UNIVERSITY OF CALIFORNIA, IRVINE

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

Dr. George E. Miller
Senior Lecturer Emeritus, *Department of Chemistry*
Supervisor: UCI Nuclear Reactor Facility
Faculty Advisor: Science Education Programs,
UCI Center for Educational Partnerships

IRVINE, CA 92697-2025
(949) 824-6649
FAX: (949) 824-6082 or (949) 824-8571
e-mail: GEMILLER@uci.edu
Home (Tel AND FAX): (949) 854-1525
WEB: http://www.chem.uci.edu/research/faculty/gemiller.html

U.S. Nuclear Regulatory Commission,
Document Control Desk,
Division of Reactor Licensing,
Washington, D.C.20555

March 26, 2002

50-326

Docket: ~~55-326~~

Licensee Report of Abnormal Occurrence
Ref: Technical Specifications 1.13.c, and 6.7.b.3.

Gentlemen:

This is a written follow-up to an e-mail report made 3/18/2002 to the NRC Headquarters office addressed to Marvin Mendonca, by the undersigned. That report is essentially included within this communication.

On Thursday, March 14th 2002, the operator noticed that there appeared to be a sluggish SCRAM response by the Fast Transient Control Rod (FTR) on shutting down the reactor. Further trials over the weekend on March 16-17th indicated that the rod drop time was very variable, including the possibility of not dropping within several minutes. During these tests, no other rods were raised so the reactor has remained fully shut down since the discovery. Since the scram potential for this rod could be considered an "engineered safety feature" its failure to scram promptly has been declared an "abnormal occurrence" and was reported in accordance with Tech Specs section 1.13.c. and 6.7.b.3. However as noted below this failure does not constitute any threat whatsoever to the safety of the reactor system or its control.

The total worth of this rod in the current core configuration was $0.66, whereas the total worth of remaining rods is $8.24. Core excess at this time is $2.73. Thus the reactor control systems meet all requirements for reactor shutdown and control without the use of this rod (which was designed only to add pulsing capability to the reactor). Thus there is NO safety significance for the reactor as a whole as a result of this failure. The reactor would remain fully compliant with or without this control element inserted.

IE22

Subsequently, about one week later to allow for rod decay, the complete rod assembly was removed for inspection. The deceleration adjustment provided for this system has a water pressure damper unit a few feet above the core. This unit consists of a small plastic piston, riding on a 1/4th inch steel rod, pulled upwards into an aluminum cylinder. The displaced water is forced out through a series of adjustable holes. This plastic piston had split, along the line of the set screw hole, allowing the set screw holding it in place to rotate through 90 degrees, forcing the plastic apart somewhat. This created an expanded diameter and was thus binding in the cylinder. The piston-cylinder contact is made only during the last few inches of travel, so that the rod drive jammed close to the upper limit of travel.

A new plastic piston, of polyethylene, was manufactured to original specifications, installed, the rod reinserted into core and the rod tested. Drop time performance was restored and perhaps very slightly faster than in February 2002 when last determined. The rod worth was redetermined and found to be $0.70, an increase of $0.04 which might indicate that the rod was not quite traveling to its full up position in February when last determined. However, this determination is probably the same within experimental error in the measurement.

Safety Concerns: In spite of the fact that this must be reported as an abnormal occurrence by the terms of our technical specifications, there is really no safety concern whatsoever as a result of malfunction of this rod. While it is used, for convenience, as a "safety rod", it was not included in the core design for safety, but entirely for experimental use reasons (to aid in creating larger pulses). The rod worth $0.65, less than 10% of the total rod worth at this facility. Since we maintain large shutdown margins (in excess of $6.00 with all rods inserted) well in excess of legal limits, whether or not this rod is operational, or even present, is not significant. This is the only rod with this piston feature at this facility.

Fortunately our history of recent operation had been quite light, so that the rod was only some 50 mr/hr at the surface (maximum) on removal from core. The section holding the piston is sufficiently above the core, that no detectable radiation above background was associated with the piston itself nor the structure at the place where it had to be replaced. Thus exposure to facility personnel handling the repair was minimal.

History:
In 1983, a problem was reported with the FTR that was attributed to dirt in the air supply system. This is not relevant to this issue (though a full inspection has been made of that portion of the system), because the piston/cylinder is water related and no air is involved at this part of the FTR system. During routine annual inspection, in 1988 it had been noted in the logbook that the piston (described as "teflon" by the writer, but in fact made of polyethylene) showed slight evidence of small superficial chipping, but no cracks were seen. This was not perceived to affect performance at that time. In 1989 when a similar event to

that reported here occurred, the color of the plastic and its hardness had changed since installation in 1969: an age of 20 years having that effect on polyethylene. A new piston was procured and installed in December 1989. This time, after a 12.3 year period (to March 2002), the plastic looked as new, the only defect being the split along the line of the set screw. The set screw is needed to prevent the piston rotating and unscrewing from its mount.

Future Plans.

The minimal safety significance and long time to failure of this part suggests that no drastic action is needed. The current inspection cycle is 5 years, so that careful note should be made in subsequent inspections, with a plan to replace every 10 years as a precaution against failure. It is postulated that a 11-20 year life cycle is normal for this component.

Up to this time, the rod has always been used as an additional "safety rod" during all steady state operations and fully tested as part of daily start-up checks. Consideration will be given to specifying that the use of the FTR, in its current core configuration, is not necessary as a "safety rod" for this reactor. In this case it need not be "fired" and tested on a daily basis, which would drastically extend the lifetime of this component. The rod would then only be used (and tested prior to such use) for its intended purpose – to enhance the size of pulses fired at this reactor. It is unclear whether this would even require a change in the technical specifications and this will be discussed at a future date with NRC personnel. Until further notice, no change will be made in the operating procedures in relation to the FTR.

Sincerely,

George E. Miller
Reactor Supervisor

cc: Reactor Operations Committee members
General Atomic, Inc.,
attention Junaid Razvi, P.O.Box 85608, San Diego, CA 92138-5608