TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE
37401

TVA 40TH ANNIVERSARY OF PEOPLE IN PARTNERSHIP

July 9, 1973

Mr. F. E. Kruesi, Director
Directorate of Regulatory Operations
U.S. Atomic Energy Commission
Washington, DC 20545

Dear Mr. Kruesi:

On May 3, 1973, TVA made initial report to AEC-DRO Inspector W. S. Little of the failure of a channel A Traveling Incore Probe (TIP) cable and detector at Browns Ferry Nuclear Plant unit 1. On June 1 we submitted an interim report on the failure. In accordance with paragraph 50.55(e) of 10 CFR 50, we submit the enclosed final report of the failure.

Very truly yours,

J. E. Gilleland
Assistant to the Manager of Power

Enclosure
CC (Enclosure):
Mr. Norman C. Moseley, Director
Directorate of Regulatory Operations
U.S. Atomic Energy Commission
Region II - Suite 818
230 Peachtree Street, NW.
Atlanta, Georgia 30303

Printed 50-259 7/26/76

3 0594

ENCLOSURE

CHANNEL A TIP SYSTEM FAILURE

It is believed that operation of channels A and B of the TIP system initiated from the Unit 1 control room during the time the containment was pressurized to 49 psig. At the time, General Electric test No. 14 for integrated leakage rate was in progress. The TIP probes were withdrawn past their shield limit switch without deactivating their limit switches. The channel A probe was pulled out of its shield and drive tube. The probe became entangled in its drive mechanism where the drive gear probably severed the cable. The channel B probe was pulled through its shield, but remained in its drive tube. The limit switches were prevented from performing their normal function by the pressure holding the limit switch plungers against their actuator buttons. Thus, the limit switches were incapable of performing in a normal manner because of the particular design details discussed below.

The system design is such that a ball valve in the guide tube to the drywell must be open for the drive mechanism outside the drywell to insert the TIP probe. An indexing mechanism inside the drywell directs the probe to the desired TIP tube that penetrates into the core region. Two relief valves are provided in the indexing mechanism. One relieves the nitrogen purge and blanket gas to the containment that is supplied to the drive tube. The second equalizes pressure between the indexing mechanism and the containment whenever the containment pressure is 2 psig higher than that inside the indexing mechanism.

Instrumentation in the TIP system is provided so that when the pressure is greater than 2 psig inside the containment, any inserted TIP probe is automatically signaled to be withdrawn. The limit switch in the shield should stop the withdrawal of the probe within the shield and signal the ball valve to close. In case of any malfunction, a shear valve, which the operator can initiate in the control room, is provided as a backup to the ball valve. The operator in the control room has position lights that tell him if the ball valves remain open after they should be closed. Also, two area radiation detectors, which are located near the drive mechanism, will annunciate in the control room upon high radiation to alert the operator to activate the backup shear valves.

The present limit switch has a spring-loaded plunger that releases the button whenever the probe is withdrawn. The plunger has a roller that makes contact with the detector and drive cable. Guidance for the plunger is provided by a close fitting nonvented cylinder that communicates directly with the drive tube. Thus, only a small leakage path is available to equalize pressure along the plunger, thereby making the limit switch susceptible to pressure actuation.

Operation of channels A and B of the TIP system during the containment leakage rate test permitted the 49 psig to permeate the entire drive systems through the indexing mechanism relief valves. The instrumentation initiated an automatic withdrawal of the probes, but the limit switches did not terminate the withdrawal and valve closure sequence properly.

In order to correct the design deficiency of the limit switch, a temporary solution of milling slots in the plunger to provide pressure equalization has already been made and tested satisfactorily for Unit 1. As a permanent solution, a proximity-type limit switch will be installed as soon as it is available at the site. Units 2 and 3 will have the proximity switches installed before fuel loading occurs.

The system design and instrumentation logic were developed to protect the health and safety of the public in case an accident occurred while the TIP

system was in use. Due to the pressure sensitivity of the limit switch, a very small path would have existed for containment leakage through the guide tube. However, had the leakage contained radioactivity, two area radiation detectors located near the drive mechanism would have annunciated in the control room and the operator would have operated the shear valves to cut the guide tube. A more careful review of designs will be emphasized to assure similar problems do not occur in the future.