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SUBJECT: Forwards Proposed Amends 151 & 104 to Licenses NPF-14 & NPF-22,respectively changing TS to delete requirements to test fuses utilized as primary containment penentration conductor overcurrent protective devices.

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MAR 12 1992

Director of Nuclear Reactor Regulation
Attention: Mr. C. L. Miller, Project Director
Project Directorate I-2
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
PROPOSED AMENDMENTS 151 AND 104 TO
LICENSE NOS. NPF-14 AND NPF-22:
DELETION OF THE REQUIREMENT TO TEST FUSES
UTILIZED AS PRIMARY CONTAINMENT PENETRATION
CONDUCTOR OVERCURRENT PROTECTIVE DEVICES
PLA-3749 FILES A17-2, R41-2

Docket Nos. 50-387
and 50-388

Dear Mr. Miller:

The purpose of this letter is to propose changes to the Susquehanna SES Units 1 and 2 Technical Specifications which delete the requirement to periodically either test or replace fuses utilized as primary containment penetration conductor overcurrent protective devices.

BACKGROUND

Technical Specification 3.8.4.1 requires that at least once per 18 months fuses used as containment penetration conductor overcurrent devices be either functionally tested or replaced. The functional testing required consists of a non-destructive resistance measurement test on a prescribed sample to demonstrate that the fuses satisfy their manufacturer's design criteria. An NRC memorandum from R.. Bernero to H. Thompson dated July 19, 1985 regarding fuse resistance testing concluded that the technical specification requirement for measuring fuse resistance is technically ineffective and unnecessary. This determination was based on the following factors:

1) Periodic measurement of fuse resistance does not provide any meaningful assurance on the fault interrupting capability of the fuse.

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2) Periodic removal of a fuse from its holder for test purposes merely compromises its integrity.

3) Operational experience does not indicate that a current limiting fuse ever becomes less protective over its life.

The above referenced memorandum also acknowledges that the original technical specification requirement for periodic testing of overcurrent protection for containment penetrations was specifically imposed for circuit breakers which are typically used for protecting medium and low voltage penetration power circuits. Additionally, the memorandum also indicated that testing requirements were erroneously extended to fuses since they are most often used for the same protective purpose in low energy circuits.

Only low energy containment penetration circuits utilize fuses for overcurrent protection at Susquehanna SES. These circuits are as follows:

1) 120V AC control circuits
2) 125V DC control circuits
3) 120 volt lighting and space heater circuits

DESCRIPTION OF CHANGE

We are proposing that Technical Specification 3.8.4.1 (Primary Containment Penetration Conductor Overcurrent Protective Devices) be revised to delete reference to fuses in the Limiting Condition For Operation, to delete requirements related to fuse testing in Action a, to delete requirements a.2.a and a.2.b from Surveillance Requirements, and to delete reference to primary containment penetration conductor overcurrent protective fuses in the Technical Specification Bases for surveillance requirements. These proposed changes are applicable to Technical Specifications for both Units 1 and 2.

SAFETY ANALYSIS

The Technical Specification requires that at least once per 18 months fuses used as containment penetration conductor overcurrent protective devices be either functionally tested or replaced.

Primary containment penetration conductor overcurrent protective fuses ensure the pressure integrity of the containment penetration. The fuses used for penetration protection consist of a metal link or several metal links in a tube filled with an arc quencher filler. These fuses open the control and/or power circuit whenever a load condition causes the metal link temperature to increase until the link melts. The subsequent arc across the metal link gap burns back the metal and lengthens the gap until the arc is quenched. This action protects the circuit conductors

against damage or failure due to overcurrent heating effects. With failure of a fuse to perform its protective function it is postulated that the wire insulation will degrade resulting in a containment leak path during a LOCA. Containment penetration degradation will be identified during normal containment leak rate test required by 10CFR50, Appendix J.

In accordance with IEEE Std. 242-1986 Section 5.2, definitions of the fuse ampere rating and melting are:

> Ampere Rating - The current that the fuse will carry continuously without deterioration and without exceeding temperature rise limits specified for that fuse. Further discussion in Section 5.17.2 identifies that all modern fuses are rated so that they will carry their rated current continuously without changes in time current characteristics if they are applied in locations where ambient temperature conditions do not exceed 40°C or (104°F).
>
> Melting Time - The time required to melt the current responsive element which is designed to melt during overcurrent conditions for a specified overcurrent.

Fuse manufacturer's published time current characteristics of a fuse predict the amount of time required for the metal links to melt and interrupt the current flow for various magnitudes of overload current. A typical time current characteristic curve for a fuse shows that less time is required for a fuse element to melt open at higher overload currents than at lower currents. The design time current characteristics of the fuse, which are a function of the fuse link physical properties, are not changed as a function of the age of the fuse. Therefore, periodic fuse testing or replacement is not required.

In support of the proposed change, an engineering study was performed in which penetration fuses were identified and representative circuits which contained fuse types found were selected to demonstrate coordination between circuit load current and the melting characteristics of the fuse as provided by the fuse manufacturer on the time current curve. In each of the representative samples, the coordination between normal circuit load current during plant operation (normal and accident) and the fuse melting characteristics were plotted. These plots showed that sufficient margin between load current and the fuse melting current was maintained such that fuse damage would not occur when normal load current flows in the circuit. It was also shown that the various fuse types would operate to clear and isolate the faulted portion of the circuit before the upstream breaker operates and before the circuit conductor is damaged.

Based on this representative sampling, it was concluded that penetration fuse ampere ratings were adequate to protect penetrations from damage during short circuits and to operate properly without opening during normal or momentary overload currents. IEEE Std. 242-1986 Section 5.2 substantiates this conclusion.

An increase in ambient temperature reduces the current carrying capacity of the fuse since a lesser amount of current is required to provide the additional heat above ambient to melt the fuse link. The resulting faster operating time of the fuse at higher ambient temperatures does not affect penetration protection since the overload current is applied for a shorter time before the fuse clears.

The purpose of the fuse holder is to hold the fuse in place to maintain circuit continuity. A failure of the fuse holder results in an open circuit which does not compromise nuclear safety as the safety function of the fuse is to clear or open the circuit.

The possible effects of corrosion creating an uneven current flow distribution between the fuse and fuse holder were reviewed. While corrosion could form on both the fuse and the fuse holder, the fuse holders are designed to apply pressure at the point of contact to prevent the formation of corrosion at that point. The formation of corrosion will not change the characteristics of the fuse; however, even if corrosion formed at the points of contact between the fuse and holder, the result would be a reduced current flow which would not negatively effect protection of the penetration.

The plant critical system function circuits are designed to be fail-safe (i.e., these circuits are not dependent upon the overcurrent protective fuse operation for their safety actions). Thus, the failure of the overcurrent protection fuses for primary containment conductors does not prevent the plant safety functions.

In the event of failure of a fuse to trip the circuit, the upstream protective device is expected to operate and isolate the faulty circuit. In the worst case fault condition, a single division of protective functions can be lost. However, this scenario is covered under a single failure criterion.

In addition to the above, based on a NRC memorandum from R. Bernero to H. Thompson dated July 19, 1985, the requirement for periodic non-destructive resistance measurement testing to demonstrate that fuses satisfy their manufacturer's design criteria and the need for periodic fuse replacement are technically ineffective and unnecessary for the following three reasons: 1) periodic field measurement of fuse resistance does not provide any meaningful assurance on the fault interrupting capability of a fuse, 2) periodic removal of a fuse from its holder for test purposes merely compromises its integrity, and 3) operational experience does not indicate that a current limiting fuse ever becomes less protective over its life.

Pursuant to the above, the proposed change does not adversely affect the safe operation of Susquehanna SES and will enhance fuse reliability.

NO SIGNIFICANT HAZARDS CONSIDERATIONS

The proposed change does not involve a significant hazards consideration because operation of Susquehanna SES in accordance with this change would not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated. This proposed change deletes the requirement for periodic functional (resistance) testing or replacement of fuses used as primary containment penetration conductor overcurrent protective devices.

Primary containment penetration conductor overcurrent protective fuses ensure the pressure integrity of the containment penetration. The fuses used for penetration protection consist of a metal link or several metal links in a tube filled with an arc quencher filler. These fuses open the control and/or power circuit whenever a load condition causes the metal link temperature to increase until the link melts. The subsequent arc across the metal link gap burns back the metal and lengthens the gap until the arc is quenched. This action protects the circuit conductors against damage or failure due to overcurrent heating effects. With failure of a fuse to perform its protective function it is postulated that the wire insulation will degrade resulting in a containment leak path during a LOCA. Containment penetration degradation will be identified during normal containment leak rate test required by 10CFR50, Appendix J.

In accordance with IEEE Std. 242-1986 Section 5.2, definitions of the fuse ampere rating and melting are:

> Ampere Rating - The current that the fuse will carry continuously without deterioration and without exceeding temperature rise limits specified for that fuse. Further discussion in Section 5.17.2 identifies that all modern fuses are rated so that they will carry their rated current continuously without changes in time current characteristics if they are applied in locations where ambient temperature conditions do not exceed 40°C or (104°F).
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> Melting Time - The time required to melt the current responsive element which is designed to melt during overcurrent conditions for a specified overcurrent.

Fuse manufacturer's published time current characteristics of a fuse predict the amount of time required for the metal links to melt and interrupt the current flow for various magnitudes of overload current. A typical time current characteristic curve for a fuse shows that less time is required for a fuse element to melt open at higher overload currents than at lower currents. The design time current characteristics of the fuse, which are a function of the fuse link physical properties, are not changed as a function of the age of the fuse. Therefore, periodic fuse testing or replacement is not required.

In support of the proposed change, an engineering study was performed in which penetration fuses were identified and representative circuits which contained fuse types found were selected to demonstrate coordination between circuit load current and the melting characteristics of the fuse as provided by the fuse manufacturer on the time current curve. In each of the representative samples, the coordination between normal circuit load current during plant operation (normal and accident) and the fuse melting characteristics were plotted. These plots showed that sufficient margin between load current and the fuse melting current was maintained such that fuse damage would not occur when normal load current flows in the circuit. It was also shown that the various fuse types would operate to clear and isolate the faulted portion of the circuit before the upstream breaker operates and before the circuit conductor is damaged.

Based on this representative sampling, it was concluded that penetration fuse ampere ratings were adequate to protect penetrations from damage during short circuits and to operate properly without opening during normal or momentary overload currents. IEEE Std. 242-1986 Section 5.2 substantiates this conclusion.

An increase in ambient temperature reduces the current carrying capacity of the fuse since a lesser amount of current is required to provide the additional heat above ambient to melt the fuse link. The resulting faster operating time of the fuse at higher ambient temperatures does not affect penetration protection since the overload current is applied for a shorter time before the fuse clears.

The purpose of the fuse holder is to hold the fuse in place to maintain circuit continuity. A failure of the fuse holder results in an open circuit which does not compromise nuclear safety as the safety function of the fuse is to clear or open the circuit.

The plant critical system function circuits are designed to be fail-safe (i.e., these circuits are not dependent upon the overcurrent protective fuse operation for their safety actions). Thus, the failure of the overcurrent protection fuses for primary containment conductors does not prevent the plant safety functions.

In the event of failure of a fuse to trip the circuit, the upstream protective device is expected to operate and isolate the faulty circuit. In the worst case fault condition, a single division of protective functions can be lost. However, this scenario is covered under a single failure criterion.

Additionally, periodic resistance measurement is not a technically adequate means of determining if a fuses capability to clear a fault has been deteriorated. Rather, the resistance verification is performed by the vendor during the manufacturing process through the assurance of proper construction - i.e., correct amount of fuse elements, correct thickness of elements and detection of poor or no solder joints. Therefore, the periodic non-destructive resistance testing of fuses only generates data and is not indicative of performance data. Periodic replacement of fuses has no technical basis as operational experience does not indicate that a current limiting fuse ever becomes less protective over its life.

2) Create the possibility of a new or different kind of accident from any accident previously evaluated. The reasons for this conclusion are provided in Item 1 above.

3) Involve a significant reduction in a margin of safety. The reasons for this conclusion are provided in Item 1 above.

We request implementation of this change to support work ongoing in the current Unit 1 refueling and inspection outage. Therefore, it is requested that the NRC approve the proposed change as soon as possible.

Any questions on the above material should be directed to Mr. W.W. Williams at (215) 774-7910.

Very truly yours,

R. G. Byram

Attachments

cc: NRC Document Control Desk (original)
NRC Region I
Mr. G. S. Barber, NRC Sr. Resident Inspector
Mr. J. J. Raleigh, NRC Project Manager
Mr. T. M. Gerusky, Pennsylvania DER

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