Ongoing Methods Development Activities in Fire PRA - A Presentation Summary

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INTRODUCTION

A range of activities to advance the reliability, accuracy, clarity, and applicability of fire Probabilistic Risk Assessment (PRA) methods are in progress. The U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Regulatory Research (RES) continues to pursue efforts both independently and in collaboration with the U.S. commercial nuclear power industry as represented by the Electric Power Research Institute (EPRI). This presentation will describe ongoing activities, including a discussion of current status and completion schedules.

DESCRIPTION OF ACTUAL WORK

One such effort involves improvements to the fire event database (FEDB). Event data are used directly to estimate fire ignition frequencies for specific fire ignition sources and/or plant locations. They are also used to estimate fire suppression times for various types of fires. Events also provide qualitative insights that are factored into fire scenario development and fire modeling assumptions. The FEDB improvement project is led by EPRI, with support from the NRC. One goal is to expand reporting to include all current U.S. nuclear power plant (NPP) sites. The update will incorporate both public records (e.g., Event Notification (EN) reports and Licensee Event Reports (LERs)) and non-public utility records. EPRI's efforts also include a comprehensive search of licensee condition reports (CRs). The initial update will cover the period from January 2000 through December 2009 (a full 10 years of data).

Once the FEDB update is complete, the first data application planned is to update fire frequency estimates. The update will include a review, and possible updating, of the fire ignition source bins defined by the consensus fire PRA methodology[4]. As allowed by the available data, including the update, the ignition source bins will be refined to reflect more detailed source characteristics. For example, it is hoped that the improved data will be of sufficient detail and quality so as to allow for the parsing of electrical cabinet fires by cabinet function and/or voltage level. A second example is the parsing of motor, pump, and transformer fires based on voltage and/or power rating. The effort will also include an assessment of fire frequency trends over time.

The second anticipated application for the updated FEDB data is the estimation of fire suppression times. Initially, an approach similar to that documented in the consensus fire PRA methodology will be pursued. Under this approach, the time to suppress fires of a particular type is characterized by a single probability distribution curve reflecting all non-automated means of suppression (i.e., both the fire brigade and other plant personnel). Over the longer term, if the data prove to be of sufficient detail and quality, refinements to the general approach may be pursued. For example, the concepts of "fire control" prior to full suppression may be incorporated into the PRA methods. Efforts may also be undertaken to provide a more refined modeling approach that would consider suppression efforts by general plant personnel separately from the efforts of the plant fire brigade.

A number of other activities related to fire scenario development and fire modeling are also underway and will be described. These include efforts to refine the characterization of transient combustible fuel sources, to investigate high-energy arc fault (HEAF) fires, to assess the impact of fire retardant cable coatings on time to fire damage, to clarify the consensus PRA methodologies approach to characterizing electrical cabinet fires based on the total fuel load, and to refine methods for the treatment of standby emergency diesel generator fires and oil fires from pump and motor leaks and spills. These and other similar topics will be covered briefly in the presentation.

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* The views expressed herein are strictly the authors' personal ones and do not necessarily represent any opinion or position by the U.S. Nuclear Regulatory Commission.

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4. "The consensus fire PRA methodology" refers to NUREG/CR-6850, EPRI TR1011989, as supplemented by the various Frequently Asked Question (FAQ) solutions promulgated since publication.