



# Fire Protection and Fire Research Knowledge Management Digest, 2013

NUREG/KM-0003  
January 2014  
Office of Nuclear Regulatory Research



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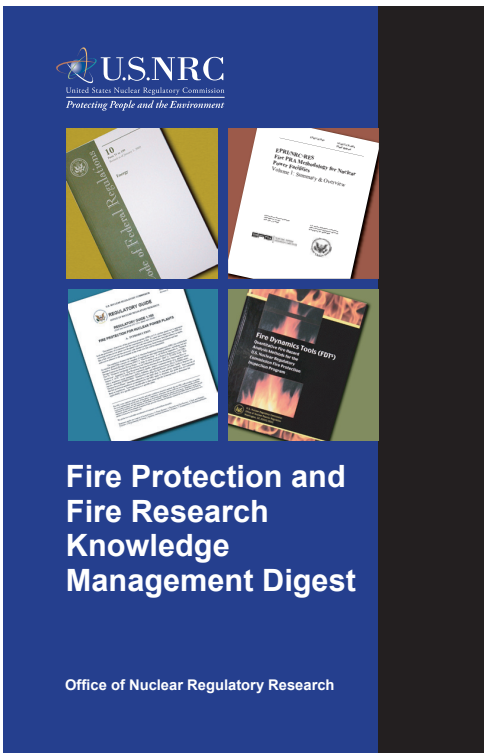
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Note: NUREG/KM-0003 supersedes NUREG/BR-0465





# Introduction

The U.S. Nuclear Regulatory Commission (NRC) knowledge management (NUREG/KM) publication series is intended to preserve the knowledge that has shaped the NRC's history and regulatory programs. The NRC Office of Nuclear Regulatory Research (RES) Division of Risk Analysis (DRA) Fire Research Branch (FRB) has prepared NUREG/KM-0003, "Fire Protection and Fire Research Knowledge Management Digest," in order to collect and share over 35 years' worth of NRC fire related experience with the Nuclear Fire Protection Community of Practice across the whole of NRC.

NUREG/KM-0003 provides fire related information for three major subject areas: current nuclear power plants, next generation nuclear power plants, and non-reactor and nuclear materials. The document collections that are used to inform the three subject areas are grouped into several categories that include: regulatory publications, technical publications, and non-NRC external documents. This digest supersedes previous fire protection digests and DVDs provided at the Regulatory Information Conference, including NUREG/BR-0465, "Fire Protection and Fire Research Knowledge Management Digest," in their entirety.

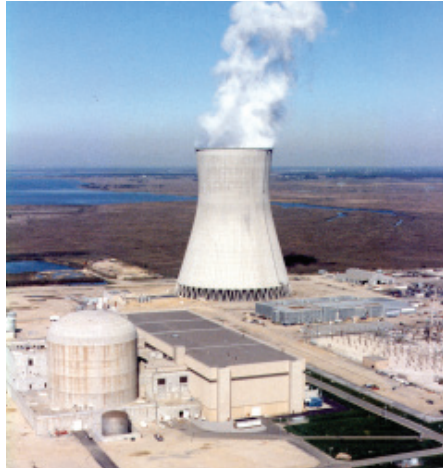


*The Browns Ferry (BFN) cable tray penetration after the 1975 fire. The fire forever changed how the NRC and industry view the threat of fire (NUREG/KM-0002).*

# Subject Areas

## *Current Nuclear Power Plants*

The NRC's Office of Nuclear Reactor Regulation (NRR) pursues a variety of regulatory and oversight activities to protect people and the environment from the effects of fire in operating nuclear power plants. Current nuclear power plant documents are related to the regulation and safe operation of nuclear power plants currently operating in the United States. The majority of NRC regulatory and technical publications issued from 1975–2013 pertain to currently operating nuclear power plants.



*Hope Creek Generating Station, Unit 1*

**Important Note:** Many of the documents on the DVD are historical in nature, and may contain information that is obsolete or superseded by today's regulations and research results. Please refer to the NRC's public Web site ([www.nrc.gov](http://www.nrc.gov)) for current information on regulations, Commission policy statements, regulatory guidelines, regulatory processes, and research results.



*Aerial view of Browns Ferry Nuclear Plant (TVA File photo)*

## *Next Generation Nuclear Power Plants*

The NRC's Office of New Reactors performs safety evaluations of fire protection programs, applicants' approaches to loss of large areas of the plant due to fires or explosions, and aircraft impact assessments, for new and advanced reactor designs in order to safely meet the Nation's future energy needs. Next generation nuclear power plant documents are related to the regulation, operation, and construction of new reactors. Several documents, such as Commission SECY papers and NRC technical reports (NUREGs), pertain only to new nuclear reactors. These documents provide additional guidance for advanced reactors designs, including passively cooled light water reactors, high-temperature gas-cooled reactors, and small modular reactor designs.



*U.S. EPR containment  
Courtesy: AREVA NP*

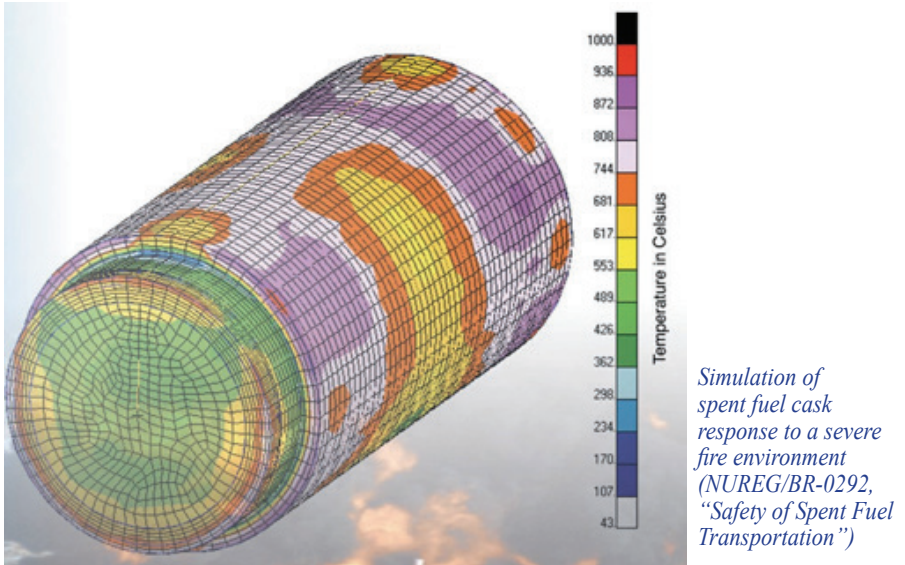


*Vogtle Unit 3 (AP1000) nuclear island; rebar placement in preparation for concrete basemat pour (Top). Vogtle Unit 3 reactor pressure vessel arrives in the United States (Bottom).  
Courtesy of Georgia Power, a Southern Company.*



## *Non-Reactor and Nuclear Materials*

The NRC’s Office of Nuclear Material Safety and Safeguards (NMSS) administers the agency’s Fire Protection Program for Fuel Cycle Facilities through a combination of regulations, guidance, and related licensing and oversight activities (including reliability assessments and modeling). Non-reactor and nuclear materials documents address requirements and guidance for: non-reactor facilities, such as NRC licensed fuel fabrication facilities; the transportation of nuclear materials; and other NRC regulated activities, such as medical and industrial uses of nuclear materials.



**Important Note:** Some documents contained in this NUREG/KM, especially fire research documents, may be applicable to two or all three subject areas. Some of these documents may be historical in nature, whereas the most recent documents may be state of the art research.



*Photos of JNES High Energy Arc Fault (480V) Test 1 (left) and Test 2 (right)*



# Document Collections

The document collections are grouped into three subject areas with several categories that include: (1) regulatory publications, such as relevant fire protection regulatory requirements, regulatory guidance, and pertinent NRC Generic Communications, (2) technical publications, such as NRC technical reports (NUREGs), which include fire test reports, fire protection studies, and probabilistic risk assessments, and (3) non-NRC external documents, such as reports and guidance by the U.S. Government Accountability Office (GAO) and the International Atomic Energy Agency (IAEA), respectively. Each category of document is discussed in greater detail below.

## Regulatory Publications

Regulatory publications are documents used by inspectors and licensees. All regulatory publications included in this DVD are NRC official records and are available to the public.

The regulatory publications part of the DVD includes the following:

- *Title 10 of the Code of Federal Regulations Part 50, “Domestic Licensing of Production and Utilization Facilities”*

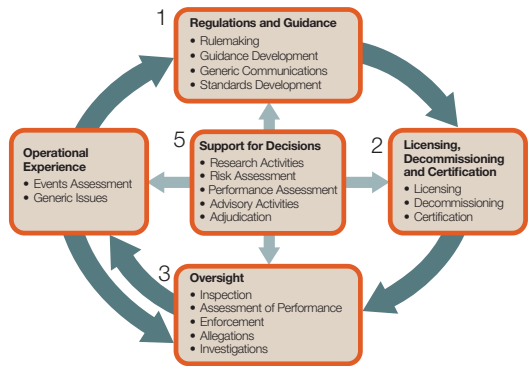
This includes 10 CFR Section 50.48 “Fire Protection” and the appendices to 10 CFR 50, “Domestic Licensing of Production and Utilization Facilities,” that form the basis for fire protection requirements.

- *Guidelines for Fire Protection in Nuclear Power Plants*

This includes the Standard Review Plan for the “Fire Protection Program” and the NRC Branch Technical Positions (BTPs) on the guidelines for fire protection.

- *Fire Inspection Procedures*

This part includes procedures used in fire protection inspections.



Overview of NRC's regulatory process

Source: <http://www.nrc.gov/about-nrc/regulatory.html>

- *Fire Inspection Manual*

This contains the significance determination process (SDP), power reactor inspection reports, and inspection documents and records. Also included is SDP guidance on identifying fire growth and damage sequences, mapping fire ignition sources, characterizing complex fire ignition sources, identifying targets and associated damage criteria, and analyzing nonsuppression probability.

- *Regulatory Guide*

A regulatory guide (RG) describes acceptable methods for implementing agency regulations, evaluating postulated accidents, and analyzing data that the NRC staff needs in reviewing applications for permits and licenses. RGs are not substitutes for regulations, and compliance with them is not required.

- *Generic Issue*

A generic issue (GI) is a well defined, discrete technical or security issues from which the risk or safety significance can be determined. A GI potentially affects the public health and safety, the common defense and security, and the environment. It must apply to two or more facilities, certificate holders, or licensees, and cannot be addressed through other regulatory programs or processes, existing regulations, policies, or guidance, or voluntary industry initiatives. NRC staff or members of the public may propose a GI when there is an issue that indicates weaknesses in NRC rules and regulations.

- *Enforcement*

This includes documents such as enforcement guidance memoranda (EGM) and notices of enforcement discretion (NOED). Enforcement Manual Appendix A contains temporary enforcement guidance, including temporary EGM that direct the staff with regard to emergent enforcement issues. A NOED is a special type of discretion that the agency may exercise under specific circumstances. NOED are addressed in Section VII.C of the NRC's Enforcement Policy.



*Picture of damaged cables resulting from an Electric Power Research Institute (EPRI) cable fire test*

- *Generic Letter*

The generic letter (GL) addresses either an emergent or routine technical issue or a policy position with generic applicability. Some GLs may also request information or compensatory actions, or require a written response from licensees regarding matters of safety, security, safeguards, or environmental significance.

- *Bulletin*

A bulletin request licensee actions or information to address urgent, significant issues regarding matters of safety, security, safeguards, or environmental significance.

- *Administrative Letter*

Administrative letters inform addressees of specific regulatory or administrative information, or clarify this information. The NRC discontinued use of these letters in September 1999.

- *Information Notice*

The information notice communicates recently identified operational information to the nuclear industry and the results of recently completed research that may affect addressees. The NRC expects the nuclear industry to review the information for applicability to its facilities or operations, and to consider actions, as appropriate, to avoid similar problems.

- *Regulatory Issue Summary*

A regulatory issue summary is used to inform stakeholders about NRC endorsement of industry guidance on technical or regulatory matters, request the voluntary participation of the nuclear industry in staff sponsored pilot programs, and inform the nuclear industry of opportunities for regulatory relief and other topics that do not require an action or information.

- *Circular*

Circulars provide time sensitive information related to public health and safety. The NRC discontinued the use of circulars in February 1985.

- *SECY Papers*

The Office of the Secretary (SECY) papers are reports and/or letters submitted by the Office of the Executive Director for Operations, Chief Financial Officer, Chief Information Officer, or other offices reporting directly to the Commission to inform or to request guidance from the Commission. The three kinds of SECY papers include policy issue papers (formulation of policy), rulemaking issue papers (promulgation of agency rules), and adjudicatory issue papers (granting, suspending, revoking or amending licenses).

- *Staff Requirements Memoranda*

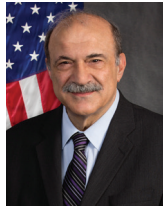
Staff Requirements Memoranda (SRM) document the Commission's decisions on a staff written issue paper and any related tasks assigned to the staff with the date due.



**Chairman  
Allison M.  
Macfarlane**



**Commissioner  
Kristine L.  
Svinicki**



**Commissioner  
George  
Apostolakis**



**Commissioner  
William D.  
Magwood, IV**



**Commissioner  
William C.  
Ostendorff**

*The NRC Commission as of November 2013 ([http://www.nrc.gov/about\\_nrc/organization/commfuncdesc.html](http://www.nrc.gov/about_nrc/organization/commfuncdesc.html))*

## *Technical Publications*

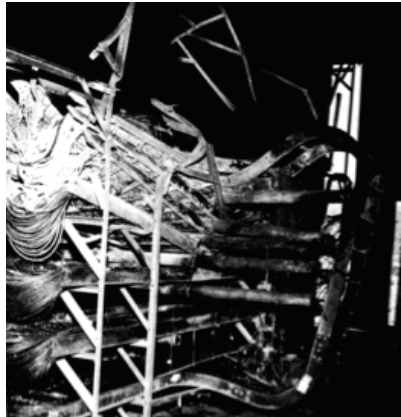
The technical publications (NUREG technical reports) include such topics as experimental investigations of fire and the behavior of components exposed to fires, surveys of plant practices, assessments of the safety implications of these practices, the development of analytical methodologies to perform such assessments, and reviews of fire probabilistic risk assessments performed by other organizations. These publications are intended to support regulatory activities that ensure fire safety.



*TVA Penetration Seal Fire Tests circa 1976*

NUREGs are generally classified as the following:

- *reports prepared by NRC staff (NUREG)*
- *reports prepared by NRC contractors (NUREG/CR)*
- *brochures prepared by or under the direction of NRC staff (NUREG/BR)*
- *conference proceedings prepared by NRC staff or contractors (NUREG/CP)*
- *knowledge management reports prepared by NRC staff (NUREG/KM)*



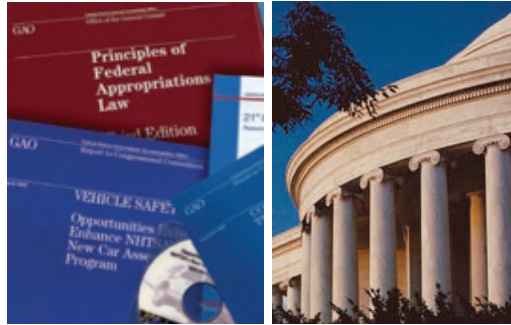
*1977 Sandia National Laboratory full scale test with RG 1.75 separation criteria and IEEE-383 qualified cable – Before (left) and After (right)*

## Non-NRC Documents

Non-NRC documents include publically available documents that were not published by the NRC but are still important to the Nuclear Fire Protection Community of Practice.

- *GAO*

This section includes oversight reports issued by the U.S. Governmental Accountability Office regarding NRC fire related activities. The GAO is an independent, nonpartisan agency that works for the U.S. Congress.



Source: [http://www.gao.gov/about/gao\\_at\\_a\\_glance\\_2010\\_english.pdf](http://www.gao.gov/about/gao_at_a_glance_2010_english.pdf)

The GAO supports congressional oversight by:

- *auditing agency operations to determine whether Federal funds are being spent efficiently and effectively*
- *investigating allegations of illegal and improper activities*
- *reporting on how well government programs and policies are meeting their objectives*
- *performing policy analyses and outlining options for congressional consideration*
- *issuing legal decisions and opinions, such as bid protest rulings and reports on agency rules*

The GAO advises Congress and the heads of executive agencies on ways to make government more efficient, effective, ethical, equitable, and responsive.

- *IAEA*

This section contains publically available reports and guidance issued by the International Atomic Energy Agency. Per Article III of the IAEA's statute, "the IAEA is authorized to establish or adopt standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards." "The principal users of safety standards in IAEA Member States are regulatory bodies and other relevant national authorities" and several "Member States have decided to adopt the IAEA's safety standards for use in their national regulations."



IAEA safety standards are issued via IAEA Safety Standard Series publications, which are categorized as Safety Fundamentals, Safety Requirements, or Safety Guides. “Safety Guides provide recommendations and guidance on how to comply with the safety requirements, indicating an international consensus that it is necessary to take the measures recommended (or equivalent alternative measures). The Safety Guides present international good practices, and increasingly they reflect best practices, to help users striving to achieve high levels of safety.” However, “many of the IAEA safety standards, in particular those addressing aspects of safety in planning or design, are intended to apply primarily to new facilities” and it is the responsibility of individual States to decide how to apply the standards to existing facilities.

The IAEA also issues Safety Reports “which provide practical examples and detailed methods that can be used in support of the safety standards.”



Source: <http://www.iaea.org/About/>

# How to use the DVD

Running the Fire Research Knowledge Management Executable File (.exe) on the NUREG/KM DVD brings up the main menu for the digest.

**U.S. NRC**  
N U C L E A R R E G U L A T O R Y C O M M I S S I O N  
Protecting People and the Environment

**NUREG/KM-0003**  
**Fire Protection and Fire Research Knowledge Management Digest**

**Fire Research Branch**

Select Document Subject

- All Documents
- Current Nuclear Power Plants
- Next Generation Nuclear Power Plants
- Non-Reactor and Nuclear Materials

Documents Collection

Reports Specific to Plants and Facilities

Search NUREG/KM

[Knowledge Management PDF](#)

[List of Documents in this NUREG/KM](#)

**Office of Nuclear Regulatory Research**

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## *Fire Protection and Fire Research KM Digest Main Menu*

Radio Buttons select the particular subject area to be searched. Select the Document Collection button to open a new menu that lists documents by document type.

### **Important Notes:**

The Knowledge Management PDF link opens a copy of this NUREG/KM.

The List of Documents in this NUREG/KM opens a list of all available documents and associated hyperlinks which are included in the digest.

One alternative to using this database is to simply use the List of Documents to search for desired files. This option is provided for user preference and for users who may be unable to use the DVD (e.g., Mac or Linux users).

Downloading the contents of the DVD to a hard drive and then running the Fire Research Knowledge Management Executable File may reduce loading times.

[Return to Main Menu](#)

[Regulations: 10 CFR](#)

[Guidelines for Fire Protection](#)

**Generic Communications**

[Generic Letters](#)

**Bulletins**

[Administrative Letters](#)

[Information Notices](#)

[Regulatory Issue Summaries](#)

[Circulars](#)

[NRC Technical Reports \(NUREG\)](#)

[Commission Documents](#)

[Non-NRC Documents](#)

**Office of Nuclear Regulatory Research**



## Bulletins

12 Documents

Document Name	Document Title	Publish Date
BL 1975-04	Cable Fire at Brown Ferry Nuclear Power Station	02/24/1975
BL 1975-04A	Cable Fire at Brown Ferry Nuclear Power Station	04/03/1975
BL 1975-04B	Cable Fire at Brown Ferry Nuclear Power Station	11/03/1975
BL 1977-08	Assurance of Safety and Safeguards during an Emergency - Locking Systems	12/28/1977
BL 1978-01	Flammable Contact - Am Retainers in G.E. CR120A Relays	01/16/1978
BL 1978-03	Potential Explosive Gas Mixture Accumulations Associated with BWR Offgas System Operations	02/08/1978
BL 1981-03	Flow Blockage of Cooling Water to Safety System Components by Corbicus SP (Pneumatic Dam) and Moxus SP (Mussel)	04/10/1981
BL 1992-01	Failure of Thermal-Lag 330 Fire Barrier System to Maintain Cabling in Wide Cable Trays and Small Conduits Free from Fire Damage	06/24/1992
BL 1992-01 Supp 1	Failure of Thermal-Lag 330 Fire Barrier System to Perform its Specified Fire Endurance Function	08/28/1992
BL 1996-04	Chemical, Galvanic, or Other Reactions in Spent Fuel Storage and Transportation Casks	07/05/1996
BL 2005-02	Emergency Preparedness and Response Actions for Security-Based Events	07/18/2005
BL 2011-01	Mitigating Strategies	05/11/2011

[All Documents](#)
[Current Nuclear Power Plants](#)
[Next Generation Nuclear Power Plants](#)
[Non-Reactor Nuclear Materials](#)

Filter By Title:

### Fire Protection and Fire Research KM Digest Document Collection Menu

The Document Collection menu contains several buttons associated with subcategories of NRC regulatory and technical publications as well as relevant, publicly available, non-NRC external publications.

Using these buttons may provide the option to further narrow search results. For example, selecting Generic Communications, which opens a dropdown list of more options, and then selecting the Bulletins button. The total number of results will be provided above the results window. The results window itself will display all results in a scrollable window. The associated documents may be opened by single clicking on the row that displays the name, title, and date or the desired document.

**Important Note:** Again, the radio buttons can be used to select the different subject areas or to search through all documents.

The Fire Protection and Fire Research Knowledge Management Digest also allows users to search for inspection reports and associated information by plant or by fuel facility. Select the Reports Specific to Plants and Facilities button to open the Inspection Report Menu.

The Inspection Report Menu allows the user to select nuclear power plants by region or to select fuel facilities. For example, Region III and Clinton Power Station were selected in the following screenshot.

**Important Note:** An Internet connection may be required to access certain documents that were not included on the DVD itself. If the document is not available without Internet access, and an Internet connection is unavailable, a browser window will open and indicate the lack of network connection.

**Return to Main Menu**

Region 1 Region 2 **Region 3** Region 4 Fuel Facilities

**Clinton Power Station, Unit 1**  
Clinton, IL  
Exelon Generation Co., LLC

Click A Plant to View

Item Type	Document Title
IN 1997-50	Excess Lubricant in Electric Cable Sheaths
IN 1995-36 Supp 1	Potential LOCA at High and Low-Pressure Interfaces from Fire Damage
IN 1999-17	Potential Problem in Post-Fire Emergency Lighting Supplement 1
	Problems Associated with Post-Fire Safe-Shutdown Circuit Analyses
License Requirements	Clinton Power Station, Unit 1 Operating License
Quarterly NCV (Green)	Failure to Control Combustible Gas Cylinders in Accordance with Fire Protection Program
Quarterly NCV (Green)	Failure to Control Transient Combustible Materials in Accordance with Fire Protection Program
Quarterly NCV (Green)	Failure to Control Transient Combustible Materials in Accordance with Fire Protection Program
Quarterly NCV (Green)	Failure to Control Transient Combustible Materials in Accordance with Fire Protection Program
Quarterly NCV (Green)	Failure to Control Transient Combustible Materials in Accordance with Fire Protection Program
Quarterly NCV (Green)	Failure to Control Transient Combustible Materials in Accordance with Fire Protection Program
Quarterly NCV (Green)	Failure to Establish Adequate Compensatory Actions (Hourly Fire Watch)

All Documents	Triennial Reports	Quarterly Reports	Information Notices	License Requirement
20 Documents				
<a href="http://www.nrc.gov/info-finder/reactor/cln.html">www.nrc.gov/info-finder/reactor/cln.html</a>				
Docket Number:	050-00461	Licensed Capacity:	065	
NRC Region:	3	CP Issued:	2/24/1976	
Containment Type:	BWR-MARK 3	OL Issued:	4/17/1987	
NSSS:	GE 6	Comm. Op.:	1/24/1987	
Architect Engineer:	SI	LR Issued:	1/4	
Constructor:	BALD	Exp. Date:	-9/29/2026	

*Fire Protection and Fire Research KM Digest Inspection Report Menu*

Finally, this digest also has a simplified built in search tool that is accessed by selecting the Search NUREG/KM button on the main menu.

**Return to Main Menu**

**Document Collection Results**

- All Documents
- Current Generation Nuclear Power Plants
- Next Generation Nuclear Power Plants
- Non-Reactor and Nuclear Materials

Search what?  
All Documents

Specific to Plants and Facilities Results

Plant	Document Title	Item Type	Event Date

Earliest Date: Sunday, January 19, 1971  
Latest Date: Thursday, January 09, 2014

Title Contains the Phrase or Keywords:

**Search** **Reset**

*Fire Protection and Fire Research KM Digest Search Menu*

Search queries are entered in the text box and are not case sensitive. Additional constraints, such as document date range and title, can be used to narrow down the number of documents returned.

One alternative to using this search feature is to download all the files contained on the DVD under the Knowledge\_Base folder and then use the Advanced Search options under Adobe (or a similar feature with another PDF reader) to search for keywords within multiple documents at once.

**Important Note for Future Editions:**

The Fire Research Branch has made every attempt to locate, recover, and preserve legacy reports to better serve the Nuclear Fire Protection Community of Practice. If you have a digital copy or hardcopy of material that you think the NUREG/KM DVD should include, or any other suggestions, please contact the Fire Research Branch (RES\_DRA\_FRB@nrc.gov).

# Fire Protection and Fire Research Knowledge Management Digest, 2013

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U.S. Nuclear Regulatory Commission  
Office of Nuclear Regulatory Research  
Fire Research Branch







This report contains a DVD with a database of documents and hyperlinks. Please e mail the Fire Research Branch (RES\_DRA\_FRB@nrc.gov) with your address to request additional DVDs be sent via the U.S. Postal Service.

This DVD was developed using Visual Basic Professional 2008. Windows XP (or above) and .NET Framework 3.5 (or above) is required.





NUREG/KM-0003

January 2014

