(7-77)

Unit 2

LICENSEE EVENT REPORT

CONTROL BLOCK: | | | | | | | (1) (PLEASE PRINT OR TYPE ALL REQUIRED INFORMATION)

0 1 | T N S N P 2 (2) 0 0 - 0 0 0 0 0 - 0 0 (3) 4 1 1 1 1 (4) | | (5)
LICENSEE CODE — LICENSE NUMBER — LICENSE TYPE — CAT

CON'T 0 1 REPORT SOURCE L (6) 0 5 0 0 0 3 2 8 (7) 1 2 2 1 8 1 (8) 0 1 0 4 8 2 (9)
DOCKET NUMBER — EVENT DATE — REPORT DATE

EVENT DESCRIPTION AND PROBABLE CONSEQUENCES (10)

0 2 Unit 2 in Mode 2, 0% power, RCS temperature and pressure at 547 degrees F and
0 3 2235 psig. During unit startup, control rod withdrawal limits established in
0 4 accordance with the action statement associated with limiting condition for operation
0 5 3.1.1.3 were exceeded. There was no effect upon public health or safety. Previous
0 6 occurrences - none.
0 7
0 8

0 9 SYSTEM CODE	R B (11)
CAUSE CODE	A (12)
CAUSE SUBCODE	X (13)
COMPONENT CODE	Z Z Z Z Z Z (14)
COMP. SUBCODE	Z (15)
VALVE SUBCODE	Z (16)

(17) LER/RO REPORT NUMBER

EVENT YEAR		SEQUENTIAL REPORT NO.		OCCURRENCE CODE	REPORT TYPE		REVISION NO.
8 1	—	1 5 2	/	0 1	T	—	0

ACTION TAKEN	FUTURE ACTION	EFFECT ON PLANT	SHUTDOWN METHOD	HOURS (22)	ATTACHMENT SUBMITTED	NPRD-4 FORM SUB.	PRIME COMP. SUPPLIER	COMPONENT MANUFACTURER
X (18)	G (19)	Z (20)	Z (21)	0 0 0 0	Y (23)	N (24)	Z (25)	Z 9 9 9

CAUSE DESCRIPTION AND CORRECTIVE ACTIONS (27)

1 0 The control rod limitations were not in the appropriate startup procedures, causing
1 1 operations and engineering personnel to inadvertently omit these limitations during Unit
1 2 2 startup. Boron concentration and control rod positions were reestablished within oper-
1 3 ating limits within one hour after discovery. The withdrawal limits will be added to
1 4 appropriate procedures until reliance on the action statement is no longer necessary.

1 5 FACILITY STATUS C (28) % POWER 0 0 0 (29) OTHER STATUS (30) NA — METHOD OF DISCOVERY A (31) DISCOVERY DESCRIPTION (32) Operator observation

1 6 ACTIVITY RELEASED Z (33) CONTENT OF RELEASE Z (34) AMOUNT OF ACTIVITY (35) NA — LOCATION OF RELEASE (36) NA

PERSONNEL EXPOSURES

1 7 NUMBER 0 0 0 (37) TYPE Z (38) DESCRIPTION (39) NA

PERSONNEL INJURIES

1 8 NUMBER 0 0 0 (40) DESCRIPTION (41) NA

LOSS OF OR DAMAGE TO FACILITY (43)

1 9 TYPE Z (42) DESCRIPTION NA

8201130046 820104
PDR ADOCK 05000328
S PDR

PUBLICITY

2 0 ISSUED N (44) DESCRIPTION (45) NA — NRC USE ONLY

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ANALYSIS AND EVALUATION OF THE

DECEMBER 21, 1981

IN WHICH THE CONTROL ROD WITHDRAWAL LIMITS

WERE EXCEEDED

PREPARED BY THE INVESTIGATING COMMITTEE CONSISTING OF:

SEQUOYAH NUCLEAR PLANT

Mike Harding, Supervisor, Compliance Staff
A. M. Carver, Compliance Section
R. L. Hamilton, Supervisor, Quality Assurance Staff
Ron Fortenberry, Supervisor, Nuclear Engineering

Report Desctiption

TVA has concluded a management and technical evaluation of the event discovered on December 22, 1981, involving operation of the Sequoyah Unit 2 reactor outside of the currently established control rod withdrawal limits. This report describes the sequence of events, the causes and contributing factors, and the actions taken to preclude recurrence of similar events. The information and conclusions were obtained through discussions with the shift operations and engineering personnel involved in the event, the reactor engineer, and reviews of appropriate shift logs and records. All times are Central Standard Time.

Event Description

During unit startup with the reactor in Mode 2, RCS temperature at 547 degrees F and RCS pressure at 2235 psig, the control rod withdrawal limits established during low power physics testing to insure a negative moderator temperature coefficient were exceeded.

Sequence of Events

11/06/81 - During the performance of Startup Test SU-7.3.1, "Nuclear Design Checklist: Boron Endpoint Determination and Isothermal Temperature Coefficient Measurement," it was determined that the Sequoyah Unit 2 reactor had a positive moderator temperature coefficient at the all rods out configuration.

This test was performed to comply with Technical Specification surveillance requirement 4.1.1.3.a.

11/06/81 through 11/10/81 - Startup Test SU-7.3.1 was again performed with control rod bank D fully inserted and with control rod banks C and D fully inserted. With this measured data and the design data, the temporary rod withdrawal limit curves were determined per Technical Specification 3.1.1.3 action a.1. It was also determined at this time that these limitations would only be in effect until a burn up of 1000 MWD/MTU had been achieved. At this conservative burnup value, the moderator temperature coefficient (MTC) was predicted to be negative. Due to the fact that these control rod withdrawal limits would only be in effect for a short period of time (1000 MWD/MTU burnup), it was decided not to revise the General Operating Instructions. The withdrawal limit curve was placed in Technical Instruction 28 and distributed to all appropriate shift operating and engineering personnel. Through this mechanism all appropriate personnel were made aware of these limitations. (During Unit 1 startup a positive MTC had been calculated and the withdrawal limits were handled in the same way. No problems were encountered.)

11/13/81 - Special Report 81-8 was sent to Mr. James P. O'Reilly on November 13, 1981, in accordance with the technical specification limiting condition for operation 3.1.1.3 action a.3.

11/13/81 through 12/20/81 - The Unit 2 generator exciter had to be disassembled for repair causing considerable delay between the completion of the low power physics testing and ascension to power. The unit was maintained in Modes 4 and 5 during this five and one half week period.

12/21/81 - Following the return to service of the generator exciter, preparations were made for Unit 2 startup. This was the first normal startup following the low power physics testing. As required by General Operating Instruction (GOI) 2, the estimated critical condition was calculated. This calculation was performed by the shift technical advisor (STA) using detailed instructions contained in Technical Instruction (TI) 21. Because the control rod withdrawal limits were not identified in GOI-2 or Surveillance Instruction (SI) 38, "Shutdown Margin Calculation", and due to the long period of inactivity on Unit 2, the STA failed to consider these limitation in his calculations. The estimated critical condition calculated by the STA was performed assuming a constant boron concentration of 1262 ppm. A bank D rod position of 87 steps was then calculated and given to the reactor operator.

The reactor operators rely on the STA to perform this calculation and therefore did not verify the calculation prior to pulling rods. The reactor operators were aware that upon entering Mode 2, the action statement in Technical Specification 3.1.1.3 would be reentered. However, when the estimated critical condition calculation was received from the STA they did not think to compare the calculated rod position with the rod limitation curves that had been distributed previously.

The reactor operators began to pull control rods and at 1857 hours the reactor went critical at 125 steps on control bank D. The shift changeover occurred at approximately 2200 hours.

12/22/81 - At approximately 0330 hours the reactor operator compared the current rod position against the rod withdrawal limitation curve and discovered that the rods were withdrawn beyond the limits. The operator took immediate steps to dilute the boron concentration in order to reestablish control rod positions within the operating limits.

At approximately 0600 hours shift turnover occurred and the oncoming shift was made aware of the incident and subsequent actions which had been taken. The oncoming shift verified that the rods were within the withdrawal limits and the Shift Engineer directed that an additional dilution be performed for conservatism. The shift began considering reportability requirements but did not begin preparation of the potential reportable occurrence form until later in the shift. At approximately 1400 hours this event was determined to be reportable under Technical Specification 6.9.1.12.b. The NRC was notified by telephone at approximately 1500 hours and by telecopy at approximately 1600 hours.

12/23/81 - A management and technical investigation of the event was initiated which has culminated in this report.

The control rod withdrawal limit curves submitted in Special Report 81-8 and in use at the plant are based on measured MTC values and are adjusted by 1.0 pcm per degree F for conservatism. The attached graph shows the design and measured MTC and verifies that the moderator temperature coefficient never exceeded a negative value.

The labeled design curve showing the control rod banks D and C configurations were taken from our Technical Instruction (TI) 42, Figure 1 (reference Westinghouse WCAP 9516). The all rods out (ARO) curve was constructed from design data and ARO measured data. An operating curve at any boron concentration at which criticality occurs has been drawn by connecting three known points. At the time of criticality on 12/21/81, the boron concentration was measured to be 1262 ppm. This point corresponds to a moderator temperature coefficient value on the curve of approximately -.7 pcm per degree F. This point is labeled "Operating Value At Criticality".

Evaluations and Conclusions

I. Based on the investigation and information described above, it has been determined that the primary cause of this event was the failure to incorporate the rod withdrawal limitations into the appropriate operating procedures and surveillance instructions. This omission resulted in the STA performing the estimated critical point calculation without consideration of the rod withdrawal limits. Additional contributing factors include:

1. The five and one half week period of inactivity between low power physics testing (when the positive MTC was discovered) and normal unit startup.

2. Routine startups on Unit 1 are accomplished by pulling rods to maintain operations within acceptable axial flux difference values per Technical Specification 3.2.1.

The above factors contributed to the engineering and operations personnel failure to consider the control rod withdrawal limitations when performing the estimated critical condition calculation and subsequent rod withdrawal to critical.

II. Based on the interviews with operating personnel and the fact that an operator discovered the situation and took appropriate corrective action, it is concluded that no additional training is required on rod withdrawal limits.

III. Based on subsequent calculations it is concluded that the reactor was not operated with a positive moderator temperature coefficient.

IV. Based on the evaluations performed, instructions GOI-2, GOI-5 and SI-38 have been revised. Additionally all startup tests should be reviewed to assure that all relevant findings derived from the startup program are factored into operating instructions.

Corrective Actions

1. The RCS boron concentration was immediately diluted in order to reestablish the appropriate control rod withdrawal limitations.

2. The NRC was notified per telephone and telecopy within required time limitations.

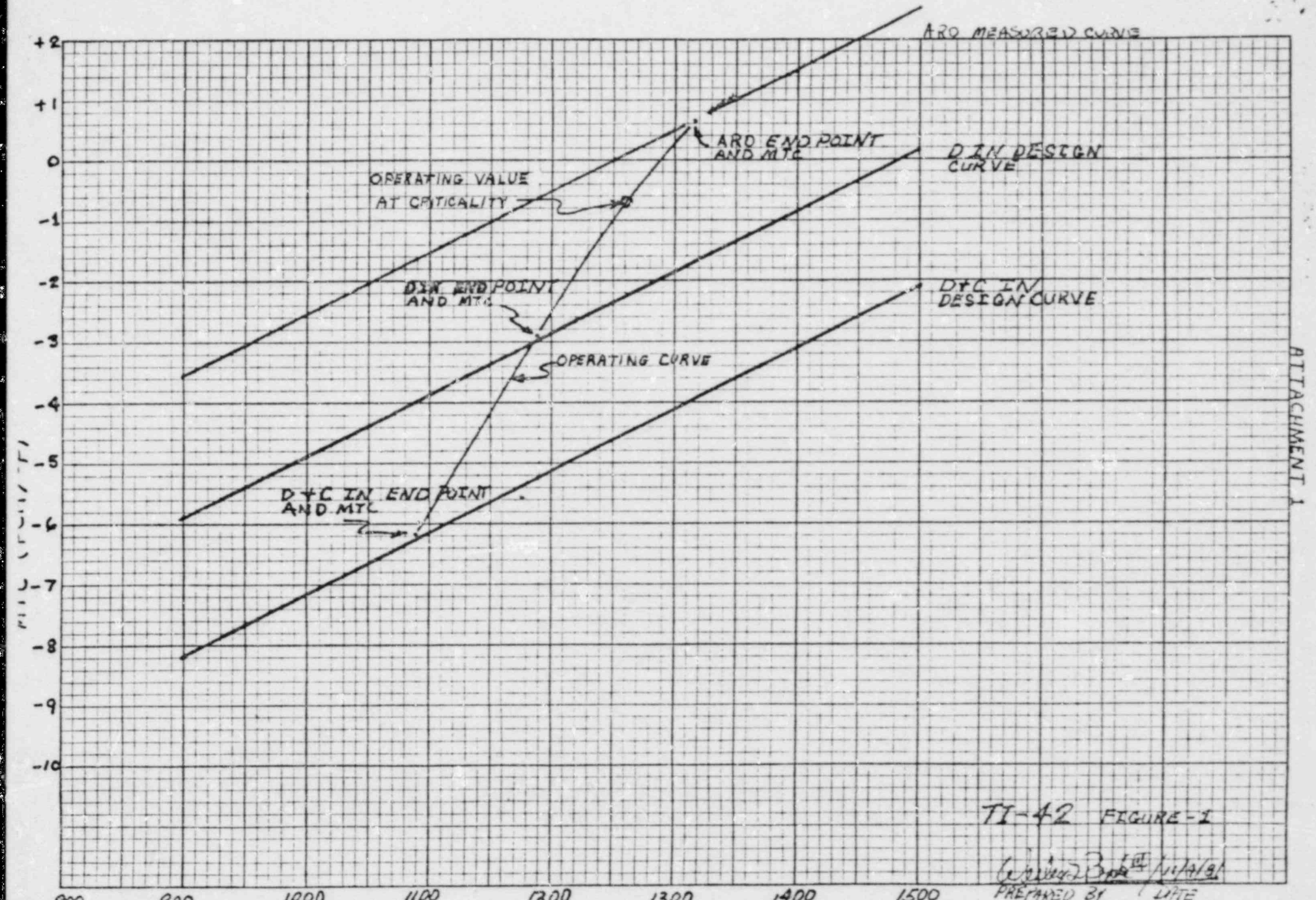
3. An investigation team was established by the plant superintendent to evaluate the occurrence and make appropriate recommendations.

4. GOI-2, GOI-5 and SI-38 were revised by 12/24/81 to incorporate appropriate precautions to assure that rod withdrawal limitations are not violated again.

5. All startup test instructions will be reviewed and revised as appropriate to assure that all predefined test results are adequately factored into plant instructions. This review will be completed by 12/30/81 and plant instructions will be revised, as necessary. Any unexpected findings will be handled as test deficiencies which receive PORC review of the final disposition. This review process is described in SQA-44 and should result in any appropriate findings being incorporated into operating instructions.

   In addition, steps will be taken to ensure that operating shift personnel are expeditiously informed of, and receive formal training in, the resulting procedural changes.

6. The operations supervisor will issue a memorandum to all appropriate operations personnel including STAs to ensure that they are aware of this occurrence and the rod withdrawal limitations.



ATTACHMENT 1

TI-42 FIGURE-1

PREPARED BY / DATE