CP&L

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BRUNSWICK STEAM ELECTRIC PLANT UNIT 1
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Gentlemen:

The following event, while not reportable, was considered of possible interest to the Nuclear Regulatory Commission.

Very truly yours,

J. W. Spencer, General Manager
Brunswick Nuclear Project

cc: Mr. S. D. Ebneter
Mr. N. B. Le
BSEP NRC Resident Office

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At 0045 on January 6, 1992, Unit 2 was at 26% Reactor power and Unit 1 was at 100% Reactor power. Both Units' Emergency Core Cooling Systems were operable. Emergency Diesel Generator (EDG) #2 had been prepared for repainting by cleaning the EDG surfaces with a solvent (de-greaser) and rinsing with clean water.

The Unit 2 Main Generator was being separated from the grid to perform a backup acceleration amplifier test as a prerequisite for main turbine overspeed trip testing. At this time, a Main Turbine Stop Valve limit switch failure resulted in an inadvertent Primary Electrical Lockout which initiated an auto start signal to all 4 EDGs. EDG #2 exhausted its starting air without completing a successful diesel engine start.

Immediately after the EDG #2 failure to successfully start Technical Support personnel started an investigation. It was concluded that #2 EDG received and correctly processed the start signal through to the starting air system and by all indication it should have started. At 0618, as part of the continuing investigation, a restart of #2 EDG was initiated with observers stationed to monitor the starting sequence. The EDG was observed to respond appropriately up to the engine being forced over by starting air and the Woodward governor sending the signal to inject fuel.

A stationed observer noted that, although the governor appeared to be fully compressing the governor linkage assembly spring, the fuel racks were not extending. Noting this, the manual fuel rack control lever was pushed and the fuel rack immediately positioned full open. Once this happened the diesel engine started and #2 EDG operated normally. It was secured a few minutes later.

The #2 EDG was placed under clearance to inspect the fuel racks. Areas requiring lubrication were inspected for proper lubrication and all linkage components were inspected for binding. The lubricated area at the eight left bank Fuel Pump Fuel Control Rack metering rods was found to be extremely dry and the rods were slightly sticking. The right bank Fuel Control Racks had slight visible lubrication but moved freely. This led to an examination of the Control Racks on the other three EDGs; they were found to be well lubricated and moving very freely. The linkages on #2 EDG were found to move freely once they were disconnected.

The condition of the lubrication on the fuel control racks was notable. A well lubricated fuel rack has a film of oil on the shaft which goes into the fuel pump for each cylinder. Instead, these racks had what appeared to be a film of dry oil which had a very thick consistency. Additionally, a white film was found on the fuel rack cylinders. Samples of the film, the dry oil from the fuel racks, and the grease from the roller bearings which support the fuel control racks were sent to the company's Harris Energy and Environmental Center (HE&E) for analysis.

HE&E found that the white film was the residue left by the cleaner (Planisol-M), a sodium meta-silicate combined with a surfactant. The surfactant is a dispersant which is used to aid the cleaning properties similar in nature to dish washing detergent. The sodium meta-silicate is basically a glass. As the sodium silicate dries it forms a crystal adhesive bond, especially if it was incompletely mixed. When broken, as with glass, the adhesive properties would no longer exist. In effect it would shatter into very small particles which would no longer hinder movement of the components to which it once adhered. The effect of this residue and the interference of any material which was washed down on top of the fuel rack cylinders caused the racks to bind. The HE&E concluded that Planisol-M is safe to use provided it is dissolved properly, residue is removed from surfaces which could bind, and proper lubrication is conducted afterwards.

Testing was conducted by Technical Support on a spare fuel pump assembly that was washed with Planisol-M and left for 2 1/2 days. The tension required to start movement was four times greater (≈ five pounds) than after it had broken free. After initially breaking free, no binding was noted.

With the failure mechanism of #2 EDG discovered, a review of the #1 EDG slow starts that occurred in May of 1991 was begun. This was due to the similarity of the cleaning process performed on #1 EDG prior to its repainting.

On May 13, 1991, #1 EDG had been cleaned with Planisol-M, in conjunction with steam cleaning, to prepare it for repainting. On May 15, 1991, #1 EDG experienced a slow start (10.15 seconds vs. 10 seconds maximum), for which no cause was initially identified. Following the successful completion of a second operability test (8.5 seconds), #1 EDG was placed under an increased surveillance schedule. Three additional #1 EDG runs were satisfactorily completed before June 8, 1991, when another slow start occurred.

The investigation of the June 8 slow start indicated a problem with the fuel booster cylinder. The booster cylinder was replaced and as a verification that the booster cylinder was the cause, the booster cylinder air signal was blocked to simulate the failure. The #1 EDG was started and displayed a start time within .1 second of the June 8 slow start. The booster cylinder was returned to service and after an operability run the #1 EDG was declared operable. Five successful #1 EDG surveillances were performed, one every two weeks, before the normal 31 day surveillance schedule was resumed.

The review of #1 EDG events concluded that sufficient evidence did not exist to dismiss the cleaning of the diesel as a contributor to the slow start experienced on May 15, 1991. The June 8, 1991, slow start is still considered to have been correctly assessed as a booster cylinder malfunction.

Prior to the repainting of either EDG, a checklist had been developed to support the extensive painting that was to be performed. This list incorporated the knowledge gained from other utilities' painting incidents (Operational Experience Reports), and site organizations with EDG experience: Operations; Maintenance (Mechanical, I&C, Plant Services); Technical Support, Nuclear Assessment Department. The checklist established a network of interfaces and agreements for daily inspections, a final EDG operability demonstration, precautions and warnings, and listings of suitable materials, supplies, and equipment to be used.

The checklist used to repaint the #2 EDG had been updated to require notification of the Auxiliary Crew to relube the fuel racks after cleaning. Late on Friday afternoon, when the cleaning of #2 EDG was completed, a request was made for the Auxiliary Crew to perform a lubrication check of the #2 EDG fuel racks but the implementation was postponed until normal working hours on the following Monday (the day of the auto-starts). The Auxiliary Crew worker made the decision to postpone the lubrication check as he was not aware of any operability concerns related to this request. He was aware of the need for a lube check after a EDG cleaning, because after #1 EDG had been cleaned and painted in May of 1991, he had been contacted to lube the #1 EDG by the maintenance manager responsible for the EDGs. During a tour the maintenance manager responsible for the EDGs had noted that #1 EDG had a linkage which was slightly stiffer than the others and the expected amount of lubrication was not visible. This observation was not considered to be an operability concern. After lubricating the linkages, the lead man contacted the individual coordinating the EDG repainting, and his input resulted in adding a step to the EDG repainting checklist. This step required notifying the Auxiliary Crew to check the fuel racks lubrication after cleaning and after painting was completed. The Auxiliary Crew worker followed-up his initial contacts with a 3-part reply memo to his supervisor and those supervisors responsible for maintaining and repainting the EDGs.

While extensive research and development was used to prepare the informal EDG repaint checklist, future EDG repainting will be controlled using a formally approved procedure. The impact of the film left by the Planisol-M is a phenomenon that had not been previously identified as a potential binding problem and this product was not extensively evaluated for EDG use. Now that we are aware of this problem, controls will be added to the EDG repainting procedure to prevent this from causing future operability concerns. Plant Services work has been brought under the formal control of the Site Work Force Control Group Process Procedure (BSP-43). Additionally, formal controls for painting on Engineered Safeguards Feature systems will be evaluated. This event will be reviewed by appropriate personnel in Operations, Maintenance, Technical Support, and Plant Services, to reinforce the importance of self-checking. This review will also stress the importance of pre-job briefings involving the appropriate organizations needed to assess operability risks to safety related equipment.