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South Texas Project Electric Generating Station P.O Box 289 Wadsworth, Texas 77483

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Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

South Texas Project
Unit 1
Docket Nos. STN 50-498
Special Report Regarding Power-Operated Relief Valve
Actuation to Mitigate a Reactor Coolant System Pressure Transient

Pursuant to South Texas Project Technical Specifications 3.4.9.3.d and 6.9.2, STP Nuclear Operating Co. (STPNOC) submits the attached Special Report regarding automatic actuation of a power-operated relief valve to mitigate a Reactor Coolant System pressure transient.

If you have any questions, please contact Scott Head at (361) 972-7136, or me at (361) 972-7849.

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AWH

Attachment: Special Report Regarding Power-Operated Relief Valve Actuation to Mitigate a Reactor Coolant System Pressure Transient

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Special Report Regarding Power-Operated Relief Valve Actuation to Mitigate a Reactor Coolant System Pressure Transient

Description of Event

[A diagram of the pressurizer pressure control is provided at the end of this attachment for reference.]

On March 26, 2003 at 20:00 hrs Unit One was in MODE 5 with Reactor Coolant System (RCS) temperature at 180 degrees and 370 psig in a water-solid plant condition to prepare the unit for chemical degassing. RCS circulation was provided by Reactor Coolant Pumps (RCP) A and C. The Pressurizer Pressure Master Controller was in automatic mode. Restoration of Vital AC Distribution Panels DP1204 and DP002, which would also restore power to Power Operated Relief Valve (PORV) 655A, was in progress. Protection system actuation trains were tagged in the "Test" position and "normalization" had been installed about 16:00.

Normalization includes inserting test signals to simulate normal at-power operating parameters, including input for pressurizer pressure. During the normalization installation, the control board operator repositioned the pressurizer pressure channel selector switch from an input channel to the Pressurizer Pressure Master Controller that was indicating actual plant conditions of less than 1700 psi to a channel that was normalized to read approximately 2235 psi. In response to the step change in input signal, the Pressurizer Pressure Master Controller made a step change to 100% output and a control board annunciator indicated a high pressurizer pressure deviation. The 655A PORV would have opened at this time if the associated interlock channel (previously normalized) had not been de-energized by the DP 1204 outage. Since the indications were received during the normalization, the Operators acknowledged the alarms but did not recognize their significance.

At 20:10, DP 1204 was re-energized, which powered up the interlock channel for PORV 655A. That channel was normalized at 2242 psig and the associated 2185 psig interlock bi-stable contact closed to allow PORV 655A to respond to the 100% demand signal from the Pressurizer Pressure Master Controller.

At about 20:11, the Control Room observed dual indication on Pressurizer Power-Operated Relief Valve (PORV) 655A. RCS pressure dropped to approximately 62 psig. The Control Room Operator was directed to take the hand switch for PORV 655A to the "Close" position because the actual plant conditions did not call for the PORVs to be open. The sudden drop in RCS pressure resulted in a change in differential pressure across both the letdown pressure control valve used for letdown flow control in manual and the charging flow control valve in manual control. The decrease in differential pressure across the valve controlling letdown and increase in differential pressure across the charging flow control valve created a mass flowrate imbalance at solid plant conditions when the PORV closed, and resulted in rapidly rising RCS pressure.

Reactor Coolant Pump (RCP) seal differential pressure was observed to be low and the Control Room Operator was directed to stop RCP's A & C in accordance with the Off-Normal procedure at about 20:13. RCP A experienced some seal damage as a result of the transient.

At about 20:14, RCS pressure increased to above the Cold Overpressure Mitigation System (COMS) setpoint and PORV 656A was observed to open twice. After observing on the Qualified Process Display System (QDPS) that the RCS pressure was below the setpoint, the Control Room Operator took the PORV 656A hand switch to "Close" in a belief that the PORV had opened because of some failure associated with re-energizing DP 1204. Closing PORV 656A disabled the second COMS channel with a solid plant pressure transient in progress. At the Unit Supervisor's direction, the hand switch was restored to automatic within approximately five seconds. At about 20:15 the RCS was stabilized. PORV 655A was then placed in "Auto" which resulted in PORV 655A re-opening because the Master Controller was still in automatic with 100% demand output signal resulting from the normalization. The hand switch was returned to the "Close" position closing PORV 655A, which disabled one COMS channel.

At 02:00 on March 27, 2003, PORV 655A hand switch was returned to "Auto" after taking the Pressurizer Pressure Master Controller to "Manual" and reducing the output to zero which made all COMS channels operable.

Analysis of the Event

Operator action was taken during the event that disabled both channels of Cold Overpressure Mitigation System (COMS) during water solid Reactor Coolant System operation while a pressure transient was in progress. As identified in the STP UFSAR, the automatic actuation of COMS to limit a rise in RCS pressure is only required for water solid operation. Under such conditions the transient pressure condition allows little time for the Operator to take action to terminate the RCS pressure rise.

The first COMS channel was disabled at 20:12:12 on March 26, 2003 when PORV 655A's handswitch was taken to "Close". At approximately 20:14:00 on March 26, 2003 the second COMS channel was disabled when the PORV 656A handswitch was taken to "Close", and that channel was returned to service about 5 seconds later at the direction of the Unit Supervisor. The station remained in a Technical Specification Limiting Condition for Operation (LCO) for the disabled PORV655A COMS channel until 0200 03/27/03. The PORV 655A restoration as a COMS channel was delayed due to the overall lack of understanding that the Pressurizer Pressure Master Controller output was sending an "Open" command to the valve while in "Auto" with 100% demand output signal.

No LCO Action Statement times were exceeded. The mechanical relief devices on the RHR System were available to limit RCS maximum pressure during the period that both PORV 655A and PORV 656A control switches were in "Close".

PRA Analysis for PORV Actuation

The Risk Management group analyzed the effects of the PORV cycling and the COMS actuation events that occurred on March 26, 2003. Three cases were analyzed:

Case 1: The actual over-pressure event
Case 2: Sensitivity evaluation of the event assuming PORV 655A is inoperable
Case 3: Potential Small Loss of Coolant Inventory given a PORV challenge

The conditional core damage probability (CCDP) results of these analyses are:

Case 1: CCDP = 1.1E-11
Case 2: CCDP = 1.1E-09
Case 3: CCDP = 7.6E-07

The safety significance of the COMS actuation event is considered to be very low based upon the results presented above.

Cause of Event

The following root causes were identified for this event:

1. The station did not have an adequate risk sensitivity for RCS solid plant operations which led to inadequate preparation and implementation of solid plant operations and proper strategies for mitigating transients in this mode of operation. Evolutions such as normalization of pressurizer pressure instruments or electrical panel switching operations should not have been allowed during solid plant conditions. In the past these practices were not explicit in the procedures; however, they were applied consistent with UFSAR statements denoting limiting activities that could lead to a solid plant pressure transient. This change management issue was not recognized prior to this event. When the decision was made to perform solid plant operations for chemical degassing, an effective assessment of the potential hazards of solid plant transients was not performed and the need for additional guidance and equipment to compensate for those hazards was not identified. The risk level, such as the increased likelihood of pressure transients and the resulting COMS actuations did not result in enhanced controls for procedures, training, outage work schedule or station sensitivity. (Corrective Action #1)

2. Outage Work Scheduling did not properly manage the risk of the normalization processes and power restoration processes. The scheduling of normalization and restoration of DP1204 and DP002 did not account for the water-solid plant condition or the potential for incurring a transient. (Corrective Action #2)

3. Inadequate knowledge of the Pressurizer Pressure Control System prevented the station from properly controlling the system during this event. Training on the control system did not translate to actual operator performance or recognition of the risk posed by the controller being at 100% demand. (Corrective Action #3)

Corrective Action

The corrective actions include:

1. STPNOC established an interim process to control work activities during solid plant operations.
2. STPNOC performed a shutdown risk assessment review of work activities that may affect solid plant operations.
3. STPNOC reviewed with the Operators the lessons learned from this event and conducted training on pressurizer pressure controllers instrument response and solid plant operational theory.

PRESSURIZER PRESSURE CONTROL SYSTEM