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United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SERIAL: HNP-00-141

Shearon Harris Nuclear Power Plant
Docket No. 50-400/License no. NPF-63
Response to Task Interface Agreement (TIA) 99-028
Resolution of Fire Protection Inspection Fire Barrier
Qualification Issues (TAC No. MA7235)

Dear Sir or Madam:

By memorandum dated August 1, 2000, the Office of Nuclear Reactor Regulation (NRR) responded to Task Interface Agreement (TIA) 99-028 regarding two potential issues identified during a pilot fire protection inspection conducted at the Shearon Harris Nuclear Power Plant on November 1 – 5, 1999. NRR's response to the TIA addressed : (1) the fire resistance ratings and qualification testing of Thermo-Lag used in fire barriers separating Switchgear Room B, Cable Spreading Room A and Cable Spreading Room B at HNP; and (2) the adequacy of Hemyc 1-hour and Promatec "MT" 3-hour fire barrier systems used at HNP.

The TIA response identified that NRR was still evaluating the potential generic implications of the Hemyc/MT concern. Although HNP feels the use of Hemyc/MT was adequately reviewed by the staff during initial licensing and is within the current licensing basis, this letter refers only to the Thermo-Lag issue.

The TIA response identified several areas where the conclusions were indeterminate. HNP would like to provide additional clarification of the technical information concerning some of these areas. The following areas are addressed in this letter:

- Fire Hazards Associated with the Thermo-Lag Barriers
- GDC 3 Combustibility
- Presence of Combustible Materials Adjacent to the Barriers
- Penetration Seal Qualifications
- Hose Stream Testing

In addition, our review of the TIA response has identified several other areas where HNP believes that additional technical information can be provided that could alter the conclusions drawn in the TIA response. These areas include:

- Flame Spread Ratings
- Cotton Waste Acceptance Criteria
- Symmetry of Fire Barrier

A029

- IPEEE Reference
- Fire Brigade Response
- Toxicity Impacts
- Raceway vs. Fire Barrier Temperature Rise Criteria

Section 3.1 of the TIA response also states that the fire test reports were not provided. As stated in the TIA response, these fire tests are the basis for the engineering evaluations and HNP feels these test results are critical to the staff's review of this issue. These fire test reports were made available to the NRC inspectors during the November pilot inspection and the TIA Request dated November 23, 1999 also identified that the qualification testing results were provided to the NRR inspector to facilitate the TIA request. Additional copies of the fire test reports can be made available for staff review.

Fire Hazards Associated with the Thermo-Lag Barriers

The TIA response draws the conclusion that the Thermo-Lag fire barriers are not adequate to withstand the hazards associated with the area(s). However, the TIA response did not address the actual hazards in the area. HNP performed several technical evaluations to determine the adequacy of the as-installed fire barrier configurations to withstand the hazards associated with the areas. These evaluations go beyond the identification of in-situ combustibles as found in the FSAR and the combustible loading calculations. These evaluations included:

- Field Verifications to determine the actual installed thickness of the Thermo-Lag materials
- Performance of three full scale fire endurance tests
- Performance of detailed evaluations of the fire test results
- Implemention of plant modifications to upgrade penetration seals installed within the Thermo-Lag barriers
- Performance of an analysis to conservatively demonstrate that a postulated fire in the areas containing Thermo-Lag barriers would not result in room temperatures that could approach those of the fire endurance tests. This analysis also demonstrated that a fire inside some of the Thermo-Lag enclosures would not have sufficient oxygen to develop into a flaming fire.
- Performance of an analysis to conservatively demonstrate that the temperature increase on the surfaces of the non-fire side cable trays would be significantly below the allowable 250^0F average raceway temperature increase criterion specified by Generic Letter 86-10, Supplement 1.
- Implemention of plant modifications to enhance the automatic fire detection system capability.

These evaluations address the potential hazards that could challenge the Thermo-Lag barriers. These evaluations, in conjunction with the upgrades performed, demonstrate that although the Thermo-Lag fire barriers do not fully meet the originally intended fire endurance capability, they are adequate to ensure a postulated fire on one side of the fire barrier would not induce damage to redundant safe shutdown circuits located on the other side of the barrier. This conclusion is based on the credible fire hazards and scenarios that are in accordance with the guidance provided in Generic Letter 86-10.

GDC 3 Combustibility

The TIA response also states, "GDC 3 Fire protection of Appendix A to 10 CFR Part 50 states that noncombustible and heat resistant materials shall be used, whenever practical, throughout

the plant. As noted above, Thermo-Lag is classified as a combustible material. Alternative construction materials such as concrete, masonry and gypsum, which are noncombustible, are typically used for fire barriers in nuclear power plants, such as walls, floors, and ceilings, that separate fire areas within the plant. 10 CFR 50.48(a) requires that each plant have a fire protection plan that satisfies GDC 3. The licensee's evaluation does not address this apparent nonconformance with GDC 3."

The NRC published its basis for the acceptability of combustible materials used by licensees in fire-rated barriers in, "Elimination of the Requirement for Noncombustible Fire Barrier Penetration Seal Materials and Other Minor Changes," in the Federal Register (Vol. 64, No. 159) dated August 18, 1999. As part of the basis for acceptance, the NRC staff addressed an apparent conflict with GDC 3 as follows: "Although GDC 3 states that noncombustible and heat-resistant materials must be used whenever practical, GDC 3 does not preclude the use of combustible materials. In fact, combustible materials are installed in nuclear power plants. In general, when these materials are incorporated as integral components of the plant fire protection program, including the fire hazard analysis, they are acceptable."

HNP has addressed the combustible aspects of the subject Thermo-Lag fire barriers. The heat of combustion values for the Thermo-Lag materials used to form the fire barriers were included in the combustible loading calculations, which form part of the Fire Hazards Analysis for the respective fire zones/areas. Moreover, Calculation FP-0109, "Compartment Heat-Up Analysis for Cable Spreading and ACP Rooms" assessed the energy released by the Thermo-Lag fire barriers undergoing combustion. On this basis, HNP believes utilization of Thermo-Lag fire barriers is not in conflict with GDC 3.

Presence of Combustible Materials Adjacent to the Barrier

The TIA response states, "For wall and ceiling assemblies, which are the configuration that is the subject of this evaluation, the purpose of the barrier is to remain intact and prevent the ignition of combustible materials in contact with the unexposed side of the barrier surface, as was done in the licensee's fire endurance tests. The licensee's evaluation does not address the presence of combustible materials that can be in contact with the barrier surface."

For wall assemblies, ESR 95-00620 Attachment C, which included field walkdowns, confirmed that the closest commodity to the surface of the wall assemblies is the side rail portion of a cable tray, which has a horizontal distance of 1 inch. The analysis also addresses the administrative controls that prohibit bulk storage of temporary combustibles in the area. The ceiling assemblies passed the acceptance criteria of the fire endurance test and therefore combustible material contact would not be a concern. The ability of the fire barrier configurations to maintain their structural integrity for a 3-hour duration of fire exposure was demonstrated by test. In addition to the integrity of the barriers being maintained, Calculation FP-0110 demonstrated that acceptable temperatures would be maintained on the unexposed side of the as-installed fire barrier configurations. Therefore, HNP's evaluation did address the location of combustible materials and their physical relationship to the barrier surfaces.

Penetration Seal Qualifications

The TIA response states, "The licensee's evaluation does not address the impact, if any, of the Thermo-Lag fire barrier configuration on the performance of the installed penetration seals. Therefore, the performance of the penetration seals installed in the Thermo-Lag barriers has not been demonstrated by the licensee to be equivalent to the fire rating of the barrier in which they are installed, in accordance with the plant's CLB *(Current Licensing Basis)*."

HNP was concerned about the performance of the installed penetration seal materials as part of our original resolution plan for Thermo-Lag and therefore included penetration seal openings within the fire test configurations for the Thermo-Lag barriers conducted in 1994 and 1995. The fire tests identified that design upgrades were required for some of the existing penetration seal configurations in order for them to be equivalent to the fire rating of the barrier. ESR 95-00620 Attachment C provides a general discussion of the penetration seal upgrades and refers to the detail design change details contained in and implemented by ESR 95-00715. Therefore, the performance of the penetration seals installed within the Thermo-Lag barriers has been evaluated and design upgrades implemented by HNP to ensure that the fire endurance capability of these seals is equivalent to that of the barrier(s).

Hose Stream Testing

The TIA response states that, "No technical basis is provided for the licensee's unique two-stage test procedure." "The ASTM E-119 standard states that the purpose of the hose stream test is to simulate the effects of cooling, impact, and erosion. It is not clear how allowing the test specimen to gradually cool for 90 minutes following the initial hose stream application prior to the final application satisfies the ASTM E-119 criteria. As acknowledged by the licensee, the hose stream test did not follow the established ASTM E119 protocol; therefore, the results of the hose stream test are indeterminate."

The HNP Thermo-Lag fire test plan included the performance of 3 separate fire tests to support resolution of the Thermo-Lag issue. A one hour and a three hour duration fire wall test were conducted on a duplicate test specimen. A separate three hour ceiling fire test was also performed.

ASTM E119, Section 10.1 allows for a duplicate specimen to be subjected to a fire exposure test for a period equal to one half of the indicated resistance period, but not for more than one hour. Immediately after the fire exposure test the specimen is subjected to the impact, erosion, and cooling effects of a hose stream. Section 10.1 does not specify a hose stream duration associated with this duplicate test specimen method. Since both a one hour and three fire endurance test were planned for qualification of the Thermo-Lag wall configurations, the hose stream requirements for the one hour fire endurance test were utilized to qualify the three hour configuration as specified by Section 10.1.

ASTM E119, Section 10.4 identifies that for the one hour fire endurance test, a 1 minute hose stream test is required. Following the completion of the 1 minute hose stream test, the test laboratory identified a potential discrepancy in using only the 1 minute duration hose stream for qualification of a three hour configuration. Therefore in accordance with ASTM E119, Section 10.4 for a three hour barrier, an additional 1 ½ minute hose stream duration was applied approximately 90 minutes later. HNP acknowledged this potential deviation in test protocol and performed an engineering evaluation to demonstrate its acceptance.

The first 1 minute of hose stream application was applied immediately after the test specimen was removed from the test furnace. This results in a significant initial cooling effect on the test specimen and severe impact on the charred Thermo-Lag material causing portions of the charred material to be dislodged. The approximate 90 minute lapse between the first and second applications allowed the Thermo-Lag material to absorb water delivered from the initial 1 minute hose stream application and subsequently to soften. Therefore, applying the second portion of the hose stream test 90 minutes later was a more severe test of the barrier to withstand the impact and erosion effects of the hose stream. The fire test report identified slight leakage of water at the

board interfaces following both portions of the hose stream test, however no holes or breeches in the barrier system and no projection of water through the barrier occurred during either portion of the hose stream test. This leakage is acceptable in accordance with the ASTM E119 criteria which states " The assembly shall be considered to have failed the hose stream test if an opening develops that permits a projection of water from the stream beyond the unexposed surface during the time of the hose stream test."

In addition, the as-installed Thermo-Lag fire barrier configurations include a layer of expanded metal lath sandwiched between the two Thermo-Lag panels. The as-tested configuration did not. This layer of expanded metal lath provides additional rigidity and support of the Thermo-Lag panels. In addition to this design feature, a 1/8 to 3/8 inch thick layer of unreacted Thermo-Lag material also remained in place on the exposed side of the barrier following the second hose stream. These features provide further assurance that the as-installed fire barriers would be capable of surviving a hose stream test administered for a continuous 2-½ minute duration per ASTM E119 without projection of water through the barrier.

Finally, the hose stream portion of the fire endurance test was applied using a solid stream of water delivered via a smooth bore playpipe nozzle. Application of the solid stream of water in this manner delivers a more dynamic impact, and therefore is a more severe challenge to the structural integrity of the fire barrier than would be experienced under actual plant fire conditions. The FSAR along with standard fire brigade training and practice at HNP dictates the use of hose streams delivered via fog nozzles when responding to fires in areas containing electrical equipment, as would be the case for a fire occurring in the fire areas containing these Thermo-Lag fire barriers. In aggregate, HNP believes the justification summarized above demonstrates that the deviation from the standard ASTM E119 hose stream test protocol was acceptable for the site specific application.

HNP believes that a meeting with the NRC is appropriate to fully explain the details of the information summarized above. As noted in the beginning of this letter, there is additional information relative to a number of other important issues that we would be pleased to provide to the NRC as well. We believe that this information will change the conclusions initially drawn by NRR staff in the TIA response. Please refer any questions regarding this submittal to Mr. E. A. McCartney at (919) 362-2661.

Sincerely,

James Scarola

EAM/eam

c: Mr. J. B. Brady, NRC Sr. Resident Inspector
Mr. R. J. Laufer, NRC Project Manager
Mr. L. A. Reyes, NRC Regional Administrator