IDAHO STATE UNIVERSITY

College of Engineering
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July 21, 1997

Mr. Marvin M. Mendonca
U.S. Nuclear Regulatory Commission
PDNP
M.S. 11-B-20
Washington, D.C. 20555
FAX: (3081) 415-2279

Subject: Transmittal of written report regarding reportable occurrence at Idaho State University AGN-201 reactor.

Dear Mr. Mendonca:

Attached please find a copy of the written follow-up report regarding the reportable occurrence at the ISU AGN-201 nuclear reactor, License No. R-110, Docket No. 50-284, which involved the abnormal degradation of a fission-product barrier. The report describes the event, assesses the probable cause and consequences, and discusses corrective actions and measures taken to prevent recurrence. It is being submitted in compliance of Technical Specification 6.9.2(a). A copy of this report was sent to your office Friday afternoon, July 18th, at 5:30 MDT.

As discussed in the report, this incident was assessed to have no adverse impact on the health and safety of the public or the environment. None of the operations staff received elevated dose equivalent as a result of the event.

Please feel free to contact me at (208) 236-3351 regarding any questions you may have concerning this matter.

Sincerely yours,

John S. Bennion
Reactor Administrator

Attachments:
(1) Report to the US NRC Regarding the Control Element Failure at the ISU AGN-201 Nuclear Reactor
(2) Memorandum Dated July 7, 1997 from J. Bennion to T. Baccus
(3) Memorandum Dated July 9, 1997 from T. Gesell to J. Bennion
(4) Memorandum Dated July 15, 1997 from T. Baccus to J. Bennion
(5) Memorandum Dated July 18, 1997 from T. Gansauge to J. Bennion

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REPORT TO THE U.S. NUCLEAR REGULATORY COMMISSION REGARDING THE CONTROL ELEMENT CLADDING FAILURE AT THE IDAHO STATE UNIVERSITY AGN-201 NUCLEAR REACTOR

Introduction

This document provides a written report of the sequence of events leading to the discovery of the failure of a primary fission-product barrier (fuel element cladding) of the Idaho State University (ISU) AGN-201 nuclear reactor, US NRC License No. R-110, Docket No. 284. Such an event, i.e., the abnormal degradation of a fission-product barrier, is defined by the Technical Specification 6.9.2(a)(3) of the facility operating license as a reportable occurrence requiring prompt notification of the NRC with a follow-up written report. As required by the Technical Specifications, the NRC was promptly notified of the incident by telephone on the day of discovery. Additional calls were placed to NRC during the following week to apprise the Project Manager of the current status of the facility and progress made towards recovery.

This report describes the event, assesses the probable cause and consequences, and discusses corrective actions and measures taken to prevent recurrence.

Description of Relevant Reactor Components

The AGN-201 is a self-contained, graphite-moderated training reactor with a maximum thermal power output of 5 watts. It consists of two basic units, the reactor unit and the control console. The reactor unit is composed of a central sealed cylindrical core can containing the nuclear fuel material enclosed in a 20-cm-thick graphite reflector, which is enclosed in a 10-cm-thick lead shield, which is enclosed by a 55-cm-thick water shield for shielding against fast neutrons. Figure 1 shows a vertical view of the AGN-201 reactor unit.

The AGN-201 reactor has four active control elements containing the same nuclear fuel material as the reactor core proper. Fuel consists of 100-μm diameter UO_2 particles, enriched to 20% in U-235, dispersed homogeneously throughout a matrix of high-density polyethylene. Fuel disks were made by pressing weighed quantities of UO_2/polyethylene powder in a mold under high pressure. The control elements, each containing 4 fuel disks (cylinders) with a total active length of about 16 cm, are inserted vertically upward into the reactor core from the bottom of the reactor unit to increase reactivity.

Table 1 summarizes the physical properties of the AGN-201 control elements. Three of the four control elements, Safety Rod No. 1 (SR-1), Safety Rod No. 2 (SR-2), and the Coarse Control Rod (CCR), are identical, having the same physical dimensions and the same approximate reactivity worth. The fourth control element, the Fine Control Rod (FCR), is smaller (about one-half the diameter) and has about one-fourth of the reactivity of each of the three large control elements. All large control elements are electromagnetically coupled to a drive carriage which moves vertically along a lead screw connected by a chain linkage to a reversible DC motor. The FCR is coupled directly to the drive carriage and has no scramming capability.

A control element assembly is comprised of the capsule, which provides the primary fission-product barrier, four fuel disks, one graphite reflector disk at the bottom, a ferrous compression spring, and the extension tube or shaft. The capsule appears to be fabricated from 0.065-inch-thick aluminum (6061T6) tubing by welding a flat end cap to the capsule tubing. The welded joint was then mechanically ground to make a smooth and slightly rounded cylindrical surface. The capsule is loaded with the four fuel disks followed by the graphite disk and compression spring. The open end of the capsule is threaded and screws onto the

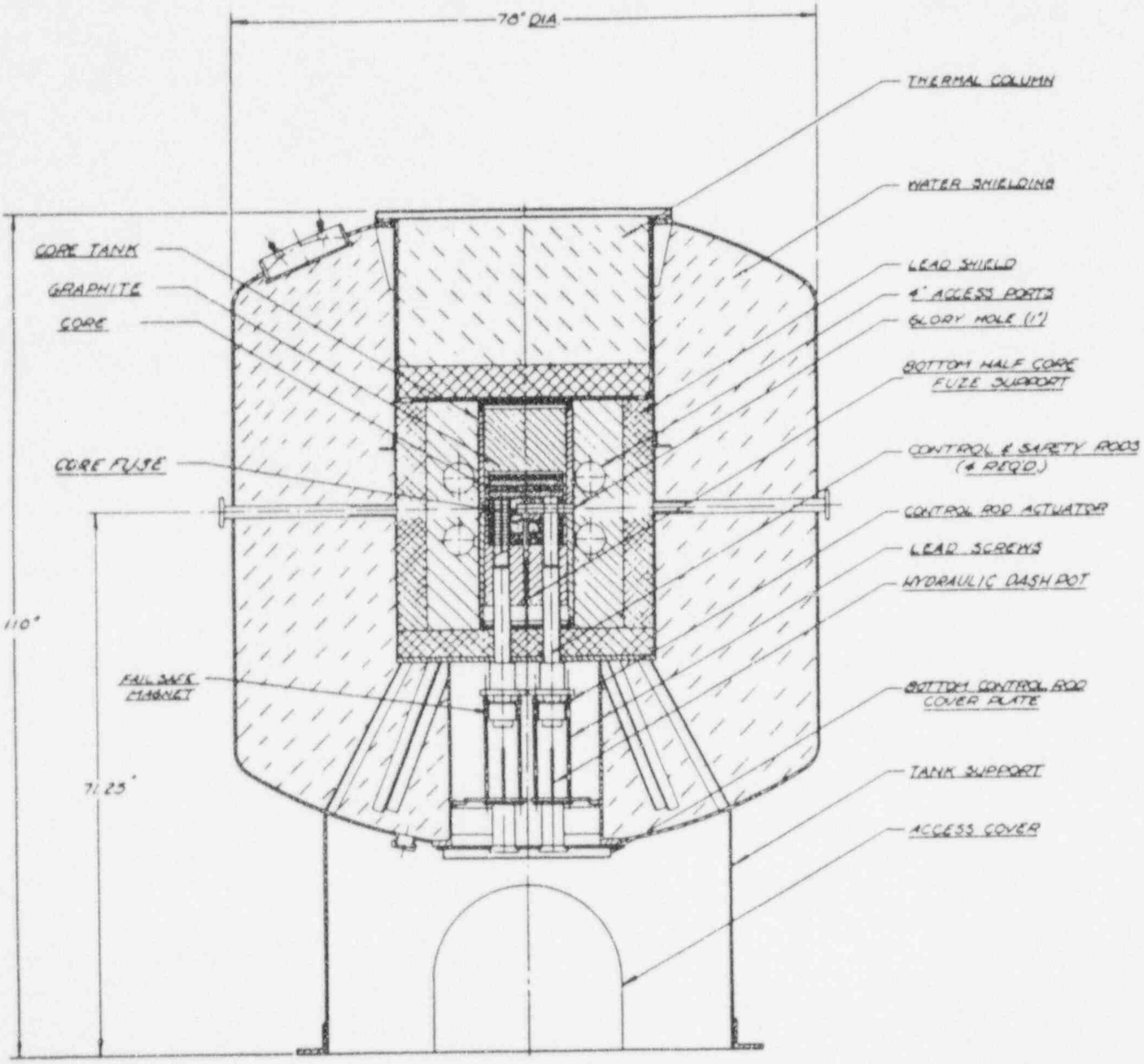

Figure 1. Side view of AGN-201 reactor unit.

extension shaft. An o-ring allows the capsule to be hermetically sealed when the capsule is tightly screwed onto the extension shaft. Within the capsule, fuel is held against the distal end cap under spring loading. The control rod assembly is connected to the armature plate by means of a threaded joint thus forming the complete control rod drive assembly, as shown in Figure 2. This latter assembly is suspended from the reactor tank by threaded studs below the sealed core can and is covered by the control element access cover which serves as a secondary barrier against the release of fission products.

Table 1. Summary of physical properties of AGN-201 control elements.

Control Element	Fuel Disk Dimensions (4 Disks per Element)	Nominal Fissile Content[1] (gm)	Reactivity[2] (%Δk/k, [$])
Safety Rod No. 1	4.7-cm diameter 4.0-cm height	14.4	1.15% [$1.56]
Safety Rod No. 2	4.7-cm diameter 4.0-cm height	14.4	1.14% [$1.54]
Coarse Control Rod	4.7-cm diameter 4.0-cm height	14.4	1.18% [$1.59]
Fine Control Rod	2.3-cm diameter 4.0-cm height	3.6	0.31% [$0.42]

[1] Total fissile mass per control element (4 fuel disk-cylinders in each).
[2] Most recent reactivity measurements, completed 3/11/97.

The AGN reactor is brought to operating power by inserting, in sequence, the two safety rods, which must be latched, or "cocked," into their fully inserted positions before the coarse and fine control rods may be driven. The coarse and fine control rods are then inserted to make the reactor slightly supercritical to allow the power to increase to the desired level. Once the desired operating power is reached, one or both of the moveable control rods are withdrawn to stabilize the power level. The reactor may then be operated at a steady power level as necessary until the operation is to be terminated. Normal shut down of the reactor is accomplished by scramming the safety and coarse control rods. This usually occurs by pressing the manual scram button which deenergizes the electromagnets and causes the three scrammable control elements to be ejected rapidly from the core to their safe positions. Ejection occurs within 120 ms under the combined action of gravity and spring loading giving an initial acceleration of approximately 5 *g*. Each scrammable element is equipped with a shock-absorbing dashpot to gradually decelerate the element during the last 10 cm of travel. SR-1 is equipped with the original hydraulic (oil-damped) dashpot, whereas the SR-2 and CCR elements are equipped with newer pneumatic (air-damped) dashpots. Once the control element reaches the safe or fully-withdrawn position it activates a proximity switch which causes the carriage to drive down so that the electromagnet engages the control element armature plate thereby allowing the reactor to be restarted.

Description of Incident and Immediate Actions Taken

On June 25, 1997, two members of the reactor operating staff, a Senior Reactor Operator (SRO) and an SRO trainee, were operating the AGN-201 nuclear reactor during a routine, after-hours training run. The purpose of the operation was to provide supplemental operating experience for the SRO trainee, who was preparing for an imminent NRC SRO examination,

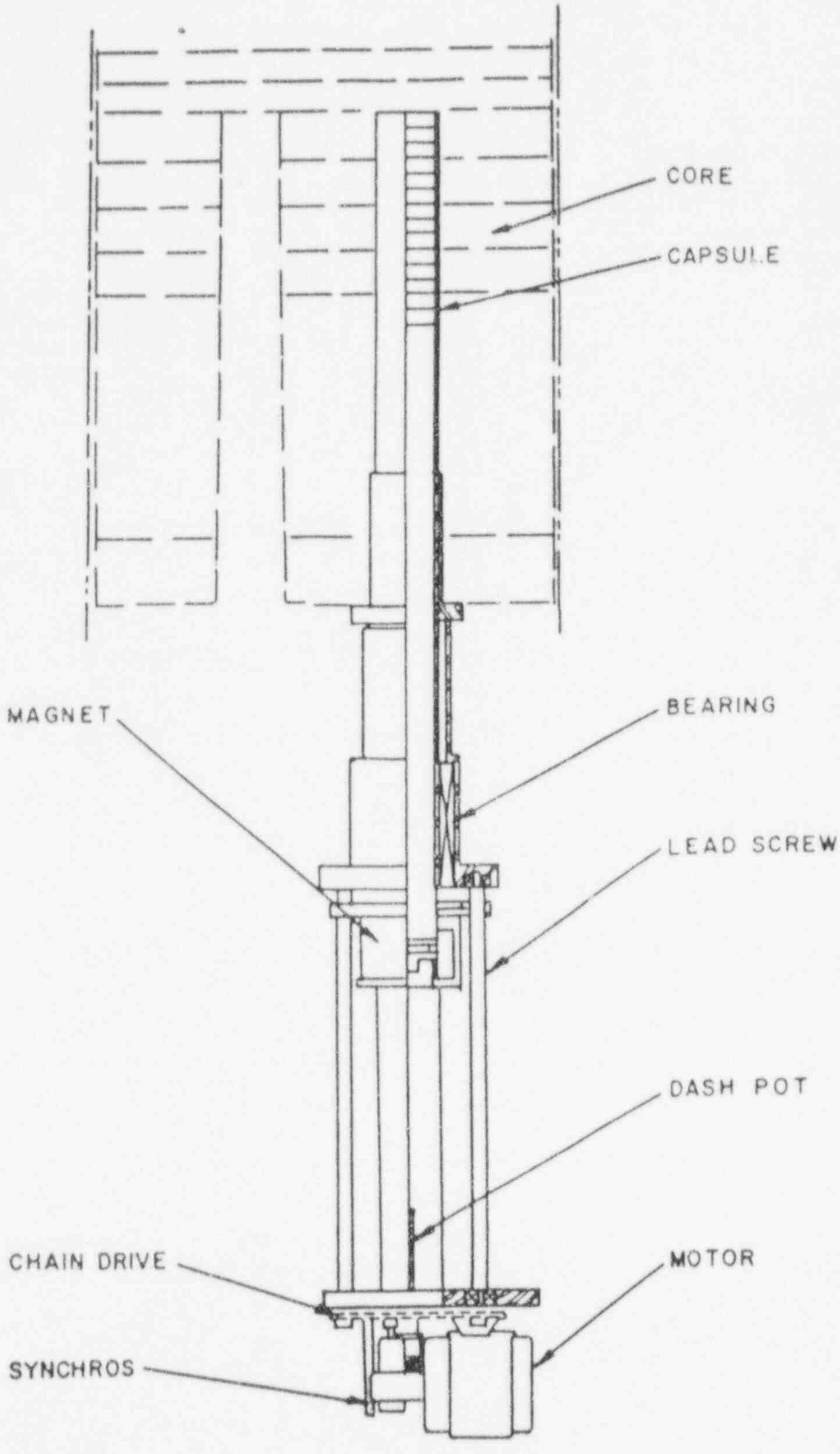

Figure 2. AGN-201 control element and drive mechanism.

and an opportunity for the SRO to meet quarterly requalification operating requirements by supervising the activities of the trainee. In addition, the CCR had been removed from the reactor two days before as part of a training activity for the SRO trainee, and the operators had been asked to verify that the CCR was reinstalled properly and was operating correctly in order to complete the control element maintenance procedure.

During the first two hours of the run, the operators verified that the CCR was installed correctly and was indeed operational. They had successfully taken the reactor to a power level of 4 W, 80% of the maximum licensed power. Reactor power was stabilized at 4 W at 20:41 MDT. They maintained the power at 4 W for 2 minutes and then reduced the power to 0.1 W to provide the trainee with additional experience in reactivity manipulation. At 20:53 the operators reduced power further to observe the power level at which the low-level trip would actuate on Nuclear Instrument Channel No. 1. The low-level scram occurred at 20:58.

The reactor operator attempted to restart the reactor at 20:59 and intended to take the reactor power to 1 W on a positive period of approximately 25 seconds. During power ascension, however, the operator made a switching error on Nuclear Instrument Channel No. 3, switching to a more sensitive power range rather than to a higher scale, and induced a high-level scram. The time of this scram was logged at 21:05. The operator then attempted a second restart. As SR-2 approached its fully inserted position (approximately 24.5 cm), it dropped unexpectedly, i.e., disengaging from the electromagnet. After scramming the reactor to drive the safety rod carriages down to engage the control elements, a second attempt was made to restart the reactor, again resulting in the SR-2 disengaging from the electromagnet as it reached its fully inserted position. Both operators noticed an abnormal sound, described as somewhat "louder than usual and more metallic in nature" than is normally heard when a control element drops.

At this time SR-1 was scrammed and, after making the necessary radiological survey, the SRO entered the pedestal area to investigate the cause for the disengagement of SR-2. Exposure levels underneath the reactor were normal and less than 0.1 mrem hr^{-1}. The SRO removed the control element access cover and unscrewed the dashpot. Examination of the dashpot internal components through the transparent cylinder revealed that the graphite piston had disintegrated thereby rendering the dashpot useless. The SRO then called the Reactor Administrator and Acting Reactor Supervisor, who was in his office, and notified him of the failure of the dashpot.

The dashpot was surveyed for induced radioactivity and contamination and inspected.

A more detailed description of the events that transpired the evening of the June 25th is given in the attached memorandum prepared by K. Bunde and T. Gansauge, the reactor operators that night.

The next morning, facility staff made a concerted effort to locate an equivalent dashpot to replace the one that had failed. Airpot, Inc., the company that had manufactured the broken dashpot, was contacted. According to company records, the dashpot was a special order that had been placed about fifteen years earlier. However, the Vice President for Research indicated that they could manufacture replacement dashpots with a 2- or 3-day turnaround. With this information, an order was placed for three new dashpots with instructions to expedite shipment. Also, the NRC was contacted to cancel the SRO examination which had been scheduled for Wednesday, July 2nd. Instead, the examination was rescheduled one week later for Tuesday, July 8th. Airpot representatives said that they would ship one of the replacement dashpots to ISU no later than Tuesday, July 1st, which should have allowed enough time to install the dashpot and ensure that the reactor was operating properly before the NRC examiner was rescheduled to arrive at ISU to administer the SRO examination.

However, the dashpot was not shipped by the date as promised and the facility administration became concerned that the dashpot might not be installed in time for the NRC examination. On Thursday, July 3rd, in preparation for installing the new dashpot, the SR-2 assembly was removed from the drive assembly for inspection to ensure that the element was not damaged when the dashpot failed. When the element was transferred from the pedestal area to the Reactor Supervisor it became apparent that the end cap of the capsule had been punched through and the distal fuel disk was protruding about 2 cm out of the end of the capsule.

The discovery of the failure of a primary fission-product barrier prompted the following actions. First, the control element was placed on a plastic sheet to prevent any spread of radioactive material. Next, the element was thoroughly surveyed for direct radiation exposure levels and for removable contamination. The Dean of the College of Engineering, a Certified Health Physicist, was notified of the incident and came to the reactor laboratory to inspect the breached control element. The ISU Technical Safety Office (TSO) was also notified. A TSO staff member came to the facility and provided assistance in completing the radiological surveys. An air particulate sampler was set up next to SR-2 near the end of the capsule and sampled airborne material for 78 min. All contamination wipes and the air particulate sample were counted in the facility and then given to the TSO for further analysis using a liquid scintillation counter.

An Internal Incident Assessment Committee consisting of the Dean (Dr. Jay Kunze), the Director of the Nuclear Engineering Graduate Program (Dr. Alan Stephens), and the Reactor Administrator (Dr. John Bennion), was formed to review the incident, determine the cause, and review an initial plan for recovery. The committee met that afternoon examined the failed components and interviewed the personnel present at the time of apparent failure, i.e., the evening of June 25th.

The following Monday, July 7th, the incident was reported to Dr. Tom Gesell, the ISU Radiation Safety Officer, who had been absent from campus when the capsule breach was discovered. Dr. Gesell ordered in vivo thyroid counting of all personnel present during the incident. In addition, the wipe samples were analyzed with a high-purity germanium spectrometer to identify gamma-emitting contaminants present in the samples. The results of various radiological surveys were consistently negative and are included in the attached memoranda.

Assessment of Probable Cause and Consequences

As a result of personal interviews with the reactor operating staff and inspection of the failed control element capsule, the Internal Incident Assessment Committee concluded that the capsule failure was caused directly by the failure of the dashpot. The impact of SR-2 at the end of travel, without benefit of the damping action of the dashpot, following ejection from its fully inserted position, was sufficient fracture the weld. The final break of the weld may not have occurred until the start of the next scram.

A conservative estimate of the inventory of I-131 in SR-2 at the time of the cladding failure gives 28 μCi. Assuming that 1% of the total radioiodine content was released at the time of the breach of the primary fission-product barrier, a very conservative assumption since the polyethylene matrix retains nearly all of the fission products, gives 280 nCi as the amount of I-131 that was released to the environment. This quantity, divided by the building exhaust rate and averaged over a 24 hour period following the incident, is well below federal effluent concentration limits published in 10 CFR 20, Appendix B, Table 2: 2E-10 μCi/ml. Furthermore, results of the thyroid counting by the TSO showed that none of the facility personnel approached the verification level of 9.4 nCi for uptake by the thyroid gland.

The overall assessment of the radiological consequences is that this incident has no adverse impact to the health and safety of employees or the public. Such a conclusion is justified because of the low power output of the reactor, the limited operating history at the time of failure, and the small fraction of fuel material that was contained in the control capsule, about 2% of the total fissile mass of the core.

Plan for Recovery

The proposed plan for recovery is as follows:

- Replace the SR-2 capsule with its fuel content of 4 disks.
- Submit a comprehensive report to the RSC for review.
- Replace the SR-2 dashpot on the drive assembly.
- Transfer replacement control elements to ISU.
- Install replacement SR-2 control elements in the ISU reactor.
- Perform requisite surveillance, e.g., measurement of scram time and rod worth.
- Submit a recovery report to the RSC for review and seek approval to resume normal reactor operations
- Submit a courtesy recovery report to the NRC.

Three options are available for replacing the capsule. First, the existing capsule could be repaired. This option would require decontamination of interior surface contamination and expert welding of the delicate components with subsequent pressure testing to ensure the capsule is air-tight. Second, a new capsule could be fabricated, a process that would be expected to be difficult at best. Third, a replacement capsule from a decommissioned AGN-201 reactor could be located and transferred to ISU for installation in the ISU reactor. This last option is preferable and will be pursued.

Conclusion

The incident described in this report resulted in negligible exposure of the facility operating staff or others present in the building. A negligible amount of radioactive material may have been released to the environment as a result of the breach of the SR-2 capsule. The amount of material released was far below effluent limits and posed no risk to the health and safety of the public or to the environment.

The reactor facility is shutdown. Operations are expected to resume when replacement control elements can be transferred from Oregon State University to ISU. Before transfer can take place, however, the AGN operating license must be amended to permit the facility to possess additional fuel. An amendment will be immediately requested to allow ISU to increase the possession limit from 700 gm of U-235 to 730 gm which will enable the OSU control elements to be transferred to the AGN license. When transfer is complete, the SR-2 will be replaced and all necessary surveillances will be performed to ensure that the reactor is fully operational and meets all pertinent technical specifications. Normal operations will resume following complete review of the repair by the ISU Reactor Safety Committee and approval to restart the reactor.

The following actions and measures will be taken in order to prevent recurrence of this type of failure of a primary fission-product barrier. First, the control element capsules will be examined more closely for signs of wear or degradation during the annual control element maintenance program. Second, all dashpots will be inspected carefully for evidence of degradation of the seal around the plunger rod which might indicate excessive wear and might contribute to the catastrophic failure of the damping piston. In addition, as a possible long-term remedy, the facility will investigate the practicality of modifying the control element drive logic to allow both safety rods to be driven down manually rather than having to scram the rods to shut down the reactor. Such a modification would help to reduce impact frequency on both the control elements and the dashpots.

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MEMORANDUM

DATE: July 7, 1997

TO: Tom Baccus, Technical Safety Office

FROM: John S. Bennion, Assistant Professor and Reactor Administrator JB

SUBJECT: Locations of wipe samples from the AGN safety rod cladding failure submitted to the TSO for analysis.

The following are the locations and results of the wipe samples taken July 3, 1997, upon discovery of the Safety Rod No. 2 (SR-2) cladding failure. The wipes were counted using a pancake G-M detector connected to a Ludlum Model 2A Survey Meter, Serial No. 8266, calibration due December 1997. Background for the detector was 60 ± 20 cpm. Information for the air particulate sample is as follows: sampler on @ 11:44:30; sampler off @ 13:02:30; flow rate meter read ~2.3 scfm. The sampler was set on the work table located against the south face of the reactor concrete-block shield, about 30 cm away from the end of the failed SR-2.

Vial 1: 4-inch diameter air sample filter.
Gross count rate at center of filter: 460 ± 60 cpm. (High count rate was suspected to be caused by short-lived radon progeny.)

Vial 2: SR-2 Dashpot.
Gross count rate: 80 ± 40 cpm.

Vial 3: Cap retrieval rod.
Gross count rate: 80 ± 40 cpm.

Vial 4: SR-2 Dashpot.
Gross count rate: 60 ± 20 cpm.

Vial 5: Top portion of SR-2 drive mechanism.
Gross count rate: 60 ± 20 cpm.

Vial 6: Top portion of SR-2 capsule near failure (within ~10 cm failure).
Gross count rate: 120 ± 60 cpm.

Vial 7: CCR fuel capsule.
Gross count rate: 60 ± 20 cpm.

Vial 8: SR-2 capsule - detached end cap.
Gross count rate: 100 ± 60 cpm.

Vial 9: SR-2 interior thimble.
Gross count rate: 160 ± 60 cpm.

Vial 10: SR-2 entire rod ~10 cm below cladding failure.
Gross count rate: 80 ± 60 cpm.

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Thomas F. Gesell
Director

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gesell@physics.isu.edu

Radiation Safety and Hazardous Waste Management

MEMORANDUM

Date: July 9, 1997

To: TSO Files

From: Tom Gesell

Subject: TSO response to broken fueled control rod incident at the ISU College of Engineering AGN 201 reactor.

Following discovery of the broken control rod on 7/3/97, reactor personnel made appropriate direct radiation and removable contamination surveys and notified the TSO. No unusual direct radiation fields were noted by reactor personnel. The removable contamination measurements (wipes) are listed on the attached memorandum from John Bennion dated 7/7/97. The wipes were recounted by TSO in a liquid scintillation counter; the results are also attached. The wipes were then counted on an intrinsic germanium detector; a small amount of ^{137}Cs was identified but not quantified because the laboratory did not have a calibration standard in geometry equivalent to the wipes, which were in liquid scintillation vials.

The instrument normally used by TSO to measure ^{125}I in thyroid (Ludlum 2200 scaler equipped with a 44-3 probe) was readjusted to improve response to ^{131}I and used to measure the thyroids of reactor personnel who were in the vicinity of the reactor following the incident. The settings used were:

HV: 195 on potentiometer
THR: 50 on potentiometer
WIN: 900 on potentiometer
0.1/1 toggle: 1
IN/OUT toggle: IN

Calibration in approximate thyroid geometry was made with a ^{133}Ba button source that had 50 nCi of activity remaining as of July 8, 1997. Efficiency was determined with the following equation.

$$efficiency(nCi\ of\ I\text{-}131\ per\ CPM) = \varepsilon = \frac{50\,(nCi\ of\ Ba\text{-}133)\cdot 1.2\left(\dfrac{photons\ per\ disintegration\ of\ Ba\text{-}133}{photons\ per\ disintegration\ of\ I\text{-}131}\right)}{CPM_{source} - CPM_{background}}$$

Thyroid counts were made on three individuals from the reactor program, Kermit Bunde, John Bennion and Todd Gansauge. None approached the verification level of 9.4 nCi for ^{131}I. The results were recorded on bioassay forms and placed in the individuals' files.

enc: as stated

cc: John Bennion, Tom Baccus

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Radiation Safety

Date: July 15, 1997

To: Dr. Bennion
Reactor Supervisor

From: Tom Baccus
Health Physicist, TSO

Subject: Analysis results for wipe samples from AGN safety rod cladding failure.

Dr. Bennion:

The ten wipe samples from the AGN safety rod cladding failure, provided by you, were counted and all were found to be less than the regulatory limit for removable contamination. Although all wipes were below the regulatory limits, some showed small amounts of ^{137}Cs contamination. It is therefore recommended that the failed safety rod be controlled as radioactively contaminated material and all appropriate safety precautions be observed.

Sample counting was performed with a Beckman LS7500 Liquid Scintillation counter, serial number 101295.

T. Baccus 7/15/97

Tom Baccus Date

MEMO

To: Dr. John Bennion Reactor Administrator and Acting Reactor Supervisor

From: Todd Gansauge and Kermit Bunde

Subject: Failure of SR2

Date: July 18, 1997

Statement of events surrounding SR2 control rod failure which appears to have occurred June 25, 1997.

On Monday June 23, 1997 Dr. John Bennion and Mr. Todd Gansauge pulled the coarse control rod and rod drive from the reactor. The purpose of this inspection was to familiarize Mr. Gansauge with the rod drive mechanism in preparation for an NRC licensing exam schedule for July 2, 1997. Procedure MP-1 was started, the rod and drive were examined, swiped for contamination, and replaced in the reactor that afternoon.

The MP-1 procedure requires that reassembly of control rod drives and control rods be verified by a second licensed reactor operator. Arrangements had already been made for Mr. Kermit Bunde to run the reactor on the evening of Wednesday June 25th for the purpose of meeting quarterly requalification requirements. It was decided that Mr. Bunde and Mr. Gansauge would complete the MP-1 procedure and Mr. Bunde would verify the control rod reinstallation before running Wednesday evening.

The completion of MP-1 for the course control rod went without incident. The reactor was brought to initial criticality for the day at a power level of 0.01 watts as per standard startup procedure. This criticality was achieved at 20:29 hours the evening of June 25th.

The power level was then raised to 4.0 watts and stabilized by 20:41 hours. At 20:43 hours power was reduced from 4.0 watts to 0.1 watt. This level was reached at 20:51 hours. At 20:53 hours it was decided to reduce the power further. The log entry indicates intention to reduce power to 10 microwatts.

The operators knew that they would not achieve this low power level, because the detector for channel 1 was in the raised position. The decision was made to follow the power down and see at what point channel 1 would scram low. This scram occurred at 20:58. Channel 3 was reading approximately 1.0 E-11 amps at that time, corresponding to a power level around 220 microwatts.

The reactor was restarted at 20:59. The operator had planned to bring the reactor to a power level of 1 watt. The reactor was increasing power on a period of approximately 25 seconds. Several decades before reaching 1 watt an operator error caused a high level scram of channel 3. The channel 3 meter was crossing the 70% mark when Mr. Gansauge reached up to switch ranges on the channel 3 power level range selector switch. Mr. Gansauge mistakenly rotated the switch in the wrong direction and switched channel 3 to a more sensitive setting. This resulted in a high scram of channel 3. The time of this event was 21:05.

Restart was attempted. As soon as SR2 was fully driven into the core, the control rod dropped away from the electromagnet. The manual scram button was then pressed allowing the SR2 rod drive to descend and reacquire the control rod.

Restart was attempted, with the same results. SR2 dropped away from the magnet as soon as fully inserted. This was accompanied by an abnormal sound. The sound was louder than usual and more metallic in nature. The reactor was scrammed via the manual scram button to reposition the rod drive mechanisms before Mr. Bunde opened the reactor skirt door and removed the access cover to investigate the unusual noise. Mr. Bunde brought a portable survey meter with him and noted no unusual radiation levels inside the reactor skirt (< 0.1 mr/hr). Removal of the dashpot by Mr. Bunde showed that the dashpot for SR2 had failed. The graphite piston within the air driven dashpot had crumbled into many pieces.

The Reactor Administrator and Acting Reactor Supervisor (Dr. John Bennion) was in the building and contacted. The dashpot was examined and surveyed for contamination.

The company who had manufactured this dashpot was contacted the following day. By Friday of that week an order was placed for a replacement dashpot.

On July 3rd 1997 Dr. Bennion and Mr. Gansauge pulled the SR2 control rod. At that time they found that the weld along the top of the control rod had broken exposing fuel.

Todd Gansauge
Mr. Todd Gansauge, Senior Reactor Operator in training

Mr. Kermit Bunde, Senior Reactor Operator SOP-70094