NON-PUBLIC?: N
ACCESSION #: 9112120224
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Sequoyah Nuclear Plant, Unit 2 PAGE: 1 OF 8

DOCKET NUMBER: 05000328

TITLE: Reactor trip on low-low steam generator level resulting from an inadvertent main steam isolation valve closure caused by a limit switch failure
EVENT DATE: 11/07/91 LER #: 91-006-00 REPORT DATE: 12/09/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Melissa Meade, Compliance Licensing TELEPHONE: (615) 843-7766

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: SB COMPONENT: ZIS MANUFACTURER: N007
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On November 7, 1991, at 1403 Eastern standard time, the Unit 2 reactor tripped on low-low steam generator level in Loop 4 during a routine performance of a main steam isolation valve (MSIV) partial stroke test in accordance with Surveillance Requirement 4.7.1.5. During the performance of the test, the MSIV fully closed because of the failure of a limit switch to actuate, which reopens the valve upon reaching the 90 percent open position. The control room staff responded as prescribed by emergency procedures. They promptly diagnosed the plant conditions and took actions necessary to stabilize the unit in a safe condition. Safety systems performed as expected with minor anomalies that did not affect the operators' capability to respond to the event. The 90 percent limit switch was replaced, and the MSIV was retested successfully.

END OF ABSTRACT

I. PLANT CONDITIONS

Unit 2 was in power operation at approximately 100 percent reactor thermal power.

II. DESCRIPTION OF EVENT

A. Event

On November 7, 1991, at 1403 Eastern standard time (EST), the Unit 2 reactor tripped on low-low steam generator level in Loop 4 during a routine performance of American Society of Mechanical Engineers, Section XI testing required under Surveillance Requirement 4.7.1.5, which requires partial stroking of the main steam (EIIS Code SB) isolation valve (MSIV) (EIIS Code ISV). During the performance of the test, the MSIV fully closed because of a component failure, resulting in the low-low steam generator level reactor trip setpoint being reached.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

None.

C. Dates and Approximate Time of Major Occurrences

1. November 7, 1991, at Pretest briefing was conducted
1300 EST for the MSIV partial stroke test.

2. November 7, 1991, at The test began. The local
1400 EST control switch for Loop 1 MSIV
was placed in "test maintained"
position, resulting in the amber
light illuminating, indicating
normal air vent path is blocked,
and the test vent path is open.

The local control switch was held
in "test momentary" position
resulting in the valve moving
into the closed direction. Green
light indicating valve is not

fully open illuminated. Within approximately seven seconds, the blue light indicating the valve is 90 percent open illuminated. The control switch was allowed to return to the test maintained position. Locally, the sound of intermittent venting of air was heard. The Loop 1 MSIV returned to the fully open position and the blue and green lights went out. The local handswitch was returned to the normal position and the amber light went out, indicating that the normal air vent path is open.

3. November 7, 1991, at 1403 EST

The local control switch for Loop 4 MSIV was placed in test maintained position, resulting in the amber light illuminating.

The local control switch was held in the "test momentary" position resulting in the valve moving in the closed direction. Green light indicating valve is not fully open illuminated. Within approximately two seconds the blue light indicating the valve is 90 percent open illuminated. The control switch was allowed to return to the test maintained position. Approximately three seconds later, the red light went out in the main control room indicating the valve was fully closed.

Steam generator No. 4 level decreased rapidly. Alarms were received for steam generator No. 4 flow mismatch and low level. The reactor trip first out panel

alarmed for the Loop 4 steam generator level low-low. Emergency instructions were utilized to respond to the trip.

D. Other Systems or Secondary Functions Affected

As designed, the turbine tripped following the reactor trip. Other systems performed as expected with minor anomalies.

E. Method of Discovery

The red light for the Loop 4 MSIV went out, indicating the valve was fully closed. The reactor trip was annunciated on the control room panels.

F. Operator Actions

The control room staff responded as prescribed by emergency procedures. They promptly diagnosed the plant conditions and took actions necessary to stabilize the unit in a safe condition.

G. Safety System Responses

Safety systems performed as expected with minor anomalies tHat did not affect the operators' capability to respond to the event. Minor anomalies with source range nuclear instrumentation are discussed in Section IV.

III. CAUSE OF THE EVENT

A. Immediate Cause

The reactor trip resulted from reaching the low-low steam generator level setpoint because of the inadvertent closure of the MSIV.

B. Root Cause

The root cause of this event has been attributed to failure of the 90 percent limit switch, which reopens the MSIV during the partial stroke test. Upon examination, the limit switch was binding; however, the exact cause of the limit switch binding

could not be determined.

C. Contributing Factors

The air exhaust test port utilized for the MSIV partial stroke test is designed to be metered to allow the valve to close slowly. Air flow through the normal port is intended to not be retarded. (Note: During normal MSIV closure, air is exhausted through both ports.) The metering of these exhaust ports was discovered to be reversed for the Unit 2 MSIVs. Therefore, the valve was closing faster than desired for the partial stroke test. If the air flow through the test exhaust port would have been retarded, the possibility exists that when the operator released the local control switch (upon receiving the blue light indicating that the valve had reached the 90 percent position), the valve may have returned to open. Investigation concluded that detailed guidance for installation and adjustment of the metering devices on the test and normal exhaust ports had not been provided in maintenance instructions.

IV. ANALYSIS OF EVENT

Reactor Coolant System (RCS) Pressure

Before the event, the RCS pressure varied at or near 2,235 pounds per square inch gauge (psig). When the reactor trip occurred, pressurizer pressure increased to 2250 psig and then dropped very quickly to approximately 2020 psig, subsequently recovering in approximately 10 minutes to a value between 2225 and 2235 psig. These pressures are consistent with the expected range of values for this type of event.

RCS Temperature

The response of the RCS temperature paralleled the aforementioned RCS pressure response. Initial RCS temperature was 578 degrees Fahrenheit (F). Following the trip, as power input from the core decreased and steam dumps and auxiliary feedwater (AFW) actuated, RCS average temperature (Tavg) rapidly dropped to 546 degrees F. In approximately four minutes Tavg returned to no-load Tavg of 547 degrees F.

Pressurizer Level

Pressurizer level was constant at 61.5 percent before the reactor trip. Response of the level to the transient closely paralleled that of RCS pressure. Pressurizer level dropped rapidly to approximately 38 percent as the reactor tripped, auxiliary feedwater and steam dumps caused the cooldown. The level then continued to drop to 25 percent (assumed no-load pressurizer level).

Examination of the pressurizer level charts revealed that the actual pressurizer level followed the program level very closely.

Forced and/or Natural Circulation

The reactor coolant pumps were in service at all times during the transient, and forced flow was maintained. No anomalies were noted in this area.

Containment Pressure, Temperature, Radiation

No perturbations were observed in containment pressure, temperature, or radiation.

Heatup and Cooldown Limits

Technical specifications limit the RCS cooldown rate to 100 deg
ees
F in any one hour period. Based upon strip chart recorder traces, this cooldown limit was not exceeded during this event. No heatup excursion was experienced during this event.

Reactor Power

Before the reactor trip, reactor power was approximately 100 percent rated thermal power. Upon receipt of the trip signal, the shutdown and control banks dropped into the core, and reactor power rapidly decreased as expected.

Steam Pressure

Before the reactor trip, the steam generator pressure was constant at 846 psig. After trip initiation, steam generator pressure (except steam generator No. 4, which had the MSIV closed) rose to 987 psig almost immediately, then slowly decreased because of the cooling effect of the AFW. The Loop 4 steam generator pressure

during the transient increased to approximately 1024 psig. Steam pressure returned to no-load setpoint (1005 psig) in approximately one-half hour following the trip.

Feedwater Flow

Main feedwater (MFW) flow terminated on reactor trip with low Tavg (554 degrees F). AFW started as designed when both MFW pumps tripped on the feedwater isolation signal. Flow to the steam generators from AFW continued at greater than 440 gallons per minute per steam generator in accordance with emergency procedures while steam generator level remained below 25 percent. Manual control of the AFW was taken by the operators when steam generator levels were at 30 percent.

Steam Flow

Loops 1, 2, and 3 steam flow were at an expected value (3.7 x 10**6 pounds per hour pph!) and dropped rapidly upon the turbine trip because of the main turbine stop valve closure. Loop 4 steam flow indicated approximately 0.8 x 10**6 pph lower than the three unaffected loops because of the MSIV closure before the trip. Flow continued to steam dumps, and the turbine-driven AFW pump from steam generator No. 1 until the turbine-driven AFW pump was removed from service. No unusual perturbations in steam flow were exhibited.

Steam Generator Level

Pretrip levels in all four steam generators were constant at the design setpoint of 44 percent. After the reactor and turbine trip, Steam Generators 1, 2, and 3 levels dropped rapidly to approximately three percent (average). This was because of the effects of RCS cooldown, increased secondary side pressure, and loss of main feedwater. A slight swell in Loops 1, 2, and 3 was observed due to primary side continued heating of the colder steam generator inventory from decay heat. Loop 4 steam generator dropped in level to zero percent (hence, reactor trip initiation on a low-low steam generator level).

Shutdown Margin

During this transient, RCS temperatures remained above the analysis limits of 540 degrees F, relative to shutdown margin. This value is based on the highest worth rod not fully inserted. Hence, based on

this transient, no challenge to the Final Safety Analysis Report or technical specification requirements was generated.

Source Range Monitors

Upon entering Mode 3, one source range monitor gave erratic reading (swinging one-half decade). Technical Specification 3.3.1 requires that two source range monitors be available in Mode 3 to ensure adequate shutdown monitoring is available. The diverse indication from the intermediate range (both channels) was available during this period, as well as the other source range monitor channel. Therefore, technical specification requirements were satisfied based on designed single failure and redundancy factors.

Limit Switch

The limit switch that failed resulting in the MSIV closure does not perform a safety function. It is only needed during the partial stroking of the MSIV. Therefore, its failure would not affect the safety function of the MSIV, i.e., ability to close.

Reversal of Air Exhaust Ports

The reversal of the air exhaust ports would not affect the safety function of the MSIV. During normal MSIV closure, air is exhausted through both ports; therefore, if the valve was called upon to close, it would close within the five seconds as required by technical specifications.

Based on the above analysis of plant parameters and components, the safety of the plant, its personnel, and the public was not compromised.

V. CORRECTIVE ACTION

A. Immediate Corrective Actions

The control room staff responded as prescribed by emergency procedures. They promptly diagnosed the plant conditions and took actions necessary to stabilize the unit in a safe condition.

B. Corrective Actions to Prevent Recurrence

1. The 90 percent limit switch was replaced and the MSIV was retested successfully. The other Unit 2 MSIVs were partial and full-stroke tested with no deficiencies noted. Evaluation has concluded a newer model switch would be more appropriate for this application. Therefore, the remaining old model, Unit 2 90 percent limit switches will be replaced during the Unit 2 Cycle 5 refueling outage. The corresponding old model, Unit 1 90 percent limit switches were replaced during the Unit 1 Cycle 5 refueling outage.

2. The Unit 1 test and normal vent port metering devices were checked and found to be correct. New metering devices were installed and adjusted on the Unit 2 MSIV test vent ports, and the normal vent ports were adjusted to be full open. As such, the vent port configuration is consistent between Unit 1 and Unit 2.

3. The maintenance instruction for the MSIVs will be revised to include detailed guidance for the installation and adjustment of the metering devices on the test and normal exhaust ports.

VI. ADDITIONAL INFORMATION

A. Failed Components

The limit switch that actuates when the MSIV reaches 90 percent open to return the valve to the full open position during partial stroke testing failed. The limit switch was binding, but after being "freed up" the limit switch moved easily. Inspection revealed no visible problems, such as misalignment or improper lubrication.

B. Previous Similar Events

No reactor trips have been reported resulting from inadvertent MSIV closure.

VII. COMMITMENTS

1. The remaining Unit 2 old model 90 percent limit switches will be replaced before restart from the Unit 2 Cycle 5 refueling outage.

2. The maintenance instruction for the MSIVs will be revised by

March 6, 1992, to include detailed guidance for the installation and adjustment for the metering devices on the test and normal exhaust ports.

PL090204/272

TVA
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J. L. Wilson
Vice President, Sequoyah Nuclear Plant

December 9, 1991

U.S. Nuclear Regulatory Commission
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Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO.
50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT (LER)
50-328/91006

The enclosed LER provides details concerning a reactor trip on low-low steam generator Level resulting from an inadvertent main steam isolation valve closure. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv) as an event that resulted in the automatic actuation of engineered safety failures, including the reactor protection system.

Sincerely,

J. L. Wilson

Enclosure
cc: See page 2

December 9, 1991

cc (Enclosure):

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