DOCKET NUMBER
PROPOSED RULE PR 50
(70FR 10901)

(3)

DOCKETED
USNRC

May 20, 2005 (3:42pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

May 19, 2005

U.S. Nuclear Regulatory Commission
ATTN: Rulemaking and Adjudications Staff
Washington, D.C. 20555-0001

Gentlemen:

TENNESSEE VALLEY AUTHORITY (TVA) - COMMENTS ON FIRE PROTECTION PROGRAM - POST FIRE OPERATOR MANUAL ACTIONS – PROPOSED RULEMAKING AND DRAFT REGULATORY GUIDE *(70 FR 10901-10917)*

This letter provides TVA's comments on proposed rulemaking and Draft Regulatory Guide (DG)-1136, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire." As published in the Federal Register, Volume 70, No. 43, on March 7, 2005, pages 10901-10917, NRC proposes to amend the fire protection regulations for nuclear power plant facilities operating prior to January 1, 1979. The amendment would allow licensees to use manual actions by plant operators as an alternative method to achieve hot shutdown conditions in the event of fires in certain plant areas, provided that the actions are evaluated against specified criteria and determined to be acceptable and that fire detectors and an automatic fire suppression system are provided in the fire area. TVA's detailed comments are provided in the enclosure.

TVA appreciates the opportunity to comment on the proposed rule and draft regulatory guide. If you have any questions, please contact Rob Brown at (423) 751-7228.

Sincerely,

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Template = SECY-067

SECY-02

ENCLOSURE

DETAILED COMMENTS

I. Implementation of the proposed rule would call for NRC clarification on existing Safety Evaluation Reports (SER) incorporated into TVA's current design bases.

The proposed rule is predicated on the assumption that the manual actions utilized by the licensees to date have not been reviewed and approved by NRC. Therefore, the proposed feasibility criteria would be applicable to actions which have not been previously reviewed and approved. The Inspection Manual states, "If manual actions were previously approved by the staff and an exemption of deviation has been issued ... ."

Based upon the rule guidance and past inspector practice, it is not clear if the following examples constitute "previously approved" manual actions. Past inspector practice has resulted in interpretations that the manual action must appear in docketed correspondence referred to as an exemption and/or deviation. Thus, NRC would need to provide clarification on the following examples:

Clarification No. 1

NRC Inspection Report 50-327/88-24 and 50-328/88-24 provides documentation of inspection results of a special inspection performed at Sequoyah Nuclear Plant (SQN). The inspection was conducted specifically to address "Appendix R" and issues associated with allegations relative to fire safe shutdown.

The report contains the following statement:

> "Such alternate methods typically include the rerouting and/or protective fire wrapping of interacting cables or procedural revisions which require additional operator actions necessary to mitigate the possible effects of fire induced faults."

The report states that various documents, including the shutdown logic calculation and the fire safe shutdown procedures were reviewed for acceptability. The report also addresses specific issues in Enclosure 3 titled "Safety Evaluation."

The above referenced inspection report was subsequently referenced in NUREG 1232, Volume 2, "Safety Evaluation Report on Tennessee Valley Authority: Sequoyah Nuclear Performance Plan" dated May 1988. Section 3.1.3 of the SER contains the following:

> "On the basis of its evaluation, the staff concludes that when the fire modifications and the procedural corrective actions associated with TVA's deviation requests (as identified in the staff's SERs of May 29 and October 6 1986) and modifications and procedures (as identified in Inspection Reports 50-327/88-24 and 50-328/88-24) are completed, TVA's Appendix R program will provide an acceptable level of fire protection equal to that required by 10 CFR 50, Appendix R, Sections III.G, III.J, III.L, and III.O."

Based upon the above, it is not clear whether the manual actions included in the inspection report referenced procedures would be considered approved, even though

they were not formally submitted as part of a "deviation" and/or an "exemption," but were approved in the restart SER (NUREG 1232).

Clarification No. 2
NUREG 0847, Supplement 18 "Safety Evaluation Report related to the operation of Watts Bar Nuclear Plant (WBN), Units 1 and 2," dated October 1995, states the following:

> "The applicant's post-fire safe shutdown analysis and associated cable interaction studies have identified a number of areas where operator actions to take manual control of equipment may be required to compensate for fire-induced equipment failures. On the basis of its analyses, the applicant performed Calculation No. WBN-OSG-165, R5, "Manual Actions Required for Safe Shutdown Following a Fire." This evaluation identified manual operator actions required to achieve safe shutdown in the event of a fire in any plant area, established the allowable operating times to accomplish these actions, and verified the feasibility of performance. A review of this calculation noted the following: (1) manual actions required for each plant area/zone for the "worst case" fire zone were identified; (2) the time estimates required to accomplish each manual action were verified by physical plant walkdowns; and (3) to either establish a shutdown path or compensate for fire damaged cable or equipment, the applicant's analysis credits the performance of one or more manual operator actions in areas/zones not requiring an alternative shutdown capability."

Based upon the above, it is not clear whether manual actions included in the referenced calculation would be considered "approved" manual actions since they were not formally submitted as part of a "deviation" and/or an "exemption," but were approved in the SER (NUREG 0847).

II. Estimated Cost -- The estimated cost of implementation:

Detection/Suppression – Installation of automatic or fixed suppression (most areas have detection in place) can be expected to cost approximately $0.5M - $1M per area. With plants potentially having 20 to 100 fire areas, costs can be expected to be $10M - $100M. The addition of a water system in these safety-related plant areas would adversely affect the internal flooding analysis and are likely to result in equipment malfunctions necessitating a license amendment request under 10 CFR 50.59.

Fire Barrier Installation (Thermo-lag) – If detection/suppression systems and/or time margin considerations cannot be satisfactorily addressed, it would become necessary to install a rated fire barrier assembly. Installation of Thermo-lag fire barriers costs approximately $1K per foot for simple conduit installations and can cost in excess of $10K per foot for complex installations. These costs would be expected to be much lower than relocating a circuit to provide rule compliance.

Time Margin Factor – In order to resolve concerns associated with time margins, it would be expected that 5 – 10 analyses would have to be "customized" for fire safe shutdown. The cost per analysis could be in excess of $50K per analysis since these analyses often require proprietary codes utilized by Nuclear Steam Supply System (NSSS) suppliers. Reanalysis would be performed to reallocate existing analysis margin to account for fire safe shutdown considerations. In general, the conservatisms contained in the existing analyses would allow for considerable margin in the calculation of operator action times.

Exemptions – Utilities would retain the option of submitting exemptions/deviations in lieu of literal compliance with III.G.2 requirements. Based on the utility preparation costs and NRC review costs (estimated at $200/hr), it would be expected that simple exemption requests could cost utilities $40K and more complex exemptions could cost up to $100K.

The licensing and/or plant modification costs associated with the installation of a suppression system, application of a time margin factor and/or requesting exemptions/deviations represent a significant cost to the utilities with no corresponding increase in plant safety.

III. TVA's general comments pertaining to the Proposed Rule and Draft Regulatory Guide are provided as follows:

One of the primary objectives of the proposed rule change is to eliminate the licensee and staff burden associated with preparation and review of multiple exemption/deviation requests. The inclusion of the detection/suppression and time margin factors will likely result in numerous exemption/deviation requests, as well as license amendment requests for other events such as internal flooding. Based on an initial assessment, it appears that up to 20 exemptions/deviations per unit may be required to comply with the proposed rule. Based on this assessment, the proposed rule does not appear to meet its intended purpose.

Comment 1 – With the exception of detection/suppression requirements and the time margin factor, the proposed feasibility criteria are consistent with past practice (both utility and regulator) and provide a high level of confidence that manual actions could be accomplished in a safe and reliable manner. Inclusion of detection/suppression and time margin factor, potentially have adverse affects on plant risk and results in significant economic impacts without a corresponding plant safety benefit.

Comment 2, "Detection/Suppression" – Attempting to equate an administrative activity (procedural manual action) to a physical plant feature for consistency within the regulations (i.e., all the other non-three hour barrier provisions have detection/suppression required) is not consistent with a risk-benefit philosophy advocated by the new oversight process.

Comment 3, "Detection/Suppression" – Installation of a suppression system in safety-related areas not designed to include water-based suppression systems is expected to result in an overall increase in CDF due to flooding, inadvertent operation, etc. Typically, internal flooding risk CDF increases will be larger than the decreases in CDF associated with fire scenarios.

Note, comments 4 through 8 (below) discuss conservative values and assumptions.

Comment 4, "Time Margin Factor (TMF)" – Imposition of an arbitrary time margin factor is not consistent with requirements in other areas such as emergency operating procedures, station blackout, flooding, etc. Introduction of a time margin factor will set a precedent which could be imposed in other areas. To date, no quantifiable safety benefit has been shown relative to this time margin factor. While reliability is a consideration, deterministic (Appendix R) rules typically ensure reliability through the imposition of conservative assumptions such as those associated with the defense-in-depth utilized in fire protection programs.

Comment 5, "Time Margin Factor" – The time margin factor discussion attempts to define a "t = 0" point which appears to be overly conservative. Typically plants utilize detection systems which are designed using the guidance contained in National Fire Protection Association (NFPA) 72. The NFPA Codes have a performance objective of protecting life and property and, as such, NFPA 72 was established to detect a fire in its incipient stages. NFPA 72 appears to consider a fire in the 260 to 270 kw range an "incipient" fire. A fire of this magnitude would only produce localized damage contained to the specific cable or component. In addition, the guidance contained in Institute of Electrical and Electronic Engineers (IEEE) 384, IEEE 279, and RG 1.75 for channels that provide signals for the same protective function to be independent and physically separated, prescribe limits for the minimal amount of physical separation that is allowed. Therefore, there is extensive margin between when a fire is detected and when a plant would be expected to experience damage of both trains of a safety-related system since fire propagation in cable raceways is a slow process. Additionally, since "banks" of cable trays also are generally separated by train/division with horizontal distance separation, propagation between banks would be further delayed such that fire suppression activities could take place. This is substantiated by the fire dynamics tools provided in NUREG 1805.

Comment 6, "Time Margin Factor" – Imposition of a time margin factor will result in the reallocation of margin currently contained in the timeline analyses. In general, the analyses are based on accident scenarios which contain conservatisms in order to satisfy the accident performance objectives. In order to accommodate the additional conservatism of TMF, reanalysis will be used to change inputs/assumptions such that the conservative accident limits are relaxed to reclaim the necessary time. These analyses are usually based on proprietary inputs and codes and as such would require expensive vendor reanalysis to be performed for no benefit to plant safety. This will also impose long-term utility costs since the new analyses will require life-of-the-plant control and updating.

Comment 7, "Detection/Suppression" and "Time Margin Factor" – The imposition of these requirements does not appear to take into account other conservatisms and philosophies contained in the defense-in-depth approach to fire protection. The following are examples of conservative assumptions currently forming the bases for plant fire protection programs.

Ignition Sources – Ignition is assumed regardless of the administrative controls and/or the equipment in a given area. Any introduction of additional ignition sources (e.g., hot work) is typically stringently controlled and requires compensatory actions (continuous fire watch).

Combustible Loading – Many areas in operating plants have insignificant amounts of in situ combustibles, however, for fire safe shutdown, complete loss of all equipment in a given fire area is assumed. Even in areas with moderate combustible loading, this is an overly conservative assumption. In practicality, very few areas of a plant have sufficient combustibles to result in significant plant damage and in most cases, no damage beyond the immediately involved cable or component.

Damage State – All equipment and cables are assumed to fail in the most challenging manner (i.e., hot shorts/associated circuits). In many instances failure in the "needed" position is just a likely as a failure in the non-conservative position.

Damage Time – All equipment in a fire area is assumed to fail at "t = 0." This assumption, while extremely conservative, is not consistent with even the most conservative fire dynamics assumptions, since even a small spatial separation can result in time to damage being several minutes. This may be verified using the fire dynamics tools contained in NUREG 1805.

Suppression Activities – No credit is given for suppression associated with automatic plant suppression systems, plant personnel, and/or trained fire brigade. Response time for suppression activities associated with a challenging fire would be immediate.

Comment 8, "Time Margin Factor" – The TMF is predicated on a thermal-hydraulic analysis which established the conservative time for accomplishing the action (T_3). The draft regulatory guide does not include sufficient guidance for performing the analysis. Specifically, no information is provided relative to the following:

1. Is the expectation for licensees to perform a transient/dynamic-type analyses?
2. Are licensees allowed to justify additional time consideration based on fire dynamics? (or)
3. For performance objectives, are licensees required to keep process functions on scale, or are brief periods of operation off scale acceptable provided an unrecoverable condition is not introduced?

IV. In addition to comments, the Federal Register requested some specific input on several points as follows:

1) *Should the Time Margin consist of a range of multiplicative factors?*

There are no technical or safety bases for implementation of a time margin factor. The existing bases for the timeline have inherent conservatisms (see discussion for question 4).

2) *If a range is appropriate, what should the range be and what variables should be considered?*

Application of a time margin factor provides no safety benefit to operating facilities.

3) *Should there be a minimum additive time for short demonstrated times?*

Reliance on manual actions with action times less than 10 minutes should be closely scrutinized on a case-by-case basis. Arbitrarily declaring an action as unachievable based on a time consideration without consideration for all defense-in-depth features, consequences of failure of the action, and action being performed is not a technically responsible position.

Implementation of plant changes to resolve a non-risk significant scenario which has no direct safety benefit could cumulatively result in an overall increase in plant risk due to (1) implementation; (2) diversion of plant resources, both personnel wise and financial; and (3) the introduction of increased fire risk due to concentrated combustible loads (i.e., thermo-lag).

4) *Are there other means of establishing margin?*

Existing timelines are typically based on design parameters and performance objectives contained in the existing accident analyses (i.e., Loss of Coolant Accident, Loss of Feedwater, etc.). These accident analyses are plant design bases limiting and, as such, have inherent conservatisms often imposed by regulations. In addition to these analytical margins, the defense-in-depth philosophy utilized in fire protection programs provides additional margin. The following are examples of non-quantifiable conservatisms associated with defense-in-depth.

Combustible Loading – Many areas in operating plants have relatively insignificant amounts of in situ combustibles, however, for fire safe shutdown, complete loss of all equipment in a given fire area is assumed. Even in areas with moderate combustible loading, this is an overly conservative assumption. In practicality, very few areas of a plant have sufficient combustibles to result in significant plant damage.

Damage State – All equipment and cables are assumed to fail in the most challenging manner (i.e., hot shorts/associated circuits). In many instances failure in the "needed" position is just a likely as a failure in the non-conservative position.

Damage Time – All equipment in a fire area is assumed to fail at "t = 0." This assumption is not consistent with even the most conservative fire dynamics assumptions, since even a small spatial separation can result in time to damage being several minutes. This is easily verified using the fire dynamics tools contained in NUREG 1805.

Suppression Activities – No credit is given for suppression associated with automatic plant suppression systems, plant personnel, and/or trained fire brigade.

5) *Should the requirement for a suppression system be automatic or fixed?*

Requiring installation of a new suppression system should be based on a Fire Hazard Analysis. Application would be determined by a Fire Protection Engineer based on the fixed (in situ) combustibles and several other considerations relative to overall plant risk. This evaluation is recognized in the existing regulations (i.e., Generic Letter 86-10, Regulatory Guide 1.189, NUREG 0800, and BTP 9.5.1).

6) *Should III.G.2 criteria also be applied to III.G.1 and III.G.3 manual actions?*

Section III.G.2 is necessarily independent of III.G.3. Attempting to apply similar performance objectives to the two areas would not provide any additional plant safety benefit, while most like resulting in major plant compliance issues, redesigns and modifications.