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June 30, 1999

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

Subject: Transmittal of Annual Facility Operating Report for 1998.

Dear Sir/Madam:

Enclosed please find a copy of the Annual Operating Report for the Idaho State University AGN-201M Reactor, License No. R-110, Docket No. 50-284, for calendar year 1998. Submission of this report fulfills the requirements of AGN Technical Specification 6.9.1. A copy of this report has also been sent to the Region IV Administrator, as required by the aforementioned technical specification.

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

Sincerely,

John S. Bennion
Reactor Administrator

cc: Mr. Marvin M. Mendonca, Project Manager
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 1998

1. Narrative Summary

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

      There were no changes in facility design, performance characteristics, and operating procedures relating to reactor safety during the reporting period.

   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.

      (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 0.039% $\Delta k/k\ s^{-1}$ ($0.053 s^{-1}) for all rods.

          (d) The shutdown margin was determined to be greater than 1.65% $\Delta k/k$ ($2.22) 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 167.1 hours thereby generating 7.98 watt-days (191.5 watt-hours) of thermal energy during this reporting period.

of continuing failure of replacement dashpots, the operating staff initiated a review of the dashpot design and proposed modifying the design of the dashpot, in consultation with the manufacturer, to prevent similar failure in the future. These design modifications were submitted to members of the Reactor Safety Committee (RSC) for review prior to implementing the proposed changes.

The dashpot failure event was reviewed by the RSC during its annual meeting in December 1998. Draft minutes of the RSC meeting are attached as Appendix A. The RSC directed the operating staff to continue with a more thorough analysis of the proposed modifications. The reactor remained shutdown during November and December of 1998 pending the completion of the required reviews and subsequent corrective repair and maintenance. Since the modification reviews were not completed until early 1999, a summary of the reviews will be submitted to the NRC in next year's facility operating report.

B. Inadvertent Scrams and Action Taken.

1/28/98 While increasing power from 4.8 watts to 4.9 watts, the reactor tripped high on Nuclear Instrument Channel No. 1 caused by a conservative set on that channel. The reactor run was terminated.

2/03/98 During ascension to the planned power level of 4.7 watts, the reactor scrammed. The scram was attributed to a power fluctuation in the building. The reactor was restarted and the run continued without incident.

2/10/98 While ascending to the planned power level of 4.7 watts, the reactor tripped high on Nuclear Instrument Channel No. 1. The reactor was restarted without incident.

2/24/98 While stabilizing power at 4.7 watts, the reactor tripped high on Nuclear Instrument Channel No. 1. The reactor was restarted, to the same power level and tripped again high on Nuclear Instrument Channel No. 1. The reactor was then restarted to 4.6 watts without further problems.

3/03/98 At 13:51 hours while irradiating samples at 4.7 watts, the reactor scrammed high on Nuclear Instrument Channel No. 1. The reactor was restarted. At 15:57 hours the Nuclear Instrument Channel No. 2 tripped high. The reactor was restarted and irradiation continued.

3/10/98 The reactor scrammed high on Nuclear Instrument Channel No. 2 at 10:20 hours from a power of 4.7 watts. The calibration on Nuclear Instrument

A summary of monthly operations for 1998 is given in Table I.

Table I. Summary of Monthly Reactor Operations
(1 January 1998 through 31 December 1998)

Month	Hours	Energy (W-hr)
January	6.6	0.65
February	27.1	40.57
March	35.7	56.72
April	36.2	49.79
May	15.4	19.39
June	8.4	6.52
July	10.5	10.39
August	18.6	4.06
September	1.6	2.10
October	5.2	1.34
November	2.0	0.00
December	0.0	0.00
Total	167.3 hr	191.53 W-hr

3. A. Unscheduled Shutdowns and Corrective Actions Taken.

11/7/98 During the rod-drop test portion of the reactor startup procedures in which the two safety rods are manually scrammed to test the operability of the manual scram switch, an abnormal sound was heard following the scram as the safety rods hit the pneumatic dashpots used to decelerate the safety rods. An investigation into the cause of the noise revealed that the Safety Rod No. 2 (SR-2) dashpot had failed. This particular dashpot was purchased in 1997 to replace an identical dashpot that failed 6/25/97 and resulted in the breeching of the SR-2 capsule containing fuel material. Because of the consequences of the 6/97 dashpot failure, the SR-2 control element was immediately removed from the drive assembly for inspection of the cladding to determine if any damage to the capsule resulted from the dashpot failure. The capsule was carefully inspected and several contamination wipe samples were taken from the surface of the capsule to detect any possible leakage of fuel material. The SR-2 capsule was found to be in good condition, and no evidence of any damage to the cladding was observed result from the dashpot failure. Since the failed dashpot was the last of three dashpots that had been ordered to replace the dashpot that failed in 1997, additional dashpots had to be acquired from the manufacturer before the reactor could resume operation. Therefore, the reactor was shutdown by facility administration pending repair of the dashpot. At this time, because

Channel No. 2 was checked and the reactor restarted. At 13:07 hours Nuclear Instrument Channel No. 2 again scrammed high. The reactor was restarted to a lower power level.

3/24/98 After several hours of irradiation at a constant power level of 4.7 watts, the reactor tripped high on Nuclear Instrument Channel No. 1. The run was terminated.

4/14/98 While raising power to 4.7 watts, the reactor tripped high on Nuclear Instrument Channel No. 1. (12:07) The reactor was restarted and again tripped high on Nuclear Instrument Channel No. 1. (12:07) The operator examined the detector for Nuclear Instrument Channel No. 1 to determine if the detector was truly in its 'up' position. The reactor was restarted again and tripped while ascending to power. (12:12) This trip was attributed to a power fluctuation in the building. The reactor was again restarted and again scrammed high on Nuclear Instrument Channel No. 1 (12:20) shortly after stabilizing power at 4.7 watts. The reactor was restarted to a lower power level and the irradiation continued for several hours. At 14:46 the reactor scrammed with no indication of cause. The scram was attributed to power line noise in the building. The reactor was restarted and the irradiation completed.

5/05/98 After several hours of irradiation, reactor power was reduced to 0.1 watts for sample removal. The reactor tripped low on Nuclear Instrument Channel No. 3. The reactor was restarted.

5/09/98 While ascending to a power of 0.5 watts, the reactor scrammed high on Nuclear Instrument Channel No. 1. The reactor was restarted.

7/30/98 While restarting to a power level of 0.01 watts the reactor scrammed with no apparent cause. The scram was attributed to power fluctuations in the building. The reactor was restarted.

4. Safety-Related Corrective Maintenance.

1/23/98 The up-limit and engage micro-switches on Safety Rod No. 1 (SR-1) were replaced with new components.

4/17/98 While performing Surveillance Procedure No. 1 (SP-1), the calibration signal was found to malfunction when the additional equipment required for calibration was connected. A bad capacitor and a cold solder joint were found in the calibration circuit and replaced.

4/21/98 The measurement needle on Nuclear Instrument Channel No. 1 began responding sluggishly. The rate meter was disassembled and sprayed with an anti-static treatment. The unit was returned to service.

6/02/98 While performing Surveillance Procedure No. 2 (SP-2) the Sensitrol relay appeared to be sluggish in responding. The relay was replaced with a spare. While replacing the relay, a broken solder joint on the reset switch was noticed and repaired.

8/03/98 Between the dates of 8/03/98 and 8/25/98 the corroded area beneath the reactor pedestal was refinished. The rust and corrosion were removed down to bare metal. The area was then repainted. A final report on the this refurbishing project is attached as Appendix B.

10/07/98 Safety Rod No. 2 (SR-2) dashpot was accidentally left installed in the reactor following a reactor run on 9/22/98. The dashpot was replaced with a unused spare as a precaution.

11/07/98 The SR-2 dashpot failed during a reactor scram. Examination of the dashpot showed failure of the graphite piston. The reactor was shutdown until replacement parts could be obtained.

5. Modifications.

A. Changes in Facility Design.

There were no changes to the facility design to the extent that such a modification altered a description of the facility in the application for license and amendments thereto during 1998.

B. Changes to Procedures.

None.

C. Experiments.

No new or untried experiments or tests were performed during 1998.

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
Todd C. Gansauge - Reactor Supervisor
Thomas F. Gesell - Radiation Safety Officer
J. Frank Harmon
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: 4.18 μCi.

The AGN-201 Reactor was operated for 167.3 hours at power levels up to approximate'y 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 4.18 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 1998 through 31 December 1998)

Month	Ar-41 (μCi)
January	0.014
February	0.886
March	1.239
April	1.087
May	0.423
June	0.142
July	0.227
August	0.088
September	0.046
October	0.029
November	0.000
December	0.000
Total activity:	4.181 μCi

C. Solid Waste - Total Activity: None.

8. Environmental radiation surveys, performed at the facility boundary while the reactor was operating at 94% of full licensed power (4.7 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	1/1/98 - 12/31/98	Regular
John S. Bennion	1/1/98 - 12/31/98	Regular
Kermit A. Bunde	1/1/98 - 12/31/98	Regular
Todd C. Gansauge	1/1/98 - 12/31/98	Regular
Dirk Howlett	1/1/98 - 12/31/98	Occasional
Raed Jaber	1/1/98 - 12/31/98	Occasional
Michael F. Jolley	1/1/98 - 12/31/98	Occasional
Jay F. Kunze	1/1/98 - 12/31/98	Occasional
Sad Jarall	1/1/98 - 12/31/98	Occasional
Alan G. Stephens	1/1/98 - 12/31/98	Occasional
William Taylor	1/1/98 - 12/31/98	Occasional
Miles Whiting	1/1/98 - 12/31/98	Occasional

Dose Equivalent summary for Reporting Period:

Measured Doses

1/1/98 - 12/31/98 Whole-Body Dose Equivalents: ≤100 mrem for all personnel.
Maximum Measured Annual Dose = 216 mrem shallow dose from a ring badge.
Minimum Detectable Dose Equivalent per Monthly Badge = 10 mrem.

None of the 128 visitors to the facility during 1998 received a measurable dose. Therefore, the average and maximum doses are all well below 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 1998 through 31 December 1998)

Estimated whole-body exposure range (rem):	Number of individuals in each range:
No Measurable Dose	5
Less than 0.10	7
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:	12

Report submitted by: John S. Bennion, Reactor Administrator
Todd C. Gansauge, Reactor Supervisor

APPENDIX A

MINUTES OF THE 12/30/98 REACTOR SAFETY MEETING

Minutes of the Idaho State University Reactor Safety Committee (RSC)

Date: December 30, 1998
Start Time: 8:40 A.M..
End Time: 11:00 A.M.
Location: Lillibridge Engineering Laboratory Rm 218

<u>Members Present:</u>
Mr. Frank Just, Chairman
Dr. Jay Kunze, Dean of Engineering
Dr. John Bennion, Reactor Administrator
Dr. Tom Gesell, Radiation Safety Officer
Mr. Mike Vaughn
Mr. Terry Smith
Mr. Todd Gansauge, Reactor Supervisor

<u>Members Absent:</u>
Dr. Frank Harmon

1. The meeting was called to order at 8:40 A.M.

2. The minutes of the December 29, 1997 Reactor Safety Committee meeting were reviewed and approved.

3. Rector Administrator Report: Dr. John Bennion

   A. Dr. Bennion stated that the missing comments about the console upgrade regarding issues raised by Mr. Jim Larson were included in the packet of material handed out at the meeting.

   B. Dr. Bennion mentioned that the metallurgical analysis of the control element cladding failure had not been performed to date. Mr. Vaughn stated that it was probably too late to have such a analysis performed by the ANL-W staff.

   C. The SNM re-licensing application was approved in September 1998. The new license was discussed at length. The bulk of the discussion centered on allowing the use of a limited quantity of SCA fuel at the Accelerator Center and the requirement for the RSC to grant approval for all experimental use of SCA fuel. Mr. Vaughn moved that the request by Dr. Frank Harmon to use SCA fuel plates for research being preformed with the Varitron, a 2 MeV electron linac, be approved under the condition that the people carrying out the experiment be trained on the requirements of the SNM license. Dr. Kunze suggested that some clarifying words be added to the experimental request of Dr. Harmon: "Up to 10 plates, containing a maximum of 100 gm of fissile material be placed as close as 0.5 meters from the bremsstrahlung production target." The motion carried unanimously.

D. Mr. Craig Bassett of the NRC performed a brief inspection of the reactor facility June 24-25, 1998. The inspection specifically reviewed radioactive material control and transportation.

E. Dr. Bennion reviewed the status of the reactor re-licensing effort. Efforts are underway to revise facility Emergency Plan, Physical Security Plan and Technical Specifications. Dr. Bennion has committed to the NRC that these items will be submitted to the NRC by the end of January 1999. Assignments were made for committee members to review these documents before submission to the NRC. Dr. Tom Gesell will review the Emergency Plan. Mike Vaughn will review the Physical Security Plan. Terry Smith will review the Technical Specifications. Dr. Bennion believed that these documents would be available for review in 2 weeks.

Dr. Bennion suggested that after the license renewal, the facility might consider amending the license to increase the reactor power from 5 to 5.5 watts. He commented that the NRC would like the Limiting Safety System Setting (LSSS) reduced from 10 watts to 6 watts. The issue was discussed at length, including implications for increased radiation levels at the outside walls of the reactor building and the need to operate at the higher power level to measure such increases. Dr. Kunze commented that he felt the additional paperwork required for such an amendment was not justified for only a 10% increase in power.

F. Dr. Bennion briefed the committee on the status of the reactor control console upgrade. Face plates for the console are near completion. The facility received a $12,000 grant from the DOE to upgrade radiation monitors. Mounting holes for these monitors need to be cut into the remaining console faceplate. Once this is complete the face plates will be sent out for anodization. They will then be shipped to Mr. Bob Henderson for mounting of the instrumentation. Detailed procedures for testing and change over will be written and submitted for RSC approval in the future.

Dr. Bennion also mentioned that a group of senior engineering students are working on a new control system for the pneumatic sample transfer system. The RSC will be asked to review and approve this new system at a future meeting.

G. Update on June 29, 1997 Reportable Occurrence.

There has been another dashpot failure. The failure was detected immediately, and the control element was removed and inspected. Careful examination of the control element revealed [illegible] signs of damage to the cladding. Replacement dashpots were ordered and received December [illegible]9, 1998. These dashpots contain some design modifications from the previous dashpots. They have been modified to support the static load of the control element without placing stress on the graphite piston. They also contain a ball joint at the top of the graphite piston and a rulon bearing to reduce shaft friction.

Dr. Bennion questions the reliability of the dashpots and feels that the modifications of the mounting system discussed at the last RSC meeting still need to be implemented. In addition to the modifications previously discussed, reactor staff are considering installation of optical sensors to provide warning lights on the reactor console in the event that a dashpot does not fully reset upon insertion of a control element.

The modifications were discussed at length. Mr. Vaughn suggested that the rod cap be manufactured out of hard rubber rather than polyethylene.

The committee decided that a more thorough 50.59 analysis should be developed addressing the modifications made to the replacement dashpots by the manufacturer. This analysis will be mailed to committee members for approval before resuming reactor operations.

The staff will continue with the planned modifications to the dashpot mounting hardware to resolve concerns noted above. A prototype will be developed and tested on the drive assembly test stand. Once results of testing are available, th RSC will be asked to approve implementation of these modifications.

4. Reactor Supervisor Report: Todd Gansauge

A. The biennial tank inspection has been completed. No abnormal findings were noted.

B. The corroded area beneath the reactor pedestal has been stripped to bare metal and the entire area beneath the pedestal has been repainted. A final report on the pedestal refinishing effort has been distributed for RSC review.

5. Radiation Safety Officer Report: Dr. Tom Gesell

A. ISU maintains an ALARA goal of 25 mrem/quarter. During the second quarter of 1998 several members of the reactor staff exceeded this goal. The maximum dose recorded was 70 mrem received by Dr. Bennion. This increased dose has been attributed to increased reactor run time during the quarter in support of Mr Kazi

Ahmed's dissertation research. The Radiation Safety Committee has approved a temporary ALARA goal increase for reactor personnel. The new goal is 100 mrem/quarter and will be in effect for the 1999 calender year. At the end of the calender year the old 25 mrem/quarter goal will again be in effect.

6. Subcommittee Report, Review of 1998 audits, Mr. Terry Smith

A. In his audit, Mr. Smith found that log entries were not being kept in a bound log. Because of the ongoing repair of the SR-2 dashpot following failure of the dashpot and control element cladding, detailed maintenance and health physics entries were made on pads of paper, gathered, and kept in a three ring binder. All log entries were accounted for, complete, and properly signed. Since Mr. Smith's audit in June 1998, log entries are being made in a bound temporary log. Efforts are underway to transfer summaries of these log entries to the official log books. The original entries will be kept in a permanent file.

B. The question was raised as to whether the current surveillance procedures are adequate to address the Technical Specification requirement of an annual power calibration. The current surveillance procedure adjusts the set points in the electronics, but does not address the issue of possible change in the detector output.

After Mr. Smith's audit, in June 1998, the facility established an administrative limit on reactor power at 2.5 watts. The reactor has not, nor will be, operated at a power greater than 2.5 watts until a neutronic power calibration can be completed. Dr. Bennion stated that a neutronic power calibration is underway to verify the power curves currently in use. Several irradiations have been performed to irradiate gold foils at various power levels. Completion of the calibration will require the irradiation of one or more additional gold foils as soon as the reactor operations resume.

Dr. Bennion commented that the last record of neutronic power calibration was in 1995. A procedure is being developed for neutronic power calibration and will be submitted for RSC approval at a later date.

7. Action Items:

A. Assignments for reviewing revised facility documents.

(i) The Chair has assigned Dr. Tom Gesell to review the Emergency Plan
(ii) The Chair has assigned Mr. Mike Vaughn to review the Physical Security Plan.

(iii) The Chair has assigned Mr. Terry Smith to review the Technical Specifications.

B. Assignments for facility audits to be completed by March 31, 1999.

(i) The Chair has assigned Mr. Terry Smith to audit the conformance of facility operations to Technical Specifications and License Conditions.

(ii) The Chair has assigned Mr. Mike Vaughn to audit the results of all actions taken to correct deficiencies occurring in facility equipment, structures, or methods of operation that affect nuclear safety.

(iii) The Chair has assigned Dr. Tom Gesell to audit the performance, training, and qualifications of the entire facility staff.

C. A form for recording the results of rod worth calibration has been completed and submitted to the RSC for approval. Comments due back by the next RSC meeting.

8. The meeting was adjourned at 11:00 A.M.

Submitted by: Todd Gansauge

Approved:______________________________ __________
Reactor Safety Committee Chair Date

APPENDIX B

FINAL REPORT ON PEDESTAL REFURBISHING PROJECT

Date: 9/9/98

Idaho State University AGN-201 Pedestal Refurbishing
Final Report

Maintenance log entries indicate that a leak developed in the 2 inch diameter nuclear instruments cable conduit sometime around June of 1988. This conduit passes vertically through the reactor shield tank and allows routing of cables from above the reactor to the area under the reactor pedestal. The cables were rerouted and the conduit was partially filled with epoxy and plugged. There is no evidence that any further leaking has occurred since this repair was made, however a significant amount of corrosion remained on the pedestal floor beneath the now repaired conduit. In addition to this corrosion, a small area of corrosion existed beneath the shield water drain valve located on the other side of the area beneath the reactor pedestal.

Attachment 1 is a procedure developed for removing this corrosion and refinishing the pedestal area. What follows is a chronological list of the steps taken to complete this procedure, a record of the results of surveys, and a narrative summary of the experience. The material contained in this report is, of course, recorded in the maintenance log.

July 31, 1998 A small sample of paint chips and rust flakes were gathered at the request of the Technical Safety Office (TSO` Survey instruments in the possession of the Nuclear Reactor Laboratory showed no measurable activity level for this sample. TSO staff counted sample before work began and found it to be at or below background.

Aug. 3, 1998 The reactor console was de-energized and the items stored beneath the reactor pedestal were neatly stacked next to the reactor pedestal and covered with a plastic drop cloth. The spare control elements were locked in the proposed fuel storage cabinet while work was underway and returned to the reactor pedestal at night. The Ra-Be neutron source was relocated to room 23 while work was in progress.

The temperature sensor, seismic interlock and the cabling running between the side of the reactor pedestal and the distribution panel on the pedestal door were carefully covered with paper and masking tape. The distribution panel on the inside of the pedestal door was covered with paper and taped in place. The blanket from beneath the reactor pedestal was draped over the distribution panel to prevent the accumulation of dust on the wiring.

A pre-survey was performed on the floor of the reactor pedestal before removal of any corrosion. Attachments 2 and 3 are survey maps created by placing a grid over photographs of the area beneath the reactor pedestal. Results of the survey are recorded on these maps. Both direct surveys and wipes were taken at the positions shown on the survey map. All readings were taken with a TBM-3S No. 2758 due for calibration 12/98. Results of wipe surveys are circled and represent gross readings. The background counts at the time of the survey were found to be 40 ± 20 cpm.

A putty knife and hand-held wire brush were utilized to remove loose contamination and paint chips from the floor of the reactor pedestal. The debris was surveyed and found to contain no appreciable activity level. The debris was sealed in a plastic bag and held for analysis by the Technical Safety Office.

Aug. 4, 1998 Over the course of 6 hours various tools were used to remove the corrosion and strip the pedestal floor down to bare metal. The tools used were: hand-held wire brush, braided wire brush mounted on the 4 inch Makita grinder, 3 inch high speed pneumatic grinder, 4 inch grinding disk on the Makita grinder, and finally an 8 inch Black and Decker Wildcat grinder. Progress was slow until the decision to use the 8 inch wildcat. The corroded areas were ground to bare metal with the wildcat, then smoothed with the high speed pneumatic grinder.

All of the dust and debris from the grinding operation were gathered and placed in the same bag as the previous debris. The Technical Safety Office found the activity of the debris to be at or below background and disposed of the debris.

Aug. 5, 1998 All of the tools used to grind the reactor pedestal were carefully surveyed for contamination. None was found, and the tools were returned to the machine shop. Details of the survey can be found in the Health Physics Log. The paper suits, dust masks, gloves used during the grinding operation were given a final survey, found to contain no measurable contamination and disposed of.

Aug. 6, 1998 The masking paper covering the distribution panel on the inside of the pedestal door was removed to allow the reactor to be operated.

Aug. 10, 1998 The pre-wash survey was performed as per procedure. The instrument used was a TBM-3S No.2758 due for calibration 12/98. The results are listed in the Table 1 below. The first 15 survey locations were on the floor of the reactor pedestal. Attachments 4 and 5 are survey maps showing the locations of the points surveyed. The rest of the survey points were taken along the walls of the pedestal and the bottom surface of the reactor tank. A wipes were numbered and given to the Technical Safety Office for counting in their liquid scintillation counter. TSO found all activities of the wipes to be at or below background.

Table 1: Results of the pre-wash survey.

Swipe Number	Location	Direct Reading (mr/hr)	Removable Contamination (cpm - net)
1	Pedestal Floor (see map)	0.02	20 ± 20
2	Pedestal Floor (see map)	0.02	10 ± 20
3	Pedestal Floor (see map)	0.02	20 ± 20
4	Pedestal Floor (see map)	0.04	20 ± 20
5	Pedestal Floor (see map)	0.03	30 ± 20
6	Pedestal Floor (see map)	0.02	20 ± 20
7	Pedestal Floor (see map)	0.02	30 ± 20
8	Pedestal Floor (see map)	0.02	10 ± 20
9	Pedestal Floor (see map)	0.03	10 ± 20
10	Pedestal Floor (see map)	0.03	20 ± 20
11	Pedestal Floor (see map)	0.02	10 ± 20
12	Pedestal Floor (see map)	0.03	10 ± 20
13	Pedestal Floor (see map)	0.02	10 ± 20
14	Pedestal Floor (see map)	0.02	10 ± 20
15	Pedestal Floor (see map)	0.02	10 ± 20
16	Pedestal Wall Low - N	0.03	10 ± 20
17	Pedestal Wall Low - NE	0.03	30 ± 20
18	Pedestal Wall Low - E	0.02	10 ± 20
19	Pedestal Wall Low - SE	.0.03	10 ± 20
20	Pedestal Wall Low - S	0.02	10 ± 20
21	Pedestal Wall Low - SW	0.02	30 ± 20
22	Pedestal Wall Low - W	0.03	20 ± 20
23	Pedestal Wall Low - NW	0.03	10 ± 20
24	Pedestal Wall Mid - N	0.02	10 ± 20
25	Pedestal Wall Mid - NE	0.03	10 ± 20
26	Pedestal Wall Mid - E	0.02	30 ± 20

Swipe Number	Location	Direct Reading (mr/hr)	Removable Contamination (cpm - net)
27	Pedestal Wall Mid - SE	0.03	10 ± 20
28	Pedestal Wall Mid - S	0.03	20 ± 20
29	Pedestal Wall Mid - SW	0.02	10 ± 20
30	Pedestal Wall Mid - W	0.03	10 ± 20
31	Pedestal Wall Mid - NW	0.03	10 ± 20
32	Pedestal Wall High - N	0.02	10 ± 20
33	Pedestal Wall High - NE	0.02	10 ± 20
34	Pedestal Wall High - E	0.03	10 ± 20
35	Pedestal Wall High - SE	0.02	10 ± 20
36	Pedestal Wall High - S	0.02	10 ± 20
37	Pedestal Wall High - SW	0.02	10 ± 20
38	Pedestal Wall High - W	0.02	10 ± 20
39	Pedestal Wall High - NW	0.03	10 ± 20
40	Bottom of Tank - N	0.03	10 ± 20
41	Bottom of Tank - NE	0.03	10 ± 20
42	Bottom of Tank - E	0.03	10 ± 20
43	Bottom of Tank - SE	0.03	10 ± 20
44	Bottom of Tank - S	0.03	10 ± 20
45	Bottom of Tank - SW	0.03	10 ± 20
46	Bottom of Tank - W	0.03	10 ± 20
47	Bottom of Tank - NE	0.03	10 ± 20
48	Bottom Side of Access Cover - N	0.03	10 ± 20
49	Bottom Side of Access Cover - E	0.04	10 ± 20
50	Bottom Side of Access Cover - S	0.03	10 ± 20
51	Bottom Side of Access Cover - W	0.04	10 ± 20

After completion of the pre-wash survey, the entire area beneath the reactor skirt was scrubbed with a scrubbing pad and an industrial cleaner by the name of "Speedball". All washing materials were collected and placed in a plastic bag.

Surveys of the wash materials revealed no measurable activity. The bag of wash materials was given to TSO for counting. TSO found no measurable activity and disposed of the wash materials.

Aug. 13, 1998 Careful washing of the reactor pedestal had revealed several small areas where paint was chipped or scratched through to bare metal. These areas were buffed lightly with emery cloth. The entire area beneath the reactor pedestal was wiped down with rags soaked in paint thinner to remove any oil or cleaning solution before painting. The areas ground down to bare metal, as well as the scratched and flaking areas were painted with X-O Rust brand oil based interior/exterior white primer #1220. A fan was placed in the opening of the pedestal door to increase air flow during drying.

Aug. 14, 1998 A first coat of X-O Rust brand oil based enamel (XO-1 gloss white) was applied to the areas primed. Color samples had previously been obtained from the hardware store and compared to the color originally under the reactor pedestal. The particular color chosen is known as formula L-4. Pigments were mixed in the paint by hardware store personnel to match this color. The original plan called for painting only the areas stripped to bare metal, and assumed that the paint selected would be a close match. The new paint ended up to be several shades lighter than the existing paint, and since between 30% and 40% of the pedestal floor had been stripped to bare metal, it was decided to paint the entire floor of the pedestal. The floor was painted as well as a strip one brush stroke wide along the bottom edge of the pedestal wall. The paint was allowed to fan dry for 8 hours before returning the spare fuel elements to the pedestal for overnight storage.

Aug. 21, 1998 At this point it was apparent that the quart of paint purchased would be sufficient to paint the entire area beneath the pedestal. The areas on the bottom of the tank and pedestal walls where scratches had previously existed had been primed and painted with a coat of enamel. The color change between old and new paint produced rather unattractive spots on the walls and bottom of the reactor tank. The walls and bottom of the reactor tank were given a single coat of the new enamel and allowed to fan dry.

Aug. 24, 1998 A final coat of enamel was painted on the floor of the reactor pedestal and allowed to fan dry.

A foam pad has been obtained and covered with plastic to place beneath the reactor pedestal replacing the old blanket stored there.

Form No. ______
Date: 8-03-98

Procedures for refinishing the pedestal area under the AGN-201 Reactor.

ALARA and Safety Considerations:

A. Personnel will wear appropriate dosimetry at all times during the procedure.
B. A minimum of two people will be in the area at all times work is underway.
C. The reactor console will be de-energized during the work activity to prevent the possibility of electrical shock.
D. Particulate face masks will be worn during any scraping and sanding activities and painting activities.
E. Safety goggles, rubber gloves and paper contamination suits will be worn during all scraping and sanding activities.

F. Personnel will be surveyed for radioactive contamination before leaving the work area.
G. A fan will be placed under the reactor skirt during priming and painting to increase ventilation and prevent the buildup of harmful fumes.
H. The control element access cover will remain in place during all activities to prevent dust from entering the reactor.
I. All debris will be analyzed for radioactive contamination prior to disposal. All surveys and results of analyses will be documented in the Health Physics Log.

1. Pre-Survey:

A. The Ra-Be neutron source will be moved to room 23 prior to performing radiological surveys and refinishing work.
B. All items normally stored under the reactor skirt will be removed and set aside while work is in progress.
C. A blanket or tarp will be placed over the pedestal door to protect the electrical distribution panel located on the inside of the door. The tarp will help keep dust from accumulating on the distribution panel.
D. The reactor temperature interlock and seismic displacement interlock, including their respective electrical wiring, will be covered with paper to prevent accumulation of dust.
E. The cable run between the pedestal distribution panel and the cable drop tube beneath the reactor will be covered in paper or cloth. This material will be held in place with masking tape to prevent dust or paint from getting onto the cabling or entering the cable drop tube.
F. The area under the reactor skirt will be surveyed and recorded in the Health Physics Log before work begins. Both direct radiation and contamination surveys will be taken on the intersection points of a 1-foot grid and recorded on the

provided maps. The location of any hot spots encountered will be noted on the survey map.

G. All loose corrosion products and removable contamination will be removed and carefully surveyed.

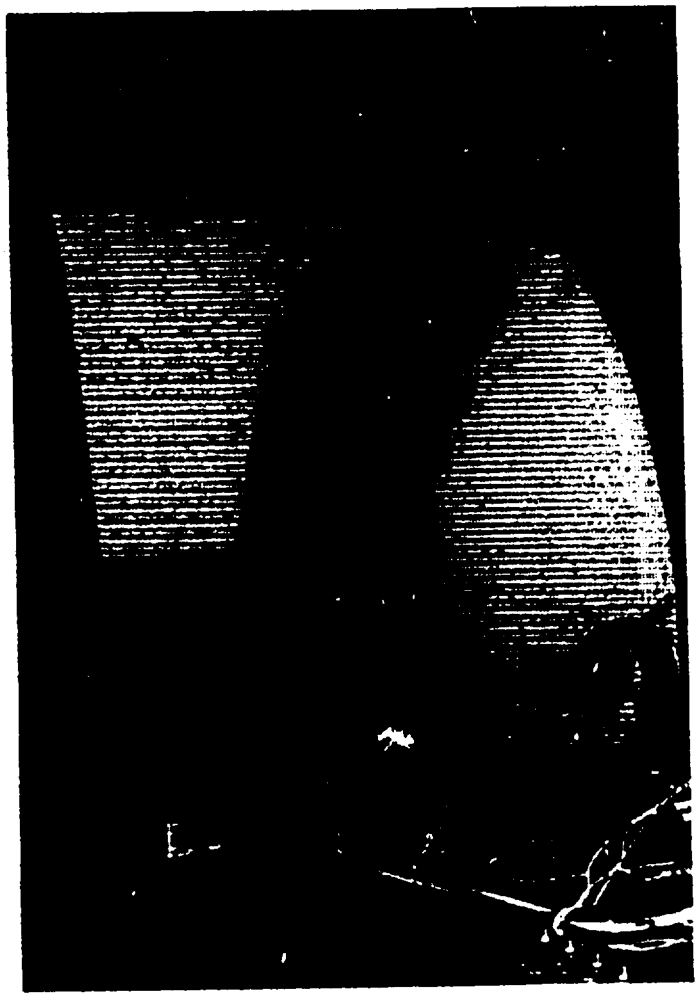
2. Rust Removal:
   A. The corroded area will be scraped with a putty knife and wire brushed by hand to remove most of the flaking rust and paint.
   B. The debris will be swept into a pile and carefully surveyed before disposal.
   C. Once the easily removed flakes of rust have been eliminated, the remaining corrosion will be removed using wire brushes, flapper wheels and grinding disks driven by a pneumatic hand grinder.
   D. Again the debris will be swept into a pile and carefully surveyed. Any remaining material will be collected in the reactor room shop vacuum cleaner. The contents of the vacuum cleaner will be surveyed before disposal.
   E. Direct radiation and contamination surveys will be performed again for the entire region beneath the reactor.
   F. The entire area under the reactor skirt will be throughly scrubbed with detergent and water. The wash water will be collected and held for analysis.
   G. The debris and samples of the wash water will be counted by the Technical Safety Office or the Environmental Radiation Laboratory and properly disposed of in accordance with 10CFR20 and University requirements. Results of these surveys will be documented.

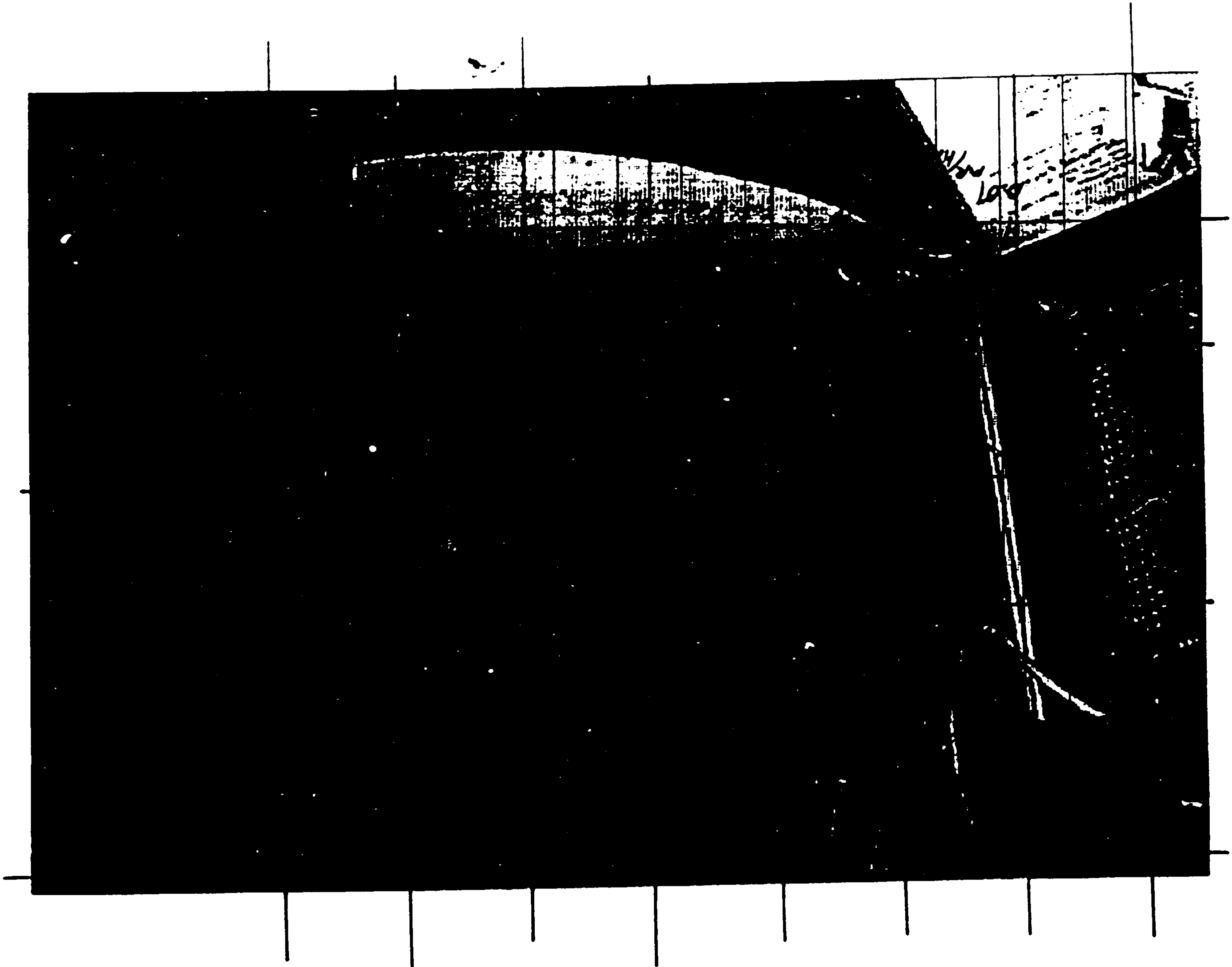
3. Preparation for Painting:
   A. Once the rusted area has been cleaned to bare metal, it will be cleaned with solvent to remove any remaining dust and oil in preparation for painting.

4. Prime Coat:
   A. A coat of oil-based primer will be brushed on the bare metal and allowed to dry before application of the final paint.

5. Final Painting:
   A. Oil-based enamel paint will be selected which reasonably matches the color of the rest of the area under the pedestal.
   B. Two coats of paint will be applied by brush. The second coat will be applied after the first coat has dried thoroughly.

6. Final Report:
   A. A final report of the refinishing project will be prepared for review by the Reactor Safety Committee. The report will contain before and after pictures of the corroded area as well as results of all surveys taken during the procedure.





8-10-90 PRE-WASH

8-10-98 PRE-WASH SURVEY