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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station Units 1 and 2
Special Report 96-03, Revision 1
Problem Investigation Process No.: 2-M96-1690 and 1-M96-1865

Gentlemen:

Attached is Special Report 96-03, Revision 1, concerning Identification Of Broken Secondary Contact Blocks on Reactor Trip Breaker 1B and Reactor Trip Bypass Breaker 2A. This incident is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

T.C. McMeekin

JWP/bcb

Attachment

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DUKE POWER COMPANY
McGUIRE NUCLEAR STATION
SAFETY REVIEW GROUP SPECIAL REPORT

This Special Report is being submitted to document the identification of broken secondary contact blocks on Reactor Trip Breaker 1B and Reactor Trip Bypass Breaker 2A. This incident is documented in Problem Investigation Process (PIPs) 2-M96-1690 and 1-M96-1865.

Report No.: 96-03, Rev. 1 Date of Report: August 9, 1996

Description of Incident

Unit Status: Unit 2 was in Mode 5 (Cold Shutdown) at 0 percent Reactor power and Unit 1 was in Mode 1 (Power Operation) at 100 percent power at the time the respective broken secondary contact blocks were identified.

This incident was initially reported on June 26, 1996, per McGuire Nuclear Station , Unit 2, License Condition 2.C(12). It was subsequently determined that License Condition 2.C.(12) was no longer applicable.

- On June 11, 1996, Maintenance technicians began performance of the Unit 2 Train A Solid State Protection System (SSPS) Monthly Test per procedure PT/0/A/4601/09A, SSPS Train A Periodic Test With NC System Pressure < 1955 PSIG.
- The technicians had completed procedure steps to rack Reactor Trip Bypass Breaker 2BYA to the Test position and close it. It was then verified closed by observing the breaker closed indication visible on the breaker front.
- The procedure then directed the technicians to verify that the breaker could be opened and thereby functionally verify breaker operation before it was placed in service.
- The technicians discovered that breaker 2BYA would not open electrically (i.e., shunt trip) after several attempts.
- At this point Engineering personnel were contacted and the Failure Investigation Process (FIP) was initiated.
- Troubleshooting was performed and it was verified that the breaker would open mechanically and after several attempts also began to work via the shunt trip circuit in question.
- The breaker was then removed from the cabinet and taken to the shop for troubleshooting and testing.
- During troubleshooting it was observed that a piece of the breaker secondary contact block was chipped off. The chip was later found on the test bench during replacement of the contact block.
- The chip was above breaker secondary contact 5, which was involved in the operation that had failed (the Shunt Trip Coil circuit).
- It was ascertained that the chip could have prevented the contact from making a good connection.

- The chipped block was replaced with a new block assembly, and as a conservative measure, the shunt trip coil was also replaced. The breaker was tested successfully and re-installed in the 2BYA cubicle.

Inspections were performed on all remaining main and bypass reactor trip breakers on both units, as well as both spare breakers and all five spare secondary contact assembly blocks in the warehouse, looking for chipped blocks as well as deformed/bent contacts. No additional problems of this type were identified. However, during these inspections, a second, separate problem was discovered on Unit 1 breaker 1RTB.

- On July 1, 1996, inspection was performed on Unit 1 breaker 1RTB during the Unit 1 Train B SSPS bi-monthly testing.
- During this testing, the Undervoltage (UV) coil was verified to operate correctly and the breaker's response time was within acceptance criteria.
- The breaker was then removed from the cabinet for inspection of the secondary contact assembly blocks.
- It was observed that one of the secondary contact assemblies was broken in two down the middle and had broken away from two of the three mounting tabs. One of the assembly's movable contacts was found lying in the back of the Reactor Trip Breaker cubicle. Subsequent investigation by Engineering personnel determined this was an unused contact.
- The FIP for the preceding problem was expanded to include this new discovery.
- Breaker 1RTB was quarantined and the breaker compartment was visually inspected. No alignment problems or other abnormalities were noted.
- Bypass Breaker 1BYA was then removed from its compartment and placed in the 1RTB compartment and the SSPS testing was completed. As part of the procedure, the former 1BYA breaker was fully tested in the 1RTB cubicle and operability confirmed prior to being placed in service.

Conclusion

The damaged secondary contact blocks which were identified on breakers 2BYA and 1RTB are attributed to mishandling of the breakers.

- Fracture analysis of the damaged secondary contact blocks was conducted at the Duke Power Metallurgical Laboratory.
- Analysis of the contact block from breaker 2BYA revealed an impact point on the top of the chip which is likely to have occurred during handling of the breaker.
- The age of the fracture was indeterminate, but the analysis did show that the block likely had been cracked and subsequent breaker operations caused the chip to break off completely at a later time.
- The type of material used in the secondary contact blocks for Westinghouse DS-416 breakers is a cellulose-filled phenolic. This type of material has a low impact strength and can be easily chipped or cracked during handling.

- The Maintenance Program Manual For DS Breakers states that a lifting rig should be used to lift the breakers out of the cubicles. However, the breakers have been manually lifted during maintenance by various groups, possibly using the secondary contact block(s) as a handle.

A contributing factor to the damage to the secondary contact block on breaker 1RTB is the possible over-torquing of the mounting bolts.

- Fracture analysis (visual examination) of the breaker 1RTB broken secondary contact assembly indicated the mounting block broke from the bolt hole outward, most likely due to cracking from stresses associated with over-torquing of the mounting bolts. The central fracture through the entire contact block assembly probably was secondary, occurring after one side of block became unsecured and free to move slightly.

Subsequent research revealed that the same secondary contact block assembly had been replaced in September of 1994 during maintenance activities, when it was found to be broken.

- At that time (September, 1994) the vendor maintenance manual for DS-416 breakers which was referenced by the breaker maintenance procedure did not include any torquing guidelines for the secondary contact assembly blocks.
- However, a later version of the manual had been received in early 1994 which included torquing values. The revised manual was attached to Westinghouse Technical Bulletin NSD-TB-93-05-R0. The Technical Bulletin addressed the use of unauthorized (i.e., third party) switchgear maintenance manuals, but did not point out that the manual included revised technical information such as torque values.
- The revised manual was incorporated into the document management system in January, 1995.
- Following incorporation of the manual into the document management system, the breaker maintenance procedure change process was initiated (and completed in October, 1995).
- Breaker maintenance personnel were unaware the revised manual included torquing values for the secondary contact blocks.
- As a result, when the chipped contact block on breaker 2BYA was replaced on June 11, 1996, good craft practice, instead of the specified torque, was used to secure the replacement contact block.

Discussions between McGuire Engineering personnel and Westinghouse revealed that a large number of broken phenolic blocks on the DS-416 breakers have been attributed to either mishandling of the breakers or over-torquing of the mounting bolts.

CORRECTIVE ACTION:

Immediate:

- Breaker 2BYA was removed from the cabinet and taken to the shop for troubleshooting and testing.

Subsequent:

1. Breaker 2BYA was repaired, tested, and re-installed in the cabinet.
2. A Nuclear Network message documenting the original Reactor Trip Breaker problem was issued on June 20, 1996.
3. All main and bypass breakers for both units, along with both spare Westinghouse DS-416 Reactor Trip Breakers and all five spare secondary contact assembly blocks in the warehouse, have been inspected for chips and deformation.
4. Fracture Analysis of the damaged secondary contact blocks from breakers 2BYA and 1RTB was performed at the Duke Power Company Metallurgy Laboratory.
5. The secondary contact block for breaker 1RTB was replaced, the mounting bolts torqued to the manufacturer's specifications, the breaker was tested, and returned to service.
6. The Reactor Trip Breaker cabinet for 1RTB was inspected for alignment of the stationary contacts.
7. The secondary contact block mounting bolts for all in-service Reactor Trip Breakers (main and bypass) were removed, the blocks were inspected for chips, cracks, or breaks, and the mounting bolts were torqued to the manufacturer's specifications.
8. During the inspection and torquing of the secondary contact blocks, breaker maintenance and technical support personnel were made aware of the need to use lifting rigs and exercise caution when handling the breakers.
9. Catawba Nuclear Station was notified of the problems identified at McGuire. Catawba Nuclear Station Engineering personnel participated in the FIP and performed inspections/repairs as required.

Planned:

1. Reactor Trip Breaker handling practices (including the use of lifting rigs, racking guidance, and exercising care when a breaker is outside of its cubicle) will be communicated to appropriate Maintenance, Operations, and ESS personnel.
2. Procedures and work practices will be revised to include inspection of the secondary contact blocks.
3. Breaker maintenance technician's review/use and adherence to vendor manual recommendations/requirements will be reinforced.
4. The need for additional training of breaker maintenance crews (and other personnel) who handle these breakers will be evaluated.
5. An evaluation will be performed of the revised vendor manual for other potential PM/PT program changes/enhancements.
6. An updated Nuclear Network Message will be developed.
7. The damaged secondary contact blocks will be forwarded to Westinghouse for analysis.