SYSTEM ENERGY RESOURCES, INC.
A Middle South Utilities Company

89 NOV 27 A10: 58

WILLIAM T. COTTLE
Vice President
Nuclear Operations

November 22, 1989

U.S. Nuclear Regulatory Commission
Region II
101 Marietta St., N.W., Suite 2900
Atlanta, Georgia 30323

Attention: Mr. Stewart D. Ebneter, Regional Administrator

Dear Mr. Ebneter:

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
RD-89/001, Revision to 10CFR21 on
Main Steam Isolation Valve Failure
to Close Due to Solenoid Valve
Malfunction
AECM-89/0195

On September 14, 1989 System Energy Resources, Inc. (SERI) notified Mr. Floyd Cantrell of your office of a Reportable Deficiency at Grand Gulf Nuclear Station (GGNS) Unit 1. The deficiency concerns a main steam isolation valve (MSIV) failure to close. This failure was caused by the disk material for the dual solenoid valve extruding into the exhaust port of the solenoid valve. This deficiency was determined to be reportable under the provisions of 10CFR21 which was submitted to the NRC on September 18, 1989.

Based on subsequent discussions with Mr. Hal Ornstein of NRC NRR, certain clarifications to the 10CFR21 notification were considered necessary. Please find attached the revised 10CFR21 notification on the subject MSIV solenoid valves. The revised information has been noted by change bars located in the margin.

Yours truly,

W T Cottle

WTC:tkm
Attachment

cc: (See Next Page)

IE19
1/1
IE22

cc: Mr. D. C. Hintz (w/a)
Mr. T. H. Cloninger (w/a)
Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)
Mr. H. L. Thomas (w/o)
Mr. H. O. Christensen (w/a)

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INTERIM 10CFR21 REPORT

1. Name and address of the individual informing the commission:

   W. T. Cottle
   Vice President, Nuclear Operations
   P. O. Box 469
   Port Gibson, Mississippi 39150

2. Identification of the facility ... which ... contains a deficiency:

   Grand Gulf Nuclear Station (GGNS) Unit 1
   Port Gibson, Mississippi 39150

3. Identification of the firm ... supplying the basic component which ... contains a deficiency:

   Automatic Switch Company
   Florham Park, N.J. 07932

4. Nature of the deficiency ... and the safety hazard which ... could be created by such a deficiency ...:

   A. Description of the Deficiency

   On August 14, 1989 Main Steam Isolation Valve (MSIV) B21F022B failed to close upon demand from automatic and remote manual actuation signals. Several minutes later the MSIV closed on its own. An investigation later revealed that the EPDM disk material for ASCO Model NP8323A20E dual solenoid valve B21SVF501B had extruded into the exhaust port of the solenoid valve. When the solenoid valve was de-energized, the disk lifted off the exhaust port and the extruded material in the exhaust port was torn away from the disk material. The extruded disk material blocked the exhaust port preventing the solenoid valve from exhausting air resulting in the MSIV remaining open. The extruded disk material was later blown out by normal air pressure allowing the solenoid valve to exhaust and the MSIV to close.

   A contributing factor which caused the disk material to be extruded into the exhaust port appears to be related to the elastomer seal being forced against the metal seat by the energized dual solenoid pressure (not spring pressure). This extruded material appears to have been separated from the remaining seat material due to the friction forces created by movement of the seat away from the exhaust port when the solenoid coils were de-energized on August 14, 1989.

The extrusion process leading to ultimate failure may be both temperature and force dependent. It appears that seal material softening allows the process to begin. Seal softening depends on ambient temperature, and extrusion depends on the softening and the force applied by the solenoid onto the seal material. If seal softening has not occurred, then the amount of protrusion of the seal material into the exhaust port is so small that it has no affect on valve operation.

The effect that ambient temperature has on the seal material softening is complex in nature. While ambient temperature is known to be a controlling factor in chemical reaction rates and its effects can be predicted utilizing Arrhenius methodology, it appears that the softening or extrusion process can occur at temperatures below those specified by the ASCO qualification reports.

The ASCO qualification report specifies a life of eight years at 140 degrees Fahrenheit ambient temperature for ASCO valves tested in an energized condition. A review of the available temperature data indicated that the average ambient temperature in each of the inboard and outboard MSIV areas at GGNS Unit 1 has been below this temperature. However, evidence of substantial extrusion has been found on all eight MSIV dual solenoid valve seats. GGNS had no history of problems with these NP8323A20E MSIV solenoid valves until the time of failure. These NP8323A20E dual solenoid valves were installed on all eight MSIVs in March 1985 to replace the ASCO Model HTX8323A20V solenoid valves after three MSIVs failed to close due to the failure of three HTX8323A20V solenoid valves. In October 1985 and during the first refueling outage (Fall of 1986), a NP8323A20E solenoid valve was removed, disassembled, and inspected. No degradation or other problems were found during either inspection. Successful completion of fast closure of the MSIVs had been documented as recently as startup from the third refueling outage (April 29, 1989). Previous to this, successful fast closures were achieved on January 5, 1989 and August 16, 1988.

System Energy Resources, Inc. (SERI) contacted ASCO in August, 1989 for additional information relating to potential thermal aging effects on the EPDM seal material utilized in the NP8323A20E valves. ASCO provided new, more conservative heat rise values than those previously received by SERI.

SERI performed an evaluation of the thermal endurance service life of these solenoid valves using the more conservative ASCO heat rise values and the thermal endurance test data from tests performed for Cleveland Electric's Perry Plant. The tests were performed on three groups of ASCO solenoids with both Viton and EPDM elastomers in each test group. Test data from one group shows that a solenoid with EPDM elastomers

functioned after 60 days at 225F ambient (oven temperature). Conservatively assuming 135F ambient temperature (equal to maximum anticipated drywell temperature), this evaluation resulted in an expected thermal endurance level of at least 5.17 years. This represents strictly a thermal life without consideration to other aging effects included in an IEEE 323 test program. It should be representative of the installed life at GGNS in that the failed valve had been exposed to a thermal environment with an insignificant cumulative radiation dose. However, all eight of the MSIV solenoid valves had been in service less than this period, one (B21F028A) approximately three years, and were all in similar condition. Therefore, it is expected that strictly from a thermal endurance standpoint this failed valve should have functioned and all the valves should not have been in similar condition.

SERI also performed a design calculation to determine the qualified life based on the new, more conservative ASCO heat rise data and the ASCO test data which accounts for the cumulative aging effects and the DBE conditions. This calculation was performed for the Drywell as well as the Auxiliary Building Steam Tunnel applications, assuming 135F and 125F, respectively for the ambient conditions. This calculation results in a qualified life of 2.84 years for the core disk and 4.17 years for the lower disk (GGNS failed part) in the Drywell (B21F022A-D) and 4.37 years for the core disk and 6.56 years for the lower disk in the Auxiliary Building Steam Tunnel (B21F028A-D). All of these calculations provide lives less than the ASCO reported life of eight years at 140F.

B. Analysis of Safety Implications:

The ASCO NP8323A20E dual solenoid valves are utilized as three-way, normally energized, dual solenoid operated main pilot control valves to reposition the main control valves in the pneumatic control units. The pneumatic control unit for each MSIV is attached to the valve's air operated cylinder and are utilized to control positioning of the MSIVs.

The MSIVs utilize air to open and spring to close with air assist actuators. The air supply to the pneumatic operated cylinder is controlled by a four-way pilot operated valve which applies air pressure to either the top or bottom end of the air cylinder operator. This four-way pilot operated valve is in turn controlled by a three-way normally energized dual solenoid operated valve. To open the MSIV, either or both solenoids on the three-way dual solenoid valve are energized to feed air pressure to the piston of the four-way pilot operated valve which in turn shifts position to feed air pressure to the bottom side of the air operating cylinder and (at the same time) exhaust air from the top side of the air operated cylinder. To close the MSIV both solenoids on the

three-way dual solenoid valve must be de-energized to allow the four-way valve to shift position to feed air pressure to the top side of the air operating cylinder and (at the same time) exhaust air from the bottom side of the air operated cylinder.

At GGNS there are four main steam lines and each steam line is equipped with two MSIVs. One in each line is placed as close as possible to the inside of the drywell and the other valve is just outside the containment. The MSIVs are designed to close fast enough to limit release of radioactivity to the environment to less than the limits of 10CFR100 in the event of a guillotine break of one steam line outside the primary containment.

Based on the deficiency described above, a potential existed for both ASCO NP8323A20E dual solenoid valves to fail and not allow the two MSIVs to fast close on a main steam line in the event of a guillotine break on that line.

Therefore, based on the redundant basic component guidelines, as defined in NUREG-0302, it is conservatively postulated that a failure of both MSIVs in a steam line potentially existed. This failure, coincident with a postulated main steam line break outside the primary containment could have resulted in a reduction in the degree of protection provided to public health and safety.

5. The date on which the information of such deficiency ... was obtained:

System Energy Resources, Inc. received information of the deficiency on August 28, 1989. An evaluation under the guidelines of 10CFR21 was completed on September 13, 1989.

6. In the case of the basic component ... the number and location of all such component:

There currently are six NP8323A20E dual solenoid valves at GGNS Unit 1, one located on each of the four Main Steam Isolation Valves in the drywell, one on the 'A' steam line (B21F028A) outside containment and one spare located in the warehouse.

We do not have knowledge of the location of other defective equipment.

7. The corrective action which has been taken ... the name of the individual responsible for the action; and the length of time that has been ... taken to complete the action:

A. <u>Corrective Actions Taken</u>

The NP8323A20E dual solenoid valves on all eight MSIVs were replaced or refurbished prior to plant restart. Five of the eight were replaced with new, identical

valves (NP8323A20E) and the other three were refurbished with Viton Elastomer rebuild kits, making them NP8323A20V.

B. Responsible Individual

W. T. Cottle
Vice President, Nuclear Operations System Energy Resources, Inc.

C. Length of Time to Complete Actions

SERI will continue with an accelerated replacement or refurbishment schedule for the NP8323A20E dual solenoid valves and in parallel is pursuing design change options such as the use of two single solenoid valves in place of the single dual solenoid valve design.

The length of time to complete this action is indeterminate at this time. However, SERI will provide a status update by startup from the fourth refueling outage.

8. Any advice related to the deficiency ... that has been, is being, or will be given to purchasers or licensees:

As the deficiency did not originate with SERI, we have no further advice to offer.