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MEMORANDUM FOR: Thomas M. Novak, Director
Division of Safety Programs
Office for Analysis and Evaluation
of Operational Data

FROM: Jack E. Rosenthal, Chief
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SUBJECT: HUMAN FACTORS TEAM REPORT - DRESDEN 2 (08/02/90)

On August 2, 1990, at 1:05 am, Dresden Unit 2 operators manually scrammed the plant after trying unsuccessfully to shut a Target Rock safety relief valve that had failed open, and over the next hour the plant cooldown rate reached about 129° F/hr., exceeding the technical specification normal cooldown rate limit of 100° F/hr. Dresden 2 was at approximately 80% power and decreasing load at 100 MWe/hr when an acoustic monitor actuated and other indications were received of a stuck open Target Rock safety relief valve. Using abnormal operating procedure 250-1, Relief Valve Failure, the operators tried to reclose the relief valve, but were unsuccessful. Following the scram, the shift engineer (SE) became concerned about the unexpected high rate of heatup of the suppression pool and without procedural guidance ordered opening two turbine bypass valves to reduce system pressure to approximately 600 psi. He did this because he believed it was necessary to reduce heat input to the torus and he hoped the safety relief valve would reseat.

As part of the AEOD program to study the human factors aspects of operational events, a team was sent to the site August 7. The team leader was Gene Trager of AEOD; other team members were John Kauffman of AEOD, and Bruce Kaplan and Brad Stockton of Idaho National Engineering Laboratory. The team was at the site for two days and gathered data from discussions, plant logs, strip chart recordings, and interviews of plant operators.

Enclosed is the report prepared by INEL of the results of the team's human factors study. Specific human performance aspects of this event are addressed in this memorandum.

Shift Organization

The shift organization during this event consisted of a shift engineer (SE; SRO), who had overall responsibility for operations, a shift control room engineer (SCRE; degreed SRO/STA) who directs control room operators and activities for both units, nuclear station operators who are the licensed control room operators, and shift foremen (SF; SROs) who report to the SE and who direct equipment operators for inplant activities.

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When the relief valve failed open, the SCRE was relieved by the SE, who was less familiar with ongoing operations, so that the SCRE could function as STA. However, his STA function (giving advice to the SE on the overall plant condition) was diminished because he was also required to make state and local and NRC notifications of the event (that may have been made by lower level personnel). In addition, the SFs for units 2 and 3 were sent from the control room into the plant to perform routine valve manipulations. Thus, the SE, who was also functioning as the emergency director, had little assistance in analyzing the condition of the plant and in monitoring and evaluating operator activities. It is noted that the MSIVs could have been shut using switches in the control room, but the operators were reluctant to do this.

Control room crew members interviewed two to three days following this event thought the response by the crew was "textbook" and that there was little room for improvement.

Procedures

The abnormal operating procedure for a stuck open safety relief valve (DOA 250-1) did not contain some of the symptoms for this event, such as the step drop in MWe, the steam flow/feedflow mismatch, and the decrease in steam flow, nor did it prepare operators for the difficulty that can be encountered in maintaining a differential pressure between the drywell and torus. In addition, plant procedures following a reactor scram provided no further guidance on control of reactor pressure with a stuck open relief valve nor on limiting reactor vessel cooldown. The emergency operating procedure authorized stabilizing pressure below 1060 psig using the bypass valves, but did not point out exceptional conditions such as a stuck open relief valve.

Communications

The shift engineer read the procedure steps but did not direct specific operators to perform specific actions nor did he verify that the actions were taken. For example, suppression pool cooling was not initially maximized as required by DEOP-200 due to a miscommunication or misunderstanding. Similarly, the SE did not specify the number of bypass valves to open nor the intended rate of depressurization.

The SCRE was involved in making notifications for a significant time period during the event, which may have impeded him from giving technical assistance. For example, the SCRE stated he was on the telephone for 30 minutes with the NRC Incident Response Center (although by this time the event was essentially concluded).

Training

The classroom and simulator training involving a stuck open safety relief valve (SRV) used the stuck open SRV as an initiating event in an anticipated transient without scram (ATWS) event. In such a scenario, the suppression pool heats rapidly following the failure to scram and control of temperature is of major importance. This training may have given the operators a strong concern about increasing suppression pool temperatures. However, given a successful reactor

scram, this concern is greatly diminished. None of the operators interviewed stated that they had been trained on the simulator for this event carried to its expected conclusion, i.e., a successful scram followed by normal plant depressurization.

The classroom training for a stuck open SRV was in some respects more comprehensive than DOA 250-1 in that the classroom training also contained additional requirements from plant Technical Specifications, i.e., cooldown at normal rates if suppression pool temperature exceeds 120° F. The classroom training did not discuss the need to limit reactor vessel cooldown or the ways this might be accomplished.

The operators were aware of the technical specification bases for scramming the plant prior to the suppression pool temperature reaching 110° F. with a stuck open SRV and for the reactor vessel cooldown limits. Thus, the operators should have been concerned with vessel cooldown as well as suppression pool temperature following the scram. Further, the operators expected that pressure would stabilize after the turbine bypass valves were closed. It is unclear why these misjudgments were made during the event. However, it appears that a lack of senior reactor operator advice and communications in the control room may have been contributing factors. The SCRE was making event notifications, and the two SFs were out in the plant operating manual valves.

Licensee Event Report

LER 237-90-006 was issued by Dresden for this event and a copy is attached. In the LER, the licensee stated that the cause of the failure of the Target Rock safety relief valve was the "severely steam cut pilot valve disc" and showed how this would account for what was observed during the event. The LER did not address non-equipment issues such as operator performance, procedures, communications, or training.

Original signed by

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Enclosure: As stated

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