COLLEGE OF ENGINEERING TEXAS A&M UNIVERSITY
TEXAS ENGINEERING EXPERIMENT STATION
TEXAS TRANSPORTATION INSTITUTE
TEXAS ENGINEERING EXTENSION SERVICE

ENGINEERING PROGRAM • THE TEXAS A&M UNIVERSITY SYSTEM

301 Engineering Research Center • Texas A&M University • College Station, Texas 77843-3126 • (409) 845-1321

8 February 1991

Mr. A. Bill Beach, Director
Division of Radiation Safety and Safeguards
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Dear Mr. Beach:

I am forwarding the final report of the reportable occurrence of 25 January 1991. This report is being submitted in accordance with the reporting requirements of Technical Specification 6.6.2 for License R-83, Texas Engineering Experiment Station/Texas A&M University System.

Respectfully,

KRHall

Kenneth R. Hall, Deputy Director
Texas Engineering Experiment Station

Enclosure

cc: D. E. Feltz, Director, Nuclear Science Center
F. Jennings, Chairman, Reactor Safety Board
K. L. Peddicord, Assistant Director, Texas Eng. Exp. Station
J. A. Reuscher, Director, Nuclear Research Reactor Programs, NSC
S. H. Weiss, USNRC, Washington, D.C.
B. Ernst, American Nuclear Insurers

IE91-359

IE 22

Final Report
Reportable Occurrence #91-01
Abnormal Degradation in Reactor Fuel
as Specified in Technical Specification 1.29e and 4.2.4d(1)

Description

In reference to fuel performance of the Texas Engineering Experiment Station/Texas A&M University System, Nuclear Science Center Reactor (NSCR), Technical Specification 4.2.4.a specifies that at least one-fifth of the fuel elements used in operation of the reactor over the previous inspection year shall be inpsected visually for damage or deterioration and measured for length and bend annually, not to exceed 15 months. Also, at least four fuel elements which occupy the highest pulse temperature positions in the core shall be inspected. These elements may be included in the one-fifth total of elements selected and scheduled for inspection.

On 25 January 1991 during performance of the annual fuel inspection of operational Core VIII-A (see attached), fuel element No. 6502 located in C-7, SE failed to pass the go-no-go gauge test for excessive transverse bend as specified in Technical Specification 4.2.4.d(1). This specification requires that the element be removed from service if the measured transverse bend exceeds 0.125 inches over the length of the cladding. There is also a requirement under Technical Specification 4.2.4.b that if any element is found to be out of tolerance, the entire core will be inspected.

Element No. 6502 showed no apparent visible damage to the fuel cladding and there was no fission product leakage detected in daily pool water samples. The element was removed from service and replaced with a spare fuel element.

Results of Inspection of All Fuel Elements in Use

A total of 97 FLIP fuel elements were inspected consisting of 90 elements from the reactor core and seven elements used in rotation or exchange. All fuel elements in use requiring inspection are FLIP TRIGA elements. During the fuel inspection, a second fuel element No. 8468 located in E-3, NW failed to pass the go-no-go gauge test for excessive transverse bend. This element also showed no apparent visible damage to the fuel cladding and, as earlier stated, there was no detected fission product leakage. Element No. 8468 was also removed from service and replaced with a spare fuel element.

Operating History of Bowed Fuel Elements No. 6502 and No. 8468

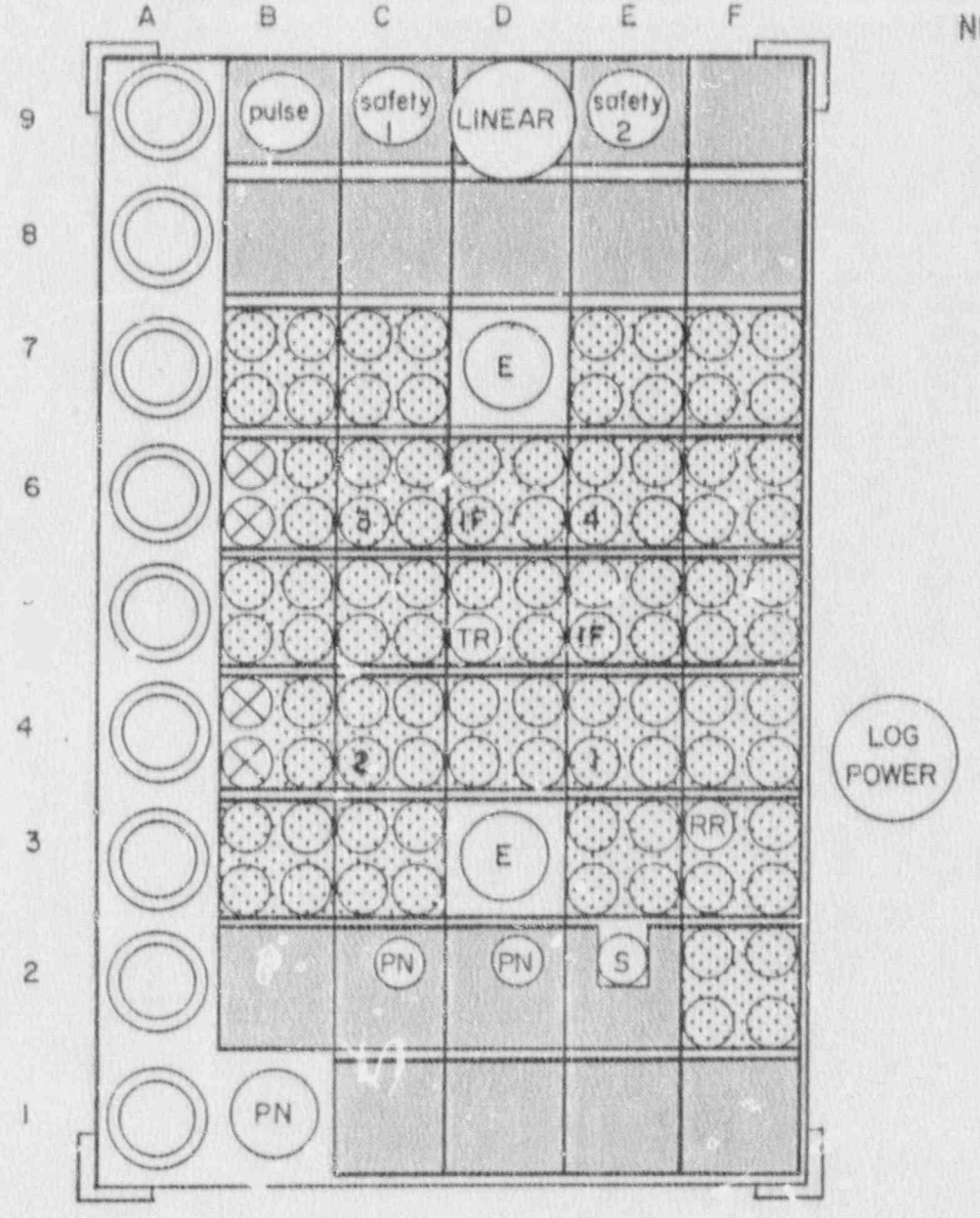
Element No.	Date of First Use	Date Removed From Service	Total Core Operation Mw Days	Initial Mass ^{235}U	Present Mass ^{235}U	$ Pulse Reactivity
6502	10/1/79	1/25/91	1007.7	122.28	105.89	829.4
8468	1/7/77	1/25/91	1224.1	121.16	101.10	829.4

Knowledge of and Actions Taken by Owner/Operators of TRIGA Fuels to Reduce the Excessive Bowing of Elements

The explanation for the bowing of Uranium-Zirconium-Hydride fuel elements is explained in detail in the General Atomics document GA-A16613, "Interpretation of Damage to the FLIP Fuel During Operation of the Nuclear Science Center Reactor at Texas A&M University", by M. T. Simnad, G. B. West, J. D. Randall, W. J. Richards, and D. Stahl, December 1981. Also, an explanation and evaluation of TRIGA fuel damage by the USNRC staff is provided in NUREG-0947, "Safety Evaluation Report Related to Renewal of the Operating License for the Texas A&M University Research Reactor", March 1983.

The excessive bowing of both Standard TRIGA and FLIP TRIGA fuels has been experienced in other operating reactors. Oregon State University, for example, observed the excessive bowing in two FLIP TRIGA elements in 1987 and one FLIP TRIGA element in 1989. These elements were removed from service. General Atomics in the past ten years also identified several elements with excessive transverse bend that required their removal from service. General Atomics periodically rotates individual fuel elements in 180° increments to help reduce excessive bowing. This procedure cannot be used in the NSCR due to a difference in element design. The NSCR fuel elements have threaded bottom ends that screw into base adapters for four rod and three rod bundles. Rotation of the element would loosen the fuel element in the bundle base adapter. This is not permitted. In comparison, the TRIGA fuel elements used by General Atomics have smooth bottom ends that can be easily rotated in the core grid plate.

- Following recent discussions with General Atomics representatives, it was concluded that the immediate action one could take to hopefully reduce or prevent excessive transverse bending would be to periodically relocate fuel bundles within the core or to relocate single elements within fuel bundles. This can be conveniently done during the annual inspections of fuel. This action was initiated in the reloading of Core VIII-A and the reestablishment of an operational core. The reloading of Core VIII-A was completed on 1 February 1991.



(I) SHIM SAFETY ROD WITH FUELED FOLLOWER

(RR) REGULATING ROD WITH H_2O FOLLOWER

(IF) INSTRUMENTED FUEL

(S) Sb-Be NEUTRON SOURCE

(E) EXPERIMENTER NOTCH

FLIP FUEL

GRAPHITE REFLECTOR

(PN) PNEUMATIC TUBE

WATER FILLED ELEMENT

CORE VIII-A 90 FLIP ELEMENTS