May 31, 2013

MEMORANDUM TO: Mark Henry Salley, Chief
Fire Research Branch
Division of Risk Analysis
Office of Nuclear Regulatory Research

FROM: Kendra L. Hill, Reliability and Risk Engineer /RA/
Fire Research Branch
Division of Risk Analysis
Office of Nuclear Regulatory Research

SUBJECT: NOTICE OF NUCLEAR REGULATORY COMMISSION-OFFICE OF NUCLEAR REGULATORY RESEARCH/ELECTRIC POWER RESEARCH INSTITUTE (NRC-RES/EPRI) COURSE ON FIRE PROBABILISTIC RISK ASSESSMENT

DATE AND TIME: Session I:
Monday, July 15th through Friday, July 19th, 2013

Session II:
Monday, October 28th through Friday, November 1st, 2013

LOCATION: EPRI Charlotte Office
1200 West W.T. Harris Blvd., Building III
Charlotte, North Carolina 28262

REGISTRATION: Session I:
http://www.cvent.com/d/FJ-GmSRNekixy82yha0bLQ/snh9/P1/1Q

Session II:
http://www.cvent.com/d/x9km2bsl8keWGxG7T5QeIw/snh9/P1/1Q

CONTACT: Kendra L. Hill, RES/DRA
301-251-3300

PURPOSE: The U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Regulatory Research (RES), in cooperation with the Electric Power Research Institute (EPRI), will jointly sponsor a course on fire probabilistic risk assessment (PRA). Since 2002, RES and EPRI, under a Memorandum of Understanding (MOU) on Cooperative Nuclear Safety Research, have been developing state-of-the-art methods for conducting a fire PRA. In September 2005, this work produced the "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," i.e., EPRI 1011989, NUREG/CR-6850[1], which is the subject of this 2013 course.

The 2013 Fire PRA Course/Seminar will be similar to the 2012 course which included in-depth technical presentations and hands-on sample problems intended for the users of this methodology.

The 2013 training includes presentations intended to relate the fire PRA portion of the ASME/ANS PRA Standard[2] to the methodology of NUREG/CR-6850 (EPRI 1011989) and also includes discussion of the fire PRA issues resolved in the NFPA 805 Frequently Asked Question (FAQ) Program[3]. More recent developments since the publication of NUREG/CR-6850 (EPRI 1011989) related to circuit analysis and its role in fire PRA will also be included. The structure of the course is described below:

Module 1: PRA - This module covers the technical tasks for development of the both system and operator response to a fire. Specifically, this module covers NUREG/CR-6850, EPRI 1011989 Volume 2, Sections 2, 4, 5, 7, 14, and 15. This module is suited for PRA practitioners responsible for the systems modeling aspects of the fire PRA. Specifically, participants in this module should possess the following knowledge:

- A general knowledge of PRA as applied to nuclear power plants, including typical approaches, modeling techniques (event trees, fault trees, interfaces between PRA and HRA), and the quantification of PRA models
- Some familiarity with plant systems typically found in nuclear power plants. A simplified, but reasonably realistic example of a few plant systems will be used to demonstrate the methodology.

[1] NUREG/CR-6850, EPRI 1011989 may be downloaded from NRC's public website at the following address: http:///www.nrc.gov/reading-rm/doc-collections/nuregs/contract/ or obtained from EPRI website at www.epri.com

[2] The ASME/ANS PRA Standard will not be provided for this course, Should students wish to access the Standard during the training, they are encouraged to bring their own copy.

[3] RES has published a joint publication with EPRI that is publicly available and consolidates the NFPA 805 FAQs related to fire PRA. This publication is designated as EPRI 1019259 / NUREG/CR-6850 Supplement 1. It may be downloaded for free from NRC's website.

- Some familiarity with piping and instrumentation diagrams (P&IDs) and their use in developing PRAs

Module 2: Electrical Analysis - This module covers technical tasks for analysis of fire induced circuit failures in support of fire PRA analysis. Specifically, this module covers NUREG/CR-6850, EPRI 1011989 Volume 2, Sections 3, 9, and 10. The electrical analysis module is geared toward PRA practitioners and fire safe shutdown analysts with a practical understanding of the concepts and methods of fire-induced circuit failure analysis within the context of fire PRA or Appendix R post-fire safe shutdown circuit failure assessments. Specifically, participants in this module should possess the following knowledge:

- General circuit design and operational control for typical plant equipment
- Basic circuit analysis techniques for identifying and classifying fire-induced circuit failure modes
- Working level knowledge of typical electrical drawings, including one-line diagrams, schematic diagrams, electrical block diagrams, wiring/connection diagrams, raceway layout drawings, instrument loop diagrams, etc.
- Cable and raceway, Appendix R post-fire safe shutdown, and fire PRA database structures and software
- Appendix R post-fire safe shutdown circuit analysis
- Progression of events stemming from the EPRI/NRC cable fire testing to characterize fire induced circuit failures (historical perspective)
- Emerging issues and challenges associated with the analysis of multiple spurious operations

Module 3: Fire Analysis - This module covers technical tasks involving plant partitioning, fire frequency analysis, and the development and analysis of fire scenarios from fire ignition to target impact and fire suppression. Specifically, this module covers NUREG/CR-6850, EPRI 1011989 Volume 2, Sections 1, 6, 8, and 11. This module is suited for PRA practitioners responsible for treating those aspects of the fire PRA specifically related to the fire growth and damage assessment tasks. Specifically, participants in this module should possess the following knowledge:

- A general understanding of the fire frequency calculation process as practiced in fire PRA,

- Knowledge of general fire protection features and systems as typically implemented at a NPP,
- A general understanding of how fire models are used in support of the fire PRA (a proficient level of fire modeling expertise is *not* required),
- A general understanding of fire behavior and the parameters most important to a fire growth and damage analysis (e.g., concepts such as fire spread, heat release rate (HRR), target response, and fire suppression and detection analyses).

Module 4: HRA - This module covers technical tasks related to modeling human failure events (i.e., the failure of operator responses) in a fire context. This module will focus on the guidance provided in NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines" which largely replaces the human reliability analysis (HRA) guidance provided in EPRI 1011989, NUREG/CR-6850, Volume 2, Section 12. This module is suited for HRA/PRA practitioners responsible for the HRA aspects of the fire PRA. Specifically, participants in this module should possess the following knowledge:

- A general knowledge of PRA as applied to nuclear power plants, including typical approaches, modeling techniques (event trees, fault trees, interfaces between PRA and HRA), and the quantification of PRA models
- Some familiarity with plant systems typically found in nuclear power plants. Simplified, but reasonably realistic examples of plant systems that may be represented in PRAs and manipulated by operators will be used to demonstrate the methodology.
- Some familiarity with plant operations and operating procedures. Examples of HRA tasks, such as human failure event identification, will use typical operator actions and simplified examples of operating procedures to demonstrate the methodology.
- A general understanding of the typical influences on operator performance and how they are represented in HRA tasks such as human failure event definition and quantification.

Module 5: Advanced Fire Modeling – The module covers the fundamentals of fire science, as well as the guidance for the use of fire models to evaluate fire generated conditions that may impact the nuclear plants safety functions and/or impair operator's ability to safely shutdown the plant after a fire. This module will use the EPRI 1019195, NUREG-1934, "Nuclear Power Plant Fire

Modeling Application Guide." This module is suited for fire modeling practitioners. It is recommended that the participants complete Module 3, Fire Analysis, prior to taking this Module. Specifically, participants in this module should possess the following knowledge:

- General knowledge of the fire dynamics
- General knowledge of the behavior of compartment fires; and
- General knowledge of basic engineering principles, specifically thermodynamics, heat transfer, and fluid mechanics
- General knowledge of mathematical computer fire models

The course will be offered in two sessions:

Session I:
Monday, July 15th through Friday, July 19th, 2013

Session II:
Monday, October 28th through Friday, November 1st, 2013

Location: EPRI Charlotte Office, Charlotte, NC

Participants can attend only one module per session. Each module is offered once during each session, and that module lasts the full session. When registering, specify your priority module and session date, as space may be limited. Requests for priority on a particular module and session will be accommodated to the extent possible.

Please note:

Printed notebooks will NOT be provided this year.

Laptop computers on which the user has administrative rights to add software are REQUIRED for participation in Module 5 Advanced Fire Modeling.

While laptop computers are not required for participation in Modules 1-4, participants may wish to bring a laptop to follow along with the course materials electronically.

Slides and other required class material will be available on the web prior to the course for download. It is essential that each student have either an electronic copy (on their laptop) or a paper copy with them for the training. It is each attendee's responsibility to download and bring this material to the training.

It is recommended that participants read appropriate sections of NUREG/CR-6850 (EPRI 1011989) corresponding to the selected training module prior to the course. This report may be downloaded from NRC's public website at the following address:

http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6850/ or obtained from EPRI website at www.epri.com.

Those interested in attending this workshop must register on the EPRI website using the links below.

Session I:
Monday, July 15th through Friday, July 19th, 2013

http://www.cvent.com/d/FJ-GmSRNekixy82yha0bLQ/snh9/P1/1Q

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http://www.cvent.com/d/x9km2bsl8keWGxG7T5QeIw/snh9/P1/1Q

Location: EPRI Charlotte Office, Charlotte, NC

Registration for this workshop is required to ensure space availability. If you have any questions, you may contact Ms. Hill at 301-251-3300.

PARTICIPANTS:

NRC/Contractor	EPRI/Contractor
S. Nowlen	R. Kassawara
D. Stroup	B. Najafi
G. Taylor	F. Joglar
J. LaChance	D. Funk
F. Wyant	R. Anoba
S. Cooper	J. Julius
K. Hill	E. Collins

CATEGORY: This meeting is a Category 3 meeting*. The public is invited to participate in this meeting by providing comments and asking questions throughout the meeting. Please note this workshop is being conducted in a classroom format; registration is required to ensure space availability.

The NRC provides reasonable accommodation to individuals with disabilities where appropriate. If you need a reasonable accommodation to participate in this workshop, or need the workshop notice or agenda in another format (e.g., Braille, large print), please notify the NRC's meeting contact. Determinations on requests for reasonable accommodation will be made on a case-by-case basis.

*Meetings between the NRC technical staff and external stakeholders are open for interested members of the public, petitioners, interveners, or other parties to attend as observers pursuant to Commission policy statement, "Enhancing Public Participation in NRC Meetings," 67 *Federal Register* 36920, May 28, 2002.

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