U.S.NRC
United States Nuclear Regulatory Commission
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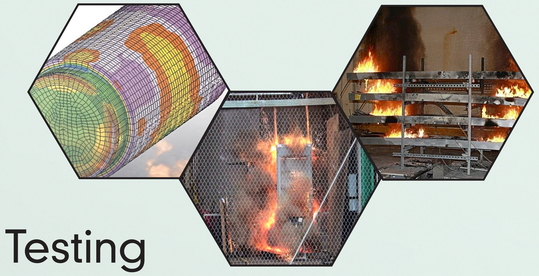
RIC 2014

Office of Nuclear Regulatory Research

Fire Research: Advancing the State-of-the-Art in Nuclear Fire Safety



Fire Testing

NUREG/CR-7010, "Cable Heat Release, Ignition, and Spread in Tray Installations during Fire (CHRISTIFIRE), Phase 2: Vertical Shafts and Corridors"
The National Institute of Standards and Technology (NIST) performed work for the U.S. Nuclear Regulatory Commission's (NRC's) Office of Nuclear Regulatory Research (RES) to better understand how to predict cable tray ignition, fire propagation (flame spread), and heat release rate. Phase 2 was completed in 2013.

Organisation for Economic Co-operation and Development (OECD) Program on High Energy Arcing Faults (HEAF) Fire Experiments, Joint Analysis of Arc Faults (JOAN of ARC)
RES is working with the Office of International Programs and OECD to investigate the impacts of catastrophic electrical failure. The international experimental testing program consists of 12 countries that will assist in better understanding the HEAF phenomena and developing more realistic tools to model the risk from this hazard.

Very Early Warning Fire Detection Systems (VEWFD Systems)
RES and NIST are currently conducting confirmatory tests to evaluate the effectiveness of VEWFD System applications.

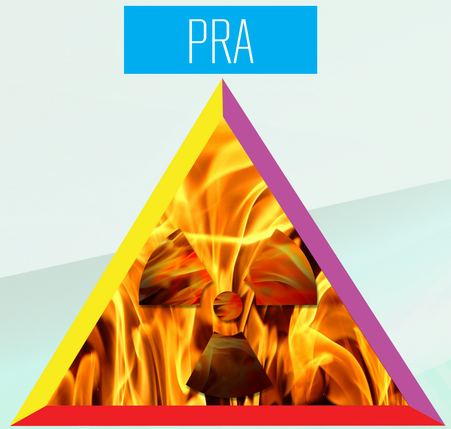
Heat Release Rate Data for Electrical Enclosure Fires
RES and NIST are performing testing to better characterize the heat release rate distribution for electrical cabinet fires in support of work to update NUREG/CR-6850 (EPRI 1011989), "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities."

Fire and Electrical Systems Circuit Analysis

NUREG-2128, "Electrical Cable Test Results and Analysis during Fire Exposure (ELECTRA-FIRE)"
In September 2013, RES issued the final report, which consolidates and analyzes test results from three major electrical functionality fire testing programs.

Fire Modeling

NUREG-1805, Supplement 1, "Fire Dynamics Tools (FDT^S) Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program"
RES issued the final report in July 2013 to support fire protection inspections conducted under the NRC Reactor Oversight Process.



Fire Research Knowledge Management

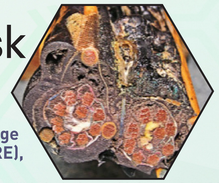
The RES Fire Research Branch continues to support the Nuclear Fire Protection Community of Practice and recently issued:
NUREG/KM-0002, "The Browns Ferry Nuclear Plant Fire of 1975 Knowledge Management Digest"
NUREG/KM-0003, "Fire Protection and Fire Research Knowledge Management Digest, 2013"

Collaborative External Partners

The Fire Research Branch continues to collaborate with external counterparts on several projects. These partners include the following:

OECD – BETTER POLICIES FOR BETTER LIVES
NIST – National Institute of Standards and Technology, U.S. Department of Commerce
EPRI – ELECTRIC POWER RESEARCH INSTITUTE
University of Maryland
BROOKHAVEN NATIONAL LABORATORY
INL – Idaho National Laboratory
Sandia National Laboratories

Fire Probabilistic Risk Assessment (PRA)



NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE), Volume 2"
RES and the Electrical Power Research Institute (EPRI) will jointly issue Volume 2 in 2014, which examines the conditional likelihood and duration of spurious actuations resulting from fire-induced electrical circuit failures. Work was conducted by Brookhaven National Laboratory.

Fire Events Database
RES coordinated with an EPRI-led project to update the industry fire events database. The updated information includes the most current fire event data and improves on previous data collection efforts.

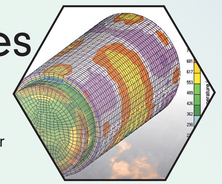
NUREG/CR-7114, "A Framework for Low Power/Shutdown Fire PRA"
RES and Sandia National Laboratories issued the final report in September 2013 which provides a framework for developing Low Power and Shutdown Fire PRA models when used in conjunction with an at-power Fire PRA developed using the methodology documented in NUREG/CR-6850 (EPRI 1011989), "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities."

Training

NUREG/CP-0301, "Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES) – 2010"
The 2010 RES/EPRI Fire PRA Workshop conference proceedings were adapted and published in August 2013 as a Fire PRA training tool.

Fire PRA Workshop 2014
RES and EPRI will continue to provide two sessions of week-long, free public training on Fire PRA in 2014. The training will consist of five separate classes: (1) Fire PRA, (2) Circuit Analysis, (3) Fire Analysis, (4) Fire Human Reliability Analysis (HRA) and (5) Advanced Fire Modeling.

Other Research Activities



NUREG/CR-7135, "Compensatory and Alternative Regulatory Measures for Nuclear Power Plant FIRE Protection (CARMEN-FIRE)"
RES issued the Draft Report in June 2013 to provide guidance for the review of fire protection program compensatory measures.

NUREG/CR-7115, "Performance of Metal and Polymeric O-Ring Seals in Beyond-Design-Basis Temperature Excursions," Phase 2
RES will begin testing in November 2014 to further characterize Polymeric Seals and Double O-Ring configurations for Spent Fuel Casks.

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