U. S. NUCLEAR REGULATORY COMMISSION
REGION I

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DOCKET NOS.	50-220 50-410
LICENSE NOS.	DPR-63 NPF-69
LICENSEE:	Niagara Mohawk Power Corporation
FACILITY NAME:	Nine Mile Point Nuclear Station Units 1 and 2
INSPECTION AT:	Salina Meadows, and Scriba, New York,
INSPECTION DATES:	July 19-23,1992

INSPECTOR: W. H. Ruland for — 9/16/93
R. Bhatia, Reactor Engineer, Electrical Section, Engineering Branch, DRS — Date

APPROVED BY: J E Beall for — 9/16/93
W. Ruland, Chief, Electrical Section, Engineering Branch, DRS — Date

Area Inspected: This was an announced inspection to assess the reliability of the offsite power supply sources for the Nine Mile Point Units 1 and 2 and to review the licensee's corrective action on previously identified inspection findings on Unit 1.

Results: No violations or deviations were identified. The offsite power supply sources for both the units were found to be adequate and reliable. Of four unresolved items reviewed pertaining to Unit 1, three items were closed. The other unresolved item was updated. These items are discussed in sections 2.0 and 3.0.

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DETAILS

1.0 PURPOSE

The purpose of this inspection was to evaluate the adequacy/reliability of the licensee's offsite power supply sources for the Nine Mile Point Units 1 and 2 Station. In addition, the effects of a postulated fire in the cable spreading room area or cable tunnels were evaluated with respect to offsite power supply availability. The inspection also included the review and verification of the licensee's corrective actions for previously identified NRC findings during the 1991 Electrical Distribution Systems Functional Inspection (EDSFI) for the Nine Mile Point Unit 1.

2.0 OFFSITE POWER SUPPLY

2.1 Background

During the past several years, six events had occurred that had resulted in a partial or complete loss of offsite power. In all cases, one or both of the 115 kV offsite power supply lines to the Nine Mile Point Unit 2 station were lost, while the unit was either operating at power or under shutdown conditions. The NRC is concerned that every time a loss of an offsite power is experienced by the station, it results in a challenge to the safety equipment, operational personnel and causes an unnecessary risk to plant safety. The review of these documented Licensee Event Reports (LERs) revealed that four out of the six events had occurred within the last two years. This inspection was conducted to focus on the circumstances surrounding the above loss of power events and the licensee's corrective actions taken or planned to enhance the overall reliability of the offsite power supply to the Nine Mile Point Units 1 and 2. In addition, the effect of the Appendix R fire in each unit's cable spreading room area scenario was evaluated with respect to offsite power availability.

2.2 Brief Description of the Events

On December 26, 1988, a current transformer exploded in the offsite Scriba substation which disabled the only 115 kV offsite power supply line available to the Nine Mile Point Unit 2 (NMP2). At that time, the plant was already shutdown and the other offsite power supply line 5 was out of service for maintenance. On May 21, 1991, NMP2 experienced an actuation of several engineered safety feature systems (ESFs) due to a loss of one of the two offsite power supply lines. During this event, the supply line 5 was lost when breakers opened in the Scriba substation as a result of cable damage caused by excavation work ongoing in the Scriba substation. The cause of the event was considered to be improper communication between various departments and lack of adequate documentation for the ongoing work. The third event occurred on March 23, 1992, when human error resulted in tripping both the offsite power supply lines, while the plant was operating at 100% power. During this event, numerous ESFs system also actuated and control room annunciation was lost; as a result, the licensee declared a site emergency. The root cause of this event was determined to be inadequate work practice. The event occurred due to an inadvertent action

by th : relay technicians, followed by operator error in attempting to supply the unit auxiliary load from the offsite power supply line 5 using cross ties with line 6. This attempt failed due to a failure to recognize the reset requirement of the tripped relay and resulted in the loss of the remaining offsite line. Again, on July 28, 1992, line 6 was lost to Unit 2, when the R60 circuit breaker tripped in the Scriba substation due to a loss of hydraulic pressure. This trip was attributed to the 115 kV R60 hydraulic pump failure. Another event occurred on September 25, 1992, offsite power supply line 5 feeder was lost to Unit 2, when a contractors's crane boom came too close to the offsite feeder resulting in an arc from the line through the crane to the ground, which tripped line 5. In all the above cases, required engineered safeguard systems actuated, the plant was stabilized, and emergency diesel generators automatically started and supplied power.

2.3 Station Electrical System Design

The offsite power supply is designed to be a reliable power supply for the plant electrical distribution system to provide adequate power during startup, normal operation, and emergency-shutdown.

2.3.1 Unit 1 Design

The Nine Mile Point Unit 1 main generator output is tied onto the grid via two 345 kV lines. Line 9 connects to the Scriba substation, approximately 0.41 miles from the site, and line 8 connects with the Niagara Mohawk Power Corporation (NMPC) cross state bulk power transmission system via the Clay station. During normal plant operations, unit non-class 1E auxiliaries loads are powered by the main generator via the unit service transformer. During plant startup, shutdown, and abnormal operating conditions, the station auxiliaries are supplied from the 115 kV offsite power supply system via the plant reserve transformers. The safety class 1E loads are supplied at all times from the 115 kV lines 1 and 4 which are not supplied from the Scriba substation 115 kV system. The simplified power supply arrangement is shown in Figure 1.

2.3.2 Unit 2 Design

The Nine Mile Point 2 main generator output is tied onto the 345 kV Scriba substation, and the Scriba substation is further connected with two transmission lines to the Niagara Mohawk Power Corporation cross state connection link. During normal plant operation, the plant auxiliaries loads are supplied (via a step-down transformer) from the generator output. However, three 4.16 kV emergency buses are supplied from the two independent 115 kV offsite supply lines 5 and 6 from the Scriba substation. During plant startup and abnormal conditions, all loads (the unit auxiliary and emergency buses) are powered from the above two sources via two reserve transformers from the above two 115 kV lines of the Scriba substation. A simple arrangement of both units and the Scriba substation is shown in Figure 1.

2.3.3 The Scriba Substation Design

The Scriba substation utilizes a breaker and a half scheme. The 345 kV buses in the 345 kV transmission lines are connected to the Unit 1, Unit 2 and two 345 kV transmission lines which feed onto the NMPC cross state power grid system. Two transformers (step-down voltage from 345/115 kV), located on diagonally opposite corners, provide two offsite power sources to NMP2. A simplified diagram depicting the general arrangement and other equipment associated with the Scriba substation is shown in Figure 1.

2.4 Offsite Power Supply Assessment

During this inspection, the inspector reviewed the assessment performed by the independent safety engineering group (ISEG) of all the above events. The ISEG assessment concluded that a lack of communication among various nuclear and non-nuclear departments was the main cause of the above events. To resolve this concern, a management meeting was held on December 3, 1992, in which both units plant management and all other applicable nuclear and non-nuclear departments reviewed jointly the previous LOOP events to evaluate the necessary corrective actions required to minimize the recurrence of offsite line losses. Per discussion with the licensee staff and review of the meeting minutes, the inspector determined that in this meeting an overview of Unit 2's electrical distribution system and the plant impact of the loss of either 115 kV supply circuit were thoroughly discussed. All departments staff members were briefed on the importance and the consequences of the loss of either of the offsite power sources. Emphasis on strong communication among all groups was promoted.

An overall design review of the Scriba station was performed by the applicable design engineering departments to further enhance equipment reliability. The licensee decided to replace the four Scriba substation 115 kV breakers as soon as possible, since they were a direct cause of the LOOP in two events. These four breakers are an older design and are required to have minimum SF6, hydraulic, and nitrogen pressures for all modes of operation. In addition, it was also recognized that, with two breakers in series per source, any maintenance problem/outage on any one of the breakers would result in a partial loss of offsite power to NMP2. The licensee also decided that until these breakers were replaced, routine monitoring of the existing breakers would be done by the plant maintenance and other departments. In addition, a contingency plan was developed that would allow bypass of one of the two breakers if necessary.

The review of the 345 kV Scriba substation breaker design feature revealed that the 345 kV breakers were more reliable than the 115 kV breakers. The 345 kV breakers do not trip under low SF6, hydraulic, and nitrogen pressure conditions because they are equipped with a blocking design feature.

Per discussion with the licensee's applicable nuclear and non-nuclear staff of the Scriba substation, the inspector noted that all of the applicable design documentation to replace the 115 kV breaker were being prepared and progressing on schedule. The new SF6 power circuit breakers design is simple and considered to be more reliable. The inspector also noted that new breakers and other required equipment parts to replace them had been procured and were available at the site. Based on the current schedule, the licensee plans to replace the breakers during the fall 1993 Unit 2 refueling outage.

The licensee's central regional control (CRC) department (non-nuclear) added detailed guidelines in the operating instructions procedure on April 22, 1993, to reflect the impact of offsite power sources on NMP2 plant safety and established guidelines for communications, work planning, access control, inspections, and equipment failure response involving the Scriba substation and its perimeter. The procedure directed that the NMP2 shift supervisor and the station maintenance staff be fully informed of all Scriba substation related activities by other departments. Additionally, all Scriba substation maintenance, relay and corrective actions activities are required to be performed under the plant work control process. The inspector reviewed sample relay testing activities recently completed and found that they were being performed in accordance with the revised established plant guidelines and procedure.

Based on discussions with the licensee's staff and a review of the relevant training documentation, the inspector determined that the licensee had adequately trained the nuclear and non-nuclear staff to understand the need and importance of the NMP2 offsite power supply sources. Several administrative plant and non-nuclear administrative and operating procedures had been revised and established which provided detailed guidance to control the work in the Scriba substation and periphery area of the station. The station and substation relay surveillance and maintenance activities are now coordinated with the plant maintenance department even though it is performed by the dedicated plant non-nuclear department. All other work in the vicinity of the plant and the switchyard is planned and reviewed by the applicable plant staff and, as details warrant, a safety evaluation and PORC approval is obtained prior to initiation. Per procedure, the station shift supervisor and CRC shift supervisor share all information pertaining to the switchyard activities, alarms received, switching information and maintenance requirements. The inspector reviewed a sample of maintenance work orders, replacement breakers design activities documentation, and substation logs for monitoring the other activities performed in the Scriba switchyard during the June and July 1993 period and identified no deficiencies in following the established guidelines by all department staff members.

To improve the reliability of the existing 115 kV breakers, the CRC staff was routinely monitoring the key equipment associated with the function of the breakers. Adequate corrective measures such as replacement of the compressor motor parts and other miscellaneous measures were taken in a timely manner. In addition, per discussion with

plant maintenance, shift supervisor and non-nuclear staff personnel, the inspector determined that the relevant information pertaining to the equipment maintenance, and other activities associated with the substation were being shared and that the staff was well aware of the impact of offsite power sources failure on the NMP2 safe operation.

The inspector performed a walkdown of the Scriba substation and found that the 115 kV breakers were equipped with a time meter to monitor compressor total running time. This time was being monitored to assure that SF6, Nitrogen and hydraulic pressures were adequate for operation. In addition, the new breakers and associated parts were on site for the replacement of the 115 kV breakers. The review of the switchyard entry log and procedures used for work in the substation reflected the updated requirements.

2.5 Appendix R Fire Impact on Offsite Power

The inspector reviewed the effects of a postulated fire on the offsite power supply for the Nine Mile Point Unit 1, in fire areas 10 and 11. These areas correspond to the control room and the cable spreading room fire zones. Unit 1 does not rely on the offsite or onsite emergency diesel generators to safely shut down the plant following a fire postulated in these areas. Instead, the reactor is cooled down and stabilized via the emergency cooling condenser system. The inspector reviewed the applicable special operating procedures and verified the assumptions of the Appendix R analysis.

In the event of a fire at Unit 2, safe shutdown is achieved by several diverse means depending upon the location of the fire, the availability of electrical power, and the components rendered inoperable. A fire event coincident with a LOOP is considered the most limiting scenario and represents a "worst case" as evaluated in the licensee's Appendix R analysis. However, based on the inspector's walkdown and review of design drawings, the inspector noted that the Unit 2 does not have a single cable spreading room for the control room. Engineered safety systems in various plant areas were routed separately up to the control room and entered from the opposite side via two separate cable tunnels. Based on the analysis, either division I or division II portions of the auxiliaries and support systems would always be available. The licensee's analysis had not taken credit for offsite power, but relied on an available emergency diesel generator to support plant safe shutdown. Based on the above review, the inspector concluded that in either unit no specific affect exists on the offsite power availability under the above fire scenarios.

2.6 Conclusion

Based on the licensee's corrective actions taken to control adequately the work activities, design review of the substation, and improved communication among all departments associated with the plant and Scriba substation, the inspector concluded that the Nine Mile Units 1 and 2 offsite power sources were reasonably reliable. Unit 2 offsite power reliability will be further enhanced once the scheduled, four 115 kV breaker replacement is completed.

3.0 FOLLOWUP OF PREVIOUSLY IDENTIFIED FINDINGS (UNIT 1)

3.1 (Closed) Violation Item No. 50-220/91-80-013 regarding the design voltages of 575 volt motors

During the previous EDSFI inspection, the team determined that approximately thirty safety-related motors with design voltage rating of 575 V might not have sufficient terminal voltage under plant degraded voltage conditions. At the conclusion of the EDSFI inspection, adequate evaluation to demonstrate the acceptability was not available. The licensee committed to provide adequate documentation for the acceptability of these motors to demonstrate their intended design functions.

During this inspection, the inspector reviewed the licensee's completed degraded voltage calculation (ELMSSAC-DEGVOLT-STUDY, Rev. 0). The calculation considered the data from the worst-case scenario assuming a unit trip concurrent with a LOCA. The licensee then determined the minimum plant voltages for the 4.16 kV buses and other lower level voltage powerboards. Further evaluation was made by utilizing the minimum available grid voltage of 115 kV and then calculating the minimum motor voltages available. The inspector noted that the various 600 volt powerboard voltages determined ranged from 517.4 to 526.2 volts. A review of the 575 volt motors (connected on various powerboards) revealed that all safety-related motors had sufficient voltage (above 90%) except four motors. These four motors were fed from powerboard 1671 and the terminal voltages calculated varied from 513.3 to 511.7 volts. Per discussion with the licensee, the inspector determined that the control room circulating fan motor 11, rated at 15 horsepower, required only 10.1 HP. Based on the system requirement and under the degraded voltage condition, the licensee assumed that these motors would draw only 11.09 amperes compared to 14.68 full load rated amperes. The licensee had previously evaluated the degraded voltage issue for these three motors (chilled water circulating pump 11 and compressor motors 111 and 112) and had concluded that these motors were capable of operating between 495 and 605 volts. Based on the above, the licensee had concluded that all safety-related 575 volt design motors would have sufficient voltage under the minimum grid voltage condition.

The inspector confirmed that the licensee had considered the applicable input data in their degraded voltage study (minimum grid voltage of 115 kV and the maximum loading condition). The sample review of the selected motors input data identified no concerns. One discrepancy was identified in the motor data assumed in the above assessment. During the walkdown verification of the motor data, the inspector determined that the operating current for the control room circulating fan 11 was 11.5 amperes versus 11.0 amperes assumed in the calculation. To resolve the concern, the licensee reevaluated motor load requirements assuming the degraded voltage condition and determined that the increase remained within motor full load capability such that the motor could still perform its intended design function under this condition. This item is closed.

3.2 (Closed) Unresolved Item 50-220/91-80-009 regarding the inadequate cable penetration protection calculation

During the EDSFI, the team was concerned that an adequate calculation or study was not available to demonstrate the adequacy of all containment penetrations. The review of the interim study available at that time determined that three, 600 volt penetration types were not fully protected from all fault conditions. At that time, the licensee performed an operability assessment and concluded that there was a reasonable assurance that the penetrations were protected despite a minor overlapping coordination condition. The licensee initiated an action plan to review all penetrations and implement actions accordingly. Subsequent to the EDSFI, the licensee found some additional molded case circuit breakers with similar overlapping conditions. The licensee committed to complete a comprehensive study or calculation to assure the adequacy of all electrical penetration protection including the verification of the 5 kV penetrations mechanical capabilities assumptions made in the interim calculation.

During this inspection, the inspector noted that the licensee had replaced seven molded case circuit breakers of General Electric Type THEF with Type THED to resolve the concerns on the 600 volt penetrations and other breakers. A selected sample review of the coordination curves revealed that the circuits were adequately coordinated for electrical protection. In addition, the licensee had completed a detailed analysis in calculation (E34-DRYWELL-PEN PROT) for all penetrations.

The inspector reviewed the study and concluded that all penetrations were adequately protected with the exception of some fuse-disconnect circuits used for welding receptacles in the drywell area. These circuits lacked electrical overload protection and were used only during the plant shutdown condition, if welding were required. To address this concern, the licensee assured that all circuits were left in the open position during normal plant operation. Per discussion with the licensee, no discrepancies were found at the time of verification. To prevent these circuits from misuse, the licensee also had initiated procedure changes to add such instructions in their operating procedure (N1-OP-43). To address the 5 kV penetration mechanical capabilities, the licensee had obtained manufacturer data and confirmed that the applicable penetrations had adequate mechanical capabilities.

Based on the adequate protection determined for all penetrations and additional corrective actions taken by the licensee to resolve the above concerns, this item is closed.

3.3 (Closed) Unresolved Item 50-220/91-80-012 regarding the fast bus transfer scheme

The EDSFI team was concerned that, during a fast bus transfer, the non-class 1E loads on the powerboards might impose degraded condition on the safety boards PB102 and PB103. The licensee committed to resolve this concern by performing a bus transfer study and/or test to demonstrate the transfer scheme adequacy.

The licensee completed a bus transfer simulation study, documented in NMP1 calculation No. 4.16KVAV-BUS-XFER and Sargent and Lundy report No. SL-4812. The inspector reviewed the study and noted that the licensee had simulated fast bus transfer effects on class 1E and non-class 1E motors assuming normal fast transfer (no fault) and also with fault. Two simulation cases performed assumed the heaviest full load winter loading conditions and full winter load conditions plus the LOCA condition. The fast transfer fault considered was a three phase to ground fault on the secondary of the station service transformer to cause the maximum reduction in motor speeds before bus transfer.

The licensee concluded that there were no adverse effects on the class 1E system during a fast bus transfer under the worst-case conditions. However, the study concluded in two scenarios that non-class 1E motors might experience stresses higher than the recommended industry guidelines (ANSI C50.41) for polyphase induction motors. To assure the integrity of these motors, a separate study was performed by the manufacturer of these motors (General Electric), which concluded that the 4 kV motors installed at Nine Mile Point One station could withstand the expected stresses under the plant installed conditions.

The inspector reviewed the input data, assumptions and minimum grid voltage and determined them to be adequate. The dead bus time (5.2 cycles) and minimum grid voltage (112 kV) considered during the transfer were found to conform to the manufacturer's published circuit breaker data and installed plant conditions. The licensee concluded that all class 1E motors could start and accelerate following a fast bus transfer. The calculated transient currents were below the value of overcurrent relays on the safety-related powerboards and the reserve transformers trip point. Transient voltages on class 1E buses recovered sufficiently to preclude transfer to the onsite power sources. The study also concluded that in two cases: (1) a fast bus transfer with winter full load, and (2) a fast bus transfer with winter full load plus LOCA, the stress on the nonsafety-related motors would be higher than the guidelines recommended by ANSI standard C50.41 for polyphase induction motors. This ANSI standard suggests that the resultant vectorial volts/hertz (V/Hz) between the motor residual and the incoming source at the instant the transfer should not exceed 1.33 per unit. Based on this study, the licensee demonstrated this value to be approximately 1.62 v/HZ. As discussed above, the licensee's original motor manufacturer's performed a fast transfer analysis on the typical smallest selected vertical and horizontal type motor and demonstrated that these motors could withstand produced stresses by the transient current and torque load under the above determined resultant 1.62 volts/hertz. The inspector's selected sample review of the above documentation revealed no concerns.

Based on the inspector's review of the licensee's calculations and test results, the inspector concluded that the licensee had adequately demonstrated that the class 1E motors and the non-class 1E motors could withstand a fast bus transfer under the worst-case loading conditions; this item is closed.

3.4 (Open) Unresolved Item 50-220/91-80-008 pertaining to the EDGs transient study

The EDSFI team reviewed the EDG surveillance test results and preliminary voltage transient analysis study, and noted that the voltage dip resulting from the initial starting of the class 1E loads might be as high as 40 percent. Based on the review of the above documentation, it was determined that input data to the transient voltage analysis and its certain assumptions needed further verification to assure adequate EDG voltage dip.

During this inspection, the inspector noted that the licensee had completed the EDG dynamic study (4.16KVAC-DG-DS, Revision 0), on January 25, 1992. In this revision of the study, the computer simulation determined the capability of EDGs by applying load as per the LOCA sequence coincident with LOOP scenario. Based on the review of this study, the inspector noted that the licensee's study (completed jointly by ABB Impell and Power Technology, Inc.) had modeled the EDG (generator) based on the last refueling (R2) test data. The study concluded that the EDGs were capable to start and accelerate the required motors without stalling during a loss of offsite power and a design basis accident. However, the study results revealed that even though the EDGs were capable of handling the above loads, in the first sequence step load block and the manual addition of load of the containment spray raw water pump, the minimum voltage might be marginal (70% of nominal voltage). Based on the marginal results obtained in above two cases and the test data used to verify and validate the EDG model, it appears that the model may not reflect the similar transients results considering the filter function developed by the transducers in the testing circuit. The licensee committed to verify the above computer models and results by performing additional studies and testing. Per discussion with the licensee, the inspector determined that the licensee had completed the additional tests and obtained the additional generator and motor data using a digital system for further evaluation of the above EDGs dynamic analysis.

Based on the above concerns in the study, this item remains open pending verification and final revision of the licensee's EDGs transient dynamic study and verification of the computer model.

4.0 UNRESOLVED ITEMS

Unresolved items are matters about which additional information is necessary in order to determine whether they are acceptable or they constitute a violation. Several unresolved items are discussed in detail under Section 3.0 and 4.0.

5.0 EXIT MEETING

The inspector met with the licensee's personnel denoted in Section 1.0 of this report at the conclusion of the inspection period on July 23, 1993. At that time, the scope of the inspection and the inspection results were summarized. At no time during the inspection was written material given to the licensee.

ATTACHMENT 1

PERSONS CONTACTED

Niagara Mohawk Power Corporation

J.Brady	Engineer, Electrical Design-Unit 1
J. Bunyan	Project Management-Unit 2
B. Crandall	System Engineering-Unit 2
R. Dean	Lead System Engineer, Unit 2
D. Goodney	Lead Electrical Design-Unit 1
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J. Kirkpatrick	Electrical Maint. Engineer-Unit 2
L. Klowsowski	General Supervisor, Nuclear Design-Unit 1
H. Kodali	Engineer, Electrical Design-Unit 1
A. Julika	Supervisor, Electrical Design Unit 2
T. McMalton	Supervisor, Electrical Design - Unit 1
A. Pinter	Site Licensing Engineer
L. Vavra	MATS Inc. Unit 2
R. Murray	Operation Planner, Operation - Unit 2
D. Hughes	Supervisor, Relay and Control, Power Delivery
S. Dudy	Electrical Maintenance Supervisor - Unit 2
K. Fisher	Electrical Maintenance Supervisor - Unit 1
M. Conway	Shift Supervisor, Operation - Unit 2
A. Raju	Electrical Engineer, Electrical Design - Unit 2
C. Polidore	Manager, Regional Control
T. Flynn	Regional Operator, Regional Control

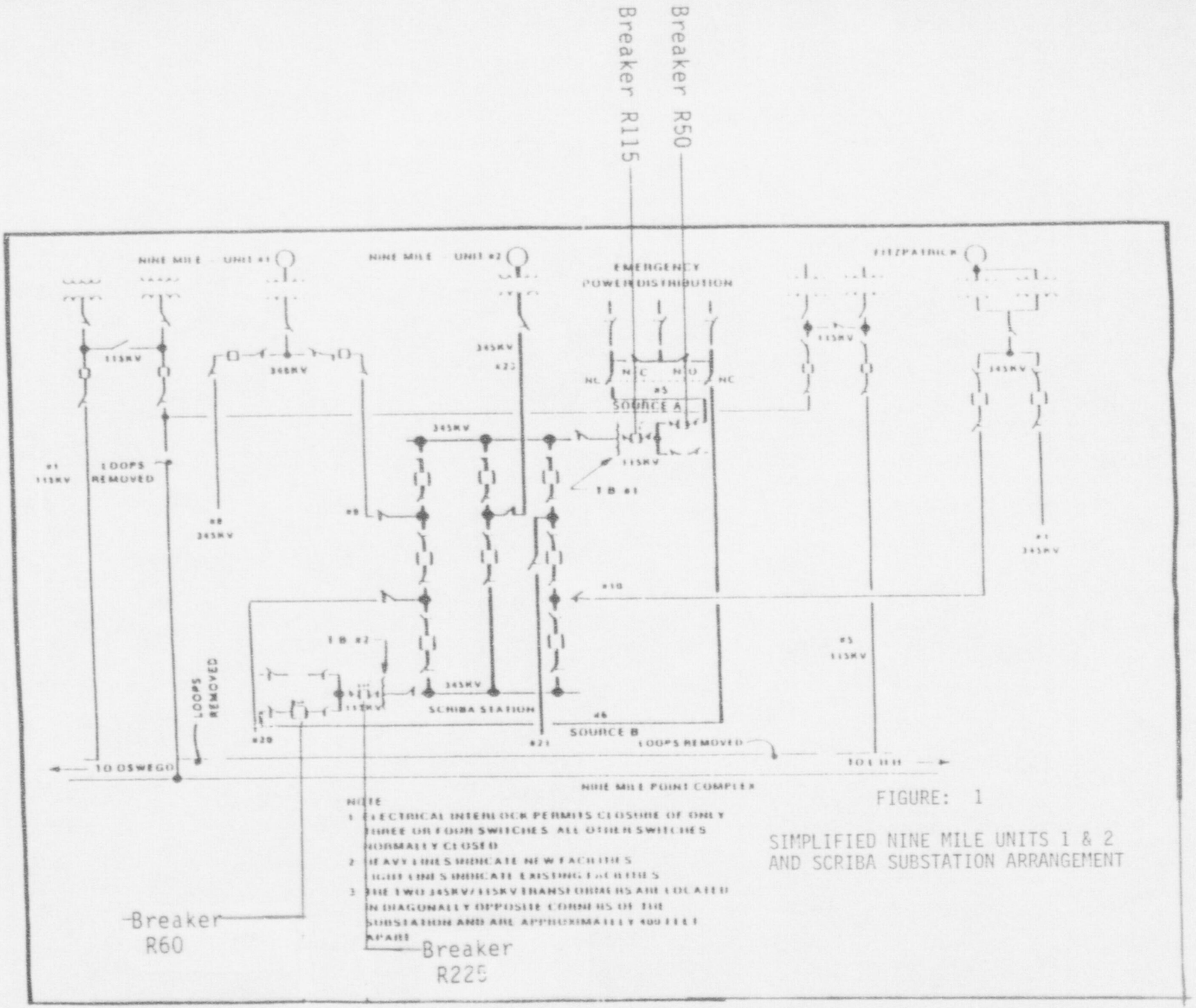

FIGURE: 1

SIMPLIFIED NINE MILE UNITS 1 & 2
AND SCRIBA SUBSTATION ARRANGEMENT