the General Dynamics Corporation. The AFRRI-TRIGA reactor first achieved criticality in 1962. The reactor is an open pool-type light water reactor which can operate in either the steady state mode up to 1 megawatt (thermal) or pulse mode with a step reactivity insertion of up to 2.8% $\Delta k/k$ (technical specifications limit) and utilizes standard-design General Atomics fuel elements. The AFRRI-TRIGA Mark-F reactor has the unique capability of a horizontally movable core. The movable core allows utilization of a variety of experimental facilities, such as two separate exposure rooms and the pneumatic transfer system. The reactor and associated experimental facilities and equipment are contained in the Reactor Building located in the AFRRI complex. A cutaway view of the reactor is given in Figure 1-1.

TRIGA reactors designed by General Atomics provide facilities for training, research, and isotope production to universities and research institutions. Many TRIGA reactors, including the AFRRI-TRIGA reactor, have been in operation for over 20 years. The first TRIGA reactor was installed in 1958. The ongoing testing program of standard TRIGA fuel elements by General Atomics and the long experience with a large number of TRIGA reactors have demonstrated the inherent safety of the family of TRIGA reactors.

On the basis of the Safety Analysis (Section 6.0) presented in this Safety Analysis Report, it can be concluded that there is reasonable assurance that the AFRRI-TRIGA Mark-F reactor can be operated at its present location without undue risk to the health and safety of the AFRRI staff or the general public.

3.0 FACILITY

3.1 GENERAL

The AFRRI-TRIGA Mark-F reactor is used to study the effects of neutron and gamma radiation on living organisms and instruments, and to produce radioisotopes. In addition to the reactor, the AFRRI complex also houses extensive research laboratories, a hot cell, a 50-MeV electron linear accelerator (LINAC), a 500 KCi Cobalt-60 facility, office space, an animal clinical research facility, and related support areas. Aerial views of the AFRRI complex are shown in Figures 2-2 through 2-4. The AFRRI complex includes six separate primary buildings with several supporting facilities, as follows:

Primary Buildings	Support Structures
1. Reactor Building (#42)	7. LINAC Modulator Building (#44)
2. Laboratory Building (#42)	8. Radiological Waste Facility
3. Animal Clinical Research Facility (#43)	9. Pump House (#204)
4. Laboratory and Technical Support building (#45)	10. Switching Station (#222)
5. Laboratory and Technical Support Building (#46)	
6. Animal Building (#47)	

The six primary buildings are arranged in an interconnected complex. Building #42, which appears from the outside to be one building, is actually two buildings: one building houses the TRIGA Mark-F reactor, and the other building contains office and laboratory space. The fact that there are six separate buildings and that the reactor is contained in its own building is important because the ventilation system in the reactor building is isolated from the ventilation systems for the rest of the AFRRI complex. The floor plan of the AFRRI complex, from the lowest level to the highest level, is shown in Figures 3-1 through 3-4, respectively. The building number designations are from Table 2-1.

Access to the entire AFRRI complex is controlled and all personnel are required to enter and exit the facility through the front and back entrances. All of the exterior doors to the facility are locked from the inside and equipped with intrusion-detection alarms. A computerized card-key system restricts access through the front and back entrances and into the reactor area. Visitors must be escorted by permanent AFRRI staff members while in the complex and persons carrying packages and briefcases are subject to search.

An updated Physical Security Plan for the AFRRI-TRIGA Reactor Facility, prepared in accordance with 10 CFR 73 and on file with the U.S. Nuclear Regulatory Commission (Docket Number 50-170) as part of the relicensing process, details AFRRI's procedures and security measures for the physical protection of the AFRRI-TRIGA reactor and its associated equipment. As outlined in 10 CFR 2.790, the updated physical security plan contains classified information--DOD Instruction 5210.67 (Security Classification For Special Nuclear Material Information)--and is therefore deemed exempt from public disclosure.

7.0 ADMINISTRATION

7.1 GENERAL

The Armed Forces Radiobiology Research Institute (AFRRI) is designated as a subordinate unit of the Uniformed Services University of the Health Sciences.

The Uniformed Services University of the Health Sciences (USUHS) is a subordinate command of the Department of Defense and, as such, is under the direction, authority, and control of the Secretary of Defense. The mission of the USUHS is to educate and train competent medical personnel qualified to serve the needs of the Uniformed Services of the United States through providing the highest quality education programs in the health sciences including conducting medical readiness training and continuing education programs.

The mission of AFRRI is to conduct scientific research in the field of radiobiology and related matters essential to the medical support of the Department of Defense.

The main organization of AFRRI consists of the Director, the Scientific Director, and the supporting staff. A Board of Governors is also established to advise the Director of AFRRI in matters of professional policy direction and related issues. The Board of Governors consists of the President of USUHS as Chairman, and the Surgeons General of the Army, Navy, and Air Force. The Board of Governors ensures equal support and participation by the three services in Institute activities and a balanced response by the Institute to the needs of each service.

The supporting staff of AFRRI consists of both military and civilian personnel. In accordance with the triservice nature of the Institute, military personnel are provided on an approximately equal basis by each military department. The cost of maintaining and operating AFRRI is borne by USUHS. The size of the staff is determined by a Joint Table of Distribution, which is developed by the President of USUHS and approved by the Joint Chiefs of Staff. The present internal structure of AFRRI is shown in Figure 7-1.

7.2 THE OFFICE OF THE DIRECTOR

The Office of the Director of AFRRI consists of the Director; the Scientific Director; the Head, Office of International Activity; and the Chief of Staff. Two committees, the Reactor and Radiation Facility Safety Committee (RRFSC) and the Radionuclide and X-Ray Safety Committee (RXSC), report directly to the Director concerning safety matters at the Institute. The RRFSC is responsible for advising the Director in matters concerning the safe operation of the AFRRI-TRIGA reactor and shall be discussed later. The RXSC exercises no control over the reactor and its operations and, therefore, will not be discussed further.

The Director of AFRRI must be a medical department officer of either the Army, Navy, or Air Force, who is technically qualified in the fields of medicine, radiobiology, and radiation effects research. He is appointed by the President of USUHS after consultation with the Board of Governors. He is directly responsible to the President of USUHS for the overall administration and supervision of the Institute. Since the Director has overall responsibility for the safe operation of the AFRRI-TRIGA reactor, he is authorized to communicate directly with the Nuclear Regulatory Commission without prior knowledge or approval of any other office, including USUHS headquarters. The Scientific Director assumes the responsibilities of the Director in his absence.

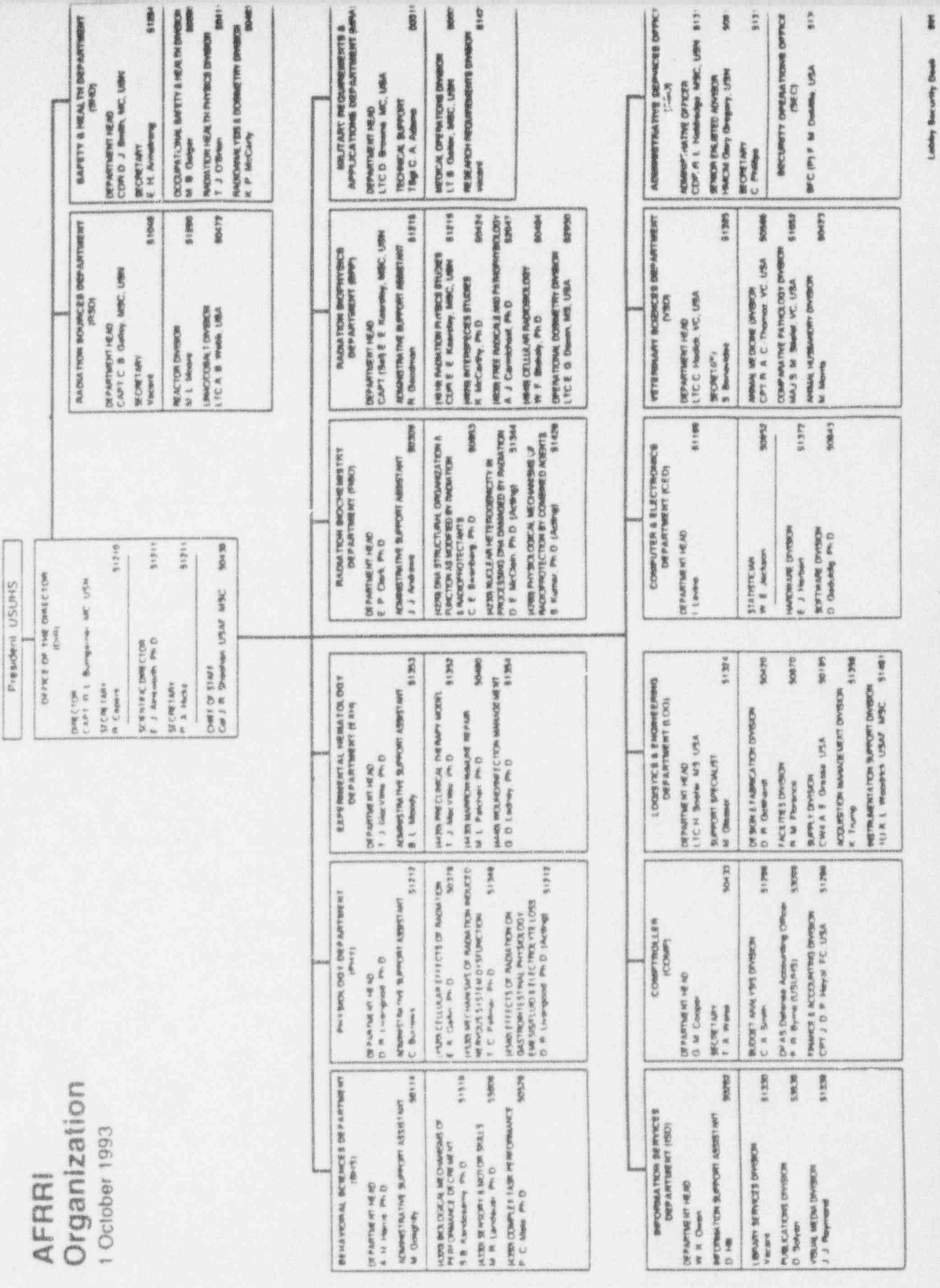


Figure 7.1 AFRRI Organization Chart

The Scientific Director and the Head, Office of International Activity must be technically and administratively qualified in the fields of radiation, radiobiology, and radiation effects research. They must have recognized capabilities, such as demonstrated experience in managing research programs, high professional stature as evidenced by publications in technical journals and appointments or membership in professional societies, and additional education above the Bachelor's degree level. They are directly responsible to the Director of AFRRI for the overall development and coordination of the multidisciplined research programs conducted at AFRRI. These responsibilities include advising the Director on technical matters, providing technical direction to the diverse professional staff at AFRRI, and acting as liaison between AFRRI and other agencies.

7.3 REACTOR AND RADIATION FACILITY SAFETY COMMITTEE

The Reactor and Radiation Facility Safety Committee (RRFSC) is directly responsible to the Director of AFRRI. The committee oversees the safety aspects of the following facilities at the Institute:

- o AFRRI-TRIGA Reactor
- o LINAC Linear Accelerator
- o Cobalt Facility
- o X-Ray Facility
- o Any other machine capable of producing radiation in excess of 1 rad/hr in an area which can be occupied at any time.

The safety aspects of these facilities include the physical facilities, the planned operations, and the qualifications of supervisory and operating personnel which relate to the safety of the Institute, its staff, the public, and the environment. With respect to the AFRRI-TRIGA reactor, the RRFSC reviews all radiological health and safety matters concerning the reactor and its associated equipment.

Regular (Permanent) RRFSC membership shall be composed of:

- Chairman, as appointed by the AFRRI Director
- AFRRI Radiation Protection Officer
- Reactor Facility Director, AFRRI
- One to three non-AFRRI members, as appointed by the AFRRI Director, who are knowledgeable in fields related to reactor safety. At least one shall be a Reactor Operator or a Health Physics Specialist.

Special (temporary) RRFSC members may include:

- Other knowledgeable persons, as appointed by the AFRRI Director, to serve as alternates for the one to three non-AFRRI regular members.
- Voting ad hoc members, invited by the Director of AFRRI, to assist in review of a particular problem.

The RRFSC or a subcommittee thereof meets at least four times each calendar year. The full RRFSC meets at least semiannually. A quorum of the RRFSC for review consists of the Chairman of RRFSC (or his designated alternate) and two other members (or alternate members), one of which must be a non-AFRRI member. A majority of those present must be regular members. All RRFSC decisions are binding upon being endorsed by the Director of AFRRI.

7.4 RADIATION SOURCES DEPARTMENT

The Radiation Sources Department (RSD) supports the AFRRI scientific research program by providing, operating, and maintaining radiation sources, which include the AFRRI-TRIGA reactor.

The Radiation Sources Department (RSD) has sole responsibility for the operation and maintenance of the AFRRI-TRIGA reactor and other assigned radiation sources. RSD is composed of various divisions, each division being responsible for a radiation source. The Reactor Division is the division within RSD responsible for the operation and maintenance of the AFRRI-TRIGA reactor.

The Reactor Division of the Radiation Sources Department operates, calibrates, and maintains the AFRRI-TRIGA reactor and associated systems in compliance with appropriate regulations. The Reactor Division consists of the Reactor Facility Director, the Reactor Operations Supervisor, and the Reactor Staff. The Chain of Command of the Reactor Division is given in Figure 7-2.

The Reactor Facility Director (RFD) is directly responsible to the AFRRI Director for operational, technical, and safety matters pertaining to the utilization of the AFRRI-TRIGA reactor, and for ensuring compliance with NRC licenses and regulations as well as internal reactor operating procedures and AFRRI instructions. The Reactor Facility Director is responsible to the Chairman of the Radiation Sources Department for administrative matters. The RFD shall possess an NRC Senior Reactor Operator License for the AFRRI-TRIGA Mark-F reactor.

The Reactor Operations Supervisor (ROS) is responsible to the RFD for the efficient and safe operation of the AFRRI-TRIGA reactor on a daily, routine basis. The ROS shall possess an NRC Senior Reactor Operator License for the AFRRI-TRIGA reactor.

Senior Reactor Operators (SROs) and Reactor Operators (ROs) are directly responsible to the Reactor Operations Supervisor for the safe and legal operation of the AFRRI-TRIGA reactor in compliance with NRC licenses and regulations, and internal reactor operating procedures and AFRRI instructions.

SROs shall possess an NRC Senior Reactor Operator License; ROs shall possess an NRC Reactor Operator License for the AFRRI-TRIGA reactor.

7.5 SAFETY AND HEALTH DEPARTMENT

The Safety and Health Department (SHD) is responsible for developing and maintaining a comprehensive Health Physics Program, encompassing all sources of radiation within AFRRI. The AFRRI Radiation Protection Officer must be academically and technically qualified in the fields of radiological safety and health physics as they relate to reactor operations. He is directly responsible to the AFRRI Director for radiation protection matters. If possible, he should be a Board Certified Health Physicist of the American Board of Health Physics. As Radiation Protection Officer, he serves as a permanent voting member of the Reactor and Radiation Facility Safety Committee.

The Safety and Health Department is responsible for developing and maintaining an adequate radiation protection program for the Institute. This includes maintaining complete personnel radiation exposure files, implementing and maintaining an ALARA program, i.e., reducing radiation exposures to the staff and the public to levels as low as reasonably achievable (ALARA), supervising adequate environmental monitoring programs, and ensuring that all applicable radiological safety regulations and directives of the Department of Defense, the Nuclear Regulatory Commission, and other agencies are followed. To ensure continuity in the area of radiation protection at AFRRI, particular attention is given to centering responsibility for radiological safety in experienced and highly qualified civilian personnel where possible.

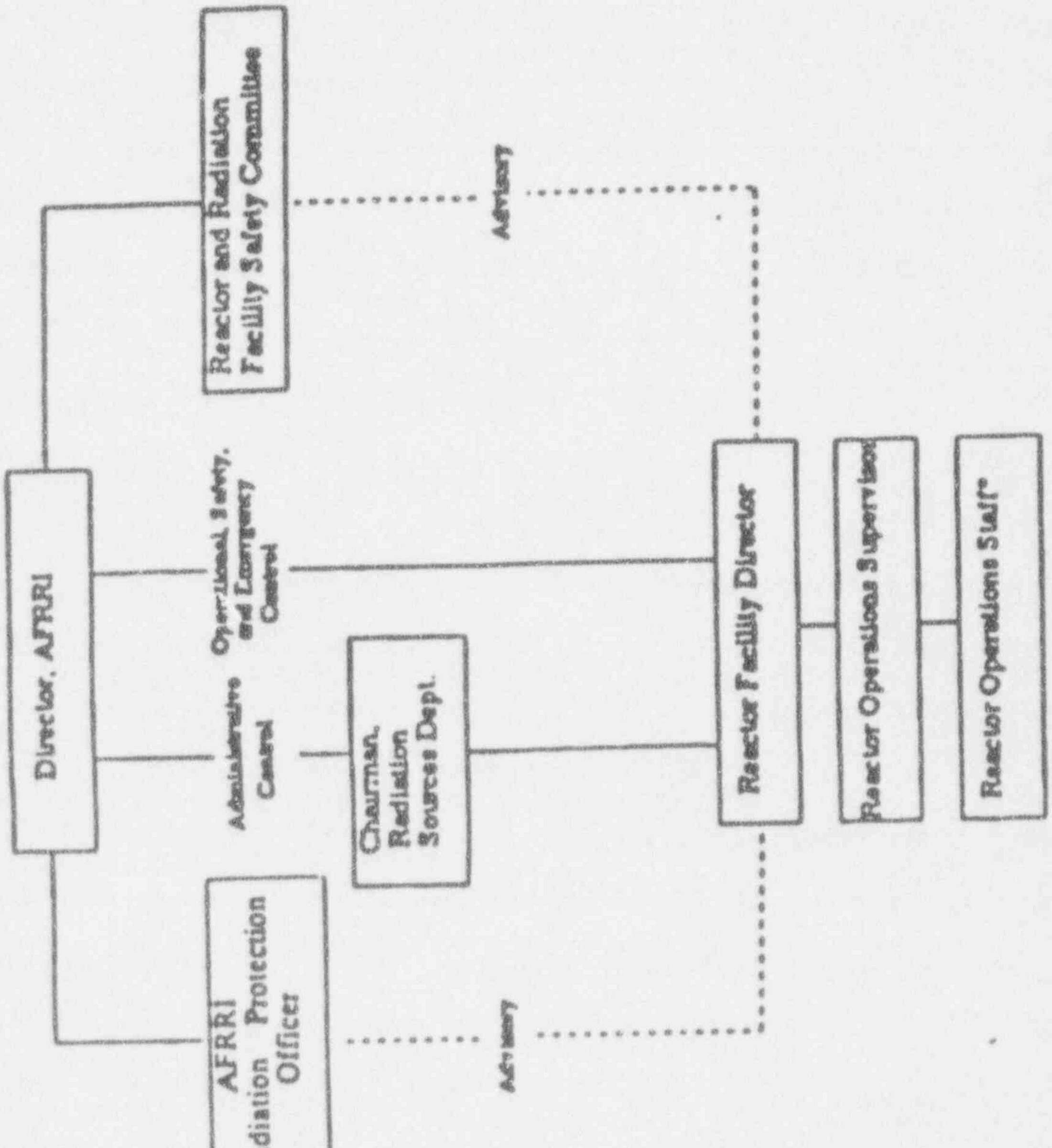


FIGURE 7-2
REACTOR DIVISION CHAIN OF COMMAND

7.6 NATIONAL NAVAL MEDICAL CENTER

The National Naval Medical Center (NNMC) is one of the major medical research centers in the greater Washington area. The close proximity of NNMC, the National Institutes of Health, and the National Library of Medicine to AFRRI gives the AFRRI staff the advantage of having ready access to a well-established and extensive research community.

The National Naval Medical Center hosts several medical commands and organizations in the military. These may or may not be under the direct military command of NNMC. The separate military commands and units at NNMC are as follows:

- o Armed Forces Radiobiology Research Institute (AFRRI)
- o National Naval Dental Center (NNDC)
- o Naval Health Sciences Education and Training Command (NHSETC)
- o Naval Medical Data Services Center (NMDSC)
- o Naval Medical Research & Development Command (NMRDC)
- o Naval Medical Research Institute (NMRI)
- o Naval School of Health Sciences (NSHS)
- o Personnel Support Detachment (PSD)
- o Uniformed Services University of the Health Sciences (USUHS)

The National Naval Medical Center itself falls under the command and coordination control of the Commandant, Naval District, Washington, D.C.

AFRRI is housed at NNMC under the conditions of a host-tenant agreement. This agreement specifies that, although AFRRI is under the military command of the Uniformed Services University of the Health Sciences, NNMC provides certain logistical support to AFRRI on either a reimbursable or nonreimbursable basis. NNMC supplies to the military personnel of AFRRI certain services such as officer and enlisted quarters as available; medical and dental treatment; and access to the Center's stores, services, and recreation facilities. NNMC specifically supplies to AFRRI certain services such as road, parking, and ground maintenance; trash removal; maintenance of AFRRI facilities; utility services such as electricity, sewage, and water; security protection for AFRRI's perimeter and security personnel in response to emergency security situations at AFRRI; and fire protection which includes fire safety inspections, training of AFRRI personnel in fire fighting techniques, routine maintenance of AFRRI fire extinguishers, and fire fighting equipment and personnel in response to a fire at AFRRI.

50.59

Update of the AFRRI TRIGA Facility Physical Security Plan

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Update of AFRRI TRIGA Facility Physical Security Plan

Modification to: Procedure X Facility ___ Experiment ___

Submitted by: MAJ C. Owens Date 2 June 1993

1.Description of change:

See attached memorandum.

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 question as defined in 10 CFR 50.59(a)(2). Verified under 10 CFR 50.54p that the proposed changes do not decrease the effectiveness of the plan.

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 Logistics. N/A

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

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

N/A

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 ___ Not Required X

Reviewed and approved by RFD M L Moore Date 2 June 93

RRFSC Notified ______ Date 29 JUN 1993

NOTE: Changes requested by the RRFSC incorporated into final plan dated 01 Aug 93.

MEMORANDUM FOR RECORD 01 AUG 1993

SUBJECT: AFRRI TRIGA Facility Physical Security Plan Revision

The AFRRI TRIGA Facility Physical Security Plan was reviewed on 30 March 1993 by CDR D. Smith, Head of the Safety and Health Department. The plan was changed based on this review.

The changes involved updating titles to reflect changes in the organizational structure of AFRRI, correcting spelling errors, reorganization of subparagraphs, and clarifying the reactor key system. The plan was printed using a different font which shifted the location of the text. Changes not listed were minor editing corrections and do not significantly alter the plan. The changes made do not decrease the effectiveness of the plan.

Specific page by page changes are listed below. If a page or subparagraph number changed, the new information was added next to the old page and paragraph number.

Page	Item	Changed to
Page 1-12	date (Summer 1990)	date on page 1 only
Page 1-12	Page 1-12	The word page was removed
Page 1	AFRRI TRIGA FACILITY PHYSICAL SECURITY PLAN	PHYSICAL SECURITY PLAN FOR THE TRIGA REACTOR FACILITY AT THE ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
Page 1	Subj: Physical Security Plan...	(removed)
Page 1	Ref: (b) 10 CFR 50.54	Ref: (b) 10 CFR 50.54, 73.60, and 73.67
Page 1	2. Cancellation. Physical Security Plan for the TRIGA Reactor Facility at the Armed Forces Radiobiology Research Institute, 1 April 1990.	2. Cancellation. AFRRI TRIGA Facility Physical Security Plan, Summer 1990
Page 1 para 3.b. New plan: Page 1 para 3.b.	internal security personnel	internal security procedures

Page 1 para 3.b.(1)(a)	3106A	(removed)
Page 2 para 3.b.(2)(a)	and the Reactor prep area 1105	and 1105 (the reactor prep area)
Page 2 para 4.	Control Measures	Control Measures for Personnel Access
Page 2 para 4.a.	Personnel Access.	(removed)
Page 2 para 4.a.(1)	Director, Head of the Resources and Administration Directorate, Scientific Director, Head of Radiation Sources Department, the RFD, Head of the Safety and Health Department, and the Reactor Facility staff are authorized unescorted access. Other personnel who need access to the RCA or CAA for the performance of their duties may be authorized such access during duty hours for a specified time period with the approval of the RFD.	Director, Chief of Staff, Head of Radiation Sources Department, RFD, Radiation Protection Officer,and Reactor Facility staff are authorized unescorted access.Other personnel who need access to the CAA for the performance of their duties may be authorized such access during duty hours with the approval of the RFD.
Page 2 para 4.a.(5)	Reactor Facility	Reactor Facility staff
Page 2 para 4.a.(5)	AFRRI member present may authorize	AFRRI staff member present may, after contacting the senior reactor operator on call, authorize
Page 2	(added)	4.b. The following categories of personnel may be authorized into the RCA (all following subparagraphs renumbered)
Page 3	subparagraph (7)	changed to subparagraph 4.b.(3)

Page 3 para 4.b.	(added)	(2) Personnel who routinely work in the Prep Area (room 1105) may be granted unescorted access to this area by the RFD. Those personnel authorized unescorted access shall be listed on an approved access list posted in the exposure room entry control book which is maintained in the prep area.
Page 3 para 4.b.(1) New plan: Page 3 para 4.c.(1)	Possession of an AFRRI employee badge does not permit unescorted access to the RCA or CAA.	Possession of an AFRRI employee badge does not, by itself, permit unescorted access to the RCA or CAA.
	(added)	... except that temporary members of the Reactor Facility staff issued U-badges under reference (c) are also permitted unescorted access when named on the approved access list.
Page 3 para 4.b.(1) New plan: Page 3 para 4.c.(1)	a person must be listed in paragraphs 4.a.(1)-(7)	a person must be listed in paragraphs 4.b.(1)-(3)
Page 3 para 4.b.(2)(b) New plan: Page 3 para 4.c.(2)(b)	unbolted	unlocked
Page 3 para 4.b.(2)(c) New plan: Page 3 para 4.c.(2)(c)	desires entry into the CAA	desires entry into the third floor CAA
Page 4 para 5.a.(1)	along with completely underground exposure rooms	and the exposure rooms

Page 4 para 5.a.(3)	internal offices and workshops, and exposure rooms	internal offices and hallways, and exposure rooms
Page 4 para 5.a.(4)	conctete	concrete
Page 4 para b.	Reactor Core	(removed) all subsequent subparagraphs renumbered
Page 4 para b.(1)	Storage Area	(removed) all subsequent subparagraphs renumbered
Page 5 para d.(1) New plan: page 5 para c.(1)	Also, the entrances to the rooms described in paragraph 3b(1)(a) are	Also, the entrance to the rooms described in paragraph 3b(1)(a) is
Page 5 para d.(2) New plan: page 5 para c.(2)	The Security Watchman shall make two rounds between 1800 and 2200, and one round between 0600 and 0700 the following day.	During the week, the Security Watchman shall make rounds every two hours between 1800 and 0600 the following day.
	AFRRI Instruction 5200.8	reference (c)
Page 5 para e. New plan: page 6 para d.	Access doors to the CAA shall be secured by lock and key systems	Access doors to the CAA shall be secured by lock and key systems (with the exception of door 3162, which can only be opened from the inside)
Page 5 para e. New plan:	The keys to the top lock access door to Hallway 3106	The keys to the lock on the access door to hallway 3106

page 6 para d.		
Page 6 para e.(1) New plan: page 6 para d.(1)	(except for top lock Reactor access key)	except for the Reactor area access key (key to door 3106)
page 6 para e.(5) New plan: page 6 para d.(5)	enclosure (1)	see enclosure (1)
Page 6 para f. New plan: page 6 para e.	centrally located within the RCA and a communications link to an equivalent Micro Access Controller	centrally located within the CAA with a communications link to an equivalent micro access controller
Page 6 para f. New plan: page 6 para e.	located at AFRRI Security desk is capable of mitigating a failure of the Micro Access controller located within the CAA	located at Security desk is capable of mitigating a failure of the micro access controller located within the CAA
Page 6 para f.(3) New plan: page 7 para e.(3)	Visible alarms are displayed by lights on a display board and a printout is displayed on a system activity logger	(removed)
Page 6 para f.(4) New plan: page 7 para e.(4)	interior perimeter door	interior perimeter door (3106A)
Page 7 para f.(6) New plan: page 7 para e.(6)	The controller provides a visual light or an alarm message to be printed whenever	The controller provides a visual and audible alarm whenever
Page 7 para f.(7) New plan: page 7 para e.(7)	Electric power for the IDA equipment is provided from an emergency power distribution panel located	Electric power for the IDA equipment is provided from an uninteruptable power supply located

Page 7 para f.(7) New plan: page 7 para e.(7)	Emergency power for the system consists of an uninteruptable power supply capable	This power supply is capable
Page 7 para 6.b New plan: page 8 para 6.b.	Military officers and enlisted personnel assigned	Military officers, enlisted personnel and civilians assigned
Page 8 para 6.d.	Any intrusion or attempted intrusion to the CAA shall be reported through the Intelligence	Any intrusion or attempted intrusion into the CAA shall be immediately reported by the Security Officer or a member of the security force through the Intelligence
Page 8 para 6.d.(1)	If unauthorized entry to the CAA	If unauthorized entry or attempted unauthorized entry into the CAA
Page 9 para 7.a.(1)(a)	Any AFRRI employee who receives a bomb threat shall immediately report the information to the Security Officer. The Security Officer shall then notify the Director, the OD, Security Operations Sergeant, the RFD, NNMC Fire Marshall, NNMC Security Officer, and the Explosive Ordnance Disposal (EOD) unit as required. If the bomb threat is specifically directed against the reactor, the RFD shall notify the USNRC and the FBI.	Any AFRRI employee who receives a bomb threat shall immediately report the information to the Security Officer or the OD, if the Security Officer is unavailable, and the NNMC Security Division and Fire Department. The Security Officer or OD shall then notify the Director, OD, Security Operations Sergeant, and Explosive Ordnance Disposal (EOD) unit as required. If the bomb threat is specifically directed against the reactor facility or staff, the RFD shall notify the United States Nuclear Reguatory Commission (USNRC) and the Federal Bureau of Investigation (FBI).

Page 10 para 7.a.(2)(a)	On receipt of a bomb threat, the Security Watchman shall immediately notify the OD, the NNMC Security Officer, the NNMC Fire Marshall, and the NNMC Administrative Officer.	On receipt of a bomb threat, the Security Watchman shall immediately notify the OD and the NNMC Security Divison and Fire Departments. The OD shall then notify the Director, Security Officer, Security Operations Sergeant, and Explosive Ordnance Disposal (EOD) unit as required. If the bomb threat is specifically directed against the reactor facility or staff, the RFD shall notify the USNRC and the FBI.
Page 10 para 7.b.(1)(a)	NNMC Administrative Officer NNMC Security Officer	(removed) NNMC Security Division
Page 11 para 7.b.(2)(a)	NNMC Administrative Officer NNMC Security Officer	(removed) NNMC Security Division
Page 11 para 7.c.(1)(a)	A visual inspection of all SNM fuel elements stored in the Reactor	A visual inspection of all fuel elements and/or fuel-follower control rods stored in the Reactor core
Page 11 para 7.c.(1)(d)	(added)	Additional accountability and inventory requirements are contained in the reactor Administrative Procedures.
Page 11 para 7.c.(2)(a)1.	The Security Officer, Security Operations Sergeant, RFD, or the Director	The Security Officer, Security Operations Sergeant, RFD and Director
Page 12 para 7.c.(2)(a)3.	The RFD shall notify the Director, Region 1, U.S. Nuclear Regulatory Commission (USNRC) by telephone or telegraph of the incident	The RFD shall notify the Regional Administrator, Region I, (USNRC) and the USNRC Operations Center by telephone of the incident

Page 12 para 7.c.(2)(b)3.	The RFD shall notify the Director, Region 1, USNRC, by telephone of the incident	The RFD shall make notifications as per paragraph 7.c.(2)(a)3.
Enclosure (1) para 3.	(added)	3. Keys to the reactor console, exposure rooms, and other spare and rarely used keys are kept in a locked key box mounted in office 3158. Only licensed operators are issued a key to this key box.
Enclosure (1)	The location of these keys...	4. The location of these keys...
Enclosure (1)	AFRRI GRAND MASTER figure	(figure changed for clarification)

Questions concerning these changes to the AFRRI security plan may be directed to the undersigned.

Mark Moore

MARK MOORE
Reactor Facility Director

50.59

Minor Revisions to AFRRI Form 62 (R)- Shutdown Checklist

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Minor revisions to AFRRI Form 62(R)-Shutdown Checklist

Modification to: Procedure X Facility ___ Experiment ___

Submitted by: Spence Date 04 Jan 93

1.Description of change: AFRRI Form 62-Shutdown Checklist (Procedure 8,TAB I) is revised to change the requirement for turning off the TV monitors to turning off the steady-state timer (Sect VI,#3). Section VI,#5 & #6 are changed to leave the secondary pump on during non-duty hours. With the installation of the new cooling tower, there is no danger of the tower freezing and the secondary can be left on to cool the pool more quickly after high-power runs.

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 question as defined in 10 CFR 50.59(a)(2). Done

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 Logistics. N/A

4. Determine what other procedures, logs, or training material may be affected and record below. None

5. List of associated drawings, procedures, logs, or other materials to be changed: None

6. Create an Action Sheet containing the list of associated work specified above, attach a copy, and submit it to the RFD. N/A

Action Sheet: Submitted ___ Not Required X

Reviewed and approved by RFD [signature] Date 12 Jan 93

RRFSC Notified ______ Date 22 MAR 1993

DAILY OPERATIONAL SHUTDOWN CHECKLIST

Checklist No. ______________ Date ______________________
Time Completed ____________ Supervised by ________________
Assisted by __________________
____

I. REACTOR ROOM (Room 3161)

1. All rod drives DOWN .... ________
2. Carriage lights OFF .... ________
3. Door 3162 SECURED .... ________
4. Door 3161 locked with key .... ________

II. EQUIPMENT ROOM (Room 3152)

1. Distillation unit discharge valve CLOSED .... ________
2. Air dryer OPERATIONAL .... ________
3. Doors 231, 231A, 3152 and Roof hatch SECURED .... ________

III. EQUIPMENT ROOM (Room 2158)

1. Primary discharge pressure (PSI) .... ________
2. Demineralizer flow rates set to 6 GPM .... ________
3. Visual inspection for leaks .... ________
4. Door 2158 SECURED .... ________

IV. PREPARATION AREA

1. ER 2 plug door CONTROL LOCKED;
   Door closed; and handwheel PADLOCKED .... ________
2. ER 2 lights ON and rheostat at 10% .... ________
3. ER 1 plug door CONTROL LOCKED;
   Door closed; and handwheel PADLOCKED .... ________
4. ER 1 lights ON and rheostat at 10% .... ________
5. Visual inspection of area .... ________

V. LOBBY ALARM

Lobby alarm audio ON .... ______

VI. REACTOR CONTROL ROOM (Room 3160)

1. Reactor tank lights OFF .... ______
2. Console chart recorder pens raised .... ______
3. Steady-state timer OFF.. ______
4. Console LOCKED, and all required keys returned to lock box .... ______
5. Diffuser pump OFF .... ______
6. Purification, secondary and primary pumps ON .... ______
7. Reactor monthly usage summary completed .... ______
8. Exposure room camera power supply turned OFF .... ______
9. Radiation monitors .... ______

MONITOR	READING	HIGH LEVEL ALARM SETTING (mr/hr)
a. R-1	______	20 ______
b. R-2	______	N/A
c. R-3	______	N/A
d. R-5	______	20 ______
e. E-3	______	N/A
f. E-6	______	N/A
g. R-6	______	N/A

50.59

Revise Several Operational Procedures

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change: Revise several Operational Procedures as shown on attached summary.

Modification to: Procedure X Facility ___ Experiment ___

Submitted by: Spence Date 15 Jan 93

1.Description of change: See attached summary sheet

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 question as defined in 10 CFR 50.59(a)(2). N/A

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 Logistics. N/A

4. Determine what other procedures, logs, or training material may be affected and record below. None

5. List of associated drawings, procedures, logs, or other materials to be changed: None

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 ___ Not Required XX

Reviewed and approved by RFD [signature] Date 28 Jan 93

RRFSC Notified ___ Date 22 MAR 1993

50.59

Changes to Various Procedures for HP On-Call and New CAM Channel Test

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change: Changes to various procedures for HP on-call & new CAM channel test.

Modification to: Procedure x Facility ___ Expe.iment ___

Submitted by: Spence Date 18 Feb 93

1.Description of change:

See attached summary sheet.

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 p· luce an unresolved safety question as defined in 10 CFR 50.59(a)(2). N/A

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 Logistics. N/A

4. Determine what other procedures, logs, or training material may be affected and record below. None

5. List of associated drawings, procedures, logs, or other materials to be changed: Procedures listed on attached summary.

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 ___ Not Required x

Reviewed and approved by RFD [signature] Date 1 March 93

RRFSC Notified ______ Date 22 MAR 1993

SUMMARY OF PROCEDURE CHANGES

Procedure 8: Specific #4 is changed to require that the names of the PIC and HP on-call be listed at the top of each logbook page. Previously the PIC was listed only at the start of the day and the HP on-call was not listed at all.

Procedure 8, Tab B: On the Startup Checklist the unnecessary list of operators is deleted from the top of the form and item V.5. is changed to require channel tests by the new Procedure 11 on both reactor room CAMs. This increases the probability of early detection of CAM malfunctions.

Procedure 8, Tab B1: The changes are the same as for the Startup Checklist (here item IV.5.).

Procedure 8, Tab I: Item I.5. is added to implement the new afternoon channel test on both reactor room CAMs as required by the new Procedure 11. The old item VI.8. in which the exposure room camera power supply was turned off is deleted. This is not a required system and the current power supply remains on at all times.

Procedure 11: This procedure is revised to require a full channel test rather than just an alarm test in the morning and a newly required abbreviated channel test during shutdown. Also, the testing is expanded to both reactor room CAMs, not just the primary. The General and Specific #1 sections are expanded. Specific #2a, b, and d and #3 are added.

REACTOR OPERATIONS

GENERAL

Logbook entries will be made in accordance with the Logbook Entry Checklist (Tab A).

SPECIFIC

1. The names of the individuals who supervised and performed the daily and weekly checklists will be shown at the top of the checklist. Checkmarks or numbers, as appropriate, will then be entered on each checklist line as that item is performed.

2. Perform reactor Daily Operational Startup Checklist (Tab B), utilizing appropriate nuclear instrumentation set points (Tab C). In the case of no planned operations, a Daily Safety Checklist (Tab B1) may be performed.

3. Record at the beginning of each day in the reactor operations logbook the SRO on-call for that date.

4. At the top outside corner of each logbook page also record the name of the senior person in charge, noted as physicist in charge (PIC), present in the reactor facility and the name of the HP on-call. If the PIC, SRO on-call, or HP on-call changes during the day, an updated entry will be made in the body of the logbook at the time of occurrence.

5. Perform K-excess measurement (Tab D).

6. Perform operations in accordance with the following:

   a. Steady state operation (Tab E).

   b. Square wave operation (Tab F).

   c. Pulse operation (Tab G).

   d. CET operations (Procedure 1, Tab B).

   e. Pneumatic Transfer System (Procedure 1, Tab D).

   f. In-pool/in-core experiment (Procedure 1, Tab E)

7. Perform Weekly Operational Instrument Checklist once during each calendar week (Tab H).

8. At the end of each day in which a Daily Operational Startup Checklist or Daily Safety Checklist has been completed, perform a Daily Operational Shutdown Checklist (Tab I).

9. Com[illegible]e monthly summary.

10. Respirator equipment will not be used on a routine basis. Respirator equipment is provided for use during emergency conditions only.

DAILY OPERATIONAL STARTUP CHECKLIST

Checklist number ____________ Date ____________

Time completed ____________ Supervised by____________

Assisted by____________

____

I. EQUIPMENT ROOM (Room 3152)

1. Air compressor pressure (psi) .... ______
2. Air compressor water trap drained .... ______
3. Air dryer operating .... ______
4. Doors 231,231A, 3152, and roof hatch SECURED........ ______

II. LOBBY AREA

Lobby audio alarm turned off .... ______

III. EQUIPMENT ROOM (Room 2158)

1. Prefilter differential pressure .... ______
2. Primary discharge pressure (psi) .... ______
3. Demineralizer flow rates set to 6 gpm .... ______
4. Stack roughing filter (inches of water) .... ______
5. Stack absolute filter (inches of water) .... ______
6. Visual inspection of area .... ______
7. Door 2158 SECURED .... ______

IV. PREPARATION AREA

Visual inspection of area .... ______

V. REACTOR ROOM (Room 3161)

1. Transient rod air pressure (psi) .... ______
2. Shielding doors bearing air pressure (psi) .... ______
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 monitors (CAM) (Primary and Backup)
   (a) Operating and tracing .... ______
   (b) Channel test completed, damper closure verified........ ______
6. Door 3162 SECURED .... ______
7. Stack gas monitor quality assurance checked .... ______

VI. REACTOR CONTROL ROOM (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 (resistivity must be > 0.5 Mohm-cm)
   - (a) Background activity(cpm) .... ________
   - (b) Water monitor box resistivity [Mohm-cm] .... ________
   - (c) DM1 resistivity [Mohm-cm] .... ________
   - (d) DM2 resistivity [Mohm-cm] .... ________
6. Stack gas flow rate [Kcfm] .... ________
7. Stack linear flow rate (Kft/min) .... ________
8. Gas stack monitor
   - (a) Background (cpm) .... ________
   - (b) Alarm check .... ________
   - (c) High alarm set to 800 MPC Ar-41 .... ________
9. Radiation monitors

Monitor	Alarm Point Functional	Reading (mR/hr)		Alarm Setting (mR/hr)
(a) R-1	________	________	________	500
(b) R-2	________	________		10
(c) R-3	________	________		10
(d) R-5	________	________	________	50
(e) E-3	________	________		10
(f) E-6	________	________		10

10. TV monitors on .... ________
11. CAM high level audible alarm check .... ________
12. Water temperature (inlet) .... ________
13. Water level log completed .... ________
14. Time delay operative .... ________
15. Source level power greater/equal to 0.5 cps. .... ________
16. Prestart operability checks performed .... ________
17. Interlock Testr
   - (a) Rod raising, SS mode ________
   - (b) Rod raising, Pulse mode ________
   - (c) Source RWP ________
   - (d) Period RWP ________
   - (e) 1 kW/Pulse mode ________
   - (f) NM-1000 HV ________
   - (g) Inlet Temp ________
18. SCRAM checks (at least one per rod)
   - (a) % Power 1 ________
   - (b) % Power 2 ________
   - (c) Fuel temp 1 ________
   - (d) Fuel temp 2 ________
   - (e) HV loss 1 ________
   - (f) HV loss 2 ________
   - (g) Pool level ________
   - (h) Reactor key ________
   - (i) Manual ________
   - (j) Emergency Stop ________
   - (k) Timer ________
   - (l) CSC Watchdog ________
   - (m) DAC Watchdog ________
19. Zero power pulse .... ________

DAILY SAFETY CHECKLIST

Checklist number ____________ Date ____________
Time completed ____________ Supervised by ____________
Assisted by ____________
____

I. EQUIPMENT ROOM (Room 3152)

1. Air compressor pressure (psi) .... ______
2. Air compressor water trap drained .... ______
3. Air dryer operating .... ______
4. Doors 231,231A, 3152, and roof hatch SECURED........ ______

II. EQUIPMENT ROOM (Room 2158)

1. Prefilter differential pressure .... ______
2. Primary discharge pressure (psi) .... ______
3. Demineralizer flow rates set to 6 gpm .... ______
4. Stack roughing filter (inches of water) .... ______
5. Stack absolute filter (inches of water) .... ______
6. Visual inspection of area .... ______
7. Door 2158 SECURED .... ______

III. PREPARATION AREA

Visual inspection of area .... ______

IV. REACTOR ROOM (Room 3161)

1. Transient rod air pressure (psi) .... ______
2. Shielding doors bearing air pressure (psi) .... ______
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 monitors (CAM) (Primary and Backup)
   (a) Operating and tracing .... ______
   (b) Channel test complet , damper closure verified........ ______
6. Door 3162 SECURED .... ______
7. Stack gas monitor quality assurance checked .... ______

V. LOBBY AREA

Lobby audio alarm turned off .... ______________

VI. REACTOR CONTROL ROOM (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 (resistivity must be > 0.5 Mohm-cm)
   (a) Background activity(cpm) .... ______________
   (b) Water monitor box resistivity [Mohm-cm] .... ______________
   (c) DM1 resistivity [Mohm-cm] .... ______________
   (d) DM2 resistivity [Mohm-cm] .... ______________
6. Stack gas flow rate [Kcfm] .... ______________
7. Stack linear flow rate (Kft/min) .... ______________
8. Gas stack monitor
   (a) Background (cpm) .... ______________
   (b) Alarm check .... ______________
   (c) High alarm set to 800 MPC Ar-41 .... ______________
9. Radiation monitors

Monitor	Alarm Point Functional	Reading (mR/hr)		Alarm Setting (mR/hr)
(a) R-1	______	______	______	500
(b) R-2	______	______		10
(c) R-3	______	______		10
(d) R-5	______	______	______	50
(e) E-3	______	______		10
(f) E-6	______	______		10

10. TV monitors on .... ______________
11. CAM high level audibl alarm check .... ______________
12. Water temperature (inlet) .... ______________
13. Water level log completed .... ______________
14. Source level power greater/equal to 0.5 cps. .... ______________

DAILY OPERATIONAL SHUTDOWN CHECKLIST

Checklist No. ______________ Date ______________________
Time Completed ____________ Supervised by _______________
Assisted by _________________
____

I. REACTOR ROOM (Room 3161)

1. All rod drives DOWN .... ________
2. Carriage lights OFF .... ________
3. Door 3162 SECURED .... ________
4. Door 3161 locked with key .... ________
5. Channel test completed on both CAMs .... ________

II. EQUIPMENT ROOM (Room 3152)

1. Distillation unit discharge valve CLOSED .... ________
2. Air dryer OPERATIONAL .... ________
3. Doors 231, 231A, 3152 and Roof hatch SECURED .... ________

III. EQUIPMENT ROOM (Room 2158)

1. Primary discharge pressure (PSI) .... ________
2. Demineralizer flow rates set to 6 GPM .... ________
3. Visual inspection for leaks .... ________
4. Door 2158 SECURED .... ________

IV. PREPARATION AREA

1. ER 2 plug door CONTROL LOCKED;
   Door closed; and handwheel PADLOCKED .... ________
2. ER 2 lights ON and rheostat at 10% .... ________
3. ER 1 plug door CONTROL LOCKED;
   Door closed; and handwheel PADLOCKED .... ________
4. ER 1 lights ON and rheostat at 10% .... ________
5. Visual inspection of area .... ________

V. LOBBY ALARM

Lobby alarm audio ON .... ________

VI. REACTOR CONTROL ROOM (Room 3160)

1. Reactor tank lights OFF .... ________
2. Console chart recorder pens raised .... ________
3. Steady-state timer OFF .... ________
4. Console LOCKED, and all required keys returned to lock box .... ________
5. Diffuser pump OFF .... ________
6. Purification, secondary and primary pumps ON .... ________
7. Reactor monthly usage summary completed .... ________
8. Radiation monitors .... ________

MONITOR	READING	HIGH LEVEL ALARM SETTING (mr/hr)
a. R-1	________	20 ________
b. R-2	________	N/A
c. R-3	________	N/A
d. R-5	________	20 ________
e. E-3	________	N/A
f. E-6	________	N/A
g. R-6	________	N/A

AIR PARTICULATE MONITOR (CAM) PROCEDURE

GENERAL

This procedure specifies how to test the CAM to ensure proper operation of this monitoring device. A channel test will be performed on both reactor room CAMs at the beginning and end of each day.

SPECIFIC

1. OPERATING and TRACING

Check that the CAM is operating and tracing with the correct time indicated on the chart. Ensure the flow rate is > 6 cfm and not off scale.

2. CHANNEL TEST WITH SOURCE

a. Place the switch on the front of the CAM to "test" and verify a reading of 3600 CPM +/- 20% on the chart. Reset the switch.

b. Open shield door and change the detector filter if the filter appears excessively dirty or the flow rate has dropped below 6 cfm. Place the used filter in the radioactive waste box in each CAM drawer.

c. Slowly bring a radioactive source near the detector. Observe the meter on the front of the CAM. The yellow light will activate at approximately 4,000 counts per minute. The red light will activate at approximately 10,000 counts per minute; the alarm will sound and the dampers will close. Reset the alarm, close the chamber door and return the source to the CAM drawer.

d. Annotate completion of the channel test on chart paper with initials and date performed.

3. TEST FREQUENCY

This entire procedure will be performed in conjuction with the daily startup or safety checklist. Items 1 and 2a will be performed again as part of the daily shutdown checklist.

50.59

Add New Section to ALARA Procedure (Procedure 4)

Facility Modification Worksheet 2

No 10 CFR 50.59 Analysis Required

Proposed Change Add new section to ALARA procedure (Op Procedure 4)

Modification to: Procedure X Facility ___ Experiment ___

Submitted by: Spence Date 04 May 93

1.Description of change: Section 3g is added to give specific details of the requirement from AFRRI Instruction 6055.8 that the RFD will monitor & control radiation exposures for personnel using the reactor facilities.

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 question as defined in 10 CFR 50.59(a)(2). N/A

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 Logistics. N/A

4. Determine what other procedures, logs, or training material may be affected and record below. None

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

None

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 ___ Not Required XX

Reviewed and approved by RFD M L Moore Date 4 May 93

RRFSC Notified ______ Date 29 JUN 1993

PERSONNEL RADIATION PROTECTION - ALARA

1. REFERENCES

a. ANSI/ANS Standard 15.11, Radiation Protection at Research Reactor Facilities

b. NRC Regulatory Guide 8.10

c. AFRRI Instruction 6055.8, Occupational Radiation Protection Program

d. HPP 0-2, 1-2, 1-4, 3-1, and 3-2

2. GENERAL

All activities performed in areas of potential personnel radiation exposure will be done in accordance with ALARA principles. These areas are the reactor room, upper equipment room (3152), lower equipment room (2158), warm storage, prep area, exposure room 1, exposure room 2, and the hot lab/cell. AFRRI Instruction 6055.8, Occupational Radiation Protection Program, is the radiation protection program followed by RSDR.

That Instruction mandates ALARA consideration in all operations involving radiation and radioactive materials at AFRRI. HPP 0-2 provides specific Personnel Dose Action Limits, requirements for investigating exposures exceeding the Action Limits, and procedures for obtaining special permission to exceed the Limits.

In the implementation of ALARA principles, the following methods and factors should be considered to the extent applicable for the control of radiation exposure, contamination, and radioactive effluents during reactor operations (ANSI/ANS-15.11):

a. Assessments of radiation, contamination, airborne radioactivity and mechanical difficulties which might be encountered in performing the operation.

b. Consideration of radioactive decay time.

c. Assessment of the feasibility of reducing the existing radiation levels by draining, flushing, or other decontamination methods, or by removing and transporting the component to a lower radiation area.

d. Consideration of personnel ingress and egress to work areas.

e. Assessment of the response capability for coping with abnormal operational occurrences.

f. Providing portable or temporary shielding.

g. Providing portable or temporary ventilation systems, or temporary enclosures and covering, or both to minimize spread of contamination.

h. Providing for personnel preoperational briefing for those assigned to perform tasks in high radiation areas.

i. Performing "dry runs" or mock-up equipment to train personnel and identify problems that may be encountered in the actual situation, and to select special tools and procedures.

j. Providing special communication systems.

k. Providing radiation monitoring instruments in adequate numbers to permit accurate measurements and rapid evaluations of the radiation and contamination levels encountered.

l. Limiting the amount of time spent in radiation areas or airborne radioactivity areas.

m. Maintaining as much distance as possible between the worker and sources of radiation.

No written record of ALARA consideration for a specific experiment is required except as indicated by the signature in section II of the RUR.

3. SPECIFIC

a. Reactor Room:

(1). CET Operations: See Procedure 1-Tab B.

(2). Chained area around pool: The reactor operator on the console shall be responsible for controlling entry into the chained area during operations. Need for access will be evaluated on a case by case basis particularly during operations above 100 KW to minimize radiation exposure.

b. Warm Storage: See HPP 3-1.

c. Prep Area: See Prep Area Briefing.

d. Exposure Rooms: See HPP 3-1 and Procedure 1-Tab A.

e. Hot Lab/Cell: Procedure 1-Tab D.

f. Upper and Lower Equipment Rooms:

(1). No written radiation protection procedures are required for entry into these rooms, however, personnel authorized access to these areas will receive safety briefings appropriate to their work.

(2). Access to these areas is controlled by the AFRRI Triga Facility Physical Security Plan.

g. As required by AFRRI Instruction 6055.8, the RFD will monitor and control radiation exposures for reactor staff members and all other personnel using the reactor facilities. To accomplish this, the Radioanalysis and Dosimetry Division (SHDD) will provide to the RFD a copy of the dosimetry records for all reactor staff member, SHD personnel involved in reactor operations, and any other personnel identified by the RFD. The listing will include both the dose for that specific dosimetry period and the total year-to-date dose and shall be given to the RFD within two weeks of SHDD receipt of the results from the TLD contractor.

After review by the RFD, the list will be retained in the reactor files. High doses and doses not consistent with the individual's job category will be investigated jointly by the RFD and RPO utilizing HPP 0-2. Details of other aspects of personnel dosimetry and monitoring are also given in HPP 1-2, HPP 1-4, HPP 3-1, HPP 3-2, and the Prep Area Briefing.

ATTACHMENT C

1993 Licensee Event Reports

4 March 1993

5 November 1993

LICENSEE EVENT REPORT

4 March 1993

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

DIR

FILE

26 March 1993

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

Attached is the Licensee Event Report (LER) for the reportable event that occurred on 4 March 1993 at the AFRRI Reactor Facility, Docket Number 50-170, License Number R-84. The event was telephonically reported on that day to appropriate NRC offices. The event was investigated and corrective action was completed by 26 March 1993.

The point of contact for further information is Mark Moore, Reactor Facility Director, at 301-295-1290.

Sincerely,

ROBERT L. BUMGARNER
Captain, MC, USN
Director

Attachment:
as stated

Cy Furn:
USNRC Region 1
Attn: Mr Thomas Dragoun
475 Allendale Road
King of Prussia, PA 19406-1415

USNRC
Attn: Mr. Marvin Mendonca
Mail Stop 11B20
Washington, DC 20555

Licensee Event Report
by the
AFRRI TRIGA Reactor Facility
Docket 50-170

Prepared by:
Mark L. Moore

Approved:

M. L. Moore — 26 March 93
M. L. Moore — Date
Reactor Facility Director

Approved for release:

Robert L. Bumgarner — 26 MAR 93
Robert L. Bumgarner — Date
Captain, MC, USN
Director

Abstract

A Senior Reactor Operator (SRO) completed a reactor experiment and shut down the reactor. After moving the core to the mid-pool position in preparation for the next experiment (with the reactor shut down), he left the control room with the key still in the console. He departed the facility shortly thereafter with the key still in the console. A second SRO returned to the facility a short time later, discovered the key, and secured the console. The first SRO was reprimanded on the failure to follow procedures, and the entire staff participated in a special training program on following procedures.

Narrative Description of Event

On 4 March 1993 at approximately 1120, John Nguyen, a Senior Reactor Operator (SRO), finished a reactor exposure run using the TRIGA Mark F Reactor in exposure room one. He shut down the reactor, and in preparation for the next experiment to be performed by another SRO, he moved the core to the mid-pool position. Upon reaching the desired mid-pool position, he was interrupted by a phone call with a request for some specific information he had to retrieve from his office which is next to the control room. Although the reactor was in a shutdown mode, he had forgotten that the key was still in the console from the previous core positioning. Upon attempting to return to the control room, he was again interrupted by other staff members wanting him to go to lunch. He declined because he was required to return later that afternoon for an overnight low-power reactor run that he and two other staff members were scheduled to perform. Shortly thereafter, at 1135, he and other staff members departed the facility, leaving it empty and secure. Another SRO, SFC Michael Laughery, returned from lunch at 1145, entered the facility, and found the key in the console. He removed the key and reported the event to the Reactor Operations Supervisor (ROS). Shortly thereafter the RFD was notified as was the AFRRI Director (the Licensee). After review, the event was considered to be a reportable occurrence under the Reactor Technical Specification 6.1.3.2[a.3].

Assessment of Safety Consequences

The event occurred during normal duty hours. Reactor procedures require a licensed operator to be present in the control room when the key is in the console. A review of the reactor facility security computer demonstrated that no one had entered the facility during the time period in which the console with the key in it was unattended, which stayed empty until the second SRO returned. A review of the console historical log (a computer recording of events occurring on the console) for this time period showed that the reactor remained in a shutdown (scrammed) mode with no rod movement or power increase the entire period that the console with the key in it was unattended. Access to AFRRI is controlled by security guards and an electronic card key system. Access to the reactor facility is controlled by an additional, independent electronic card key system. The reactor is located within an area protected by an additional cipher lock. All doors to the facility are kept locked, and therefore uncontrolled access is denied. Only authorized reactor staff members have access to these areas. These reviews confirmed that there were no adverse safety consequences as a result of this event.

Description of Corrective Actions

Facility management investigated the circumstances of this event, and concluded that an operator error occurred, possibly because of fatigue due to multiple long runs (27 hours) occurring during the week and a phone interruption. The following actions were taken and completed by March 26, 1993.

1. The operator was reprimanded and cautioned that future failure to follow procedures would result in disciplinary action.

2. All operators were required to attend a detailed training class on the necessity to follow procedures. Emphasis was placed on the requirements to control access to the console keys and heightened overall staff awareness and attention to details.

3. All operators were instructed not to answer the phone for other than operational information while they were logged on the console.

4. In future operations when extended runs occur, the actual time on the console for each operator will be shortened with more frequent rotation of operators. Licensed operators have been directed to notify the ROS for console relief if they feel fatigued or under any circumstance that could distract them from giving full attention to the operations being conducted.

Reference to Any Previous Similar Events

A complete review of facility records failed to show any similar earlier event.

Point of Contact for Any Questions

Points of contact for further information are Mr. M. L. Moore, Reactor Facility Director or MAJ Christopher Owens, Reactor Operations Supervisor; telephone 301-295-1290.

LICENSEE EVENT REPORT

5 November 1993

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

DIR

30 November 1993

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

Attached is the Licensee Event Report (LER) for the reportable occurrence of 5 November, 1993 at the AFRRI Reactor Facility, Docket Number 50-170, License Number R-84. The event was telephonically reported on 8 November, 1993 to the appropriate NRC offices. The event was investigated, and corrective actions were completed by 26 November, 1993.

The point of contact for further information is Mr. Mark Moore, Reactor Facility Director, at 301-295-1290.

Sincerely,

Robert L. Bumgarner
Captain, MC, USN
Director

Attachment:
as stated

Cy Furn:
USNRC Region 1
Attn: Mr. Thomas Dragoun
475 Allendale Road
King of Prussia, PA 19406-1415

USNRC
Attn: Mr. Marvin Mendonca
Mail Stop 11B20
Washington, DC 20555

Licensee Event Report
by the
AFRRI TRIGA Reactor Facility
Docket 50-170

Prepared by:
Stephen I Miller

Submitted by:

M. L. Moore — 29 Nov 93
Date
Reactor Facility Director

Approved by:

Robert L. Bumgarner — 29 Nov 93
Date
Captain, MC, USN
Director

Abstract

A Senior Reactor Operator (SRO) was performing a test involving the measurement of the gamma background from the shutdown core under the supervision of the Reactor Operations Supervisor (ROS). The test required the operator to move the shutdown reactor in increments of 50 units, (approximately one foot) from Exposure Room one (ER1) toward Exposure Room Two (ER2). Unknown to the ROS, the operator had closed the lead shield doors blocking the core path. After taking a full-in ER 1 measurement, the ROS instructed the operator to move the core in 50 unit increments toward ER2 while the dose was being recorded at each point. At a core position of approximately 430, the ROS gave the instruction to move the core again (toward position 450). At that time the operator explained that the requested move was not possible, due to the lead shield doors being closed, and that the core support shroud was in contact with the lead shield doors. The ROS realized that there was a miscommunication. The facility interlock did not stop the carriage as it entered region 2 of the reactor tank where the closed lead shield doors are located. Further investigation revealed that the interlock switch which should have inhibited the core carriage from moving inside region two toward the lead shield doors had become misaligned. The core was repositioned in region one, the switch was realigned and tested. The entire staff received training highlighting the importance of good communication while performing reactor operations and the importance of visual observation of core and door position by both CCTV and console indications. There was no damage to reactor or reactor facility components.

Narrative Description of Event

On 5 November 1993 a Senior Reactor Operator (SRO), under the general supervision of the Reactor Operations Supervisor (ROS), began setting up to take background radiation measurements in Exposure Room One (ER 1). The reactor test involved using portable radiation monitoring equipment viewed by a camera with a remote monitor in the reactor control room to determine the radiation levels in ER 1 from a shutdown, cold core at various core positions within the reactor pool. The test involved the routine movement of the reactor core from the full-in, position one location, where the core is against the tank projection in exposure room one, to a location in the mid-pool area. The test was being done in accordance with safety committee reviewed plans to insure that during the exposure room ventilation system replacement program there would be no radiation streaming through the exposure room walls via air system penetrations. The monitoring data would verify that there would be no exposures to workers outside the building during construction.

There was a lack of communication between the ROS and the SRO on the procedure to accomplish the measurements. Instead of opening the lead shield doors prior to reaching region 2 the SRO, following the verbal direction of the ROS, continued moving the core in 50 unit steps taking dose readings at each step as the core passed from region one into region two (the lead shield doors region). The test continued until the carriage movement was stopped by the slip clutch mechanism in the core dolly drive after the core support shroud contacted the lead shield doors. Not realizing the shroud had contacted the doors, the ROS instructed the operator to continue driving the core, believing that the lead shield doors were open. The SRO then stated that he could not move the core, because it was in contact with the closed lead shield doors. All proceedings were stopped. Shortly thereafter, the Reactor Facility Director was notified of the event, as was the acting AFRRI Director (the Licensee). Further investigation revealed that the interlock switch responsible for cutting power to the core dolly drive motor in the event that the core is driven into region 2 with the lead shield doors closed had failed because it was out of alignment. This prevented the actuator arm on the core dolly from changing the microswitch to the correct position which resulted in the interlock failure. The switch was realigned, and the core dolly interlock system tested. After review of the events and facility documentation on the following work day (8 Nov 1993), the event was determined to be a reportable occurrence under the Reactor Technical Specifications, paragraph 3.2.3., and as such, a report was made to Region I, USNRC. To insure the operability of the full system the RFD directed a complete check (both visual and functional), of all reactor interlock switches, indicator lamps, and system components. This was begun on 8 November 1993 and completed on 18 November, 1993.

The core dolly interlock functions have been checked annually, during the maintenance shutdown, throughout the facility history. The last check occurred approximately six weeks ago in September, 1993. During this functional check, the core dolly was driven into the interlock region, and the core drive motor shutdown was verified.

Later investigation has shown a probable cause of the malfunction. From reconstruction of possible actions it appears that the center core position switch had been inadvertently kicked during the final portion of the reactor facility annual shutdown. This occurred after the facility interlock system check. This switch gives indications to the facility interlock logic on the pool location of the core, and allows recovery if the interlock is violated thereby locking the core drive.

To prevent this from reoccurring, an interlock modification will remove this switch. The switch will be replaced with a switch/relay network. The new network will achieve the same purpose, but will require two operators to recover from an interlock system challenge.

Assessment of Safety Consequences

The event occurred with a cold, shutdown core. The operator has CCTV to observe the core movement and lead shield door position, but failed to do so. In addition to operator observation there are three physical safety mechanisms which prevent the core from being damaged by attempting to or actually driving the reactor core into contact with the lead shield doors. The first is the microswitch and associated facility interlock logic; this device failed. The second protective device is the drive clutch mechanism, which slips in the event that there is an obstruction blocking the free movement of the reactor carriage; this device did not fail and protected the core from damage. If both of these protective devices and operator observation had failed there is a 1/4 inch thick aluminum shroud protecting the core itself from contact with any obstruction in the pool. The maximum speed at which the core can move is 2.25 feet per minute. This speed is not sufficient to damage the core shroud. The second and third protective devices did not fail. Our inspection and review confirm that there were no adverse safety consequences or visible damage to the core as a result of this event.

Description of Corrective Actions

The facility director investigated the circumstances of this event and concluded that, in addition to the interlock failure, operator errors occurred, due to mis-communication between the ROS and the operator. Because this is the second event involving this SRO within the past year, a stringent retraining program has been instituted for this SRO as described below. The following actions were taken and completed or are in progress as of 29 November, 1993.

1. Two operators , the ROS and a SRO were reprimanded and cautioned that future incidents would result in severe disciplinary action. In addition, the SRO responsible was placed in a specialized training program, which included a full examination and review of the interlock system. The SRO will operate the reactor only under supervision until the training with appropriate exams are complete. In addition, the operator will complete thirty operations under the direct supervision of a licensed Senior Reactor Operator (SRO). After completion of the training, a

review of the operators performance will be conducted by the RFD. If performance warrants, the SRO will then be returned to a full operational status.

2. All operators attended a training class on the necessity to visually observe the indicators for lead shield door position and, to verify via the CCTV, the location of the core and the position of the lead shield doors before attempting to move the core. This training class also addressed in detail the necessity for clear communications among reactor staff, and the ultimate responsibility of the operator on console to ensure the appropriate operation of the reactor and associated equipment.

3. The switch was realigned and all switches in the facility interlock system were thoroughly tested, both visually and functionally, to ensure the proper operation of the interlock system.

4. The maintenance procedure for the facility interlock system has been upgraded to include a more rigorous testing, and the core position interlock surveillance frequency was increased from annually to quarterly on the maintenance surveillance checklist.

5. A daily indicator lamp check has been added to the daily startup checklist to insure there is no malfunction in indication of core or shield door position as seen on the console.

6. A modification of interlock hardware is being accomplished to enhance the interlock system which is currently in place. This change will decrease the probability of further failures in the core dolly interlock system. This will require an operator to obtain assistance if the facility interlocks are challenged. This change is being accomplished under a 50.59 review and will be completed at the next safety committee meeting.

7. Although the switches have not become misaligned in the thirty plus years of operation, the current check-out procedure of all interlock switches will be upgraded from the annual maintenance checklist to a quarterly verification of correct operation.

Reference to Any Previous Similar Events

A review of facility records failed to show any similar events.

Point of Contact for Any Questions

Points of contact for further information are Mr. M. L. Moore, Reactor Facility Director, or Mr. S. I Miller, Assistant Reactor Facility Director; telephone 301-295-1290

RSDR November 15, 1993

MEMORANDUM FOR REACTOR FACILITY DIRECTOR

SUBJECT: The Reportable Event That Occurred On 5 November 1993

On 05 November 1993, I, John Nguyen, under supervision of the reactor operations supervisor (ROS) conducted an experiment that allowed for measurement of radiation levels in the exposure room 1 (ER1). During the test, we found that the reactor core moved near the lead shield doors due to a miscommunication between myself and the ROS and also a misalignment of the interlock switch. The following paragraphs describe what occurred on that day.

At 9:25 the ROS discussed with me, Mr. Miller and Captain Robbins how to conduct the experiment. His proposal was to close the lead shield doors in order to get maximum scattering from them. He also pointed out that a measurement needed to be taken in different core positions as the reactor moved in increments of 50 units from ER1 toward to ER2.

At 10:12 I unlocked the reactor.

At 10:16 I moved the reactor core from position 700 to position 250.

At 10:20 I closed the lead shield doors.

At 10:26 the ROS instructed me to move the reactor to position 300, so he could measure the radiation level.

At 10:30 The ROS instructed me to move the reactor to position 350

At 10:34 the ROS again instructed me to move the reactor to another 50 units (to position 400)

At 10:36 the ROS instructed me to move the reactor to position 450. He measured and noted no radiation from that position up to ER2, so he instructed me to move the reactor to position 700.

At that moment, I explained to the ROS that the requested move was not possible due to the lead shield doors being next to the reactor core. The ROS was surprised because he did not know the lead shield doors were closed; and also because the facility interlock system would have prevented a movement of the reactor from region 1 (position 300) to region 2 (position 350) if the lead shield doors were in the closed position. As a result, he instructed me to secure the reactor and started an investigation. The investigation revealed that the interlock switch was misaligned, and did not stop the core as it entered into region 2. The further investigation conducted by Mr. Miller showed that no damage to either the reactor core or the lead shield doors. The event was also reported to the reactor facility director (RFD) and the U.S. Nuclear Regulatory Commission (NRC) office on the same date

John E Nguyen

John Nguyen
Senior Reactor operator

RSDR November 15, 1993

MEMORANDUM FOR REACTOR FACILITY DIRECTOR

SUBJECT: MALFUNCTION OF THE CORE POSITION SWITCH

On 5 Nov 93 I directed the staff to take measurements of core background in ER1 by moving the shutdown core various distances from ER1 and reading a radiation meter in ER1 with a video camera. During the measurements I walked into the control room to check the progress of the measurements. I found the operator had just taken a measurement. The operator was not moving the core at the time. I felt that the operator was waiting for some direction because I was in the room, so, I directed the operator to move the core 50 units to take the next measurement. The operator did as directed and we took the next measurement. I then directed the operator to move the core another 50 units. We took the next measurement and I directed the operator to move the core another 50 units. The operator then informed me that the core would not move. I asked why it would not move and the operator then informed me that the core was contacting the lead shield doors. I then notified the RFD and other staff members, diagnosed the problem to a core position switch, repositioned the switch, and directed the operator to move the core away from the lead shield doors. The switch which controls movement of the core in region 2 had become flipped in the wrong position. Careful study of the switch indicated that it had become misaligned about 10 degrees. The switch was adjusted and tested. The core moves slowly enough that there was no damage to the core housing. The fuel inside the core housing was thus undamaged.

Robert George
Reactor Operations Supervisor

ATTACHMENT D

Appointment Letters for Current Reactor and Radiation Facility Safety Committee Changes

ATTACHMENT E

Request for Approval of Slightly Radioactive Material Disposal

FILE

RSDR

RVS - Thanks for input.

Capt Robbins/djr/51290
13 May 1993

MEMORANDUM FOR DIR
THROUGH RSD CBD
COS

SUBJECT: Assignment of Recorder for Radiation and Reactor Facility Safety Committee (RRFSC)

Re. My Memorandum of 11 May 1993, Same Subject.

The assignment of Captain Robbins as Recorder for the RRFSC will improve efficiency and speed completion of the minutes as requested by the Chairman. Our secretary, though skilled and dedicated, doesn't have the technical background to understand the discussions which routinely occur at the RRFSC meetings. Some of the technical details which are discussed must be included in the minutes while much of the discussion can be paraphrased or summarized. Captain Robbins has the technical background to know the difference so that he can write the minutes more succinctly while requiring fewer iterations to complete an accurate summary of the meeting. He currently attends the meetings to take notes and reviews the minutes before they come to me. Assigning him as Recorder will make him the author of the minutes and eliminate a redundant step in the review process.

Mark Moore

MARK MOORE
Reactor Facility Director

RSDR

Capt Robbins/djr/51290
11 May 1993

MEMORANDUM FOR RRFSC

SUBJECT: Assignment of Recorder for Radiation and Reactor Facility Safety Committee.

Request that effective this date Ms. Carol King be relieved as Recorder for the Radiation and Reactor Facility Safety Committee (RRFSC). Further request that Captain Daniel J. Robbins, USAF be appointed as Recorder (non-voting member) for the RRFSC.

Mark Moore
MARK MOORE
Reactor Facility Director

Concur/Nonconcur

C. B. Galley
C. B. GALLEY
Captain, MSC, USN
Head, Radiation Sources Department

Concur/Nonconcur

N. W. Manderfield
N. W. MANDERFIELD
Colonel, MSC, USAF
Chair, RRFSC

Approved/Disapproved

R L Bumgarner
ROBERT L. BUMGARNER
Captain, MC, USN
Director

OK — but why?

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

DIR

14 June 1993

MEMORANDUM FOR RRFSC FILES

SUBJECT: Acting Chaiman of Reactor and Radiation Facility Safety Committee

Colonel Sheehan is appointed as the Acting Chairman of the Reactor and Radiation Facility Safety Committee on 29 June 1993.

for ROBERT L. BUMGARNER
Captain, MC, USN
Director

DEFENSE NUCLEAR AGENCY
ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
BETHESDA, MARYLAND 20889-5145

AFRRI/DIR

04 JUN 1992

MEMORANDUM FOR DISTRIBUTION A

SUBJECT: Appointment to the Reactor and Radiation Facility Safety Committee

1. The following appointment is made:

REGULAR MEMBERS:

Col Nicholas W. Manderfield	Chairman, AFRRI
Thomas O'Brien	Safety and Health Department, AFRRI
Mark L. Moore	Reactor Facility Director
Marcus Voth	Pennsylvania State University
Ronald Luersen	Naval Research Laboratory

SPECIAL MEMBERS:

CAPT Charles B. Galley	Radiation Sources Department, AFRRI
Samuel Levine	SHL Nuclear Associates

NONVOTING MEMBERS:

James Caldwell	Montgomery County
LTC Eric Daxon	Radiation Biophysics Department, AFRRI

2. ACTION: Appointment to the Reactor and Radiation Facility Safety Committee.

3. AUTHORITY: AFRRI TRIGA Reactor Technical Specifications, Section 6.2.1.1

4. EFFECTIVE: 01 July 1992

5. PERIOD: Until superseded or rescinded.

6. SUPERSEDES: All previous appointment Distribution Forms/Memorandums

7. SPECIAL INSTRUCTIONS: To fulfill review and audit functions as prescribed by the appointing authority. All appointments are for an indefinite period.

Robert L. Bumgarner

ROBERT L. BUMGARNER
Captain, MC, USN
Director

CY FURN:
Individuals
ASO

ATTACHMENT F

Reactor Operator Requalification Program

For The AFRRI TRIGA Reactor Facility

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

27 December 1993

U. S. Nuclear Regulatory Commission
Executive Director for Operations
Document Control Desk
Washington, DC 20555

Subject: Request For Approval of Slightly Radioactive Material Disposal Procedures

Gentlemen:

A major construction project to replace the ventilation system for the exposure rooms associated with the Armed Forces Radiobiology Research Institute (AFRRI) TRIGA Reactor Facility (License R-84) has been underway since October 1993. This project has required major excavation efforts to permit access to the ventilation ducts for the facility. During the excavation process, extensive radiological monitoring was performed using survey instrumentation with a sensitivity in the micro-Roentgen per hour range and environmental sampling and counting techniques with a lower limit of detection (LLD) in the range of 10^{-14} curie per gram.

While performing this work, we detected trace amounts of radioactivity in the corroded steel duct at the access point into the facility and in soil samples taken adjacent to that duct. The steel duct and contaminated soil were removed and retained for analysis and appropriate disposition. The duct will be disposed of as low-level radioactive waste. Soil samples taken from the excavation pit indicated there was limited migration into the soil and at locations one meter radially from the duct no radioactivity was detected using similar counting techniques. The specific activity of all soil samples is well below one picocurie per gram. The total activity in the contaminated soil is estimated to be less than ten microcuries. The contaminated soil is currently being contained and segregated from other soil.

Due to the extremely low activity of the material, AFRRI is requesting authorization to rebury the material as described in the attachment in accordance with 10 CFR 20.302. If authorization is granted prior to January 8, 1994 the contractor will be directed to put the soil back into its original location at a depth of approximately eight meters below the final grade. If authorization cannot be granted until after that date, we propose to bury the soil at a depth of at least one meter in another location on-site. In either case the projected dose equivalent for the maximally exposed individual is expected to be well below one millirem per year. Moreover, both the specific activity of the soil and the total activity is well below values that have already been authorized for on-site disposal as discussed in "Disposal of Slightly Contaminated Radioactive Wastes from Nuclear Power Plants", *Radiation Protection Management* 9(6):72, 1992.

Attachment to AFRRI Application for Proposed Burial of Radioactive Material Under 10 CFR 20.302

Reference:

a. NUREG 5512, Residual Radioactive Contamination from Decommissioning.
b. Radiological Health Handbook. Washington, DC: USHEW, 1970.

BACKGROUND INFORMATION

A major construction project to replace the ventilation system for the exposure rooms associated with the AFRRI TRIGA Reactor Facility (License R-84) has been underway since October 1993. This project has required major excavation efforts to access the ventilation ducts for the facility. During the excavation process, extensive radiological surveying and sampling has been conducted.

High resolution gamma spectrum analysis of the soil adjacent to the facility was conducted at various depths of excavation. Gamma analysis of the soil immediately surrounding the exhaust ventilation duct for Exposure Room 1 (figure 1) indicated trace amounts of the activation products Mn-54, Co-60, and Eu-152.

The soil from this area has been environmentally isolated in an eleven foot square holding compartment. External dose rate surveys using a micro-R meter indicate levels do not exceed existing background levels (9 μR/h). Gamma analysis of this soil was performed by sampling approximately 3500 grams of soil from the center of the eleven foot square and from the center of each quadrant. Samples were analyzed in a Marinelli beaker geometry on a gamma spectroscopy system. The results are documented in Table 1.

Table 1. Gamma Analysis of Soil Excavated to Access ER1 Duct

#	Co-60 (pCi/g)	Mn-54 (pCi/g)	Eu-152 (pCi/g)
1	<LLD	<LLD	<LLD
2	0.18 ± 0.06	<LLD	0.23 ± 0.09
3	0.08 ± 0.05	<LLD	0.17 ± 0.09
4	<LLD	<LLD	<LLD
5	0.05 ± 0.05	0.05 ± 0.03	<LLD

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

27 December 1993

U. S. Nuclear Regulatory Commission
Executive Director for Operations
Document Control Desk
Washington, DC 20555

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While performing this work, we detected trace amounts of radioactivity in the corroded steel duct at the access point into the facility and in soil samples taken adjacent to that duct. The steel duct and contaminated soil were removed and retained for analysis and appropriate disposition. The duct will be disposed of as low-level radioactive waste. Soil samples taken from the excavation pit indicated there was limited migration into the soil and at locations one meter radially from the duct no radioactivity was detected using similar counting techniques. The specific activity of all soil samples is well below one picocurie per gram. The total activity in the contaminated soil is estimated to be less than ten microcuries. The contaminated soil is currently being contained and segregated from other soil.

Due to the extremely low activity of the material, AFRRI is requesting authorization to rebury the material as described in the attachment in accordance with 10 CFR 20.302. If authorization is granted prior to January 8, 1994 the contractor will be directed to put the soil back into its original location at a depth of approximately eight meters below the final grade. If authorization cannot be granted until after that date, we propose to bury the soil at a depth of at least one meter in another location on-site. In either case the projected dose equivalent for the maximally exposed individual is expected to be well below one millirem per year. Moreover, both the specific activity of the soil and the total activity is well below values that have already been authorized for on-site disposal as discussed in "Disposal of Slightly Contaminated Radioactive Wastes from Nuclear Power Plants", *Radiation Protection Management* 9(6):72, 1992.

The attachment describes the site, counting data, principal exposure pathways, and calculations of the estimated dose to the maximally exposed individual. In the interest of enhanced protection to the general public and maximum savings in dollars to the government, we request the most expeditious reply to this request that is possible.

The point of contact for further information is Thomas J. O'Brien, AFRRI Radiation Protection Officer (301-295-1285) or Mr. Mark Moore, Reactor Facility Director (301-295-1290).

Attachment:
as stated

Sincerely,

JOHN R. SHEEHAN
Colonel, USAF, MSC
Acting Director

Cy Furn:
USNRC Region 1
Attn: Mr. Thomas Dragoun
475 Allendale Road
King of Prussia, PA 19406-1415

USNRC
Attn: Mr. Marvin Mendonca
Mail Stop 11B20
Washington, DC 20555

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Reference:

a. NUREG 5512, Residual Radioactive Contamination from Decommissioning.
b. Radiological Health Handbook. Washington, DC: USHEW, 1970.

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High resolution gamma spectrum analysis of the soil adjacent to the facility was conducted at various depths of excavation. Gamma analysis of the soil immediately surrounding the exhaust ventilation duct for Exposure Room 1 (figure 1) indicated trace amounts of the activation products Mn-54, Co-60, and Eu-152.

The soil from this area has been environmentally isolated in an eleven foot square holding compartment. External dose rate surveys using a micro-R meter indicate levels do not exceed existing background levels (9 μR/h). Gamma analysis of this soil was performed by sampling approximately 3500 grams of soil from the center of the eleven foot square and from the center of each quadrant. Samples were analyzed in a Marinelli beaker geometry on a gamma spectroscopy system. The results are documented in Table 1.

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3	0.08 ± 0.05	<LLD	0.17 ± 0.09
4	<LLD	<LLD	<LLD
5	0.05 ± 0.05	0.05 ± 0.03	<LLD

The maximum lower limits of detection (LLD) for the radionuclides are as follows:

Co-60	0.04 pCi/g
Mn-54	0.04 pCi/g
Eu-152	0.09 pCi/g

It is estimated that the total volume of soil is 11.3 cubic meters and, based on a density of 1.7 g/cm^3, the total mass of the soil is 2×10^7 grams. If the sample with the maximum specific activity is used (sample #2 from Table 1), the projected total activity is 9 μCi. Based on the average value of the five samples and assuming the LLD value for samples below the LLD of the counting technique, the projected total activity is 1.7 μCi.

BURIAL SITE INFORMATION

Method of Disposal

Alternative 1: Replace the contaminated soil to its original location as a part of the scheduled completion of the ventilation system replacement project. The soil would be covered by approximately 8 meters of uncontaminated soil.

Alternative 2: Bury the contaminated soil at a depth to ensure that at least one meter of "clean" soil covers the contaminated soil in an alternate on-site location.

Location of the disposal site:

Figure 2 marks the proposed burial sites.

Local land use:

Both of the proposed sites are adjacent to the Armed Forces Radiobiology Research Institute which is located on the grounds of the National Naval Medical Center (NNMC). The NNMC government facility is used by the Department of Defense for medical care, research, education, and some limited residential areas (see Figure 3). There are no drinking water wells on the NNMC site, only environmental monitoring wells.

Physical or administrative barriers to prevent present or future use of the site for other than its intended purpose:

At least one meter of "clean" soil will cover the contaminated soil. The property is exclusively a federal installation and is likely to remain such for the indefinite future. Both sites are adjacent to the Armed Forces Radiobiology Research Institute. Excavation of these areas cannot occur without authorization by the Director of the Institute (Licensee) and other higher authorities.

EXPOSURE PATHWAYS:

External Exposure: The external exposure for the maximally exposed individual was calculated for the three radionuclides of concern (^{54}Mn, ^{60}Co, and ^{152}Eu). The maximum values of the specific activity of each of these isotopes reported in Table 1 was used to calculate the dose equivalents reported in Table 2. The second column of Table 2 is the dose equivalent rate factor taken from Table 2.1 of reference (a). This external dose rate factor can be used to calculate the dose at the center of the surface of a cylinder of soil with uniform activity of the indicated isotope having a radius of 5 m and a depth of 15 cm. The third column is the maximum value of the specific activities of each of the isotopes reported in Table 1. The fourth column is the product of columns two and three and displays the projected external dose equivalent rate if the contaminated soil makes up the top 15 cm. The fifth column is the projected annual dose equivalent calculated by multiplying column four by 8760 hours. The sixth column is the projected annual dose equivalent corrected by the attenuation factor for 100 cm of soil placed directed over the contaminated soil. The attenuation factor was calculated by the product of a buildup factor (18.0) and a mass attenuation coefficient of 0.0518 cm^2/g, the minimum mass attenuation coefficient for the gamma rays of interest.

Table 2. Total Dose for the Maximally Exposed Individuals

Radionuclide	External Dose Rate Factor (mrem/h/pCi/g*)	Maximum Value of Specific Activity (pCi/g)	External Dose Rate (μR/h)	Annual Dose Equivalent (no attenuation) (mrem)	Annual Dose Equivalent with 100cm Soil Cover (mrem)
^{54}Mn	7.9×10^{-4}	0.05	0.04	0.35	0.001
^{60}Co	2.4×10^{-3}	0.18	0.43	3.77	0.010
^{152}Eu	1.1×10^{-3}	0.23	0.25	2.19	0.006

* Obtained from table 2.1 of reference (a)

An alternative and more conservative external dose equivalent calculation is to assume that all of the activity is reduced to a point source located at a depth of one meter below the surface. Using the maximum values of Table 1 for the specific activity of each of the isotopes, a soil mass of 2×10^7 grams, individual Γ factors for each of the isotopes (reference b), and the attenuation/buildup factors used above, the total annual dose equivalent is 0.2 mrem/year.

Inhalation of Resuspended Radionuclides: Inhalation of resuspended radionuclides will not occur because the material will be isolated from surface winds or disturbances by at least one meter of earth.

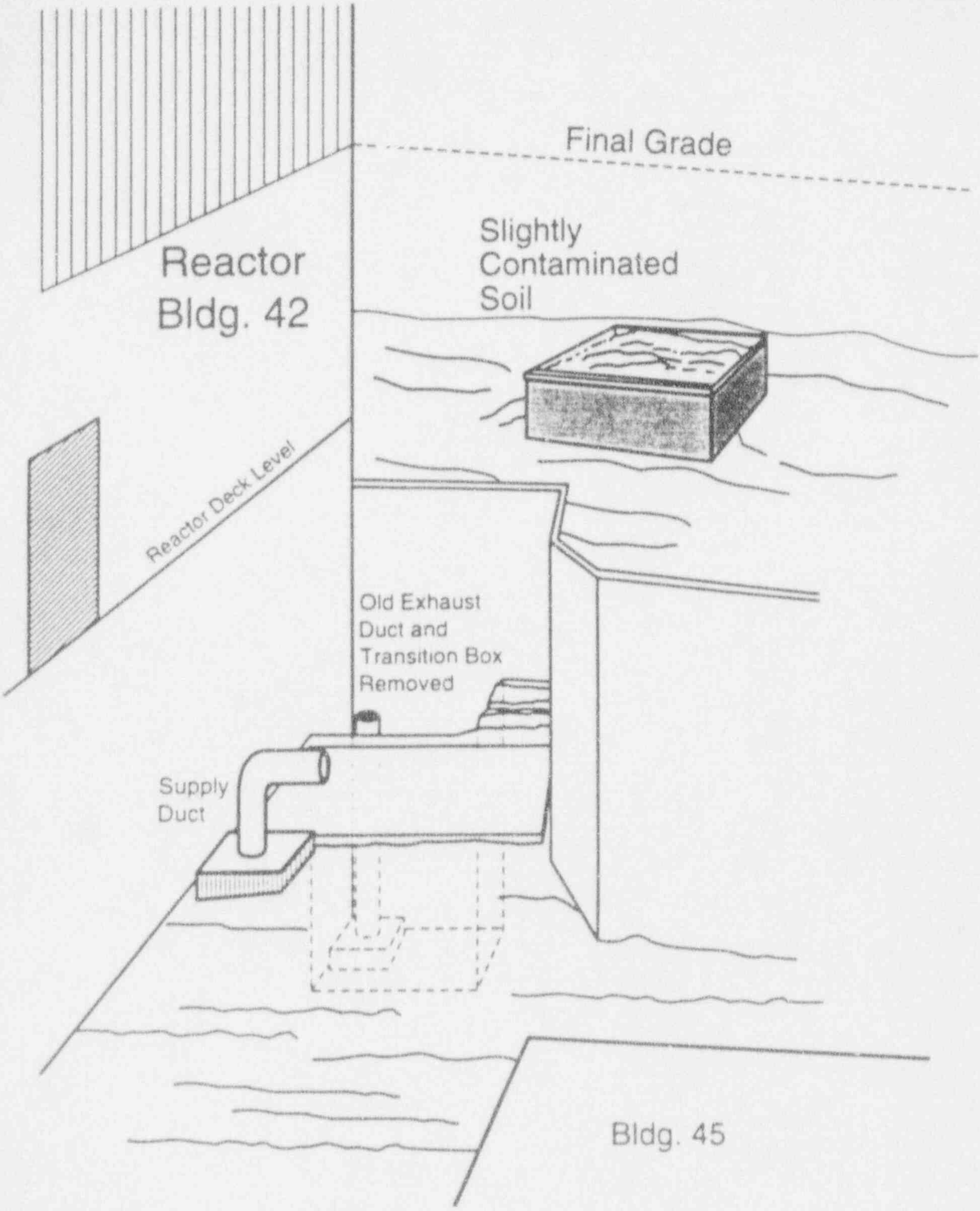
External and Internal Exposure to an Inadvertent Intruder: External and internal exposure to an inadvertent intruder will be significantly less than 0.2 mrem/yr due to lesser occupancy time.

External and Internal Exposure from assumed recycling of the contaminated material: External and internal exposure of an individual from assumed recycling of the contaminated material at the time the disposal site is released from regulatory control will be significantly less due to decay of isotopes concerned. The time of government oversight, assumed to be 50 years for purposes of this document, will assure that all of the ^{54}Mn and ^{60}Co will have decayed approximately ten half-lives. The ^{152}Eu will have decayed approximately four half-lives.

Internal Exposure from Ingestion of Groundwater: Both proposed burial sites are located at least 50 meters from the closest surface water. The composition of the soil is predominantly clay which will reduce transport of these isotopes. Furthermore, sampling one meter from the duct did not show detectable contamination. Historical environmental monitoring records of soil and water samples completed around the National Naval Medical Center have shown no evidence of contamination. Therefore, internal exposure from ingestion of groundwater will be significantly less then the external exposure calculated above.

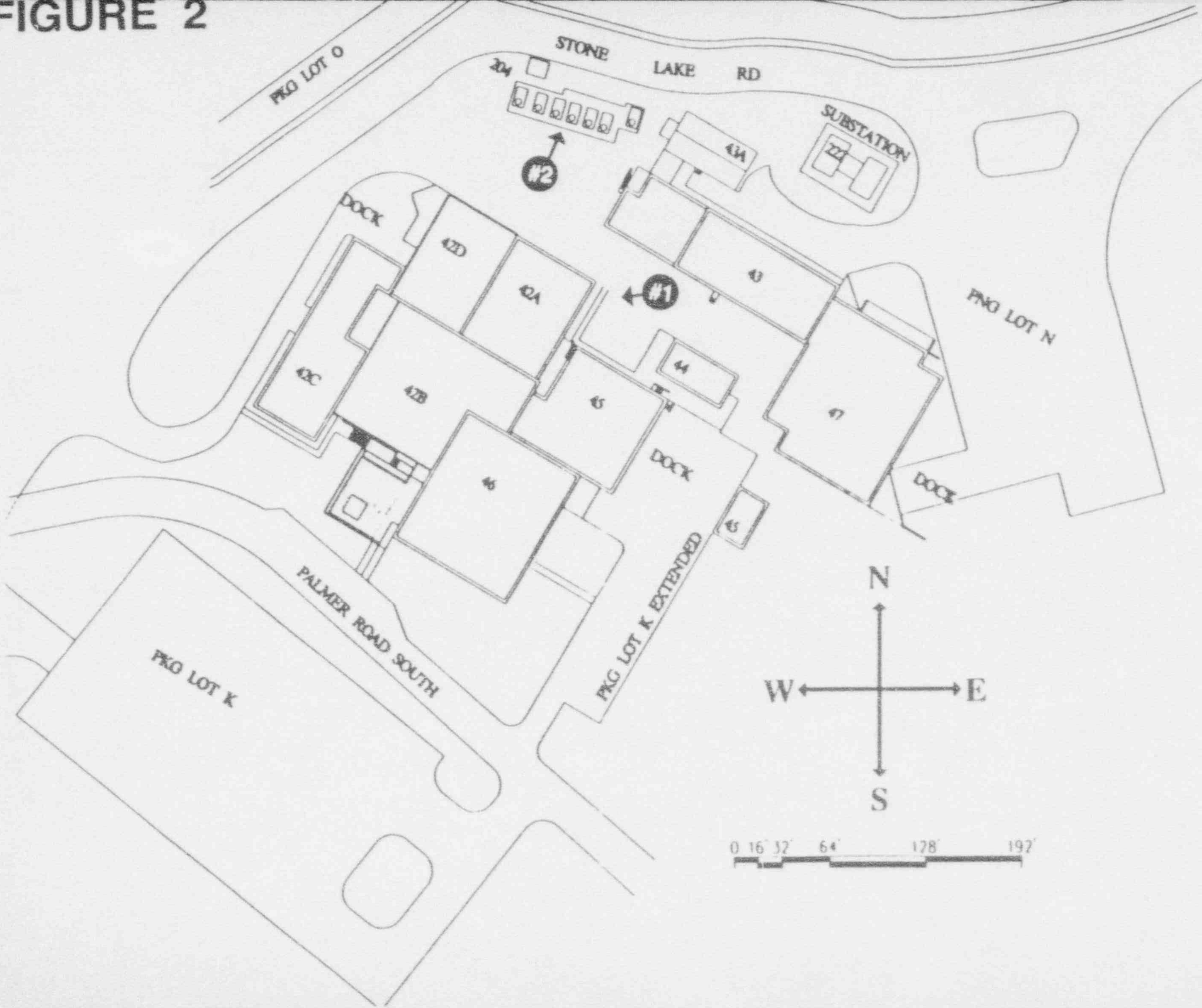
Internal Exposure from Ingestion of Food Grown on the Disposal Site: Due to the present and future anticipated uses of the proposed burial sites while under government control, no food will be grown. The proposed burial depth is well below plow depth cited in reference(a)

FIGURE 1



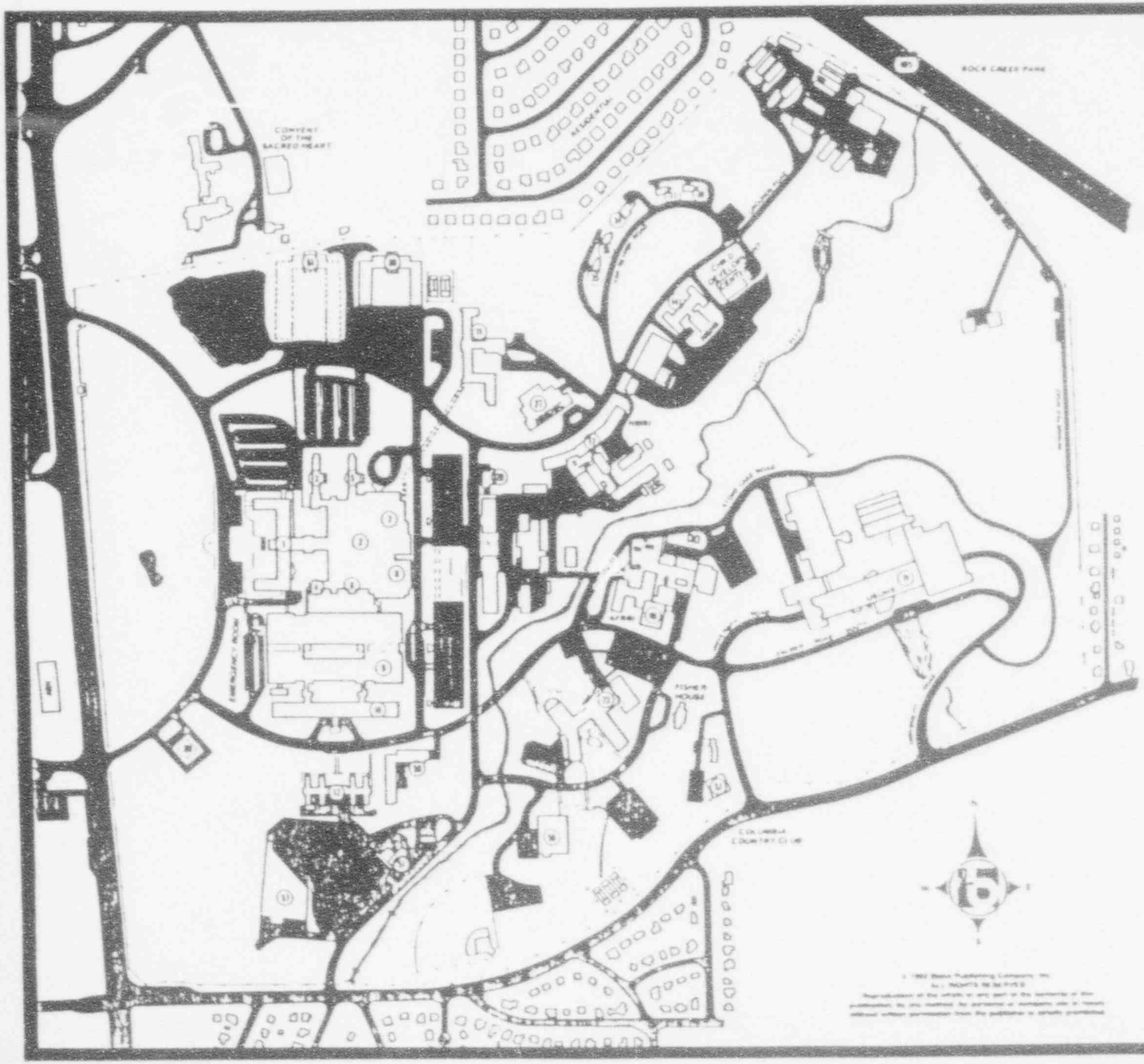
Final Grade
Reactor
Bldg. 42
Slightly
Contaminated
Soil
Reactor Deck Level
Old Exhaust
Duct and
Transition Box
Removed
Supply
Duct
Bldg. 45

FIGURE 2



PKG LOT O
STONE LAKE RD
204
#2
SUBSTATION
222
43A
DOCK
42D
42A
#1
43
PKG LOT N
44
42C
42B
45
47
DOCK
46
DOCK
45
PALMER ROAD SOUTH
PKG LOT K EXTENDED
PKG LOT K
N
W
E
S
0 16' 32' 64' 128' 192'

FIGURE 3



Bldg

8 Chapel

Barber Shop

Post Office

ATTACHMENT G

Changes to the AFRRI TRIGA Reactor Emergency Plan

REACTOR OPERATOR REQUALIFICATION PROGRAM
FOR THE
AFRRI TRIGA REACTOR FACILITY

Armed Forces Radiobiology Research Institute
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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 may appoint a Training Coordinator, in writing, who will be 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. Physical Security Plan for AFRRI TRIGA Reactor Facility
H. AFRRI Manual M91-1, 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
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. Facility changes, modifications, and malfunctions
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 AFRRI 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 contain 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 (4) 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 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 written and oral examinations, including a demonstration at the reactor console. These examinations will be prepared in accordance with 10 CFR Parts 55.41, 55.43, 55.45, and 55.59. The oral examination and demonstration at the reactor console shall be administered annually, not to exceed 15 months, to each licensed operator. Written examinations shall be administered every two years, not to exceed 27 months, to each licensed operator. All examinations will be administered and graded by either the RFD or his designee.

The operating examination 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 examination. This examination 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.

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 AFRRI 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.

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 a licensed operator scores less than 70% on any section of the written examination, that licensed operator will be entered into an accelerated requalification program on that section topic. If an individual receives a grade of less than 80% overall, he/she will enter an accelerated requalification program with training emphasis placed on identified weaknesses.

An unsatisfactory evaluation on the annual oral examination will require that discussions of deficiencies take place between that licensed operator and the RFD or ROS. A second oral examination 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 preparation of all examinations, training schedules, materials, and documentation associated with these evaluations. The RFD is the senior technical manager and, as such, shall oversee the preparation and administration of written examinations. Additionally, he will give senior staff members oral examinations. These senior staff members may then administer the remaining oral examinations. As the senior supervisor in charge, the RFD shall not be required to take examinations.

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 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 exams, and console performance or oral examinations. The additional training and the examination that the operator receives will depend upon the weaknesses exhibited on previous examinations. The number of lectures and examinations that an operator will receive will be determined by either the RFD or his designee. 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 examinations, 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 requalification exam

C. The licensed operator's Requalification Program Checklist

D. The licensed operator's Requalification Memorandum for Record

E. 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

F. The licensed operator's medical evaluation record

G. 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.