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U. S. NUCLEAR REGULATORY COMMISSION
Document Control Desk
Mail Station P1-137
Washington, D. C. 20555

Attention: Mr. Conrad E. McCracken, Chief
Chemical Engineering Branch
Division of Engineering and
Systems Technology

Gentlemen:

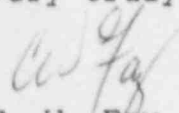
INTERNAL SEALING OF CONDUITS THROUGH FIRE BARRIERS

Attached is our response to your request for additional information dated May 18, 1988 regarding the final report of the Conduit Fire Protection Research program which was previously submitted to you for review. We agree that a meeting to discuss these issues would be mutually beneficial.

Mr. Michael S. Kaminski of Wisconsin Electric will contact Mr. Kubicki of your staff to make arrangements for a meeting to discuss our response to your request and any other issues pertaining to the report.

If you have any questions regarding this matter, please contact Mr. Kaminski at 414-221-2662.

Very truly yours,


C. W. Fay
Vice President
Nuclear Power

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Attachment

Copies to NRC Resident Inspector
NRC Regional Administrator - Region III

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RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Conduit Sealing Topical Report

NRC Question

1. The term "closed" is defined in this report as "any conduit terminating in a junction box or noncombustible closure or seal." This implies that a conduit terminating at a cabinet containing electrical components such as a control room console would be considered closed. What consideration has been given to the effect of heat and smoke on the components inside the enclosure? Under guidance for smoke seals (5.1 on page 22), it is stated that no smoke seal would be required if the conduit terminated in a noncombustible closure. Has the concern for component operability within the enclosure previously mentioned been considered for this guidance?

Response

Our testing verified that fire would not propagate outside the terminating enclosure. The acceptability of damage to that terminating enclosure from smoke or heat must be determined on a case by case basis as necessary and is beyond the scope of this guidance.

In general, if the cables to the enclosure are destroyed in the exposed conduit, it is assumed that the components in the terminating enclosure are not operable. If the terminating enclosure is large enough to contain other components, not supplied by cables in the exposed conduit, this enclosure would need to be evaluated as a common enclosure from an associated circuit analysis standpoint as described in 10 CFR 50.48, Appendix R and subsequent clarification letters.

As with fire tests on all barriers and barrier components, this testing and guidance deals only with the ability to prevent the propagation of fire, not operability or serviceability after the fire.

NRC Question

2. The guidance in this report states that conduits that run through an area and do not terminate in that area need not be sealed. Also that conduits which terminate in a noncombustible closure need not be sealed. Have cases where a conduit may run through an area and terminate in closures in areas adjacent on either side of this area been considered? It appears that a fire in the "middle" area could cause failure of the conduit, thus exposing the areas on both sides to the effects of fire, since no seals exist within that

conduit. This would be of particular concern when the barriers between these areas may be separating redundant trains of shutdown equipment or one of the areas may contain alternate shutdown equipment for one of the other two areas.

Response

If the conduit terminates "closed" as defined in our guidance in both adjacent rooms, our testing verifies that a fire would not propagate to either adjacent room through the conduit.

NRC Question

3. Why is design guidance using cable fill of 40% or over given? Based on information in this report, it appears that 40% is generally the maximum cable fill and that most conduits are filled to this level. Therefore, if 41% or over was given as the criteria for not sealing, the majority of the conduits would now require a seal provided they did not meet the other criteria in the report. There does not appear to be conservatism built into this guidance.

Response

It is assumed this question refers to guidance provided for smoke seals, as cable fill is not a significant parameter with respect to fire sealing. This testing demonstrated that cables in conduits provide a significant obstruction to the flow of hot gases and smoke. The effects were pronounced even with 25% fill. Since 40% was the maximum fill tested and since 40% was even more effective than 25%, 40% fill was used for guidance. The test data verifies that 40% fill is a conservative value.

NRC Question

4. Since percent of cable fill is a major parameter for design guidance as defined in this report, has implementation of such a conduit sealing program been considered? What criteria would be used for visually determining the percent of cable fill? How would design modifications requiring the pulling of additional cable impact this sealing program? Would guidance using multiple parameters for conduit size versus distance from the barrier coupled with different smoke seal criteria, cause a sealing program to be difficult to implement and impossible to verify?

Response

Cable fill is only one of several parameters which could be implemented in a sealing program. Implementation has been considered in this guidance. The guidance flow chart shows

that implementation which addresses closure first, diameter second, length third and last, conduit cable fill. If any user considers conduit fill an undesirable parameter to assess, the user can apply the first three criteria.

Modifications requiring additional cables would be treated as they are now; any sealing requirements would be included in the modification package. Based on this testing, any additional cables added would reduce the need for sealing.

It was the consensus of the participating utilities that this guidance is easier both to implement and verify than existing guidance. This proposed guidance is also more realistic and technically based than the existing guidance.

NRC Question

5. This report states on page 23 that "minimization of smoke propagation through conduits may be prudent." This report also states on page i that "considerable smoke was emitted during the first hour of the test, mostly from the open 2 inch conduits especially those with 10% cable fill." Additionally, it is stated on page 32 that "it was necessary to open the door to vent the laboratory because of the excessive smoke produced during the first hour of the test." Since guidance has been provided in BTP CMEB 9.5-1 and in Generic Letter 86-10 on the need for smoke seals, why doesn't this report give a single set of criteria for conduit sealing, encompassing both fire and smoke seals, similar to the way it is provided in NRC guidance?

Response

As stated in our report, "the passage of smoke through conduits penetrating fire barriers does not constitute a breach of the fire barrier and is not a requirement for the rating of a fire barrier penetration just as with door openings, duct penetrations and cable tray penetrations." For this reason, passage of fire and smoke were treated as two separate issues. Based on plant specific parameters, which are many and varied, a plant may decide that sealing against smoke propagation is also necessary. For such cases, guidance is provided.

NRC Question

6. It is unclear from the report how conduits larger than 3" are related to smaller conduits regarding the passage of heat. Although a table is provided showing temperature gradients for conduits larger than 3" and with 40% cable fill, limited data appears to be present for larger conduits with limited cable fill. This is important because the guidance for conduits

that terminate in noncombustible closures is not dependent on cable fill or size. Cases could be postulated in which a 6" conduit penetrates a wall and terminates in noncombustible component enclosures on either side of the wall. It appears that this configuration may allow for a significant passage of heat, particularly if the enclosures are relatively close to the barrier.

Response

The passage of heat through a closed conduit should not be considered any different than that through a pipe or a capped conduit. In any of these cases, fire would not propagate through the conduit. The case of the 6" conduit described above would not allow the propagation of fire. In this regard, the cable fill density is not an important parameter for closed conduits.

General Comments

Investment in the development of the conduit test program was justified because of the lack of technical basis for the existing guidance, the perceived excessiveness of the sealing requirements, and the impossible surveillance requirements. The goal of the test program and of the resulting guidance documentation was to provide guidelines which would be applied using engineering judgment to plant specific configurations. The guidelines developed achieve this goal. Although application of this guidance requires an engineering assessment, the resulting conduit sealing program will be more effective, readily verifiable and more economical than one based on the previous regulatory guidance.

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