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MEMORANDUM TO: Distribution

FROM: Alan M. Rubin
Probabilistic Risk Analysis Branch
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

Alan Rubin

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SUBJECT: EPRI'S RESPONSE TO GENERIC REQUEST FOR ADDITIONAL INFORMATION (RAI) ON THE FIRE PRA IMPLEMENTATION GUIDE - MISSING PAGES

On January 31, 2000, I sent you a final report from EPRI entitled "Guidance for Development of Response to Generic Request for Additional Information on Fire Individual Plant Examination for External Events (IPEEE)." This report contained EPRI's final responses to the NRC's generic RAIs on EPRI's Fire PRA Implementation Guide. Two pages from the appendix to that report, pages A-7 and A-8, were inadvertently omitted from the copies on distribution. These two pages are attached. Please add them to your copy of the report. Sorry for any inconvenience this may have caused.

Attachment: As stated

cc (w/o attachment)
T. King

DF03

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adverse effect on safety-related components either through direct contact with suppression agents or through indirect interaction with non-safety related components. It is important to recognize that fire suppression can impact components outside the immediate area of the fire as a result of actuation of fire suppression systems due to transport of smoke, propagation of hot gas layers, or misdirected manual suppression efforts.

*Please describe how the IPEEE fire analysis accounted for the impact on component and system availability arising from the actuation of fire suppression systems in areas not directly involved in a fire.*

10. As defined in the *EPRI Fire PRA Implementation Guide* (page 4-2 of [1]), a special initiator trips the plant and causes loss of a mitigating safety system. Examples of such special initiators include loss of service water and loss of component cooling water. It can be seen that a special initiator, even if it occurs at a relatively low frequency, can be risk-significant because of the consequences of the initiator. (In some plants, an unrecovered special initiator can lead directly to core damage.)

    Fire is a potential cause of special initiators. If the frequency of a fire-induced special initiator is comparable to or greater than the random frequency for that initiator (and note that there may be a number of areas in the plant where a fire can cause the initiator), then an analysis which does not evaluate the CDF contribution due to the fire-induced special initiator may overlook an important vulnerability. Note that potential collateral damage caused by the fire may increase the importance of this issue.

    *Please discuss the process used to identify and analyze fire-induced special initiators. In particular, if special initiators with non-recoverable frequencies less than $10^{-4}$ per year were screened, please provide the basis for this screening criterion. If recovery actions are assumed, please include in the discussion the approach used to address the impact of fire on recovery.*

11. The *EPRI Fire PRA Implementation Guide* assumes that all enclosed ignition sources cannot lead to fire propagation or other damage (page 4-18 of [1]). This can be an optimistic assumption for oil-filled transformers and high-voltage cabinets. The *Guide* also assumes that fire spread to adjacent cabinets cannot occur if the cabinets are separated by a double wall with an air gap or if the cabinet in which the fire originates has an open top (page H-3 of [1]). This can also be an optimistic assumption for high-voltage cabinets since an explosive breakdown of the electrical conductors may breach the integrity of the cabinet and allow fire to spread to combustibles located above the cabinet. For example, switchgear fires at Yankee-Rowe in 1984 and Oconee Unit 1 in 1989 both resulted in fire damage outside the cubicles.

    *Please provide the basis for the assumption and a discussion on how the specific enclosures were analyzed to ascertain that the assumption is applicable to them.*

12. In the EPRI Fire PRA Implementation Guide, test results for the control cabinet heat release rate have been misinterpreted and have been inappropriately extrapolated. Cabinet heat release rates as low as 65 Btu/sec are used in the Guide. In contrast, experimental work has developed heat release rates ranging from 23 to 1171 Btu/sec.

    Considering the range of heat release rates that could be applicable to different control cabinet fires, and to ensure that cabinet fire areas are not prematurely screened out of the analysis, a heat release rate in the mid-range of the currently available experimental data (e.g., 550 Btu/sec) should be used for the analysis.

*Discuss the heat release rates used in your assessment of control cabinet fires. Please provide a discussion of changes in the IPEEE fire assessment results if it is assumed that the heat release from a cabinet fire is increased to 550 Btu/s.*

13. The *EPRI Fire PRA Implementation Guide* allows the screening of ignition sources if a non-combustible shield lies between the source and key targets. This screening may not be valid in cases where: (a) there is a high hazard source (e.g., an oil fire); (b) flames are impinging on the shield; or (c) hot gases in the plume above the fire can move around the shield. Improper screening of ignition sources may lead to improper screening of fire scenarios.

    a. *Have any ignition sources with targets directly above been screened out because a non-combustible shield lies between the source and the targets? If so, please identify and describe the sources and their targets.*

    b. *Have any high hazard fire ignition sources (e.g., rotating machinery with large amounts of oil) been screened out because a non-combustible shield lies between the source and its targets? If so, please identify and describe the sources and their targets.*

    A reanalysis may be requested for any improperly screened ignition sources.

14. In general, the fire risk associated with a given compartment is composed of contributions from fixed and transient ignition sources. Neglect of either contribution can lead to an underestimate of the compartment's risk and, in some cases, to improper screening of fire scenarios. The *EPRI Fire PRA Implementation Guide* allows the screening of transient ignition sources in compartments where all fixed ignition sources have been screened out. Based on this approach, a cable spreading room or a cable shaft that does not contain any items other than IEEE 383 qualified control and instrumentation cables, and access to the compartment is strictly controlled, can be screened out. If such compartments contain the cables for all redundant trains of important plant safety systems, a major vulnerability may be overlooked, without sufficient analysis of potential accident sequences and needed recovery actions.

    *In compartments where all fixed ignitions sources have been screened out, has the possibility of transient combustible fires been considered? For each compartment where transient fires have not been considered, please provide the justification for this conclusion and provide a discussion on compartment inventory in terms of system trains and associated components (i.e, cables and other equipment). Please explain whether or not the conditional core damage probabilities, given damage to all cables and equipment in these compartments, are significant (i.e., cables from redundant trains are present). If the conditional core damage probability for a compartment is considered significant, please provide justification for assigning a very low likelihood of occurrence to transient fuel fires for the compartment.*

15. In order for suppression efforts to be successful, all fires within a compartment must be suppressed. The *EPRI Fire PRA Implementation Guide* appears to consider suppression efforts successful if fires involving the ignition source or any subsequently ignited targets are suppressed (see p. 4-39 of the *Guide*). Analyses employing such an erroneous success criterion will result in optimistic assessment of fire scenario risk and may lead to improper screening of fire scenarios.