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August 29, 1997

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

Subject: Transmittal of Annual Facility Operating Report for 1996.

Dear Sir/Madam:

Enclosed you will find a copy of the Annual Operating Report for the Idaho State University AGN-201M Reactor, License No. R-110, Docket No. 50-284, fo. calendar year 1996. Submission of this report fulfills the requirements of AGN Technical Specification 6.9.1.

Please note that the report is overdue and should have been subm[illegible]d before June 30, 1997. However, because of an unexpected maintenance problem with one of the reactor control element drive assemblies, which occurred several days before the report due date, and which required immediate attention, the report could not be completed as expected. The anticipated late submission was discussed with Mr. Marvin M. Mendonca, the Project Manager at NRC Headquarters, who indicated that this minor delay was acceptable to him. I apologize for any inconvenience this delay may cause NRC staff members.

If you have any questions concerning the report, please contact me at (208) 236-3351.

Sincerely,

John S. Bennion
Reactor Administrator and Acting Reactor Supervisor

cc: ✓Mr. Marvin M. Mendonca, Acting Director
Non-Power Reactors and Decommissioning Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

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Idaho State University
AGN-201M Reactor Facility
License R-110, Docket No. 50-284
Annual Operating Report for 1996

1. Narrative Summary

A. Changes in Facility Design, Performance Characteristics, and Operating Procedures:

A few minor changes in the facility design were made during the 1996 calendar year. The changes are described in section 5.A. of this report.

B. Results of Major Surveillance Tests and Inspections:

(1) Channel tests performed on all safety channels and scram interlocks were found to be satisfactory and within specifications.

(2) Power and period calibrations were performed with satisfactory results.

(3) The shield water tank was inspected and no leaks or excessive corrosion were observed. However, because the licensee had recently submitted to NRC an application to extend the operating license for another 20 years, a major inspection of the tank and contained water was initiated to allay any concern for the structural integrity of the tank and its penetrations.

Water samples were analyzed for chemistry parameters such as pH, conductivity, and sediment content. In addition, ultrasonic testing of the beam tubes and glory hole was performed to determine if excessive corrosion had reduced the thickness of these penetrations such as to cause concern that leaks might develop in the future.

After reviewing the ultrasonic testing data, which showed no significant reduction in material thicknesses, and in consultation with corrosion experts at Argonne National Laboratory, it was decided that no action should be required to prevent additional corrosion because outer oxide layers are believed to be sufficient to inhibit further corrosive losses. A final report providing the results of the tank inspection is attached as Appendix A.

(4) The seismic displacement interlock was tested satisfactorily.

(5) (a) The control rod drive mechanisms were inspected and tested with satisfactory results.

(b) Ejection times were measured for all scrammable rods and found to be less than 120 milliseconds.

(c) The reactivity worths of all safety and control rods were measured, as well as the time required to drive each rod to its fully inserted position. Reactivity insertion rates were determined to be less than 0.043% $\Delta k/k\ s^{-1}$ (\$0.057 s^{-1}) for all rods.

(d) The shutdown margin was determined to be greater than 1.49% $\Delta k/k$ (\$2.01) with both the most reactive scrammable rod and the fine control rod fully inserted.

(e) All surveillances were within the appropriate Technical Specification requirements.

2. Operating History and Energy Output.

The reactor was operated at power levels up to 5 watts for a total 96.5 hours thereby generating 2.19 watt-days (52.5 watt-hours) of thermal energy during this reporting period. A summary of monthly operations for 1996 is given in Table I.

Table I. Summary of Monthly Reactor Operations
(1 January 1996 through 31 December 1996)

Month	Hours	Energy (W-hr)
January	8.6	2.52
February	12.3	0.49
March	23.5	4.65
April	14.5	24.88
May	8.1	2.73
June	8.3	11.93
July	2.6	0.23
August	0.0	0.00
September	0.0	0.00
October	0.0	0.00
November	0.0	0.00
December	18.6	5.03
Total	96.5 hr	52.46 W-hr

3. A. Unscheduled Shutdowns and Corrective Actions Taken.

None.

B. Inadvertent Scrams and Action Taken.

3/22/96: High trips on Nuclear Instrument Channel Nos. 1 and 3 because of improper range switching by the operator-in-training. Reactor restarted.

3/27/96: High trip on Nuclear Instrument Channel No. 1 because of improper range switching by the operator-in-training. Reactor restarted.

4/1/96: Two spurious low-level trips on Nuclear Instrument Channel No. 3 occurred during pre-operational checks. During the subsequent ascension to the planned power level, an automatic scram occurred without any indication of the cause on the console annunciator panel. The apparent cause was suspected to be a voltage fluctuation in the line power from the intermittent cycling of the backup uninterruptable power supply. Run terminated.

5/3/96: High trip on Nuclear Instrument Channel No. 1 because of improper range switching by the operator-in-training. Reactor restarted.

6/7/96: High trip on Nuclear Instrument Channel No. 3 because of signal spike during range switching. Reactor restarted.

4. Safety-Related Corrective Maintenance

1/30/96: Replaced 1.5 V, N-type battery in Nuclear Instrument Channel No. 2.

2/25/96: Repaired a loose solder connection to the G-M tube of the Area Radiation Monitor after the instrument failed to respond to a check source during pre-operation checks. The calibration of the instrument was verified by the Technical Safety Office before returning the instrument to service.

3/20/96: Replaced 1.5 V, N-type battery in Nuclear Instrument Channel No. 2.

6/7/96: Replaced 1.5 V, N-type battery in Nuclear Instrument Channel No. 2.

11/26/96: Replaced 1.5 V, N-type battery in Nuclear Instrument Channel No. 2.

11/26/96: Repaired a broken solder joint to one lead of a 16 μf capacitor in the logarithmic amplifier in Nuclear Instrument Channel No. 2. Another broken solder joint connecting the reset switch for the Channel No. 2 sensitrol relay was found in the Safety Chassis and repaired. In addition, the connector for the power cable to the solenoid that controls raising the Channel No. 1 BF_3 proportional counter was replaced after the locking ring on the connector had seized. The reactor was returned to service 12/6/96 after the repairs had been completed.

12/6/96 A polyethylene extender cap was fabricated for the end of the dashpot plunger armature plate connected to rod of Safety Rod No. 2 (SR-2). The cap was required to slightly raise the armature plate to make contact with the electromagnet after an approximately 5-mm-thick neoprene pad dislodged from the end of the plunger. The polyethylene cap was installed and tested and normal operation of the rod was obtained 12/10/96.

5. Modifications.

A. Changes in Facility Design.

The support beam for the siphon-breaker experiment, which had been located in the southwest corner of the reactor room, was dismantled and removed from the reactor room. Originally installed in 1989, the beam extended from and was attached to the subsurface tank. The steel cover for the underground tank was replaced over the pit after the beam was removed.

A tube was installed on the east end of the glory hole that extends the glory hole to the outer face of the concrete block shielding. Additional shielding in the form of lead bricks was added around the extension tube to reduce radiation streaming through the unshielded access port to the glory hole. In order to reduce radiation streaming from the glory hole, a polyethylene-tipped steel plug was fabricated for insertion into the glory hole during reactor operations. The plug is not used when samples are irradiated in the glory hole, or when other experiments are conducted that require direct access to the glory hole or otherwise utilize the radiation emission therefrom. Further details of these modifications are included in Appendix B.

B. Changes to Procedures.

There were no changes to facility procedures as described in the facility's Technical Specifications.

C. Experiments.

No new or untried experiments or tests were performed during 1996.

D. Reactor Safety Committee.

As of the end of the reporting period, membership of the Reactor Safety Committee (RSC) consisted of the following individuals:

Frank H. Just - Chair
Jay F. Kunze - Dean, College of Engineering
John S. Bennion - Reactor Administrator
Raymond R. Noy - Reactor Supervisor
Thomas F. Gesell - Radiation Safety Officer
J. Frank Harmon
Fredrick M. Cummings
Terry W. Smith
Michael E. Vaughan

6. Summary of Changes Reportable under 10 CFR 50.59.

None.

7. Radioactive Effluents.

A. Liquid Waste - Total Activity Released: None.

B. Gaseous Waste - Total Estimated Activity Released: 1.1 μCi.

The AGN-201 Reactor was operated for 96.5 hours at power levels up to approximately 5 watts. At this power level argon-41 production is negligible and substantially below the effluent concentration limit given in 10 CFR 20 Appendix B, Table 2. The total activity of Ar-41 released to the environment was conservatively estimated at 1.14 μCi. This activity corresponds to the total activity of all gaseous radioactive effluent from the facility. A monthly summary of gaseous releases is given in Table II.

Table II. Summary of Monthly Gaseous Radioactive Effluent Releases
(1 January 1996 through 31 December 1996)

Month	Ar-41 (μCi)
January	0.055
February	0.011
March	0.101
April	0.542
May	0.060
June	0.260
July	0.005
August	0.000
September	0.000
October	0.000
November	0.000
December	0.110
Total activity:	1.14 μCi

C. Solid Waste - Total Activity: None.

8. Environmental radiation surveys, performed at the facility boundary while the reactor was operating at 90% of full licensed power (4.5 watts), measured a maximum combined neutron and gamma dose equivalent rate of less than 1 mrem hr^{-1} at the outside walls of the building proximal to the reactor.

9. Radiation Exposures.

Personnel radiation exposures are reviewed quarterly by the Radiation Safety Officer. Annual reports of ionizing radiation doses are provided by the Radiation Safety Officer to all monitored personnel as required under the provisions of 10 CFR 19.

Personnel with duties in the reactor laboratory on either a regular or occasional basis have been issued radiation dosimeters by the Idaho State University Technical Safety Office. The duty category and monitoring period of personnel are summarized in Table III:

Table III. Personnel Monitored for Exposure to Ionizing Radiation

Name	Monitoring Period	Duty Category
Kazi Ahmed	1/1/96 - 12/31/96	Occasional
John S. Bennion	1/1/96 - 12/31/96	Regular
Robert D. Boston	1/1/96 - 12/31/96	Regular
Kermit A. Bunde	1/1/96 - 12/31/96	Regular
R. David Clovis	1/1/96 - 10/31/96	Occasional
Dmitri Drozhko	1/1/96 - 12/31/96	Occasional
Irina Glagolenko	1/1/96 - 12/31/96	Occasional
Raed Jaber	1/1/96 - 12/31/96	Occasional
Andrew Johnson	1/1/96 - 12/31/96	Occasional
Michael Jolley	1/1/96 - 12/31/96	Occasional
Jay F. Kunze	1/1/96 - 12/31/96	Regular
Pavel Medvedev	1/1/96 - 12/31/96	Occasional
Lonnie McCulloch	1/1/96 - 12/31/96	Occasional

Table III. Personnel Monitored for Exposure to Ionizing Radiation (Continued).

Name	Monitoring Period	Duty Category
Jon D. McWhirter	1/1/96 - 12/31/96	Regular
Raymond R. Noy	1/1/96 - 12/31/96	Regular
James Sample	1/1/96 - 12/31/96	Occasional
Kevin Schroeder	1/1/96 - 12/31/96	Occasional
William Taylor	1/1/96 - 12/31/96	Occasional

Dose Equivalent summary for Reporting Period:

Measured Doses

1/1/96 - 12/31/96 Whole-Body Dose Equivalents: ≤10 mrem for most personnel. One member of the operating staff received 20 mrem in the second quarter of 1996. Minimum Detectable Dose Equivalent per Monthly Badge = 10 mrem.

None of the 244 visitors to the facility during 1996 received a measurable dose. Therefore, the average and maximum doses are all within NRC guidelines. A summary of whole-body exposures for facility personnel is presented in Table IV.

Table IV. Summary of Whole-Body Exposures
(1 January 1996 through 31 December 1996)

Estimated whole-body exposure range (rem):	Number of individuals in each range:
No Measurable Dose	17
Less than 0.10	1
0.10 to 0.25	0
0.25 to 0.50	0
0.50 to 0.75	0
0.75 to 1.00	0
1.00 to 2.00	0
2.00 to 3.00	0
3.00 to 4.00	0
4.00 to 5.00	0
Greater than 5 rem	0
Total number of individuals reported:	18

Report submitted by:

John S. Bennion
Reactor Administrator

APPENDIX A

Final Results of the AGN-201 Reactor Shield Water Tank Assessment

Final Results of the AGN-201 Reactor Shield Water Tank Assessment

An assessment of the AGN-201 reactor shield water tank was recently performed in an effort to determine the extent of the corrosion on the internal components of the tank. The assessment was made on the basis of two different evaluative processes.

Chemistry analyses of water samples taken from the shield tank revealed pH levels consistent with those found in local potable water. Results of the water chemistry analyses were discussed with ANL-W personnel having considerable expertise in the area of corrosion control to obtain guidance on possible remedial actions. According to Mr. John Kursl, manager of the EBR-II analytical laboratory, these pH levels would not cause an acceleration of the corrosion rate within the tank.

Ultrasonic testing (UT) of beam port and glory hole tubes was performed to determine if corrosion had significantly deteriorated the tubes' wall thickness. Continuous scans made across beam port #3's north tube revealed consistent wall thicknesses of 0.200" to 0.278", with no indication of pitting, in a tube with nominal wall thickness of 0.250". Unfortunately, continuous scans were not able to be made in the smaller glory hole tube. However, discrete scans made in the glory hole's east tube revealed consistent wall thicknesses of 0.110" to 0.120", with no indication of pitting, in a tube with nominal wall thickness of 0.125".

Based on the information gathered through chemistry analyses and nondestructive testing, it is concluded that the corrosion within the shield tank is not excessive and that the integrity of internal components is not compromised. Therefore, no further action with respect to assessing or refurbishing the tank internals will be taken. In addition, Mr. Kursl believes that adding corrosion inhibitor to the tank water, with a pronounced oxide layer present on the tank internals, would produce no discernable slowing of the corrosion rate. Therefore, the system will be left in its current condition.

Two refurbishment items will be performed on the shield tank exterior:

1. The corroded portion of the pedestal will be stripped to bare metal, primed, and repainted.
3. The inside of the glory hole tube will be cleaned of surface corrosion and painted.

APPENDIX B

Modification of the AGN-201 Reactor Glory Hole and Radiation Shielding

Modification of the AGN-201 Reactor Glory Hole and Gamma Shielding

Introduction

During reactor operation, the glory hole of the AGN-201 reactor is accessible only through a 5-inch wide by 4⅝-inch high opening in the concrete shielding surrounding the reactor. The opening is large enough to allow insertion of objects into the glory hole. However, the lower portion of the glory hole flange is nestled behind the concrete shielding. Removal of the flange requires that several bricks be removed from the shield wall to allow access to the lower retaining screw. This is a very laborious process. In addition, the glory hole entrance is situated over a foot behind the front of the shield wall, making it difficult to see and access the glory hole. To facilitate work on and access to the glory hole, a modification to the glory hole and shielding is proposed.

Proposed Modification to the Glory Hole and Shielding

The east end of the glory hole will be extended to the outer edge of the concrete block shielding by means of an extension tube assembly (Figure 1). The extension tube is welded to a flange which will be bolted to the existing glory hole flange. The entire assembly is constructed from carbon steel, and is sized to accommodate the aluminum glory hole sleeve. To eliminate abrupt internal edges at the glory hole/extender interface, the sleeve will be replaced by one which reaches the end of the extension tube.

The shielding in front of the glory hole region will be modified to include frames which will accommodate lead shield plugs (Figure 2). The lead plugs are solid except for a 1¾-inch diameter hole through which the extension tube will pass. Since the outside diameter of the extension tube is 1½ inches, a ⅛-inch clearance between the tube and shield plug is provided. This design eliminates the large opening which now exists in front of the glory hole, thereby reducing radiation levels in this region. Handles on the plugs will allow easy installation and removal. The frames are constructed of ¼-inch plate carbon steel (Figure 3). Two assemblies are used to facilitate initial installation of the frames into the shielding wall (Figure 4). Figure 5 shows a front view of a shield and frame assembly. The regions on either side of the shield frames will be filled in with lead brick (Figure 2).

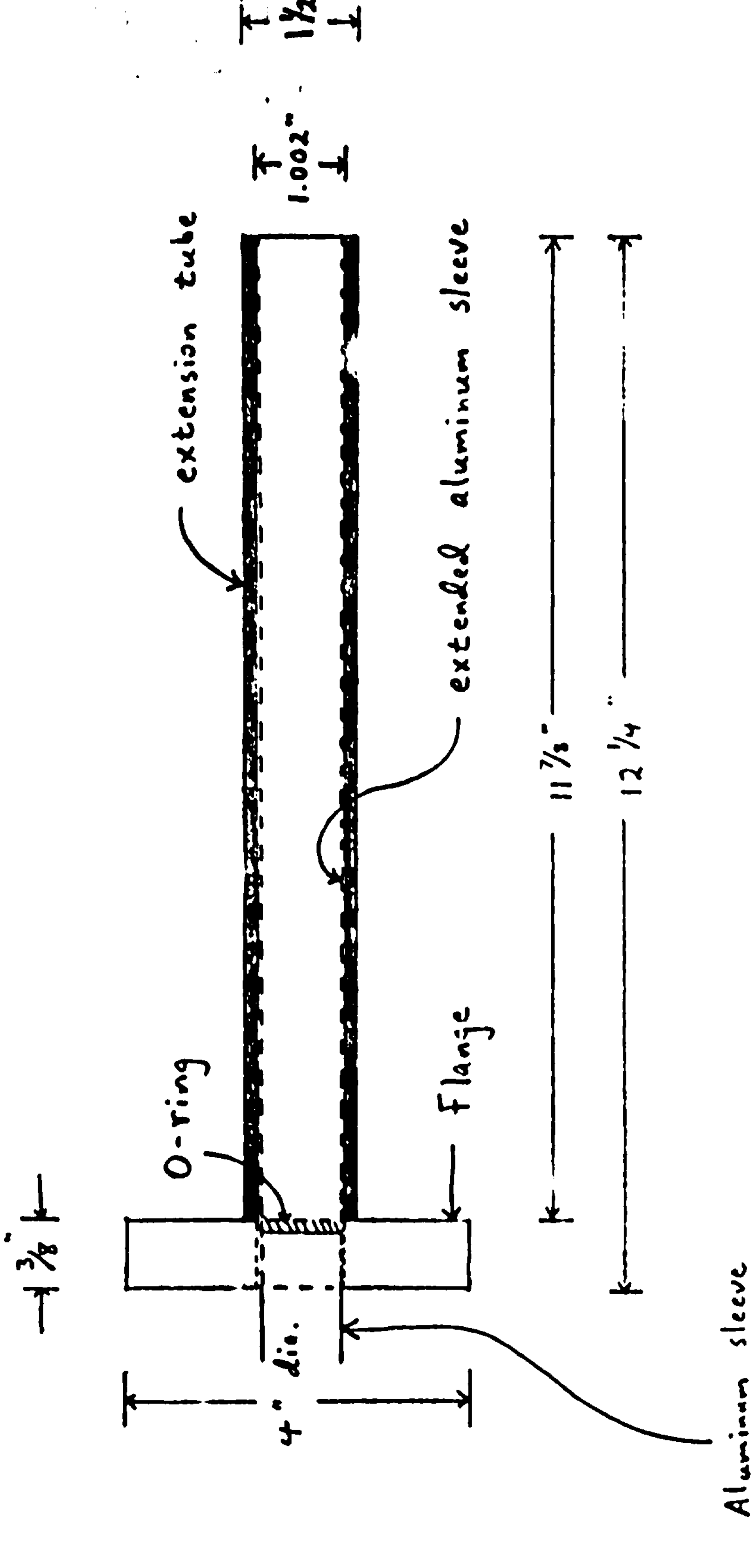


Figure 1 - Extension Tube Assembly

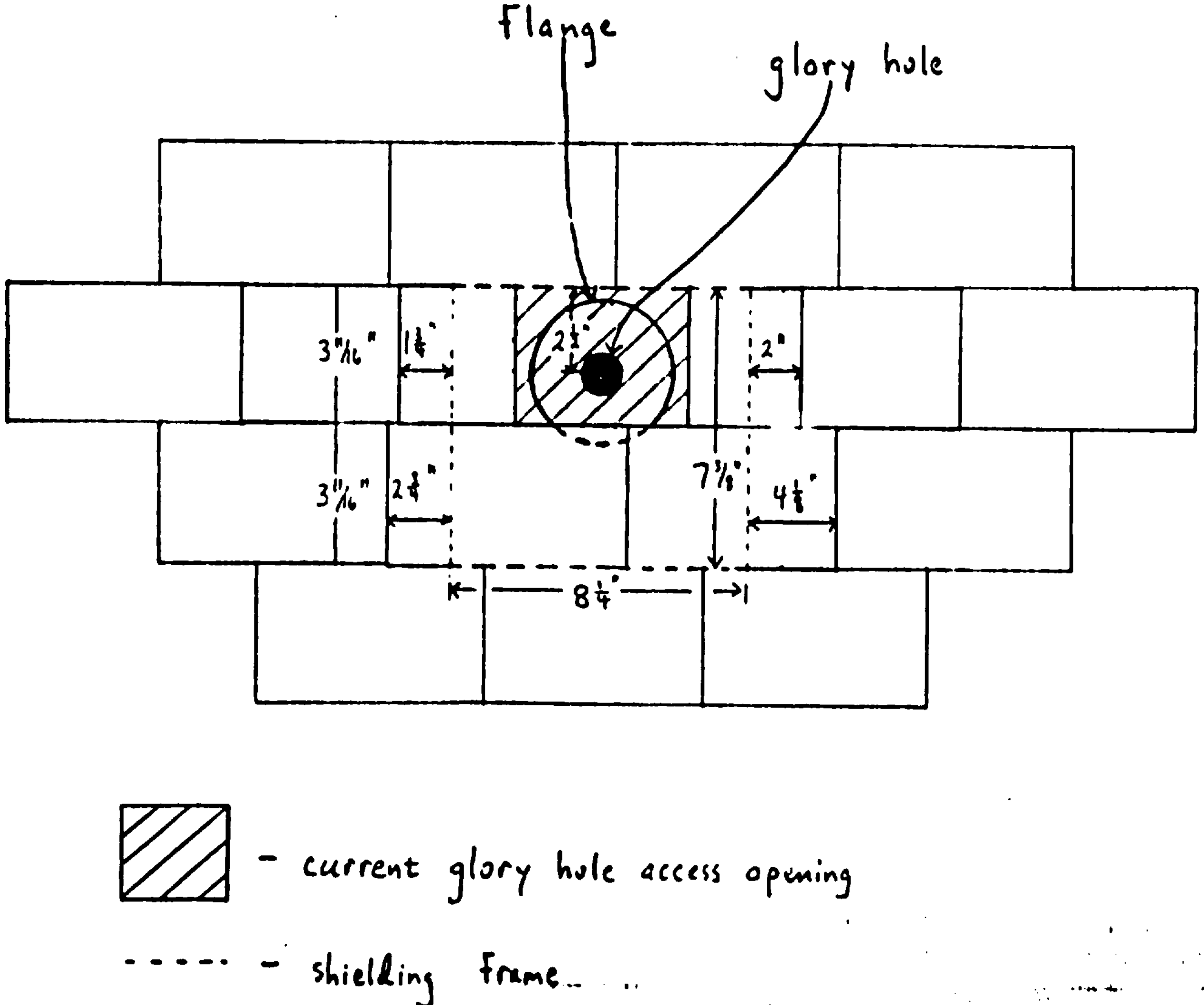


Figure 12 – Current Glory Hole/Shielding Access

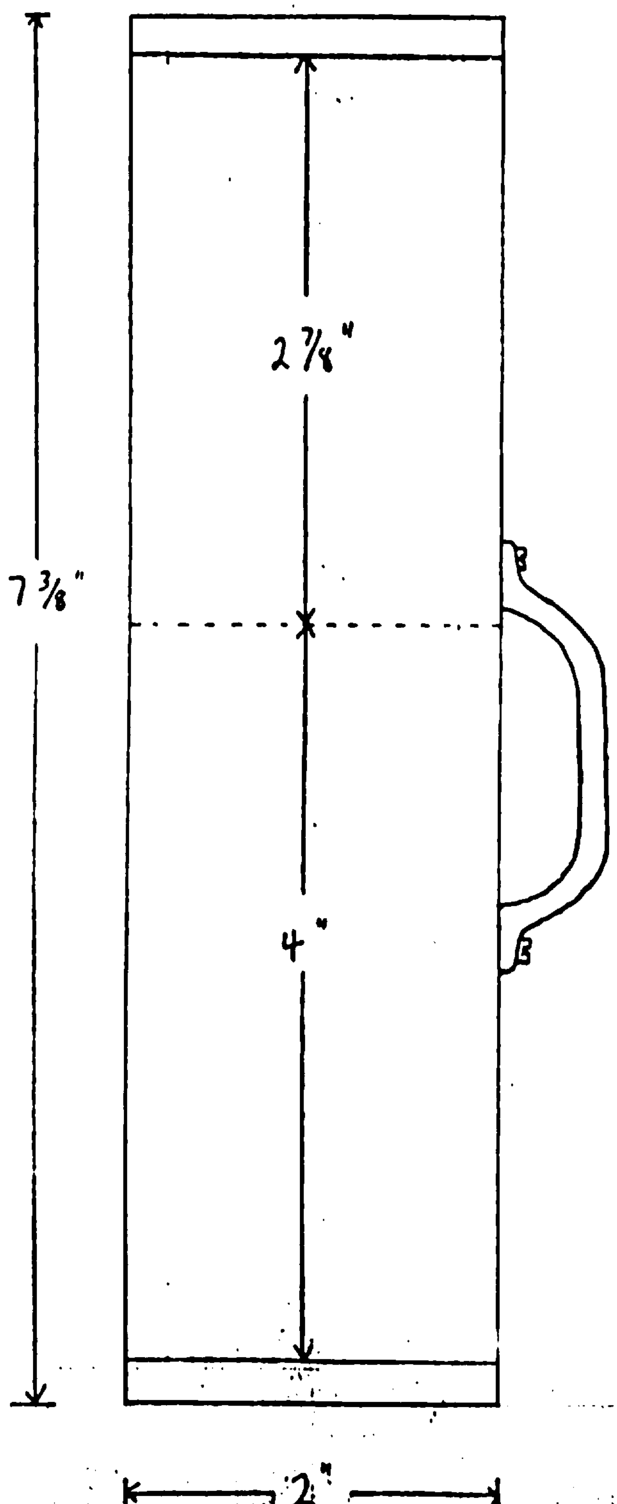


Figure 3 - Shield Plug Frame (Side View)

Idaho State University AGN-201M Reactor
1996 Annual Operating Report
page 13

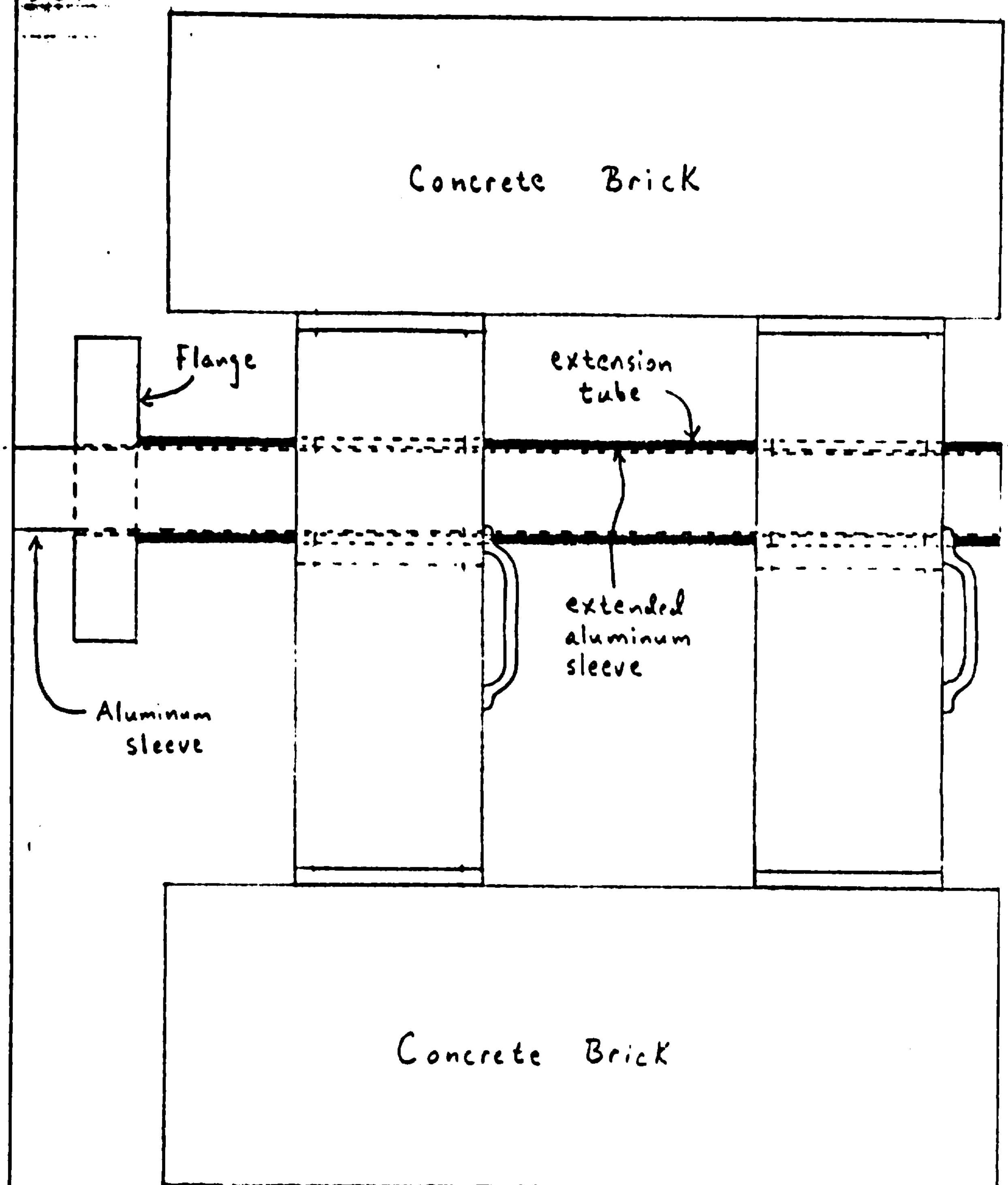
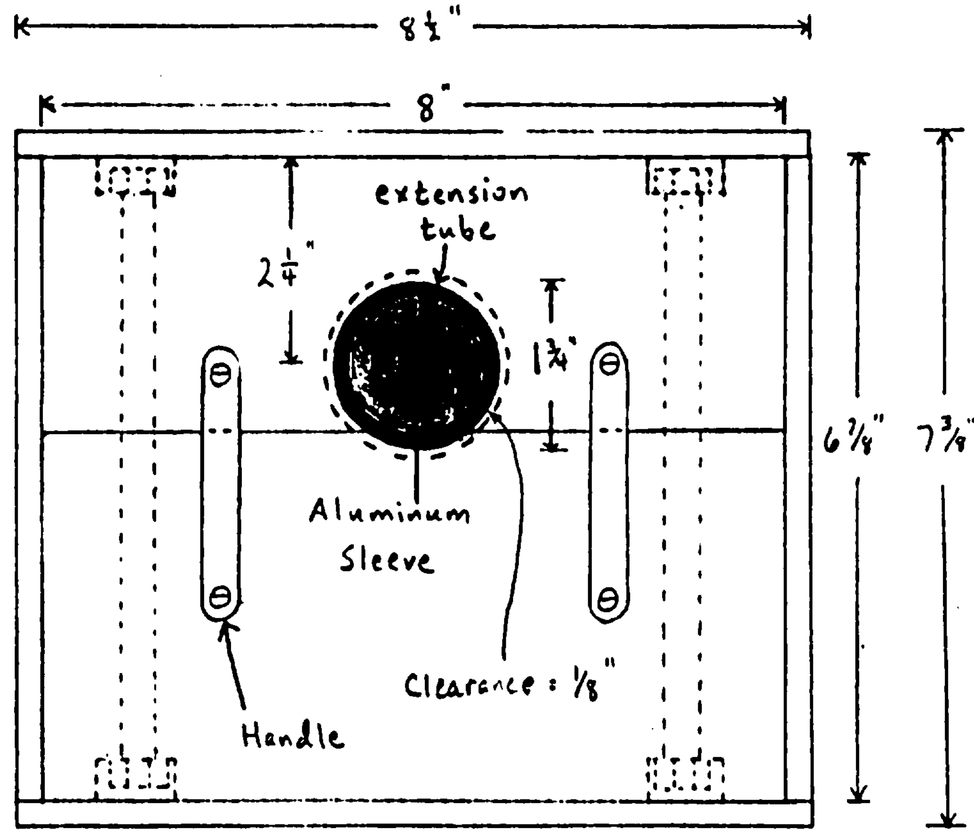


Figure 4 - Extension Tube and Shield Plug Arrangement (Side View)



The frame is constructed of ¼-inch steel plate.

The depth of the frame is 2 inches to accomodate the 2-inch thick lead shield plug.

Figure 5 - Shield Plug and Frame Assembly (Front View)