

U.S. NUCLEAR REGULATORY COMMISSION

REGION I

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Licensee: Niagara Mohawk Power Corporation

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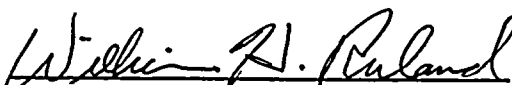
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EXECUTIVE SUMMARY

Nine Mile Point Units 1 and 2 NRC Inspection Report Nos. 50-220; 50-410/97-05

This engineering inspection was conducted: 1) to review licensee's corrective actions following their identification that certain motor-operated valves (MOV) in the safe shutdown systems at both Units 1 and 2 were vulnerable to valve damage caused by fire-induced hot shorts during a postulated control room fire; 2) to assess licensee's performance in response to their identification, on two separate occasions, that isolation switches were not provided for Unit 2 Division I and II emergency diesel generator (EDG) service water outlet valves; 3) to review licensee's corrective actions in resolving the issue associated with Unit 2 Agastat GP relay service lives; and 4) to close out several previously identified inspection items and licensee event reports (LER).

Engineering

- The licensee's review in 1992 failed to identify that certain motor-operated valves in Unit 1 shutdown cooling systems were vulnerable to valve damage caused by a fire-induced hot short. The licensee's review at that time was narrow in scope in that it restricted the potential damage to the valve motor only and did not include potential mechanical damage to the valve by the excessive torque of the valve motor.
- The licensee revisited the 1992 review following a request by the NRC and identified that two safe shutdown MOVs in Unit 1 were vulnerable to valve damage caused by a fire-induced hot short during a postulated control room fire. The damage of any one of these two valves could cause the Unit 1 shutdown cooling system to be inoperable. This condition constituted an apparent violation of 10 CFR 50.48(b).
- After identifying the multiple wiring number and termination point errors in Unit 1 valve repair procedures, the licensee promptly revised the affected procedures and initiated a corrective action to preclude recurrence. This condition constituted a non-cited violation, consistent with Section VII.B.1 of the NRC Enforcement Policy.
- The licensee identified similar MOV problems (hot short issues) in Unit 2 shutdown cooling system and the reactor core isolation cooling (RCIC) system. The licensee promptly corrected the deficient conditions following their identification. However, these conditions constituted an apparent violation of Unit 2 operating license No. NPF-69, Item 2.G, Fire Protection Program.
- The licensee's failure to identify and correct the deficient conditions at Units 1 and 2 (valves vulnerable to hot short issues) during the 1992 review constituted an apparent violation to 10 CFR 50, Appendix B, Criterion XVI, Corrective Action, which requires conditions adverse to quality are promptly identified and corrected.



- On two separate occasions, the licensee initiated good efforts in identifying the discrepancies within the control circuitry (lack of isolation switches for short-to-ground protection) for Unit 2 EDG service water outlet valves. The licensee's actions to minimize EDG's unavailable time during the repairs were also good. However, this deficient condition could have caused a loss of cooling water to the EDGs during a control room fire and adversely affected the safe shutdown of the plant from the remote shutdown panel. This condition constituted an apparent violation of Unit 2 operating license No. NPF-69, Item 2.G, Fire Protection Program.
- A weakness was identified in the licensee's reportability evaluation for discrepancies, as evidenced by the numerous questions from the inspectors and excessive time required for the licensee to determine that the above condition was reportable under 10 CFR 50.72.
- The licensee's program for calculating the service lives of Unit 2 normally energized Agastat relays was poor. Calculation methods were not based on sound engineering judgement. The licensee was in the process of revising the program and developing a better calculation method. The original unresolved item is closed. A new unresolved item is open for this issue.
- Three previously identified unresolved items and one violation were closed.



Report Details

I. Engineering

E1 Conduct of Engineering

E1.1 Unit 1 Motor-Operated Valve Hot Short Issues

a. Inspection Scope

On November 1, 1996, Niagara Mohawk Power Corporation (NMPC) identified that two motor-operated valves (MOV) in the shutdown cooling system were vulnerable to valve damage if a fire-induced hot short (short circuit between control wiring and a power source) bypass the control, limit and torque switches during a postulated control room fire. The licensee promptly notified the NRC of this event and issued a Licensee Event Report (LER). The inspectors reviewed the licensee's corrective actions in response to their identification of this issue.

b. Observations and Findings

Background

On February 28, 1992, the NRC issued Information Notice (IN) 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire," to alert all operating licensees to conditions found at several reactors that could result in the loss of capability to maintain the reactor in a safe shutdown condition in the unlikely event that a control room fire forced reactor operators to evacuate the control room. The control room fire could cause hot shorts that could bypass the control switches, torque switches, and limit switches of the MOV control circuits, and initiate spurious operations of the MOVs which were required for safe shutdown. These spurious operations could cause the valve motor to be continuously energized, resulting in excessive torque and current, causing mechanical damage to the valve or electrical damage to the motor.

In response to IN 92-18, the licensee issued Deviation/Event Report (DER) 1-92-Q-0881 on March 17, 1992, to determine its applicability to Unit 1. Because of their narrow scope of review and a misinterpretation that spurious maloperations were limited to functional failure only, the licensee failed to identify and correct the potential problem of valve damage (mechanical damage due to excessive torque from the valve motor) at that time.

The Event

During a recent (October 7, 1996) MOV inspection by the NRC, the licensee was requested to revisit their review of IN 92-18. The licensee reviewed the 1992 disposition of DER 1-92-Q-0881, recognized potential valve damage in spite of thermal overload protection, and identified that two valves in the shutdown cooling system could be damaged mechanically if a fire-induced hot short bypasses certain control, limit and torque switches of the valves. These two valves, IV 38-01 and IV



38-13, were normally closed, were both inside the drywell, and were in the common suction and the common discharge paths of the shutdown cooling system. Any one valve that became inoperable would cause the shutdown cooling system to be inoperable. Subsequently, the licensee issued LER 96-10 on December 2, 1996, to report this issue to the NRC. The licensee also noted that the circuit breakers for these two valves, IV 38-01 and IV 38-13, had been administratively locked open since April 12, 1995, because of an unrelated modification (for 10 CFR 50, Appendix J water seal issue). This administrative control (circuit breakers locked open) would preclude spurious maloperations of these valves during a control room fire. The licensee also issued, on February 28, 1997, Supplement 1 to the LER. Supplement 1 included the result of the root cause evaluation. The licensee attributed the root cause for not identifying these problems earlier (during the 1992 review) to be a misinterpretation that the effects of the spurious operations were limited to functional failures (electrical failure of the valves), without the assessment of mechanical failure. The licensee also acknowledges that NMPC personnel failed to recognize, at that time, that valve actuators could develop sufficient thrust to mechanically damage the valves.

Review of the LER

The inspectors reviewed the LER, including Supplement 1, and found the LER properly described the event. The inspector agreed with the licensee for the root cause of the event.

Short term corrective actions taken by the licensee included: 1) performing additional detailed reviews for all other motor-operated valves in the safe shutdown systems, including the hot shutdown system, and found that the other valves were not affected; 2) starting promptly a similar review of Unit 2 motor-operated valves in the safe shutdown system and found many valves that were susceptible to this fire-induced hot short issue, as discussed in Section E.2 of this report.

Long term corrective actions planned by the licensee included: 1) revising Appendix R safe shutdown analysis in the FSAR to require that the valve breaker be locked open to preclude spurious maloperation, by May 30, 1997; 2) training by December 31, 1997, of NMPC technical staff of the details of this LER to preclude future occurrences of inadequate failure mode effect analyses relative to motor-operated valve spurious actuations.

The inspectors determined that the licensee's short-term and long-term corrective actions for this event to be appropriate. The inspector also determined that for the period from March 3, 1983, when the 10 CFR 50 Appendix R program was implemented to April 12, 1995, when the circuit breakers for motor-operated valves IV 38-01 and -13 were administratively locked open, Unit 1 was in apparent violation of 10 CFR 50.48(b) as follows:



10 CFR 50.48(b) requires, in part, that all nuclear power plants licensed prior to January 1, 1979, shall satisfy the applicable requirements of Appendix R to 10 CFR 50, Section III.G, including the requirements of Section III.L, alternative and dedicated shutdown capability, which, according to the NRC's response to Question 5.1.3 for Generic Letter 86-16, applies to the alternative safety shutdown option under Section III.G, as follows:

Although 10 CFR 50.48(b) does not specifically include Section III.L with Sections III.G, J, and O of Appendix R as a requirement applicable to all power reactors licensed prior to January 1, 1979, the Appendix, read as a whole, and the Court of Appeals decision on the Appendix, Connecticut Light and Power, et al. v. NRC, 673 F2d. 525 (D.C. Cir., 1982), demonstrate that Section III.L applies to the alternative safe shutdown option under Section III.G if and where that option is chosen by the licensee.

The alternative shutdown capability had been chosen by the licensee (two alternative shutdown panels were provided). Appendix R, Section III.L.5 requires that equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable and cold shutdown can be achieved within 72 hours. Materials for such repairs shall be readily available on site and procedures shall be in effect to implement such repairs.

During the period from March 3, 1983, to April 12, 1995, the licensee did not have written evidence, including repair procedures that if valves IV 38-01 and -13 were damaged mechanically due to a fire-induced hot short during a postulated control room fire, the damaged valves could be repaired and still achieve the cold shutdown function within 72 hours. Therefore this condition constituted an apparent violation of 10 CFR 50.48(b). (EEI 50-220/97-05-01)

Review of Repair Procedures

The inspectors reviewed two P&IDs (piping and instrumentation diagram) for two systems: C-18017-C for the emergency cooling system, Revision 46; and C-18018-C for the reactor shutdown cooling system, Revision 23 to identify the motor-operated valves (MOV) that were used for hot and cold shutdown following a postulated control room fire. The inspectors also reviewed the elementary wiring diagrams for valves IV 38-01, IV 38-13, IV 39-05, -06, -07, and -08, and did not identify any deficiencies. The inspectors also reviewed Damage Repair Procedure N1-DRP-GEN-004, "Emergency Damage Repair for Fire Zones C2 and C3" Revision 3, dated April 25, 1995. This procedure was used to repair valves IV 38-01 and -13 following a postulated control room fire. The licensee also checked the procedure steps against the wiring diagrams for errors. The licensee found several steps containing wire numbers and termination point errors, which could hamper



valve repair process if left uncorrected. The licensee promptly issued an immediate PCE (procedure change evaluation) to correct these errors. The licensee also issued DER 1-97-0682 on March 12, 1997, to document this issue. The corrective action for this DER included expanding the procedure reviews to include the other four repair procedures. Additional errors were identified in three of the procedures reviewed. Subsequently, the licensee issued additional PCEs to correct the identified errors. All four repair procedures had not been actually used, therefore, no hardware (repair) errors had been involved.

The licensee attributed the apparent cause for these errors to be a failure to perform verification of written documentation by the procedure writer. The licensee also stated that all these repair procedures were special procedures and had never been used before.

To eliminate other possible errors, the licensee planned to perform a complete walkdown of all five repair procedures and label all accessible wires (for better identification of wire numbers and termination numbers). The licensee stated that these corrective actions would be completed by July 1, 1997. The inspector's review of the resolution of DER 1-97-0682 indicated that these actions had been documented and tracked by the DER.

The inspectors determined that the completed and planned corrective actions for this procedure deficiency were appropriate. However, failure to establish acceptable repair procedures constituted a violation of 10 CFR 50, Appendix B, Criterion V, "Instruction, Procedures, and Drawings," which requires activities affecting quality to be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances. However, this licensee-identified violation is being treated as a Non-cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy.

c. Conclusion

In response to NRC Information Notice 92-18, the licensee issued a DER (DER 1-92-Q-0881) in 1992 to document their review for its applicability to Unit 1. Because of their narrow scope of review (restricting to potential electrical damage to the motor only), the licensee failed to identify and correct at that time the potential problem of valve damage (mechanical damage due to excessive torque from the valve motor) due to a fire-induced hot short.

During a recent MOV inspection, the NRC had asked the licensee to revisit their review of IN 92-18. The licensee's re-review identified that two valves in the shutdown cooling system could subject to mechanical damage, due to high torque from the valve motors, if a fire-induced hot short bypasses certain control and torque switches of the valves. The licensee also noted that the circuit breakers of the two affected valves had been administratively locked open since April 12, 1995, because of an unrelated modification. Locking the circuit breakers open would preclude maloperations of these valves during a control room fire. The licensee attributed the root cause for not identifying these problems earlier (during



the 1992 review) to be a misinterpretation that the effects of the spurious operation were limited to functional failure (electrical failure of the motors), without the assessment of mechanical valve failure due to excessive torque. The licensee also acknowledges that NMPC personnel failed to recognize at that time (during the 1992 review) that valve actuators could develop sufficient thrust at stall to damage the valves.

The inspectors concluded that during the period from March 3, 1983, when the 10 CFR 50 Appendix R program was implemented to April 12, 1995, when the circuit breakers for the affected two valves were administratively locked open, Unit 1 was in apparent violation of 10 CFR 50.48(b).

The inspectors concluded that the licensee's failure to identify these potential valve damages (during a postulated control room fire) during the 1992 review constituted an example of an apparent violation of 10 CFR 50. Appendix B, Criterion XVI, Corrective Action, which requires conditions adverse to quality such as failures, malfunctions, and nonconformances, to be identified and corrected promptly. (EEI 50-220/97-05-02)

The inspectors' review of LER 96-10, including Supplement 1 to the LER, indicated that the LER properly described the event. The inspectors concurred with the licensee for the root cause of the event. The inspector determined that the licensee's short-term and long-term corrective actions, in response to this event, were appropriate.

A non-cited violation was also identified in the area of valve repair procedures.

E1.2 Unit 2 Motor-Operated Valve Hot Short Issues

a. Inspection Scope

On December 17, 1996, and January 15, 1997, the licensee identified that multiple MOVs in the shutdown cooling system and the RCIC system were vulnerable to valve damage if a fire-induced hot short bypass the control, limit and torque switches during a postulated control room fire. The licensee subsequently notified the NRC of this event and issued LER 96-15. The inspectors reviewed the licensee's corrective actions in response to their identification of this issue.

b. Observation and Findings

In response to NRC IN 92-18, the licensee conducted an applicability review in 1992 to determine whether similar problems existed at Unit 2. The licensee issued DER 2-92-Q-1056 on March 25, 1992, to document the review process and review results (disposition). At that time, the licensee considered that the examples provided in IN 92-18 only applied to MOVs of which thermal overload protections were bypassed. Since the thermal overload protections for Unit 2 were not bypassed, the licensee concluded at that time that IN 92-18 did not affect Unit 2 operation.



Shutdown Cooling System Motor-Operated Valves

Following Unit 1 engineering identification that two motor-operated valves in the shutdown cooling system were susceptible to valve damage caused by a fire-induced hot short during a postulated control room fire, NMPC management questioned Unit 2 engineering whether similar conditions existed on the Unit 2 design. An initial evaluation by Unit 2 engineering indicated that similar problems existed in the shutdown cooling mode of the residual heat removal (RHR) system. At Unit 2, there were two shutdown cooling trains (two pumps and two heat exchangers) sharing a common suction path, containing 2RHS*MOV-112 and -113 in series. At that time, the power supply circuit breaker for 2RHS*MOV-113 was administratively controlled in the open position. Therefore, this valve was not vulnerable to the hot short problem. However, the power supply breaker for 2RHS*MOV-112 was closed, and was susceptible to the hot short problem, if the fire-induced hot short bypassed the control, limit and torque switches. The licensee also found that 2RHS*MOV-112 had sufficient torque that could cause mechanical damage to the valve. Subsequently, the licensee notified the NRC of this issue on December 17, 1996, and issued DER 2-96-3379 to document this deficiency. Since the opening of 2RHS*MOV-112 was required for the plant to achieve cold shutdown, the inspectors determined that the above condition constituted an example of an apparent violation of the Unit 2 operating license as follows:

Nine Mile Point Unit 2 operating license No. NPF-69, Item 2.G requires the licensee to implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report (FSAR) for the facility.

Nine Mile Point Unit 2 FSAR, Section 9B.8.2, which is part of the approved fire protection program, states that the main control and relay rooms fire protection analysis postulates a fire in the main control or relay rooms that necessitates evacuation of the main control room and verifies that capability for safe shutdown of the plant exists from the remote shutdown room and other local control stations outside the main control or relay rooms. This analysis was based on the assumptions which include that a single, spurious maloperation, in addition to the loss of all automatic signals, is considered for evaluation purposes for components controlled from the main control room. Section 9B.8.2.2 of the FSAR identified that the cold shutdown under these conditions could be achieved within 72 hours. In addition, Unit 2 FSAR Section 9B.8.2-4, Conclusion, states that necessary administrative procedures, operating instructions, and operator training are provided for the main control and relay rooms fire event.

However, the operating conditions described below was not based on the above assumptions:

As of December 17, 1996, a potential fire-induced hot short in the control circuit of shutdown cooling motor-operated valve 2RHS*MOV-112, which is located in the common suction path inside the drywell, could cause damage to the valve and prevent the shutdown cooling system from achieving its cold shutdown function within 72 hours. Specifically, the fire-induced hot short could bypass the valve



control, limit, and torque switches, and the excessive torque generated by the motor could cause mechanical damage to the valve, making the valve inoperable. At that time, there was not written evidence, including administrative procedures and operating instructions, that the potentially damaged valve could be repaired and still achieve cold shutdown within 72 hours (EEI 50-410/97-05-03).

Following the identification of the above deficiency, the licensee promptly deenergized the control circuits for valve 2RHS*MOV-112 and administratively controlled its power supply circuit breaker in the open position during normal plant operation, to preclude spurious operation during a control room fire. Two other motor-operated valves (2RHS*MOV-142 and -149) in the shutdown cooling system also had their control circuits deenergized, and their power supply circuit breakers administratively controlled in the open position. These two valves were used to flush the stagnant water upstream of the residual heat removal heat exchanger and to provide pre-warming of piping system before the start of shutdown cooling.

Reactor Core Isolation Cooling (RCIC) Motor-Operated Valves

During the review of the preliminary LER 96-15, which was intended to report the condition discussed above, Unit 2 Station Operations Review Committee (SORC) questioned Unit 2 engineering if the RCIC system motor-operated valves (MOV) were subject to the same deficiency.

The results of Unit 2 engineering's reviews indicated that there were multiple motor-operated valves in the RCIC system that were vulnerable to the fire-induced hot short problem. These valves included 2ICS*MOV-121, -126, -128. A failure of any of these valves would render the RCIC system inoperable. On January 15, 1997, the licensee notified the NRC of these deficient conditions. The licensee also issued DER 2-97-0118 to document and track the resolution of this deficiency. Because an inoperable RCIC system, at that time, would cause the remote shutdown panel to be unable to provide a safe shutdown path, the licensee entered a seven-day LCO (limiting condition for operation) on January 15, 1997, in accordance with Unit 2 Technical Specification Section 3.3.7.4. The licensee immediately contracted Generic Electric (GE) to conduct an analysis for an alternate success path using safety relief valves (SRV) in the automatic depressurization system (ADS) mode in conjunction with the RHR system, the "Pseudo LPCI" path. The GE analysis results indicated that hot shutdown could be achieved by manually reducing the reactor vessel pressure through ADS and the Pseudo LPCI paths. The licensee also issued the applicable procedures for using the alternate safe shutdown path. Subsequently, the licensee exited the seven-day LCO on January 22, 1997. The Pseudo LPCI paths consisted of two (redundant) loops. Each loop took suction from the suppression pool through manual valves, passed through the RHR heat exchanger, and injected coolant into the reactor vessel through the recirculation line. The licensee stated that appropriate sections of the Unit 2 fire protection program (FSAR Section 9B) would be updated to incorporate the alternate shutdown path when the RCIC system was inoperable following a postulated control room fire.



Review of Unit 2 LER 96-15

The licensee issued LER 96-15 on January 16, 1997, to report the two issues (potential shutdown cooling system MOV damages and RCIC system MOV damages) to the NRC. The licensee also issued Supplement 1 to LER 96-15 on March 27, 1997, to include the result of their root cause evaluation. The licensee attributed the root cause of the design deficiencies to be a failure to fully evaluate hot short vulnerability of safe shutdown valves by the design organizations (the Architect Engineer) responsible for the initial plant design. The licensee also attributed that the root cause for not identifying these deficiencies during the 1992 evaluation (in response to IN 92-18) was a mindset that information contained in IN 92-18 was outside the design basis of NMP Unit 2.

The short term corrective actions taken by the licensee was prompt as discussed in various parts of this report (Section E1.2.b). The long-term corrective action was to provide training to the engineering support staff, on LER 96-15, to preclude improper evaluation of NRC Information Notices in the future. The licensee expected to complete this training by September 30, 1997.

The inspectors reviewed LER 96-15, including Supplement 1, and concluded that the LER appropriately described the event. The root causes and corrective action discussed in the LER were determined to be appropriate.

Violations

The inspectors determined that before a successful alternate safe shutdown path was fully established and proceduralized, the potential loss of the RCIC system due to a potential valve damage caused by a fire-induced hot short following a postulated control room fire constituted another example of an apparent violation of Unit 2 operation license No. NPF-69, Item 2.G, Fire Protection Program, is as follows:

As described in Section E1.2(b) of this report, Unit 2 fire protection analysis for control room fire protection was based on the assumptions which include that a single, spurious maloperation, in addition to the loss of all automatic signals, is considered for evaluation purposes for components controlled from the main control room. Section 9B.8.2.2 of the FSAR identified that the hot shutdown under these conditions could be achieved within 10 minutes.

However, the operating conditions described below were not based on the above assumptions:

As of January 15, 1997, a potential fire-induced hot short in any one of the control circuits of multiple motor-operated valves (2ICS*MOV-128, -121, and -126) could prevent the RCIC system from achieving its hot shutdown function within 10 minutes. Specifically, the fire-induced hot short could bypass the valve control and



limit switches and the motor torque switch, and the excessive torque generated by the motor could cause mechanical damage to the valve, making the affected valve inoperable. The RCIC system would be inoperable when any one of the multiple motor-operated valves was inoperable (EEI 50-410/97-05-04).

The inspectors also determined that the licensee's failure to identify, during the 1992 review in response to IN 92-18, that the shutdown cooling motor-operated valve 2RHS*MOV-112 and multiple motor-operated valves (2ICS*MOV-128, -121, - and -126) in the RCIC system were susceptible to mechanical damage when their control circuits were subjected to a fire-induced hot short during a postulated control room fire, constituted an apparent violation of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action, which requires conditions adverse to quality, such as failures, malfunctions, and nonconformances to be identified and corrected promptly. The licensee failed to identify the deficient conditions at that time because a mindset existed at NMPC that the information contained in IN 92-18 was outside the design basis of the plant (EEI 50-410/97-05-05).

c. Conclusion

On two separate conditions, the licensee had identified that there were motor-operated valves in the shutdown cooling system (for cold shutdown) and in the RCIC system (for hot shutdown) that were vulnerable to valve damage when subjected to a fire-induced hot short during a postulated control room fire. The inspectors concluded that these deficient conditions constituted two examples of an apparent violation of the Unit 2 operation license No. NPF-69.

The inspectors also concluded that the licensee's failure to identify the above deficient conditions, during the 1992 review in response to IN 92-18 constituted an apparent violation of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action, which requires conditions adverse to quality, such as failures, malfunctions, and nonconformances to be identified and corrected promptly.

E1.3 Inadequate Isolation of Unit 2 Remote Shutdown Panel Control Circuits from the Control Room

a. Inspection Scope

On two separate occasions during the week of April 7, 1997, the licensee identified deficient condition within the control circuitry for the Unit 2 emergency diesel generator (EDG) service water valves. The inspectors assessed the licensee's performance in response to the associated events. Included in the inspectors' assessment were discussions with the on-duty station shift supervisors (SSSs), operations and licensing department management, and system and design engineers.



b. Observations and Findings

Service Water Valves Vulnerable to Short-to-Ground Damage

During a review of an operating experience report from another facility regarding a deficiency that could potentially result in damage to plant EDGs during the performance of the alternate shutdown procedure, NMPC identified a different deficiency that could damage both Division I and II EDGs during a control room fire. Specifically, the licensee identified that the remote shutdown panel (RSP) control circuits for EDG service water outlet valves 2SWP*MOV66A and 66B were not completely isolated from the control room. Therefore, during a postulated control room fire, the potential existed that a short-to-ground in the control circuits could result in a loss of control power to 2SWP*MOV66A and 66B. This deficiency placed the plant in a condition outside the design basis, as described in Unit 2 fire protection program. On April 7, 1997, the licensee notified the NRC in accordance with 10 CFR 50.72. Additionally, the SSS declared the RSP inoperable and entered a seven-day LCO per Technical Specifications (TS) 3.7.4.b. The licensee documented the deficiency in DER 2-97-1092. This deficiency is discussed below.

Although the additional fuses were in place, because of lack of isolations, portions of the control circuits for 2SWP*MOV66A and 66B, located in the control room, would have remained connected to RSP even after the transfer switches were operated. Therefore, a short-to-ground within the control room could result in blowing the fuses at the RSP panel, rendering the valves inoperable. Since a loss of off site power (LOOP) is postulated in conjunction with a control room fire, the loss of 2SWP*MOV66A and 66B would cause a loss of cooling water to both EDGs. This could cause a station blackout condition and adversely affect the safe shutdown capability of the plant from the RSP.

The inspectors reviewed DER 2-97-1092, and discussed related issues with the SSS. The inspectors considered the licensee identification of the deficiency to be good, and the immediate actions taken to address the deficiency were appropriate. However, the deficient condition described above constituted an apparent violation of Unit 2 operation license No. NPF-69, item 2.G, Fire Protection Program, as follows:

Nine Mile Point Unit 2 FSAR Section 9B.8.2.3, which is part of the approved fire protection program, states that in case of a fire in the main control or relay rooms, the design modifications necessary to maintain availability and controllability of systems required for safe shutdown and to prevent spurious maloperations included the provision of disconnect switches outside the main control or relay rooms for certain safe shutdown equipment, which included two motor-operated valves 2SWP*MOV-66A and B.



As of April 7, 1997, disconnect switches (isolation) located outside the main control room were not provided to the control circuits for these two valves as necessary to prevent spurious maloperations. These two valves controlled the cooling water supplies to emergency diesel generators EG1 and EG3. Because of this lack of isolations, a potential short-to-ground in certain parts of the control circuits during a control room fire could render the associated valves inoperable. (EEI 50-410/97-05-06)

To address this deficiency, NMPC completed Design Change N2-97-049 to add transfer switch contacts to isolate the RSP from the control circuits for 2SWP*MOV66A and 66B, located in the control room. The inspectors reviewed portions of this design change, including the associate 10 CFR 50.59 applicability review, and found them appropriate. Additionally, the design change was discussed with the responsible engineers, with no concerns identified. During implementation of the design change, the inspectors observed that the licensee properly entered TS limiting conditions for operations (LCOs) for the EDGs and the service water system, and performed appropriate post-modification testing. Additionally, the licensee's actions to minimize EDG unavailability, during the design change implementation, was considered good.

Additional Deficient Condition

On April 11, 1997, during the post-modification testing for the design change to the 2SWP*MOV66A control circuit, the licensee discovered eleven drawing discrepancies. These discrepancies consisted of both editorial and deviations between the drawing and plant configuration, and were documented in DER 2-97-1136. Nine of the eleven discrepancies were minor in nature, including several typographical errors, which were to be resolved with the closeout of the design change. However, two discrepancies involved a wire that jumpered one of the contacts associated with the RSP transfer switch, and a lifted lead. The combination of the jumper and the lifted lead effectively voided the protection that the transfer switch was to provide the RSP control circuit for 2SWP*MOV66A.

The SSS informed the inspectors of these discrepancies at 4:34 p.m.. Subsequently, the inspectors discussed the discrepancies in detail with the SSS and was satisfied that only the jumper and lifted lead impacted the operation of the RSP or other equipment. The resident inspectors also verified that the applicable TS LCOs for the affected equipment were being implemented.

The initial reportability determination made by the SSS, as indicated on the DER reviewed by the resident inspector the evening of April 11, 1997, was that the event was only reportable under 10 CFR 50.73 (a 30-day written report). The resident inspectors questioned the SSS as to why this event was not reportable under 10 CFR 50.72 (a one-hour telephone notification) for a condition outside design basis, as was the case on April 7. Subsequently, the SSS included the General Manager of Operations, and eventually the Licensing Manager into the discussion. At 6:58 p.m., NMPC determined that the event was reportable under 10 CFR 50.72 for a condition outside the design basis, and notified the NRC at 7:37



p.m. Although NMPC eventually determined the event was reportable under 10 CFR 50.72, the inspectors considered their evaluation to be weak. This weakness was evidenced by the numerous questions from the inspectors and excessive time required by the licensee to determine that the event was reportable under 10 CFR 50.72.

The licensee corrected the wiring discrepancies under a work order. Additionally, the licensee compared the as-installed configuration to plant drawings for five other valve control circuits associated with the RSP. No additional discrepancies were identified during this comparison. The inspectors considered the licensee's actions taken to correct the discrepancies and the performance of the precaution checks for similar discrepancies to be appropriate. However, this failure to meet the design basis was considered the second example for the apparent violation of Unit 2 operation license No. NPF-69, item 2.G, as discussed above. (EEI 50-410/97-05-06)

c. Conclusions

On two separate occasions, during the week of April 7, 1997, NMPC identified discrepancies within the control circuitry for the Unit 2 Division I and II EDG service water outlet valves. These discrepancies could have caused a loss of cooling water to the EDGs during a control room fire and adversely affect the safe shutdown of the plant from the RSP. The licensee's identification of the discrepancies and the actions to minimize EDG unavailability time during the repairs were good. However, on both occasions, the plant failed to meet the design basis, as described in the Unit 2 Fire Protection Program, and were considered additional violation of Unit 2 operation license No. NPF-69, item 2.G. Also, a weakness was identified in the licensee's reportability evaluation for discrepancies identified on April 11, as evidenced by the numerous questions from the inspectors and excessive time required for the licensee to determine that the event was reportable under 10 CFR 50.72.

E8 Miscellaneous Engineering Issues (92903)

- E8.1 (Closed) Unresolved Item 50-410/95-24-02: This item pertained to the calculations of the service lives of Unit 2 Agastat relays. During the November 1995 inspection when this item was identified, the licensee stated they had performed various aging calculations using test data from Southwest Research Institute Report 04-1738-001, the measured temperatures at the relay locations, and the mechanical activation energy of 0.84 eV. Their calculations indicated that the service lives of the normally energized (NE) Agastat GP relays in the control building were greater than 14 years. The licensee also stated that they had a preventive maintenance program in place to replace the relays before their service lives expired.

Since all Agastat GP relays at Unit 2 were located in mild environment areas, they were not covered by Unit 2 environmental qualification (EQ) programs.



Review of Relay Service Life Calculations

During this inspection, the inspectors reviewed the licensee's program for calculating the service lives of normally energized relays and the program for relay replacement. The licensee had developed Nuclear Engineering Report NER-2E-007, entitled, "Agastat Relay Service Life." This document was used by the licensee to calculate the service lives of all NE Agastat GP relays and to schedule the replacement of those relays.

The inspectors reviewed Revision 1 of this document, dated March 10, 1997, and noted the following:

Section 4.2.1 discussed a Grand Gulf document, No. 04-1738-001, entitled, "Grand Gulf Nuclear Station Test Report for Agastat Relays," dated December 1988. Based on the Grand Gulf test, the licensee established two sets of curves, designated as Attachment 1, "Ambient Temperature vs. Coil Temperature," and Attachment 2, "Coil Temperature vs. Relay Service Life." The licensee also stated in this section, that: "the ambient temperature surrounding the relay and the inside coil temperature were the two key elements in determining the service life of the relay; the Grand Gulf document established these relationships based on actual thermal aging tests. Attachment 1 provided the relationships between ambient temperature and coil temperature based on Grand Gulf's actual test results." Attachment 2 consisted of three curves, providing the relationships between the relay coil temperatures and the expected service lives, for 24 Vdc, 125 Vdc, and 120 Vac relays. Attachment 1 indicated that for ambient temperature above 86°F, the coil temperature and the ambient temperature had a linear relationship. However, for ambient temperature below 86°F, the coil temperature stayed above 186°F.

In Section 4.2.2, the licensee used another means to estimate the relay coil temperatures. The licensee used thermography readings, aiming at the target relay, and added 40°F. The licensee claimed that the result represented the relay coil inside-temperature. Typically, the temperature of the energized relay coil and that of the relay base differed substantially. In addition, the relay coil was covered by a thick plastic cover. Therefore, it was not clear that the thermographic reading represented the temperature of which part of the relay. This method was not based on actual testing, and the result was in conflict with Attachment 1 described in Section 4.2.1, which was in the same document.

The licensee calculated the service life of 120 Vac relays E31A-K029B and K024B in panel 2CEC*PNL642, relays 3X-2HVCA05, 42X-HVCA02, 42X-HVCA05, 3-2HVYA16, and 3-2-2HVRA90, in panel 2CEC*PNL859, using the thermographic reading method to be 40 years. However, if the Attachment 1 method was used, the calculated service life would be 10 years. There was a 30-year-life difference for the same relays. The inspector concluded that the licensee's calculations for the relay service life were unacceptable.



Review of Relay Failure Reports

The inspector also reviewed two DERs (DER 2-96-2038, dated August 28, 1996; DER 2-97-0391, dated February 12, 1997). Both DERs documented problems due to failed, normally-energized relays. The licensee later sent these failed relays to PECO Energy Laboratories in Valley Forge, Pennsylvania, for testing to determine the root cause. The test results, as documented in PECO report No. 9700406, dated April 2, 1997, indicated that all relays had brittle, cracked relay coil bobbins, indicating excessive thermal aging. The licensee calculated the service lives for these two relays, using thermography reading, to be 12 years and 15 years. Again, if the Attachment 1 method was used, the service lives for both relays would be 10 years. If these relays were replaced within 10 years, relay failure could have been avoided.

Licensee's Corrective Actions

The licensee stated that they had contracted PECO Laboratories to perform more tests and to establish a more reliable methodology to determine the relay coil temperatures based on measured ambient temperatures. On April 28, 1997, the licensee transmitted, for the inspector's review, a preliminary schedule for developing a new methodology to calculate all Unit 2 NE Agastat relay service lives. This schedule indicated that they could complete the new calculations, based on the test results from independent laboratories (PECO Laboratories), by June 30, 1997.

On a telephone call on June 2, 1997, the licensee stated that the PECO test report was just completed and was being reviewed by the licensee. The licensee also stated that they would start promptly to establish the new calculation methodology.

During the inspection, the inspectors emphasized the importance of replacing the safety-related relays on time to prevent relay failures due to over-aging, because all of these relays perform important functions, including initiating reactor trip, starting and stopping engineered safety feature pumps, and opening and closing important valves for accident mitigation. Since relay failure normally could not be detected until the system testing following the failure, common mode failure could result if over-aged relays were not replaced on time.

The inspector asked the licensee why the Attachment 1 method was not used in their calculations, but did not get a satisfactory answer. However, the licensee did state that: 1) they intended to replace all normally energized safety-related Agastat relays, that had not been previously replaced, by the next refueling outage, even if the new calculated service lives were greater than 13 years; 2) for second round relay replacement, all normally energized and safety-related Agastat relays would be scheduled for replacement within a 10 year interval even if the calculated service lives were longer. The inspectors considered this replacement schedule acceptable.

The original item is closed: However, the relay service life calculation issue remains unresolved pending further NRC review of licensee's corrective actions. (URI 50-410/97-05-07)



- E8.2 (Closed) Unresolved Item 50-220/96-13-04: This item pertained to hot short vulnerability of Unit 1 shutdown cooling motor-operated valves IV 38-01 and -13. The details of this issue and the licensee's corrective actions were discussed in Section E1.1 of this report. This item is closed.
- E8.3 (Closed) Unresolved Item 50-410/96-14-01: This item pertained to hot short vulnerability of three motor-operated valves (2RHS*MOV-112, -142, and -149) in the Unit 2 shutdown cooling system. The details of this issue and the licensee's corrective actions for this issue were discussed in Section E1.2 of this report. This item is closed.
- E8.4 (Closed) Unresolved Item 50-220/96-15-01: This item pertained to the motor-operated valves that were vulnerable to fire-induced hot short damage during a control room fire. For Unit 1, the detail and the resolution was discussed in Section E1.1 of this report. Therefore, this item is closed.
- E8.5 (Updated) Unresolved Item 50-410/96-15-01: For Unit 2, the design basis for their fire protection program only postulates a single maloperation (involving mechanical valve damage) during a postulated control room fire. The design basis assumptions regarding multiple hot short scenarios were not discussed in the fire protection program. Region I will request the Office of Nuclear Reactor Regulation (NRR) to conduct a review of this issue. Therefore, this item remains open pending review results from NRR.
- E8.6 (Closed) Violation 50-220/95-24-01: pertained to inadequate corrective actions for replacing over-aged, normally energized Agastat GP relays and for replacing commercial-grade Agastat time-delay relays. During this inspection, the inspector reviewed the licensee's corrective action taken to resolve these two issues, including the licensee's expanded review of Wyle Laboratories EQ test reports. Corrective actions were discussed in NMPC letters NMPIL1035, dated February 22, 1996, and NMPIL1066, dated April 29, 1996, in response to the Notice of Violation. The inspector determined that the licensee's corrective actions were adequate to prevent recurrence. This item is closed.
- E8.7 (Closed) LERs 50-410/96-15 and 96-15-01: This LER pertained to Appendix R fire-induced hot shorts in remote shutdown system valves. LER 50-410/96-15 described issued associated with fire-induced hot short potentially rendering valves unable to perform the intended 10 CFR 50, Appendix R functions during a postulated control room fire. Supplement 1 to LER 96-15 was issued by NMPC to provide the root cause and corrective actions not included in the original LER. The technical details pertaining to the events were described in NRC Inspection Report 50-410/96-14 and 50-410/97-01. The original LER, 50-410/96-15 was reviewed in Inspection Report 50-410/97-01, but since the licensee had yet to complete their root cause evaluation and determine the subsequent corrective actions, the LER review was left open. The inspectors reviewed the root cause and corrective



actions provided in the LER supplement, and they were determined to be appropriate. The details associated with the root cause and corrective actions are provided in Section E1.2 of this report. Therefore, based on the inspectors' review, LERs 50-410/96-15 and 50-410/96-15-01 are closed.

- E8.8** (Closed) LERs 50-220/96-10 and 96-10-01: This LER pertained to Appendix R fire-induced hot shorts in shutdown cooling valves. LER 50-220/96-10 described issues associated with fire-induced hot shorts potentially rendering valves unable to perform the intended 10 CFR 50 Appendix R functions during a postulated control room fire. Supplement 1 to LER 96-15 was issued by NMPC to provide the root cause and corrective actions not included in the original LER. The technical details pertaining to the events were described in NRC Inspection Report 50-410/96-13. The LER and supplement were found to be timely and to satisfactorily describe the event. The inspectors reviewed the root cause and corrective actions provided in the LER supplement, and they were determined to be appropriate. The details associated with the root cause and corrective actions are provided in Section E1.2 of this report. Therefore, based on the inspectors' review, LERs 50-220/96-10 and 50-410/96-10-01 are closed.

E9 UFSAR Reviews

A recent discovery of a licensee operating their facility in a manner contrary to the updated final safety analysis (UFSAR) description highlighted the need for a special, focused review that compares plant practices, procedures and/or parameters to the UFSAR descriptions.

While performing the inspections discussed in this report, the inspector reviewed the applicable portions of the UFSAR that related to the areas inspected. Nonconformances with the UFSAR for the unit fire protection program were discussed in Sections E1.2 and E1.3 of this report. The inspector verified that other reviewed sections of the UFSAR wording were consistent with the observed plant practices, procedures and/or parameters.

X1 Exit Meeting

The inspector met with the licensee personnel at the conclusion of the site inspection on April 18, 1997, and summarized the scope of the inspection and the inspection results. No proprietary materials were reviewed during this inspection. The licensee acknowledged the inspection findings at that meeting.

The inspector amended the exit meeting in a telephone call on June 4, 1997, to Mr. D. Baker of Niagara Mohawk. The inspector stated that: 1) the violation that pertained to Unit 1 repair procedures would be changed to a non-cited violation; and 2) NRC management review resulted in an additional apparent violation -- 10 CFR 50, Appendix B, Criterion XVI, Corrective Action, for the motor-operated valves, that were vulnerable to the hot short issue at both Units 1 and 2.



PARTIAL LIST OF PERSONS CONTACTED

Licensee

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C. Beckham, Manager, Quality Assurance
D. Bosnic, Operations, Unit 2
J. Burton, Director, ISEG
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NRC

T. Beltz, Resident Inspector
B. Norris, Sr. Resident Inspector



ITEMS OPENED, CLOSED AND DISCUSSED

Opened

50-220/97-05-01	VIO	Unit 1 failure to meet 10 CFR 50.48(b) requirements
50-220/97-05-02	VIO	Unit 1 failure to identify and correct the MOV deficiency earlier
50-410/97-05-03	VIO	Unit 2 failure to meet the fire protection program in achieving cold shutdown
50-410/97-05-04	VIO	Unit 2 failure to meet the fire protection program in achieving hot shutdown
50-410/97-05-05	VIO	Unit 2 failure to identify and correct the MOV deficiencies earlier
50-410/97-05-06	VIO	Unit 2 failure to provide disconnected switches to MOV control circuits
50-410/97-05-07	URI	Unit 2 normally energized Agastat GP relay service life calculations

Closed

50-410/95-24-02	URI	Unit 2 normally energized Agastat GP relay service life calculations
50-220/96-13-04	URI	Unit 1 shutdown cooling MOVs susceptible to hot short issue
50-410/96-14-01	URI	Unit 2 shutdown cooling MOVs susceptible to hot short issue
50-220/96-15-01	URI	Unit 1 MOVs susceptible to hot short issue
50-220/95-24-01	VIO	Inadequate corrective actions for replacing Agastat GP and time delay relays
LER 50-410/96-15 and 96-15-01	LER	Unit 2 MOVs susceptible to hot short issue
LER 50-220/96-10 and 96-10-01	LER	Unit 1 MOVs susceptible to hot short issue

