Mr. Oliver D. Kingsley, Jr.
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Chief Nuclear Officer
Tennessee Valley Authority
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May 10, 1995

SUBJECT: WATTS BAR UNIT 1 - REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING CARBON DIOXIDE AUTOMATIC FIRE SUPPRESSION SYSTEMS (TAC NO. M63648)

Dear Mr. Kingsley:

The Watts Bar Safety Evaluation Report (NUREG-0847, dated 1982), documents TVA's commitment to provide automatic carbon dioxide fire suppression capability, designed and installed to meet National Fire Protection Association Standard 12, "Carbon Dioxide Extinguishing Systems." However, Inspection Report 50-390/95-16 identified several discrepancies in the design and testing of these systems. As a result, we decided to review the systems design further.

We discussed these carbon dioxide fire suppression system design issues with TVA during a March 22, 1995, conference call and at an April 27, 1995, technical meeting (summary dated May 9, 1995). In order to determine the adequacy of these systems to perform their automatic fire control and extinguishing function for the associated fire hazards in the diesel generator rooms, auxiliary instrument rooms and the diesel generator board rooms, we request TVA to provide additional information. Attached is our request for this information.

Please respond within 45 days of receipt of this letter. The requirement affects nine or fewer respondents and, therefore, is not subject to the Office of Management and Budget review under P.L. 96-511.

Sincerely,

Original signed by

Peter S. Tam, Senior Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure: Request for Additional Information

cc w/enclosure: See next page

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REQUEST FOR ADDITIONAL INFORMATION

WATTS BAR UNIT 1 (DOCKET NO. 50-390)

CARBON DIOXIDE AUTOMATIC FIRE SUPPRESSION SYSTEM

INTRODUCTION

The Watts Bar Safety Evaluation Report (NUREG-0847, dated 1982), documents the Tennessee Valley Authority's commitment to provide automatic carbon dioxide fire suppression capability, designed and installed to meet National Fire Protection Association Standard 12, "Carbon Dioxide Extinguishing Systems," 1973 edition (NFPA-12-1973). This SER identified that carbon dioxide (CO_2) extinguishing systems were installed in the emergency diesel generator rooms, turbine lube oil dispensing room, computer room, paint shop and storage room, auxiliary instrument room, cable spreading room, 480-V board rooms, lube oil storage room, fuel oil transfer room, and lube oil purification room.

BACKGROUND

Inspection Report (IR) 50-390/95-16 identified the following CO_2 fire suppression system design and pre-operational system testing findings: 1) the CO_2 fire suppression systems, when subjected to a full system discharge test, repeatedly failed to maintain the CO_2 concentration required to control and extinguish the fire hazards within the protected compartment; and 2) resulting failures from pre-operational full discharge tests (failing to achieve the required soak time). TVA has taken the position that the code of reference (NFPA 12-1973) does not specify a soak or hold time for CO_2 systems installed in areas classified as having "deep-seated" fire hazards.

On the basis of our review, we have found, for example, that prior to 1990 the applicant's CO_2 system description specified that the design of the diesel generator room system was capable of achieving a 40-percent CO_2 concentration with a hold time of 10 minutes and that the system for the computer room, the Unit 1 and Unit 2 auxiliary instrument rooms, and diesel generator electric board rooms was capable of achieving a 50-percent CO_2 concentration for 10 minutes. Subsequently, TVA performed a series of full discharge tests, which resulted in measured concentrations that were significantly less than those specified by the pre-1990 system description. Based on the results of this testing, TVA revised its system description to either reduce the required CO_2 concentrations or eliminate the specified hold (soak) time.

Currently, the system description requires that the diesel generator rooms achieve a 34-percent CO_2 concentration within 1 minute after system discharge and maintain a 30-percent CO_2 concentration for 20 minutes. For the

ENCLOSURE

computer room, the Unit 1 and Unit 2 auxiliary instrument rooms, and diesel generator electric board rooms, the system description was revised to require that these systems achieve a 30-percent CO_2 concentration within 2 minutes and a concentration of 50 percent be reached within 7 minutes with no soak time. TVA's current position that no soak time is required for "deep-seated" type fires (e.g., cable fires, electrical cabinet fires) is not consistent with NFPA-12-1973, which states, "the required extinguishing concentration shall be maintained for a sufficient period of time to allow the smoldering to be extinguished and the material to cool to a point at which re-ignition will not occur." The 1989 edition of the code has been revised to state, "The quantity of carbon dioxide for deep-seated fire is based on fairly tight enclosures. After the design concentration is reached, the concentration shall be maintained for a substantial period of time, but not less than 20 minutes." Results of fire suppression experiments performed by Sandia National Laboratories (NUREG/CR-3656, "Evaluation of Suppression Methods for Electrical Cable Fires," October 1986) indicate that for "deep-seated" fires in cable trays containing non-IEEE-383-qualified cables, a 50-percent CO_2 concentration with a minimum 10-minute soak time was required to suppress the fire. For "deep-seated" fires involving IEEE-383-qualified cables, these test results indicated a 50-percent CO_2 concentration with a minimum 15-minute soak time was required to suppress this fire. TVA has not provided a technical basis for its position.

REQUEST FOR ADDITIONAL INFORMATION (CO_2 SUPPRESSION SYSTEMS)

As a result of TVA's changing its design requirements (minimum required CO_2 concentration for a specified soak time) for its CO_2 suppression systems, the staff has initiated a re-review of the adequacy of these systems. In order to further evaluate these inspection findings and assess the design of these suppression systems, the staff is requesting TVA to provide the following additional information:

1. NFPA 12-1973, Section 2232 states, "For deep seated fires, the required extinguishing concentration shall be maintained for a sufficient period of time to allow the smoldering to be extinguished and the material to cool to a point at which re-ignition will not occur when the inert atmosphere is dissipated." In addition, NFPA-12-1973 Section 241 states, "The quality of carbon dioxide for CO_2 for deep seated type fires is based on fairly tight enclosures because the concentration must be maintained for a substantial period of time to assure complete extinguishment." Considering the results of the Sandia tests and the recommendations of NFPA-12, 1989 edition, to maintain a 50-percent CO_2 concentration for 20 minutes for dry electrical hazards in general, justify how the current CO_2 system designs meet Section 2232 of your code of reference. In support of your justification, submit the results of fire tests or experiments that substantiate your position that no soak time is required to suppress deep-seated fires.

2. Recent system discharge testing has not demonstrated favorable results which would provide reasonable assurance that the CO_2 systems will properly perform, and develop the CO_2 concentrations and maintain them for a period of time sufficient to suppress a deep-seated fire.

Therefore, justify your current position that there is not a need to reconfirm, by test, that all CO_2 suppression systems installed in plant areas important to safety meet the system performance criteria of Section 2523 (design concentration achieved within 7 minutes with a rate of discharge not less than that required to develop a concentration of 30 percent in 2 minutes) of NFPA-12, and that an adequate soak time to address all related fire hazards within the protected area can be accomplished. In addition, provide a description of your CO_2 system full discharge (concentration) test methodology, its acceptance criteria, all past test results, including a description of pre-test room conditions (e.g., actions taken to reduce leakage such as taping of door frames, plugging open penetrations), and your schedule for conducting future tests.

3. The current designs of the Watts Bar CO_2 suppression systems are not sized to compensate for appreciable leakage of CO_2 from the protected space; this condition can affect the overall fire suppression performance of the system. Recent testing has demonstrated that in these compartments, the CO_2 concentration is quickly affected by excessive leakage. NFPA-12, Section 253 states, "Where leakage is appreciable and the design concentration must be obtained quickly and maintained for an extended period of time, CO_2 provided for leakage compensation may be applied at a reduced rate." Describe the measures that will be taken to minimize leakage from these rooms and what test methods will be used to demonstrate that the CO_2 suppression system will meet its performance objectives. In addition, describe your surveillance testing program for controlling room leakage and assessing its potential impact on the effectiveness and operability of a CO_2 suppression system.

4. In reviewing the fire hazards associated with rooms protected by CO_2 suppression systems, the diesel generator room has several major fire hazards which require diverse CO_2 concentrations. For example, for combustible liquid surface fires (diesel fuel), the minimum concentration is 34 percent with no soak time (refer to NFPA-12-1973, Section 23, "Carbon Dioxide Requirements For Surface Fires"), for rotating electrical equipment, the minimum concentration is 30 percent with a soak time of 20 minutes (refer to NFPA-12-1973, Section 253, "Extended Rate of Application"), and for deep-seated dry electrical fire hazards, the minimum concentration is 50 percent with a soak time ranging from 10 to 20 minutes (refer to Sandia test results and NFPA-12-1989, Section 2-4, "Carbon Dioxide Requirements for Deep-seated Fires"). Considering these diverse fire hazards in the diesel generator rooms, provide your technical bases, including test results, which demonstrate how the current CO_2 suppression system design is capable of suppressing fires associated with these diverse fire hazards.

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