NILS J. DIAZ, DIRECTOR
W.G. VERNETSON, REACTOR MANAGER
NUCLEAR REACTOR BUILDING
GAINESVILLE, FLORIDA 32611
PHONE (904) 392-1429 TELEX 56330

NUCLEAR FACILITIES DIVISION

UNIVERSITY OF FLORIDA

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September 17, 1985

Nuclear Regulatory Commission
Suite 2900
101 Marietta Street, N.W.
Atlanta, Georgia 30323

Attention: J. Nelson Grace
Regional Administrator, Region II

Re: University of Florida Training Reactor
Facility License: R-56, Docket No. 50-83

Gentlemen:

Pursuant to the reporting requirements of paragraph 6.6.2(3)(c) of the UFTR Technical Specifications, a description of a potential abnormal occurrence as defined in the UFTR Technical Specifications, Chapter 1 is described in this interim report to include NRC notification, occurrence scenario and proposed solutions. The potential abnormal occurrence involved the failure of one of the UFTR control blades (Safety Blade #3) to drop fully into the core on demand from a 64% withdrawn position.

NRC Notification

The Executive Committee of the Reactor Safety Review Subcommittee reviewed this occurrence on September 4, 1985 and concluded that it is a potential abnormal occurrence as defined in UFTR Technical Specifications, Chapter 1. The RSRS then instructed NRC notification as per Section 6.6.2 of the UFTR Tech Specs. This notification was carried out by both telephone to Mr. Paul Frederickson and a following telecopy on September 4, 1985 (See Attachment I). This interim report represents the 14 day followup report as required in UFTR Tech Specs, Paragraph 6.6.2(3)(c).

Occurrence Scenario

As indicated in the telephone conversation with Mr. Paul Frederickson, Section Chief, Region II, and a following telecopy on 4 September 1985 (Attachment I), one of the reactor control blades (Safety-3) on the University of Florida Training Reactor failed to completely insert on demand from a 64% removed position. This failure (sticking about 31% removed) was discovered by a Reactor Operator as he commenced a power increase from the 1 watt critical position where a complete set of readings are required to be entered into the daily operations log. The operator had accidentally raised the Safety-3 about 20 units instead of the Regulating Blade for this power increase; in returning it to the normal 640 unit position he felt the response was sluggish and so he attempted to drop the blade from 640 units withdrawn to check it. Following clutch current release the blade stopped at the 310 unit position and was subsequently driven in with the other three blades to shut the reactor down. The Facility Director and then the Reactor Manager were notified immediately of this occurrence.

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It should be noted that the most recent blade drop times performed on June 21, 1985 showed a slightly increased drop time from the values determined in March following previous maintenance work. However, the blade was dropped four times with consistent and successful drop times on each check. In addition, several trips, both unscheduled and for training, showed proper S-3 drop response over the several months prior to this occurrence on September 3, 1985.

Immediate checks (with all other control blades fully inserted) involving subsequent removal to various heights showed this sticking problem to be intermittant and to center in the 290-315 unit range but with some possible sluggishness in the drop from other higher and lower heights. It should be noted that this is essentially a recurrence of the event reported by our facility in a letter dated January 28, 1985 with subsequent followup in an interim report dated February 9, 1985 and closed out in a report dated March 26, 1985.

As indicated to Mr. Frederickson on September 4, 1985 and again on September 16, 1985, the need to formulate plans, make various checks and, as entry into the core region is required, to let the core and structure cool for a period, prevents a final report on this occurrence at this time. However, Mr. Frederickson did advise the submission of an interim 14-day report and recommended including an update on the status of the problem. This update is provided in this report.

Evaluation

Evaluation and determination of the methods for alleviating this problem of a sticking control blade as well as preventing recurrence were discussed by the UFTR staff on September 4, 1985.

Essentially this event represents a recurrence of the previous sticking blade event so the staff reviewed and expanded upon those items considered at the January 31 staff meeting following the original S-3 problem where it was decided that potential blade drag points would include:

1. Inside gear boxes and/or bearings (previously identified as the cause of the January 28 problem),

2. Inside the blade shrouds perhaps due to failed rivets, buckling or warpage of the shroud or the control blade,

3. Shifted blade shaft/pedestal or bearing,

4. Shifted blade shaft/drive unit or bearing,

5. Mechanical drag of the blade shaft in its guide channel.

It was agreed that all of these possiblities should be investigated in a systematic program until the cause of the sticking blade is isolated, corrected and prevented from recurring.

The Executive Committee of the Reactor Safety Review Subcommittee (RSRS) was apprised of this occurrence on the day it happened and met to evaluate it on September 4, 1985. The decision was also made to put the UFTR on administrative shutdown with limitations noted in Attachments II and III. As indicated, they recommended reporting the event. The entire RSRS considered the event in more detail at its regular meeting on September 6, 1985. In both cases, the RSRS concluded in agreement with the facility administration that this potential abnormal occurrence did not compromise the health and safety of the public. The blade has always responded properly to drive in to allow reactor shutdown. Required shutdown margin has always been available.

The RSRS agrees that all the possibilities listed above should be investigated in a systematic program to assure the cause of the sticking blade is isolated, corrected and prevented for recurring.

Work Progress To Date

Following staff and RSRS evaluations, this sticking S-3 blade problem is being addressed in a series of planned maintenance/inspection checks beginning with the right angle gear box, drive motor, magnetic clutch, etc. external to the biological shield (designated ex-core meaning essentially environmental background radiation levels) and working in toward the core regions where relatively high radiation levels are expected. Each planned maintenance/inspection activity or series of activities is described in a procedure or instruction discussed by the UFTR staff and administration prior to performance. It is then being reviewed and approved by the Executive Committee of the RSRS consisting of the RSRS Chairman, the Radiation Control Officer and the Reactor Manager prior to the start of work.

As of this date, the following maintenance has been performed:

1. Right angle drive gear box inspection has been performed with all components found to be functioning properly.

2. Bearings in right angle drive unit were inspected and replaced since a small amount of rough operation was noted in one bearing. This roughness was not considered sufficient to be the source of the problem.

3. The shaft and connecting bearing were uncoupled from the blade drive unit and removed from the control blade. Both were inspected for scar marks with no significant problems noted.

4. The shaft penetration was cleaned - some oxidation and carbon products were removed but not considered sufficient to have been the cause of the problem.

5. The bearing and shaft were reinstalled and recoupled, the potentiometer was repositioned and blade drop and timing checks made.

6. Preliminary checks indicated the sticking problem is not cleared.

Conclusions To Date

The problem has been isolated to within the biological shielding in the vicinity of the core reflector; most likely causes are a problem with the bearings supporting the blade/shaft coupling or with the magnesium shroud housing-to-blade clearance either warpage, misalignment or loose rivets.

Consequences

As concluded by the RSRS Executive Committee, the full RSRS Committee and UFTR administration, this potential abnormal occurrence did not compromise the health and safety of the public. This occurrence was discovered at a low power condition. The Safety-3 blade drive system was always functional; and even with the S-3 blade at ~30-35% withdrawn, the UFTR core has a shutdown margin of ~3.7% $\Delta k/k$.

Followup

Since further work will involve considerable radiation dose commitment, the core and structure has been allowed to cool while the above checks and maintenance efforts were completed. A preliminary procedure to address the remaining in-core maintenance checks is nearly complete and will be presented to the RSRS Executive Committee for approval on September 18. Work to check and inspect for the possible in-core sources of the problem and to perform maintenance where necessary and approved is expected to begin later this week.

Commitment

The UFTR administration with concurrence of the RSRS is committed not only to clear the sticking blade problem but also to obtain a significant reduction in the S-3 drop time. This reduction is considered necessary to preclude recurrence of this event. In addition, the UFTR administration has committed to the RSRS to clear any restart with NRC Region II prior to removing the facility from the current administrative shutdown.

William G. Vernetson — 17 Sept 1985

William G. Vernetson — Date
Acting Director of Nuclear Facilities

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Attachments
cc: P.M. Whaley
Reactor Safety Review Subcommittee