

NUCLEAR ENGINEERING SCIENCES DEPARTMENT
Nuclear Reactor Facility
University of Florida



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March 31, 1989

Final 14 Day Report:
Failure to Post Part
of Restricted Area
As a Radiation Area

U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, N.W.
Suite 2900
Atlanta, Georgia 30323

Attention: Malcolm L. Ernst
Acting 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)(g) of the UFTR Technical Specifications, a description of a potential violation of NRC regulations is described in this 14-day report to include NRC notification, occurrence scenario, evaluation of consequences, corrective action and current status. The potential promptly reportable occurrence involved the failure to post part of a restricted-type area as a radiation area.

NRC Notification

The Executive Committee of the Reactor Safety Review Subcommittee (RSRS) reviewed this occurrence on March 20, 1989 and concluded that it is a potential license violation as defined in UFTR Technical Specifications, Section 6.6.2, and requires a special report per UFTR Technical Specifications, Section 6.6.2(3)(g). The RSRS Executive Committee also concurred with management evaluation of the occurrence. 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 to NRC Region II on March 21, 1989 after initial attempts at telephone communications were unsuccessful on March 20, 1989, due to problems with the Region II telephone system.

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Initial Event Scenario

As a result of a routine NRC inspection on February 27-March 3, 1989 in the area of radiation safety and control, a commitment was made by UFTR management to post the area of the vertical experimental ports because of the relatively high streaming radiation level (close to being a high radiation area) present at the vertical ports during full power operation. This streaming field was well known to the UFTR operations staff and the small area was avoided during reactor operations. Nevertheless, the NRC inspector recommended posting (completed prior to the inspector's departure on March 2) and better surveys of the facility in the future.

As a follow-up to this inspection, it was decided to perform detailed radiation surveys in the cell and upgrade the posting of any existing hot areas or hot spots to assure the adequacy of existing surveys. Various localized areas around the reactor cell, especially on the sides away from the control room, are known to have 5-30 mR/hr radiation fields associated with them. The existence of such levels is known which is why most visitor groups do not tour out into the reactor cell area for extended periods of time when the reactor is at full power or even in the power range. Several of the hotter areas were posted prior to the inspector's visit. At any power level below 10-20 kw, most of these radiation levels become insignificant, even for long term visits to the cell.

This follow-up detailed survey was begun on March 17, 1989 as a concurrent activity with an irradiation begun at 1038 hrs. During the survey performed by P.M. Whaley after some time at full power, a streaming collimated beam about 1-inch across was discovered to be coming through the rabbit system shield on the west side of the reactor. Though a thin beam, the radiation level was noted to be approximately 45 mR/hr at the face of the rabbit shield using the 740F-2418 Ionization Chamber (a true gamma dose indicator). Since the cell is posted as a radiation area and this entire back area of the cell is avoided at power for visitors other than those classified as radiation workers, this level is not, in itself, thought to be a violation. After review of the records, it has been concluded that this situation had probably existed since the new shielding arrangement was installed on January 20, 1987 to provide a better, less leaking shield for the rabbit system where it penetrates the west face of the reactor structure. Upon discovery of the higher than expected radiation level at the west face, the level at the door inside the cell was surveyed to be about 18 mR/hr., also in a thin though spreading beam. Immediately upon determining this level at the inside of the door, additional portable shielding was placed in front of the beam to eliminate the collimated beam. As a follow up, the ionization chamber was also used to survey in the west reactor lot looking for the collimated beam emanating from the rabbit system shield. A small spot on the outside of the door (not allowed, by technical specifications, to be used for entry/exit during reactor operations at any power level) registered about 14.5 mR/hr with values in the 4-8 mR/hr range at the door inside a 9-12 inch circle. With distance from the door, measurements with the ionization chamber showed radiation levels dropped off rapidly so the level at 45 inches on the direct beam were down to about 0.5 mR/hr.

With the portable shielding removed and the area properly posted, a detailed survey at the back reactor cell door showed that the area in the back lot at which the radiation level is at or above 0.5 mR/hr extends to about 45 inches from the door and is roughly cone-shaped at about 4-feet above ground level. The cone is about 10 inches wide at the door and not much different at the outer edge.

Corrective Action - Prompt

Immediately upon discovery of this streaming (collimated beam) field emanating from the rabbit system shield, an extra piece of portable shielding was placed at the west rabbit shield face to eliminate the collimated beam and reduce radiation levels in the area of the end of the rabbit shield below 5 mR/hr and eliminate levels that would require posting outside the back door. Although temporary, the addition of sufficient shielding to provide permanent corrective action for this collimated beam was expected to be a relatively simple matter. In addition, a sign was posted to prevent anyone from removing the extra shielding.

A permanent though still portable arrangement of shielding was installed at the west side of the rabbit shield on March 23, 1989. Again an official notice has been posted warning that the extra shielding is not to be removed without checking with the Facility Director. Removal of the shielding will also necessitate a new radiation survey of the area involved. A complete detailed survey of the entire west side of the reactor room to include the entire equipment door area was completed on March 23, 1989 showing resolution of the occurrence with all levels external to the cell at the door surface below 2 mR/hr at full power and dropping rapidly with distance from the wall to below 0.1 mR/hr.

Corrective Action - Follow-up

Analysis indicates the root cause of this occurrence is an inadequate survey performed on the new rabbit system shield on January 20, 1987. This inadequacy was probably abetted by the expectation that a single-piece monolithic shield should be better than a multipiece pile of shield pieces as had been used previously. What was not accounted for was the reduction in effective shielding thickness along the direct path of the rabbit exit line from the west side of the UFTR.

In addition, it is felt that quarterly radiation surveys of the restricted areas were not designed to locate such collimated beams. This quarterly survey has been used more to assure unchanging conditions versus finding hot spots which are expected to be taken care of by surveys performed at the time when shielding is changed as required by UFTR SOP-E.1, "Alterations to Reactor Shielding and Graphite Configurations." Therefore, as committed to the NRC Inspector and to the UFTR Safety Review Subcommittee Executive Committee on March 20 and to the full RSRS at its meeting on March 21, 1989, the Radiation Control Technique used to conduct quarterly radiation surveys is under revision to assure that adequate surveys are conducted, both to assure conditions are not changing and to assure the location, identification, mitigation and/or posting of radiation areas and hazards as necessary. Finally, all UFTR-associated personnel are receiving oral instructions

in the proper performance of radiation surveys; in addition, a formal class with a practical exercise will be conducted in this area using the new radiation control technique as a basis prior to performance of the next quarterly radiation survey due in April, 1989 with a one month delay allowed to May, 1989 per UFTR Technical Specifications.

Consequences

Since the west reactor lot is a semi-restricted access area, the occurrence basically involves a failure to post a small area that would properly be labeled a "Radiation Area." The lot itself is locked most of the time, required so after normal work hours. Those using the lot for parking do not, because of the location, use the area where the radiation area was located. Since this area is in a location that is not normally accessed by those using the back lot and since anyone standing there would have to do so in a small area for an extended period to receive even a measurable dose to the whole body, the consequences of this failure to post the area outside the door are considered to be negligible. In addition, the area that would have been classified a "Radiation Area," has a slope away from the building for control of water runoff making it even less likely anyone would have spent considerable time in the area. The area is not one where cars are parked due to several concrete abutments left over from an old cooling tower plus about a 6 inch drop from the concrete and to the dirt/gravel surface of the lot. Visitors to the facility would also never have occasion to be in this area. Service personnel using the lot typically are involved with the Nuclear Sciences Center building power room or the diesel generator room, both at the far end of the lot. Whenever those personnel have work assignments involving the UFTR, they clock in with the reactor staff for guidance and/or clearances. Therefore, it is very unlikely for anyone to have received a significant or even measurable dose from this location.

This occurrence is nevertheless considered reportable as a failure to post adequate notices due to failure to conduct adequate surveys of the rabbit system shielding. Mitigating conditions for the occurrence would be the fact that we did discover it and correct the problem, that the area involved that would have required posting is small, uncomfortable to stand in and sees little activity as it is in a part of the larger restricted-type fenced west reactor lot. Since additional portable shielding was moved into place immediately and a "permanent" portable shield was installed within a few days prior to further power running, this occurrence is not considered to have affected the health and safety of personnel or the safe operation of the UFTR.

Further mitigating circumstances from the point of view of assessing possible doses would be that the UFTR, over the last 2-1/2 reporting years from January, 1987 through February, 1989, has had a total energy generation of only 63.536 megawatt-hours with only 598.976 hours at full power over the 30 months which averages to less than 5 hours per week at full power. This means the small radiation area also only existed for about 5 hours per week on average.

