JUL 28 1981

Docket No. 50-288

Mr. L. B. Church, Director
Reactor Facility
Reed College
3203 SE Woodstick Blvd.
Portland, OR 97202

Dear Mr. Church:

Our review of the proposed changes to the Physical Security Plan for the Reed College TRIGA reactor submitted by letter dated June 2, 1980 has indicated the need for revision and additional information.

Please make changes and revisions in accordance with "Procedures for Updating or Revising Pages" of the enclosed Regulatory Guide 5.59.

You are requested to respond to the comments in the enclosure by August 28, 1981. This enclosure contains information of a type specified in 10 CFR 2.790(d) and should be withheld from public disclosure.

Sincerely,

Original signed by
Robert L. Tedesco

Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

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Reed College

cc w/enclosure(s):

Director, Oregon Department
of Energy
528 Cottage Street, N.E.
Salem, Oregon 97310

Mr. Neil Goldschmidt
Mayor of Portland
1220 Southwest 5th Avenue
Portland, Oregon 97204

December 5, 1991

Ted Michaels
Office of Nuclear Reactor Regulation
U.S.Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Michaels:

As a result of the recent leak detected from a fuel element in the reactor at Reed, and the subsequent Confimatory Action Letter dated November 25, 1991 from Mr. John Martin, U.S.N.R.C., Region V, it is unlikely that we will be able to comply with several surveillance requirements of our Technical Specifications on a timely basis.

This Confimatory Action Letter requires Reed College to develop a Recovery Plan to evaluate the fuel cladding failure, to communicate this plan to NRC, and to receive NRC concurrence prior to any action on the Plan. We have agreed not to manipulate the reactor control rods nor take the reactor critical until this concurrance is obtained. We anticipate that this Recovery Plan will be developed and submitted to the NRC around February 1, 1992.

In the mean time, we are hereby requesting relief from the following requirements of our Technical Specifications:

Section E.3. Each standard fuel element shall be visually inspected at least once every five years. At least 1/5 of all the fuel elements of the core shall be inspected at yearly intervals. . .

Section F.2. The control elements shall be visually inspected at least once every two years. . .

Section F.9.. The tests listed below shall be performed at least once semi-annually, . . .:
a. Verification that all control element drop times are less than one second. . . .

D/3

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15.

The Recovery Plan which we will submit to the NRC will address these Technical Specification requirements and present a schedule for completion of each. The reactor will not be operated for any purpose not specifically addressed in the Recovery Plan (upon which the NRC will have concurred) until the surveillance items covered by this letter have been satisfactorily completed.

Thank you for your prompt consideration of this relief request.

Sincerely,

J. Michael Pollock
Acting Director

cc. D. Bennett
Reactor Documents and Correspondence file, library

December 5, 1991

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Document Control Desk

RE: License R-112, Docket 50-288

This letter and the two attachments are submitted as a report on the "Unusual Event" which occurred at the Reed College Reactor Facility on November 23, 1991. Please accept this report as meeting the 30 day reporting requirement of 10CFR50.

Additional information which is still being generated will be submitted along with the Evaluation and Recovery Plan required by the Confirmatory Action Letter of November 25, 1991 from Mr. John B. Martin, Regional Administrator, Region V, USNRC to Reed College. Based on that Confirmatory Action Letter and our understandings with the USNRC inspectors, we will not be manipulating control rods on the reactor nor will we begin the inspection of fuel elements to identify the leaking element until our plan for the evaluation of the cladding failure is approved by NRC. At this time, we anticipate submission of the Evaluation and Recovery Plan on or about February 1, 1992.

Sincerely,

J. Michael Pollock

ATTACHMENT 1

REPORT ON "UNUSUAL EVENT"
REED COLLEGE REACTOR FACILITY
NOVEMBER 23, 1991

DESCRIPTION OF REACTOR OPERATION IN PROGRESS

The Reactor was being operated for a scheduled 6 hour irradiation for three batches of samples. The largest set were geologic samples as part of a Master's thesis study of S.E. Oregon hot springs at Portland State. The second batch were sediment samples being analyzed for selenium as part of a high school research project. The third batch were air filter samples collected by researchers at Oregon State with whom one of the reactor operators had worked last summer.

Due to the failure of the reactor heat exchanger last August, the reactor had been receiving limited use. Only operations which did not require heat removal had been performed, most less than 1 hour in duration. The water temperature at the beginning of operation on November 23 was 23°C. It was projected, in advance, that the final pool temperature would be about 35°C. The most recent calibration of the Bulk-water alarm indicated that the alarm setting was 40°C. The maximum operation temperature allowed in the Technical Specifications is 120°F (48.8°C)

Samples were loaded into the reactor late Friday and early Saturday. Shortly before 9:00 A.M. the Acting Director contacted the initial reactor operator for final discussions of the days irradiation. The core excess was measured beginning at 9:30 and operating power (237.5kW) was achieved at 9:47. The Acting Director arrived at the Facility at about 10:15 and began loading samples from a previous irradiation for transfer and shipment to PSU. This transfer took place at 12:23 and the Acting Director left the Facility.

At about 13:15, the Acting Director was contacted by the Senior Reactor Operator on duty (SRO-3 below) because the Bulk Water Alarm had sounded with a tank water temperature of only 30°C. That temperature was verified by comparison of guages in the Primary Water System and an independent, portable probe measuring surface water temperature. It was decided that operation could continued provided that the temperature was checked every 15 minutes with both the Primary Water System and the portable probes. The water temperature recorded at 15:15 was 35.4°C.

DESCRIPTION OF THE UNUSUAL EVENT

At 15:17 an alarm sounded in the Gaseous Stack Monitor (GSM and the room isolation cycle was tripped. The reactor was scrammed immediately. Since the alarm immediately ceased and the trace on the Gaseous Stack Monitor did not indicate unusually high readings, the operator (SRO-1) and assistant (SRO-2) set about trying to identify the cause of the alarm. At 15:29 the GSM and the Continuous Air Monitor (CAM) which measures activity in the reactor bay both began to alarm and an "Unusual Event" was declared by the operators.

What follows in this section is an abbreviated description of actions taken subsequent to this declaration. Attachment 2 is a detailed chronology of events.

Consistent with requirements of the Facility Emergency Plan and Emergency Implementation Procedures, the two Senior Reactor Operators (SROs) began an evaluation of the event including collecting a sample of tank water and a CAM filter for isotopic analysis. They also shut off the Reactor Primary Water System and began emergency notifications. Initial analysis indicated that the fission product Rb-88 was present on the air filter. Gamma radiation levels in the reactor bay remained at levels below 0.5 mR/hr. Radiation levels on the CAM and the GSM and Air Particulate Stack Monitor (APM) continued to rise.

The Acting Director (herafter referred to simply as the Director) evaluated the data collected by the operators. One of the experimenters whose samples were in the reactor was contacted to test all samples for abnormal natural radioactivity. None was found thus tentatively eliminating experiment failure as the cause of the airborne radiation levels.

Since levels in the reactor bay continued to rise, the Oregon State Health Division was contacted to assist with radiation monitoring outside of the facility. The NRC was notified as was the Oregon Department of Energy (through the Oregon Accident Response System).

Subsequent water samples confirmed the presence of noble gas fission products (Kr-85m, Kr-88, and Xe-135) in the reactor tank water confirming a fuel element source for the activity. The activity on the CAM filter was again analyzed as primarily Rb-88 (from Kr-88) with increasing concentrations of naturally occuring radon decay products. The reactor bay was left in its "isolation cycle" mode overnight to minimize any releases to the environment.

By about 15:00 on 11/24, radiation levels on the stack monitors had returned to normal levels. Activity determined on the CAM was attributed entirely to naturally occurring radon gas and the room ventilation system was reestablished.

The "Unusual Event" was officially terminated at 15:20 on 11/24/91.

ESTIMATIONS OF RADIOACTIVITY INVOLVED

The following information is based on the best estimates currently available. While we recognize that there are some problems with the calibration procedures as they are currently used at Reed, the results are consistent enough to provide us with a reasonable assurance that we understand the nature of the activity. With assistance we have requested from the TRTR (Test Research and Training Reactor Directors Association) we intend to continue to evaluate these levels as they were measured on November 23, and to improve calibration procedures for subsequent operations.

Airborne Radioactivity in the Reactor Bay:

Direct gamma radiation levels in the Reactor Bay resulting from airborne activity were measured as high as 0.4 mR/hr using a portable ion chamber and this reading is consistent (within a factor of 2) with levels recorded from a fixed Area Radiation Monitor. Assuming this level resulted from a uniform distribution of noble gas fission product activity in the room air, a maximum value on the order of about $10^{-5}\mu$Ci/ml in the room air is estimated (a lot of assumptions went into this calculation but the order of magnitude is accurate)..

Based on a CAM filter removed from the reactor bay about midnight on 11/23, a maximum concentration of Rb-88 (and hence Kr-88) in the air is estimated at $3 \times 10^{-5}\mu$Ci/ml is obtained.

Airborne Release from the Reactor Facility

The following releases are as calculated within the effluent stack. No credit for any dilution, dispersion, or radioactive decay from that point to any point of occupancy is taken. All assumptions used are considered to be conservative, ie. to over estimate rather than under estimate the release.

It is assumed that no radioactive particulates escaped. When the reactor bay is in the isolation mode, air is exhausted from the facility at a rate of 100 cfm in order to assure that the room remains at negative pressure and that no air escapes around doors and cracks. the small amount of air which is vented is filtered through HEPA filters prior to release. The AFM chart was indicated higher than normal levels which may appear to be from particulate release, however, the detector for this system is unshielded, is located in the reactor bay and these levels are completely consistent with direct radiation by air within the room.

Gaseous Releases were estimated by integration of the chart recorder records and the most conservative calibration data from recent calibrations. Based on this level, an average concentration of 2.5×10^{-6} µCi/ml (averaged over the 24 hours of the event) is estimated. This concentration is consistent (within a factor of about 2) with an assumption of release of noble gas from the room (at the concentrations described above) and dilution by a factor of 12 (the design dilution) within the room exhaust system prior to release from the stack.

Based on these data, a total release of noble gas fission products of about 110 mCi is estimated. This corresponds to approximately 0.25 MPC on an annual average.

To emphasize again, we believe that we have utilized conservative estimates at every step of this calculation and no credit is included for anything that happened to the gas after it left the stack. It thus represents an upper limit on the release. Simple dispersion calculations indicate that at least a factor of 10 reduction in these levels would have existed at any point outside of the Facility accessible to a human being.

We will be working with assistance provided by the TRTR to recalibrate and evaluate the entire monitoring system to try to provide even better estimates prior to resuming operations.

These data confirm that the emergency classification, as declared, was an "Unusual Event".

DESCRIPTION OF PRESENT AND FUTURE ACTIONS

The Reed Reactor Facility Oversight Committees (Reactor Operations and Safety Committees) have met and reviewed preliminary information on this event. Additional meetings are scheduled for January prior to completion of a final Evaluation and Recovery Plan.

We have requested and been provided assistance through the TRTR organization and Oregon State University. We intend to continue to utilize this assistance throughout the coming evaluations.

Preliminary contact with General Atomic has been made. This contact will intensify as plans for Evaluation of the fuel Element Leak and for Recovery are developed during January.

ATTACHMENT 2

DETAILED CHRONOLOGY OF "UNUSUAL EVENT" OF 11/23/91

The following chronology was prepared from notes taken during the unusual event which was declared on 11/23/91, involving the apparent release of fission products from a fuel element at the Reed College Reactor Facility. It has been modified by the addition of events recalled by participants. Times reported with an * were recorded at the time they occurred (including logbook entries) and serve as mileposts on which the other estimated times are based. Throughout this chronology, "Director" refers to J. Michael Pollock, Acting Director, Reed Reactor Facility

*15:17 GSM alarmed; operator on duty (SRO-1) performed a Manual SCRAM of the reactor and removed the key.

*15:29 CAM and GSM alarming simultaneously. CAM at 4kcpm and rising sharply; GSM barely at alarm level. (levels checked by SRO-2) Unusual Event declared; emergency procedures initiated. Operators moved operations to Facility Conference room.

*15:35 SRO-2 called Reactor Supervisor; SRO-1 called pager in attempt to contact Director

*15:40 CAM filter was changed by SRO-1; old filter was put in a plastic bag and counted on the gamma spectrometer.

*15:44 CAM rising rapidly and approaching 6kcpm (Checked by SRO-2).

*15:52 APM reading 4.9kcpm, but its failsafe has not yet tripped. (Nominal failsafe level 4kcpm) GSM approximately 100 cpm, and alarming intermittently (Also checked by SRO-2)

*15:53 Supervisor arrived at RRF, became emergency coordinator

*15:55 Second attempt to contact Director again via pager and home answering machine.

*16:00 SRO-1, SRO-2, and Reactor Supervisor have been issued dosimeters and are entering the bay minimally. SRO-2 entered bay, measured CAM (9kcpm and rising); GSM< at 120cpm. While in the bay, a water sample was collected by SRO-2 for gamma spectrometer analysis.

*16:05 Notified security; instructed them to suspend their walk through until further notice.

*16:10 Contacted SRO-3 for advice; SRO-3 agreed to come to the facility.

*16:15 Facility evacuated to Directors office emergency coordination center.

*16:18 Peaks in CAM filter were found to be the following:

RB-88 or Y-88 (later confirmed as Rb-88)

Peaks in Pool water:

Na-24

Mn-56

*16:21 Health Physicist notified. H.P. suggested that an experiment failure was the most likely cause of the readings.

*16:27 Gates to back parking lot were checked and found to be closed and locked

16:45 SRO-3 arrived at Emergency Support Center

17:15 Director contacted staff in response to earlier page

17:30 Director arrived at Emergency Center

*17:45 The following readings were obtained in the control room

APM 20 kcpm; stable for about 15 min

GSM 300cpm; stable for about 15 min

CAM aux. readout; 3.3kcpm. (This reading was previously found to be well below the readings of the CAM reading located in the bay.)

18:00 Attempt to reach Provost failed. Director spoke with Acting President, briefed him on the situation and left message for Provost.

18:05 The Principal Investigator for the PSU geology project was contacted at his office at PSU. He was asked to locate the samples (each 1 gram sample in the reactor was taken from a much larger sample retained at PSU) which are in the reactor and, using the PSU Geiger Counter, scan all samples for unusual natural radioactivity.

18:20 Provost returned call and was appraised of situation.

18:35 PSU Geology department reported no unusual natural radiation levels in any samples.

*19:00 Director contacted Health Physicist for concurrence in decision to allow entry into bay to collect CAM filter. Additional info to be collected includes RAM, RO-2, CAM recorder history, console CAM reading. Entry to be aborted if measurable gamma radiation dose rates are detected.

*19:20 Reactor Supervisor's entry into the Reactor Bay with half-face, respiratory protection aborted due to elevated gamma levels (0.4 mR/hr). APM and GSM levels steady at GSM 300, APM 20,000. Read CAM chart paper from exit corridor with telescope, reading level at 50 k cpm.

19:25 Health Physicist requested to come to Facility.

*19:40 Director contacted the Oregon State Health Division. Spoke with Ray Paris to request assistance in outdoor air monitoring and gamma particle monitoring.

*19:50 (approximately) Martha Dibblee, OSHD, arrived and began interviewing staff about incident. Health Physicist also arrived and was informed of developments in the situation.

*19:57 Contacted NRC; Director spoke with Tom Andrews of the USNRC headquarters in Washington.

*20:20 Oregon State Health division contacted Reed; they are loading monitoring equipment into the vehicle; will call back on cellular phone on arrival at Reed.

*20:22 Oregon DOE contacted by the Health Physicist through Oregon Emergency Management .

*20:27 (NRC call continuing) Stu Richards , the region 5 duty officer joined the NRC line in a conference call.

*20:27 Oregon DOE returned call. David Stewart-Smith was appraised of the situation and was most concerned with media attention to the incident. He will be called if the situation worsens.

*20:30 (NRC call continuing) Frank Wenslawski of the NRC will be joining the conference line.

*20:38 (NRC call continuing) Jack Rowe of NRC headquarters joined the NRC conference line.

*20:47 (NRC call continuing) Ted Michaels joined the NRC conference line.

*20:51 Health Physicist and Reactor Supervisor prepare to enter the facility, but not the reactor bay; this was authorized by Director.

*20:53 OSHD called Reed to say that they would arrive at the facility in approximately 10 minutes.

*20:58 The Health Physcist and SRO-3 Prepared to enter the facility to recheck levels. Since the Director was still tied up on the NRC call, the Health Physicist was designated as emergency coordinator.

*21:04 David Stewart-Smith, ODOE, called Reed to inform the facility that the ODOE had notified 911 of the incident, (apparently an SOP) so that there is now some possibility of media calls. If such calls occur, we are to refer them to David Stewart-Smith.

*21:08 SRO-3 and Health Physicist obtained the following information from the entrance to the facility.

CAM	>50,000 cpm
APM	18,000 cpm and declining

GSM 250 cpm and declining
RAM 0.1 mR/hr

*21:10 Health Physicist contacted by the head of the Portland Fire bureau, George Monague.
*21:12 Phone number of the Trojan shift supervisor obtained.
*21:15 Oregon State Health Division representatives set up air sampling equipment including zeolite cartridges for iodines and walked around the facility with survey meters (μR/hr) and detected no elevated levels.
*21:20 PGE was contacted by Heath Physicist with request for assistance
*21:21 (NRC call continuing) Junaid Razvi, General Atomic had joined the NRC call by this time.
*21:22 Health Physicist attempted to call ODOE Trojan inspector
*21:28 NRC call finished with agreement that Reed would call them to call them back at 22:30. NRC has dispatched Trojan On-site inspector to Reed.
*21:30 Provost was updated on the current situation.
*21:42 PGE, called; someone from PGE will bring appropriate respirators to the facility.He is expected at 22:45 to 23:00.
*21:49 Ruth Behn of DEM called. she was informed of the situation.
*21:49 William Henle of the Portland Fire Bureau arrived at the facility to offer assistance. He was also informed of the situation.
22:00 SRO-2 was released for the night
*22:10 (approx.) Reed College Hazardous Materials Manger notified of the event

*22:31 Director contacted the NRC with update.
22:35 Oregon State Health Division reported that air samples of about 1.5 hours duration detected no measurable radiation levels in air near the stack.
*23:10 PGE arrived with the respirators and other HP assistance.

12/24/91

*00:04 SRO-3 and the Reactor Health Physicist entered the reactor bay, wearing full-face respirator and contamination suits. SRO-3, changed the CAM filter and verified that the CAM was operational. The CAM was fully functional. Health Physicist collected 2.5 l pool water.
*00:06 SRO-3 left the reactor bay and underwent decontamination. No contamination was found.
*00:06 CAM filter counted and data stored on disk. Only detectable activities due to ^{88}Rb and ^{222}Rn
*00:10 Health Physicist left the reactor bay and underwent decontamination. No contamination was found.
*00:40 Water sample (100 ml) collected from tank counted on gamma spectrometer. Activity detected due to ^{88}Kr, ^{85m}Kr, ^{135}Xe, ^{24}Na, and ^{56}Mn. Ion exchange resin started for the pool water sample collected.
*00:55 The reading on the radiation monitors were as follows:
CAM 30k cpm
APM 9k cpm
GSM 150 cpm
RAM 0.08 mR/hr
*1:07 Jim Melfi from the NRC (Trojan on-site inpector) arrived.
*1:32 PGE-i left.

*2:00 NRC called back to talk to Jim Melfi

*2:20 Oregon Emergency Management called back for status report. Director reported that all was stable and no off-site impacts. OEM off for the night.

*2:30 Began securing the facility for the night; notified community Safety to set Chem building alarms; asked them not to conduct normal watch. Reactor Staff to handle watch.
*7:00 Director returned to facility. Greg Cook USNRC called for additional information before leaving for Portland. Wanted FAX of press release. I indicated that it would be going out later this morning following my meeting with Reed Administration.
*7:10 Status of monitors:
CAM 7,000 cpm (through window--still in alarm)
APM 3,200 cpm (Failsafe light has returned to the on condition)
GSM 65 cpm (Failsafe light flickering on and off with fluctuation in readings.
RAM (through window--0.07 mr/hr--normal)

*7:30 Director called USNRC (301-951-0550) Initial conferees were Bob Faukenberry, Frank Wenslowski, and Stu Richards. Jim Melfi arrived at 7:40 and joined on the Reed end of the call.

*9:17 PGE-1 called and indicated that PGE-2 was being dispatched to the Reed facility with decontamination and monitoring supplies as back-up to ours. Should arrive about 10:30
*9:18 Tried to reach David Stewart-Smith, ODOE; left message on recorder.
*9:25 Discussed status with Dan Gerrity; requested his help in notifying reactor oversight committees.

*9:53 Martha Diblee, Oregon State Health Division, called to offer assistance if we needed any more. She provided phone numbers for several ODOE employees.

11:00 Press Release issued
11:15 U.S.N.R.C inspectors arrived.

13:00 Several staff members were contacted to begin meeting with NRC inspectors.

15:00 Radiation levels on APM and GSM have returned to normal; failsafe lights have been on for several hours. Alarm on CAM still sounding with level of 5,000 cpm constant since about 11:30 A.M. Particulate filter removed from CAM and counted on Gamma Spectrometer. Only detectable radiation levels were due to the particulate daughters of naturally occuring Radon gas.
15:20 The "Unusual Event" was terminated. Ventilation system was restarted to vent radon daughter activity. the NRC (headquarters) was notified.

16:00 Press conference held as scheduled in A.M. press release.

17:00 The reactor Health Physicist completed wipe tests of 5 surfaces in the reactor bay, all with negative results. These results were left for the review of the Director.

11/25 (General events) The Director informed the Health Physicist that additional wipe-tests were required before the Reactor Bay could be declared contamination free. Wide area wipes were conducted, especially of floor surfaces. Several reactor staff assisted in the analysis of wipes including gamma spec. analysis. Additional water sample was analyzed. The NRC inspection continued with inspectors interviewing involved staff members and reviewing reactor logs and chart recorder records of the event and previous extended

irradiations. Numerous interviews both live and by phone were granted to news media. Both SROs who entered the reactor bay during early phases of this incident received Whole-body counts. Initial results were called to the Director as negative.

11/26 (General Events) The Director met at 7:00 with the NRC inspectors. Final requests for information were delivered to the Director along with a discussion of preliminary findings. From 8:00 to 10:30 data on gaseous release estimates and the mix of fission product gases based on entrained gases in reactor water were calculated and presented to the inspectors. At 10:30, the Director held a briefing for supervisors of construction workers employed on near-by construction site. At 10:30, an exit review was presented with NRC inspectors, Reed College Administrators, and the Reactor Director. It was agreed that the NRC inspection would continue by phone contact through about Wednesday, 12/4, to allow for the finding of additional facts in the investigation.