Regulatory File Cy.

Commonwealth Edison Company

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April 26, 1972

Mr. Donald J. Skovholt
Assistant Director for Reactor Operations
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

50-249

Subject: Additional Information to Final Report of Safety Valve Operation following a Feedwater Transient - Dresden Unit 3 (DPR-25)

Dear Mr. Skovholt:

The attached additional information is in response to your letter of March 29, 1972 concerning the December 8, 1971 incident at Dresden Unit 3.

In addition to one signed original, 39 copies of this information are also submitted. Should you desire any additional information, please let us know.

Very truly yours,

Byron Lee Jr.

Byron Lee, Jr.
Assistant to the President

cc: Boyce H. Grier, Region III

2332

ENCLOSURE

Question 1:

What is the approximate number and nature of grounds that developed in the 125 volt dc systems? What annunciations were lost or were erroneous as a result of the grounds? Is the information provided by the annunciator panel also provided elsewhere in the control room? Do you have procedures for required action following loss of annunciator panels?

RESPONSE:

There were five grounds experienced during the December 8, 1971 incident. These were:

1 - When the "3A" electromatic valve was damaged by the steam jet from the "3F" safety valve the damage to the control wiring resulted in a ground on the 125VDC operating power supply and on the annunciator power supply. This damaged circuitry caused the fuses in the power supply to the 903-3 annunciator panels to blow.

2 - Grounds were found on the LPCI manually operated maintenance isolation valves 26A and 26B indication circuits inside the primary containment. These grounds were caused by moisture and cleared when the indicating switches were dried out.

3 - Grounds were found in the annunciator power supply for "3C" and "3D" electromatic valves. These grounds were caused by moisture and cleared when switches were dried out.

Erroneous annunciation developed on electromatic valves "3A", "3C", and "3D" indicating that they were open when, in fact, they were closed. The damage to the "3A" valve referenced above also resulted in the valve indicating open; valve position indication for "3C" and "3D" valves showed them to be closed. When the fuse blew, all annunciation for panel 903-3 was lost with the exception of window 124 which signalled the loss of power. These annunciations were only lost for the short periods of time necessary to install replacement fuses. The majority of the information conveyed by these annunciators can be obtained from other indications in the control room. The remaining information can be obtained locally, either through observation of local instruments or through observation of the individual systems.

Procedures for loss of an annunciator panel address themselves to prompt restoration of the panel rather than to an elaborate and time consuming verification of the individual pieces of information. Enough information is available in the control room to monitor system performance until the annunciator panel is restored to operation. The existing procedures will be revised, however, to ensure that these indications are monitored during this period when annunciators are unavailable.

Question 2:

What other functions could be lost by similar grounds in the dc systems (125 volt and 250 volt)? What is the relative susceptibility of these systems to similar types of grounds?

RESPONSE:

There are no 250 VDC services brought into the drywell and, therefore, the 250 VDC system is not susceptible to the drywell environment.

In addition to the Automatic Blowdown System (ABS), the 125 VDC system is used as a power supply for:

1 - Various (LPCI, Core Spray, etc) check valve position indication circuits.

2 - Various (LPCI, Core Spray, Standby Liquid) manually operated maintenance shutoff valves position indication switches.

3 - The DC solenoid operated pilot valve for the MSIV's.

4 - Drywell floor drain sump level alarms.

5 - Drywell equipment drain sump level alarms.

6 - Drywell equipment drain sump temperature alarms.

The position indication switches on the valves and the DC solenoid operated pilot valves on the MSIV's are designed to withstand the environment during plant operation. The position switches and solenoids are the totally enclosed type and are designed to operate in a 100% relative humidity environment. Physical damage can be done to the equipment which could result in a circuit ground, short or open. These conditions are protected against by properly protecting these circuits with fuses and circuit breakers.

The DC solenoid operated pilot valves on the MSIV's are normally energized and a failure would be in the direction to de-energize the solenoid and to close the MSIV.

The drywell sump alarm contacts are also totally enclosed construction and are designed to operate in 100% relative humidity.

Question 3:

What is the effect on ECCS systems in the event of grounds in the dc supply in the drywell?

RESPONSE:

The General Electric Company document NEDO-10139 dated June, 1970 titled "Compliance of Protection Systems to Industry Criteria: General Electric BWR Nuclear Steam Supply System" among other things discusses the effect of shorts, opens and grounds on the DC supply systems to the ECCS systems.

Section 3 of this document provides information for each ECCS system. The paragraphs titled Equipment Qualification, Channel Integrity, Channel Independence, Control and Protection Interaction and Environmental Considerations for each ECCS system discusses the effect of DC supply faults on each ECCS system.

The paragraph concerning control and protection interaction states that annunciator circuits using contacts of sensor relays or logic relays cannot impair operability of the system control because of the electrical separation between controls of the two subsystems. The grounds on the DC supply to annunciator panel 903-3 experienced in the December 8, 1971 incident on Unit 3 at Dresden substantiates this conclusion since all ECCS systems except the ABS performed normally during this incident.

The "3A" electromatic valve solenoid operation was damaged by the steam jet from the "F" safety valve and, therefore, the ABS system was not completely operable. The remaining four electromatic valves were tested and found to be operable after this incident occurred. Only four electromatic valves are required for adequate ABS operation.

Question 4:

Are changes planned to further protect these dc systems from similar kinds of failure?

RESPONSE:

Subsequent to the Dresden December 8, 1971 incident the "3F" safety valve discharge "rams horn" was repositioned to direct the opening away from the "3A" electromatic relief valve solenoid operator. The other safety valve discharge paths were inspected to verify that they were not directed towards an electromatic valve operator. This should preclude any damage to an electromatic valve from the discharge of a safety valve.

The other equipment in the drywell which gave evidence of grounds on the DC supply system was dried and cleaned.

The ABS system is the only system affected by grounds on its DC supply inside the drywell. A discussion of the operation of the ABS system with various faults on the DC supply appears in NEDO-10139 paragraph 3.5.2.2 and concludes that any single failure of this nature could not disable more than one valve. This conclusion was also substantiated during the December 8, 1971 incident at Dresden. The "3A" electromatic valve had been physically damaged and at least a partial ground existed on its associated wiring yet the remaining four valves were found to operate properly subsequent to the incident.

It is Edison's conclusion that the ECCS systems are not adversely affected by grounds on the DC supplies to components in the drywell because of proper circuit protection and separation practices incorporated in the Dresden installation.

While the separation criteria used in the Dresden installation do not separate the DC supply to the valve solenoids to the same extent as the system analyzed in NEDO-10139 (i.e. the cables share penetrations and may share cable parts since all are in division I) the analysis is still valid where the faults applied to the DC solenoids are concerned.

Because the ECCS system operation was not degraded by the appearance of grounds on the DC system in the drywell as experienced during the December 8, 1971 incident, there are no further modifications planned for the DC system other than those outlined above which were complete prior to restoring the unit to service following the incident.

QUESTION 5:

As a result of the incident, have any changes been made or been considered in operating procedures, operator training or operator retraining?

RESPONSE:

The existing procedures have been augmented by an Operating Order which amplifies the existing procedures and specifically addresses the tripping of the Reactor Feed Pumps on high water level. This Operating Order is posted on the Control Panel in the Control Room. In addition, a complete revision of the Operating Procedures is in the final review stages. This revision will incorporate the provisions of this Operating Order.

Operator training in proper response to transients such as occurred in this incident have been reviewed by all Operating Shifts. In addition, operator retraining at the BWR Simulator has been implemented for all licensed personnel. At this time, 9 SRO's and 15 RO's have completed this retraining.

Question 6:

What are your present instructions regarding manual vs automatic feedwater control?

RESPONSE:

Chapter 32 of the Operating and Procedures states, as a criteria, the following:

> A controller may be placed in the manual mode from the automatic mode whenever, in the judgement of the operator, continued automatic operation is unsafe, or when it may cause any unnecessary transients.

In addition, the Operating Order mentioned in the reply to Question 5 states:

1 - Run the Auto Level Set Point down to +10 to +15".

2 - Leave the Feedwater Control System in the Automatic Mode.

3 - Close the low flow feedwater valve.

4 - If the water level continues to increase past the high level alarm point at +44", trip all Reactor Feed Pumps immediately.

Question 7:

With reference to your evaluation of modifications to the feedwater control system in paragraph E.17 of your final report, provide the following information:

a. What is the current status of your evaluation?

b. Provide the proposed details of the reactor feedwater pump high reactor water level trip and the bases for selecting the trip water level.

c. Does elimination of the run out circuitry remove overload protection from the feedwater pump and motor drive?

RESPONSE:

a. Status (Numbers Reference Report)

(17.a) The design of the high reactor water level reactor feedwater pump trip is complete and installation in accordance with this design has been approved by the Dresden Station Review Board. Installation will be completed during the first convenient unit outage.

(17.b) An additional pipe anchor for the start-up feedwater regulator valve piping has been designed and approved for installation. Installation will be completed during the first convenient unit outage.

(17.c) The alternate type valve positioner will be tested as part of a feedwater control system improvement program. The purpose of this program is increasing the stable response rate of the feedwater control system. The program consists of four parts. The first part of the program consists of tests of the existing system with the intent of isolating the cause of the tendency to instability at high control system response rates. The last three parts of the program involve adding damping to the existing valve positioner, changing to a different type positioner, and adding lag-lead compensation to the control loop. Each part of the program involves extensive testing of the installed control system with the unit operating. The four parts will be carried out sequentially until the required system performance is accomplished. The detailed test procedure has been prepared and is currently being reviewed. It is presently scheduled to begin testing by May 1, 1972.

(17.d) The improved amplifier will be installed at the first convenient outage.

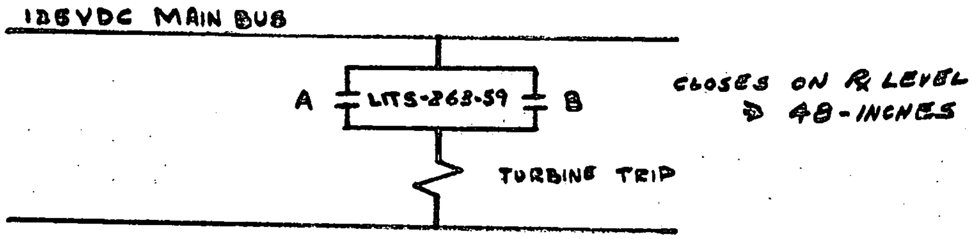
(17.e) Feedwater regulator valve position indication will be installed in the control room during the first convenient outage after materials are available.

(17.f) Although the feedwater system is not directly a safety system, an evaluation of elimination of "Run-out" is being performed on the basis that it may provide safeguard protection which compliments the required ECC systems. The evaluation currently in progress includes predicting the performance of the feedwater system with and without the run-out circuit in the event of a small sized loss of coolant.

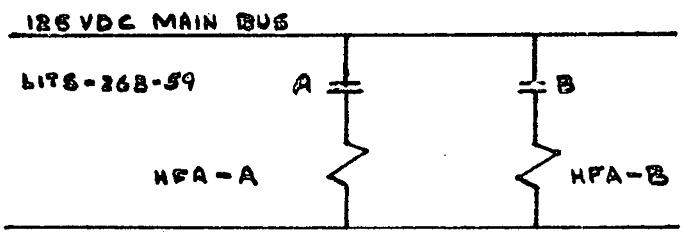
b. The reactor feed pump trip initiation signal is taken from the turbine trip contacts set at reactor water level 48 inches. Through appropriate relaying, the pumps will be tripped by a

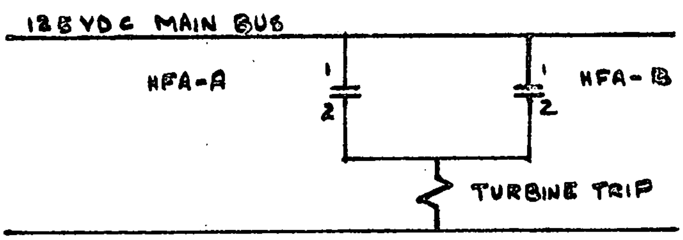
DRESDEN STATION, UNIT 3
REACTOR FEEDWATER PUMP
HIGH REACTOR WATER LEVEL TRIP
PRELIMINARY DESIGN

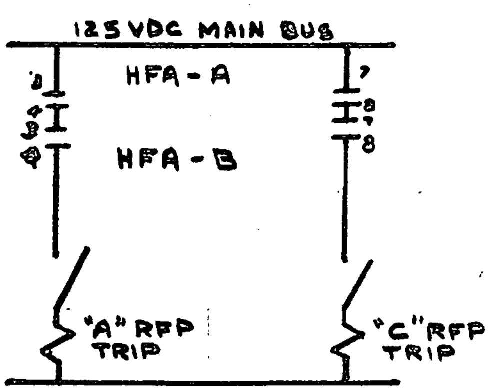
PRESENT TURBINE TRIP

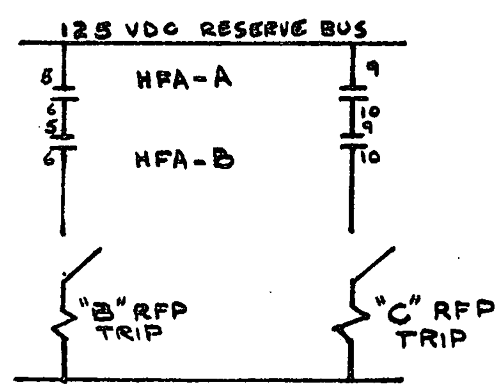


MODIFIED TURBINE TRIP WITH Rx FEEDPUMP TRIP









two out of two logic circuit (an electrical schematic is attached). The level set point was selected the same as the turbine trip and high level isolation, because isolation and turbine trip eliminate major loss of primary system water inventory and the need for feedwater. This level setpoint was also selected to terminate a high level transient before water reached the HPCI, isolation condenser or main steam nozzles.

c. No, if run-out is eliminated, the pump and motor protection will remain without change.

Question 8:

What are your plans for the study of the phenomena which caused the premature lifting of the safety valves?

RESPONSE:

The preliminary program includes three parts: Monitoring the valves in place on Dresden Unit 3, mathematical modeling/analysis of the valves and primary system, and full scale laboratory testing. Negotiations are currently in progress with various consultants to provide the last two phases of the program. It is planned to monitor pressure transducers installed for reactor dynamics testing and temperature during flooding of the main steam lines at the next scheduled outage on Dresden Unit 3.

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