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October 9, 1992

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.U.S. Nuclear Regulatory Commission Region II Office of Inspection and Enforcement 101 Marietta St. N.W. Atlanta, Georgia 30323



NUCLEAR REACTOR FACILITY Department of Mechanical, Aerospace & Nuclear Engineering

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Subject: Special Report from the University of Virginia Reactor Facility [Reactor Docket Nos. 50-62 and 50-396].

To whom it may concern:

A report is being made to the NRC that describes the in-pool disassembling of two canisters used for neutron activation of ceramic beads. This resulted in the dispersion of small, insoluble and nonfloatable aluminum oxide/silicon dioxide beads to the research reactor's pool floor and primary coolant system. Canister irradiation, performed on September 22, 1992, was halted when the top lid to one of the canisters was observed to have come loose. The reactor has remained shut down since then to permit study and resolution of the situation. On October 1, 1992, an unsuccessful attempt was made to retrieve the topless canister with its contents intact, using Reactor Safety Committee (RSC) approved special procedures. Lispersion of beads from the canister occurred at that time. Also on October 1, the second canister was successfully retrieved from the reactor grid plate and placed on an underwater work table where further transfer measures were planned. When such measures were attempted, a spill of contents from that canister onto the underwater work table occurred on October 6, 1992.

This report is not required by UVAR Technical Specification 6.4.2 because an unsafe condition was not created and is unlikely to be generated in the future. However, an inadequacy in the implementation of quality assurance controls over irradiation experiments has been recognized. A short summary of the event is provided in this cover letter and a detailed accounting is found in the enclosed report.

Ceramic beads encapsuled in aluminum canisters have been provided on a regular schedule since January 1992 for irradiation in the UVAR by Spectratek Services of Albuquerque, NM, a subsidiary of ProTechnics of Houston, TX. The canisters were specially designed, manufactured and filled with ceramic beads by Spectratek and therefore are not generic commercial items. The ceramic beads place in the canisters contain bonded trace-levels of iridium metal and are manufactured for Spectratek under a patented process. Activated Ir-192 ceramic beads serve as tracer material in the petroleum exploration industry.

The canisters lids came loose during and after neutron activation of a new batch of canisters obtained from Spectratek. The majority of the beads spilled when the recovery of the canisters was unsuccessfully attempted using specially designed handling tools.



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(Cover letter to Special Report, page 2, cont.)

The in-pool spill of solid-state material has not resulted in a release of radioactive material to personnel work areas of the Reactor Facility. Ambient radiation levels in the workplace have not increased. Radioactive releases to the environment have not occurred. There has been no contamination nor exposure to personnel. Also, these concerns are not likely to occur in the future for reasons described in the attached report. The activated iridium is physically encapsulated in a ceramic matrix and poses no danger in its present location within the reactor pool. Safe recovery of most of the beads is possible and the recovery process is currently being planned, reviewed and practiced in dry-runs.

Reactor safety was not affected during or as a result of this incident. The beads are too small (0.004 < dia.< 0.058 in.) to block fuel element coolant flow (the plate gap being 0.112 in., or about twice the maximum bead diameter). Also, the beads were released below the level of the fuel element coolant intake, and they are sufficiently heavy so that they could not have entered the fuel element coolant flow intake, which is at a relatively high position in the reactor pool.

The reactivity worth of the iridium ceramic bead containers, activated in pairs, is equal to or less than the absolute value of 0.05% deltaK/K, depending on the positions the canisters occupy on the grid plate. UVAR TS permit samples worth less than 0.1% deltaK/K to be moved in and out of the core while the reactor is at power. Hence, release of beads at power would not have been detrimental to reactor safety. It is noted that the most beads were dispersed following a normal reactor shutdown during the initial canister retrieval process. A check of the reactor power level trace for the irradiation period revealed no abnormality.

To permit recovery from this event, the UVAR has remained shut down since the discovery of the loose canister lid (9/22/92). The Reactor Safety Committee (RSC) and Office of Environmental Health and Safety were apprised of the occurrence. The RSC has already met twice to evaluate the situation and proposed bead recovery measures. With special recovery procedures reviewed and approved by the RSC. the reactor staff will vacuum the beads into suitable underwater containers and then to consider whether to ship these back to the source company where the beads could be processed. The vacuuming apparatus has been assembled and successfully tested out-of-pool on inactivated beads.

Reactor restart will be conditional on an approval by the Reactor Safety Committee, following conclusion of remedial actions. Continuation of the iridium irradiation program will depend on RSC approval of improved irradiation containers and the investigation of whether it might be necessary to adopt improved quality assurance procedures by both the licensee and the company providing the containers with source material for radioactivation. The reactor staff will proceed slowly and deliberately in the recovery effort. It is estimated that the UVAR may be ready to return to operation in about two weeks.

(Cover letter to Special Report, page 3, cont.)

Regulations reviewed for applicability to this event include 10CFR50.71 (...making of reports), 10CFR50.72 (Immediate notification requirements for operation of nuclear power reactors), and 10CFR50.73 (Licensee event report system). In general, these regulations apply to power reactors and in the Reactor Director's opinion do not appear applicable to the reporting of this event. Also checked were 10CFR20 (Standards for Protection Against Radiation), 10CFR21 (Reporting of Defects and Noncompliance) and 10CFR50.59 (Changes, Tests and Experiments).

Please contact the Reactor Director ac (804) 982-5440 or the Radiation Safety Officer at (804) 982-4916 should there be a need for additional details. A report of the recovery of the beads will made to the RSC and NRC. All particulars related to the event will be available to NRC inspectors during a future inspection.

In addition to the enclosed report, we are sending you under separate cover a confidential description of the ceramic beads as well as a proprietary list of Spectratek and Protechnics personnel who have been associated with this irradiation program. We have been in close contact with them and they are supportive of our efforts to remediate the situation. They will be sent a copy of this mailing.

Sincerely, Julden

Robert U. Mulder, Director U.VA. Reactor Facility

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cc: Mr. John T. Casteen, III, University President Mr. Thomas H. Jackson, Provost Mr. John Scott, Associate Provost for Research Mr. Ed Starke, Dean of Engineering Mr. Paul E. Allaire, Chairman of MANE department U. Va. Reactor Safety Committee Mr. Michael Brewer, Spectratek Services, Albuquerque, NM Mr. Larry Stevenson, ProTechnics, Houston, TX

enc: Dispersion of Ir-laced ceramic beads into UVAR pool ...