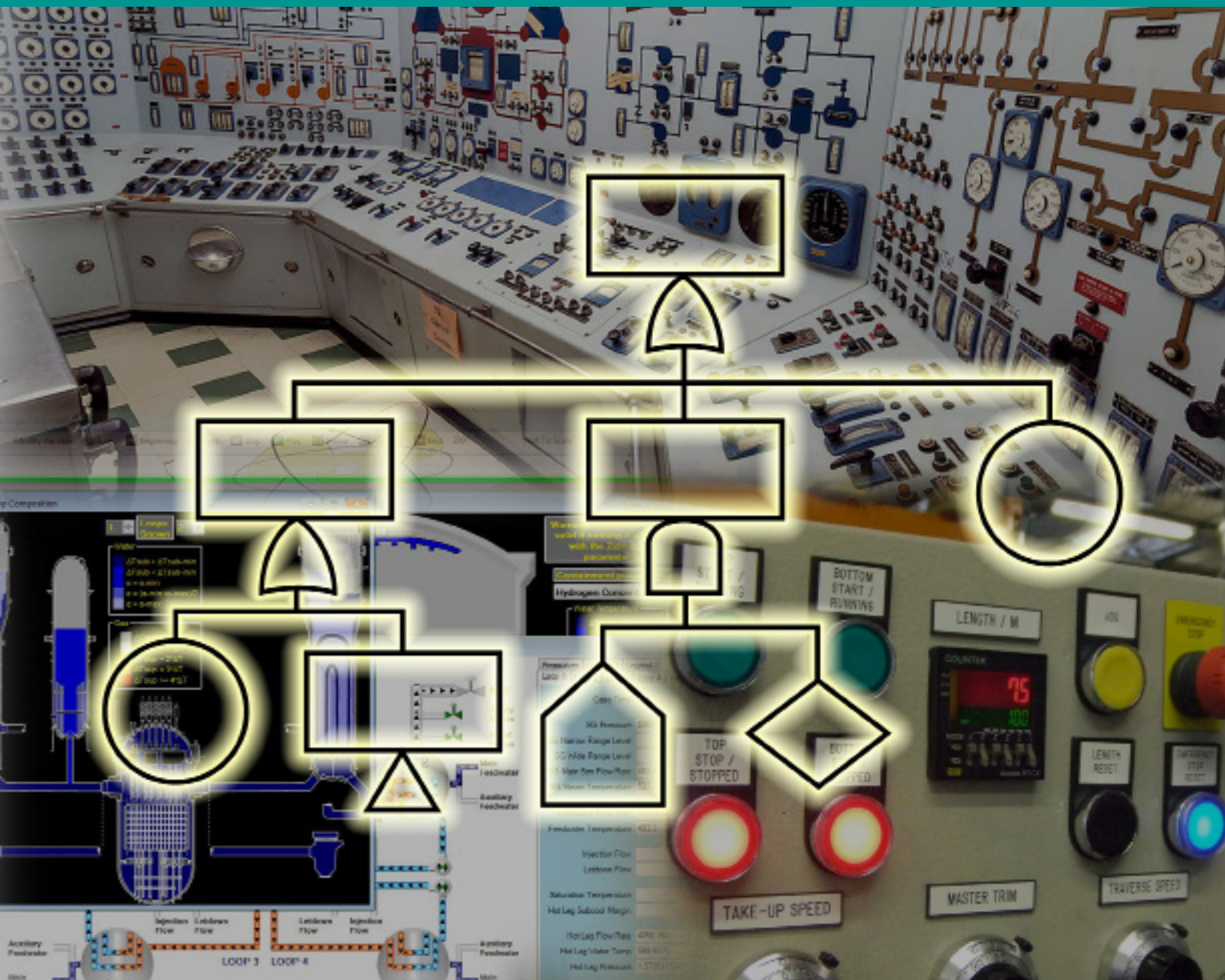


# Risk and Safety Management Catalog and Product List



# RSM Product Catalog

## Introduction

Risk and safety assessments provide information that enables nuclear plant owners to make technically sound decisions about plant design and maintenance and operating practices. These decisions contribute to safer and more cost-effective plant operation. Risk models and techniques are being used in a growing number of applications, including online maintenance, surveillance interval extensions, flexible allowed outage times, and risk-informed performance-based fire protection. Continuous refinement of methods and application

approaches are necessary to ensure that decisions best reflect industry operating experience, improve understanding of plant response, and state-of-the-art computational advances.

The Risk and Safety Management Program develops risk-assessment methods and the tools to implement them to enhance the safe and economic operation of existing and future nuclear power plants. These tools include software EPRI to assist utilities in performing detailed risk analyses necessary to achieve these objectives most effectively.

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## Product Listing

Below is a list of Risk and Safety Management (RSM) publications organized by topical area. Items from this list can be downloaded or ordered from our website at [www.epri.com](http://www.epri.com). Please note, some older or outdated reports are excluded from this list, but can still be ordered via the website.

In the list below, certain items are flagged as key reference documents for new PRA analysts; these items have a diamond ♦ preceding the product ID.

### Containment Testing and Analysis

NP-6260	1989	Criteria and Guidelines for Predicting Concrete Containment Leakage
NP-3774	1984	Concrete Containment Structural Element Tests: Volumes 1–3
NP-2694	1982	Control of Containment Air Temperature: An Industry Survey and Insulation Test

### Emergency Diesel Generators (EDGs)

TR-102814	1993	A Methodology for Determining an EDG's Capability to Start its Emergency Loads: Capability to Start Its Emergency Loads
NSAC-108	1986	Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants

### External Events Other Than Fire and Seismic

#### External Flooding Hazard

♦ 3002015989	2019	External Flooding Probabilistic Risk Assessment Walkdown Guidance
3002010667	2017	Paleoflood Evidence of Past Flooding Events: Investigation into the Available Sources of Paleoflood Evidence in Humid Environments
3002008111	2016	Probabilistic Flooding Hazard Assessment for Storm Surge with an Example Based on Historical Water Levels
3002008113	2016	Evaluation of Deterministic Approaches to Characterizing Flood Hazards
3002005292	2015	External Flooding Hazard Analysis: State of Knowledge Assessment
3002004400	2014	Local Precipitation-Frequency Studies: Development of 1-Hour/1-Square Mile Precipitation-Frequency Relationships for Two Example Nuclear Power Plant Sites
3002003013	2014	Riverine Probabilistic Flooding Hazard Analysis Pilot: Proof-of-Concept Study for a Nuclear Power Plant Tornado Missiles High Winds (including Tornado Missiles)

#### High Winds (Including Tornado Missiles)

3002020906	2021	Consideration of Wind-Driven Rain in High Winds PRA
3002018232	2020	High Winds PRA Loss of Offsite Power
3002015994	2019	Evaluation of Windborne Missile Fragilities for Piping, Vent Stacks, Liquid-Filled Tanks, and Concrete Panels
♦ 3002008092	2016	Process for High Winds Walkdown and Vulnerability Assessments at Nuclear Power Plants
3002003107	2015	High Wind Risk Assessment Guidelines
1018054	2008	Full Scale Tornado Missile Impact Tests
1018052	2008	Full Scale Turbine Casing Impact Tests
1018053	2008	Full Scale Turbine Missile Concrete Impact Tests
NP-4334-CCMP	1985	Probabilistic Analysis of Turbine Missile Risks: Volumes 1-3
NP-2746	1983	Scale Modeling of Turbine Missile Impact Into Concrete
NP-2745	1983	Full-Scale Missile Concrete Impact Experiments
NP-2898	1983	Windfield and Trajectory Models for Tornado-Propelled Objects
NP83-02	1983	Full Scale Turbine Missile Casing Tests
NP-2741	1982	Full-Scale Turbine Missile Casing Tests
NP-2742	1982	Scale Model Turbine Missile Casing Impact Tests

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### High Winds (Including Tornado Missiles) (continued)

NP-2005	1981	Tornado Missile Simulation and Design Methodology, Volumes 1–2
NP-1883	1981	Pipe Missile Impact Experiments on Concrete Models
NP-748	1978	Wind Field and Trajectory Models for Tornado Propelled Objects
NP-768	1978	Tornado Missile Risk Analysis
NP-769	1978	Tornado Missile Risk Analysis Appendixes
NP-440	1977	Full-Scale Tornado-Missile Impact Tests
NP-148	1976	Full Scale Tornado Missile Impact Tests
NP-154	1976	Tornado Missile Risk Analysis

### Probabilistic Risk Assessment for External Hazards

3002020758	2021	External Hazards: Information Compilation and Analysis—2021 Catalog of Relevant Information Sources
3002020767	2021	Resiliency of Nuclear Plants in the Face of Climate Change
3002020757	2021	External Hazards: Information Compilation and Analysis—2020 New Information Report
3002018237	2020	External Hazards: Information Compilation and Analysis—Description of Process and Criteria
3002018235	2020	External Hazards: Information Compilation and Analysis—2019 New Information Report
3002016048	2019	External Hazards: Information Compilation and Analysis—2018 New Information Report
3002012989	2018	External Hazards: Information Compilation and Analysis—2017 New Information Report
◆ 3002005287	2015	Identification of External Hazards for Analysis in Probabilistic Risk Assessment: Update of Report 1022997

### Fire Data and Events, Fire PRA

#### Cables Testing and Performance

3002009214	2017	Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE) — Volume 3: Technical Resolution to Open Issues on Nuclear Power Plant Fire-Induced Circuit Failure
3002001989	2014	Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE) Volume 2: Expert Elicitation Exercise for Nuclear Power Plant Fire-Induced Electrical Circuit Failure
1026424	2012	Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE)
1003326	2002	Characterization of Fire-Induced Circuit Faults: Results of Cable Fire Testing
1006961	2002	Spurious Actuation of Electrical Circuits Due to Cable Fires: Results of an Expert Elicitation
TR-106714	1996	Methods for Evaluating Cable Wrap Fire Barrier Performance
NP-7332	1991	Design Guide for Fire Protection of Grouped Electrical Cables
NP-2660	1982	Fire Tests in Ventilated Rooms: Extinguishment of Fire in Grouped Cable Trays
NP-2751	1982	Fire Tests in Ventilated Rooms: Detection of Cable Tray and Exposure Fires
NP-1881	1982	Categorization of Cable Flammability-Intermediate-Scale Fire Tests of Cable Tray Installations
NP-1675	1981	Assessment of Exposure Fire Hazards to Cable Trays
NP-1193	1979	Water as a Means of Cable Fire Protection and Operational Effects Experience

#### High-Energy Arcing Faults (HEAF)

3002020692	2021	Survey and Analysis of US Industry relative to High Energy Arcing Faults in the Presence of Aluminum
3002015992	2019	Nuclear Station Electrical Distribution Systems and High-Energy Arcing Fault Events
3002015459	2019	Critical Maintenance Insights on Preventing High-Energy Arcing Faults
3002011922	2017	Characterization of Testing and Event Experience for High-Energy Arcing Fault Events

#### Fire Protection Programs

1013211	2006	Optimization of Fire Protection Impairments at Nuclear Power Plants
1000196	2000	Fire Barrier Penetration Seal Handbook

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**Fire Protection Programs (continued)**

TR-107337	1997	Reducing Operations and Maintenance Costs of Nuclear Power Plant Fire Protection Programs
TR-105925	1996	EPRI Fire Protection Cost Reduction Workshop
NP-7253	1991	Effects of Fire Suppressants on Electrical Components in Nuclear Power Plants
NP-6476	1989	EPRI Workshop on Fire Protection in Nuclear Power Plants

**Fire Event Data**

3002005302	2016	Fire Events Database Update for the Period 2010–2014: Revision 1
1025284	2013	The Updated Fire Events Database: Description of Content and Fire Event Classification Guidance
3002002936	2014	Fire Ignition Frequencies and Non-Suppression Probability Estimation Using the Updated Fire Events Database
1022994	2011	An Improved Methodological Approach for Estimating Fire Ignition Frequencies
1003111	2001	Fire Events Database and Generic Ignition Frequency Model for U.S. Nuclear Power Plants
TR-105929	1995	Fire Ignition Frequency Model at Shutdown for U.S. Nuclear Power Plants
NSAC-179L	1994	Automatic and Manual Suppression Reliability Data for Nuclear Power Plant Fire Risk Analyses
NP-6343-L	1989	Fire Test Summaries Database
NP-3179	1983	Nuclear Power Plant Fire Loss Data
NP-1731	1981	Ignitability of High Fire Point Liquid Spills

**Modeling and Simulation of Fires**

3002020747	2021	Modeling of Oil Fires in Fire Probabilistic Risk Assessment
3002020746	2021	Heat Release Rate Testing Results for Small Electrical Panels
3002016052	2019	Refining and Characterizing Heat Release Rates from Electrical Enclosures During Fire, Volume 2: Fire Modeling Guidance for Electrical Cabinets, Electric Motors, Indoor Dry Transformers, and the Main Control Board
3002015997	2019	Heat Release Rate and Fire Characteristics of Fuels Representative of Typical Transient Fire Events in Nuclear Power Plants
3002005578	2016	Refining and Characterizing Heat Release Rates From Electrical Enclosures During Fire (RACHELLE-FIRE): Volume 1: Peak Heat Release Rates and Effect of Obstructed Plume
3002002182	2016	Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications: Supplement 1
3002005303	2015	Fire Modeling Method Enhancements - Fire Location Factor, Oil Spill Heat Release Rate and Transient Fires
1023259	2012	Nuclear Power Plant Fire Modeling Application Guide (NPP FIRE MAG)
1011999	2007	Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications
TR-108875	1998	Fire Modeling Code Comparisons

**Probabilistic Risk Assessment for Fire**

3002018268	2020	A Practical Approach for Addressing Uncertainty in Fire Probabilistic Risk Assessment Modeling
3002018231	2020	Methodology for Modeling Transient Fires in Nuclear Power Plant Fire Probabilistic Risk Assessment
◆ 3002018230	2020	Fire PRA Wiki version 1.0
3002016004	2019	Alternative Method for Quantification of Decision Making for Main Control Room Abandonment
3002013023	2019	EPRI/NRC-RES Fire Human Reliability Analysis Guidelines—Quantification Guidance for Main Control Room Abandonment Scenarios
3002016054	2019	Methodology for Modeling Transient Fires in Nuclear Power Plant Fire Probabilistic Risk Assessment
3002016053	2019	Methodology for Modeling Plant Trip Probabilities in Nuclear Power Plant Fire Probabilistic Risk Assessment
3002016051	2019	Methodology for Modeling Fire Growth and Suppression Response for Electrical Cabinet Fires in Nuclear Power Plants

**Probabilistic Risk Assessment for Fire (continued)**

3002009215	2017	EPRI/NRC-RES Fire Human Reliability Guidelines: Qualitative Guidance for Main Control Room Abandonment
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Scenarios (NUREG-1921, Supplement 1)

3002005205	2016	Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES) - 2012
3002000267	2013	Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES)-2010, NRC-RES/EPRI Fire PRA Workshop, Volume 1 – Prerequisite Bas 10, NRC-RES/EPRI Fire PRA Workshop, Volume 2 – Module 4: Human Reliability Analysis
1023001	2012	EPRI/NRC-RES Fire Human Reliability Analysis Guidelines (NUREG-1921)
1020621	2010	Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES)
1019259	2009	Fire Probabilistic Risk Assessment Methods Enhancements
1016735	2008	Fire PRA Methods Enhancements
1011989	2005	EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities Volume 1: Summary and Overview, Volume 2: Detailed Methodology
1008239	2004	EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities: Volume 1: Summary and Overview; Volume 2: Detailed Methodology
SU-105928	2000	Guidance for Development of Response to Generic Request for Additional Information on Fire Individual Plant Examination for External Events (IPEEE): A Supplement to EPRI Fire PRA Implementation Guide (TR-105928)
TR-112933	1999	IPEEE Fire Review
NSAC-181	1993	Fire Probabilistic Risk Assessments (PRA) Requantification Studies
TR-100443	1992	Methods of Quantitative Fire Hazard Analysis

### Risk Management for Fires

1013489	2006	Use of EPRI/NRC-RES Fire Probabilistic Risk Assessment (PRA) Methodology in Estimating Risk Impact of Plant Changes
1012948	2005	Methodology for Fire Configuration Risk Management
1010981	2004	Transition Process Pilot Report; NEI 04-02 Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)
1001442	2001	A Pilot Plant Evaluation Using NFPA-805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants"
TR-108799	1997	Planning and Risk-Informed/Performance-Based Fire Protection at Nuclear Power Plants

### Fukushima Response

3002009564	2017	Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation
3002005298	2016	Technical Evaluation of Fukushima Accidents: Phase 2—Potential for Recriticality During Degraded Core Reflood
3002005301	2015	Technical Evaluation of Fukushima Accidents: Phase 2
3002005295	2015	Technical Evaluation of Fukushima Accidents: Phase 2 - Revised GOTHIC Analysis
3002002707	2014	Fukushima Radiological Assessment Tool, Version 2: Benchmarking Radiological Assessment and Dose Models Using Fukushima Dataset
3002002749	2014	Technical Basis for Establishing Success Timelines in Extended Loss of AC Power Scenarios in Boiling Water Reactors Using MAAP4: A Guide to MAAP Thermal-Hydraulic Models
3002001785	2013	Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications
3002000704	2013	Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic
1025287	2013	Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic
1025286	2012	Seismic Walkdown Guidance: For Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic
1025750	2012	Fukushima Technical Evaluation: Phase 1 – MAAP5 Analysis
1024946	2012	Fukushima Daiichi Accident – Technical Causal Factor Analysis
1023422	2011	EPRI Fukushima Daiichi Independent Review and Walkdown

### Generation Risk Assessment and Asset Management

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**Aging and Life Extension**

1021085	2010	Desired Characteristics for Next Generation Integrated Nuclear Safety Analysis Methods and Software
1016732	2008	Program on Technology Innovation: A Preliminary Study on Decision Support for the Nuclear Power Industry
TR-102731-T2	1996	Stiffness of Reinforced Concrete Walls Resisting In-Plane Shear: Tier 2: Aging and Durability of Concrete Used in Nuclear Power Plants

**Asset Management**

1021083	2010	Program on Technology Innovation: Computational Models for Optimal Project Prioritization
1019205	2009	Nuclear Asset Management (NAM) Model - Update for Project Prioritization
1016733	2008	Project Prioritization for Nuclear Plant Investments
1016734	2008	Capital Budgeting Under Uncertainty - Project Prioritization
1015092	2007	Program on Technology Innovation: Project Prioritization Optimization Under Budget Uncertainty
1013488	2007	Leading Business Performance Indicators for Nuclear Power Enterprises
1011925	2006	2005 EDF/EPRI Collaboration on Life Cycle Management and Nuclear Asset Management
1012914	2006	Risk-Informed Asset Management
1011000	2005	Business Performance Indicators for Nuclear Asset Management
1009632	2005	Risk-Informed Asset Management (RIAM): Method, Process, and Business Requirements
1009634	2005	2004 EDF/EPRI Collaboration on Life Cycle Management and Nuclear Asset Management
TR-108261	1997	Property Damage Risk Assessment Scoping Study: for South Texas Project Electric Generating Station
TR-108061	1997	Nuclear Property Insurance Study

**Note:** Additional technical information related to Maintenance Rule issues may be found through EPRI's Nuclear Maintenance Applications Center (NMAC) program.

**Generation Risk Assessment**

1021084	2010	Program on Technology Innovation: Integration of Degradation Predictions on Generation Risk Assessment
1016461	2008	Case Study: A Comparison of Generation Risk Assessment and Failure Modes and Effects Analysis Methodologies at TEPCO's Nuclear Power Plants
1013575	2006	Comparison of Qualitative (AP-913) and Quantitative (Generation Risk Assessment) Equipment Reliability Assessment Techniques
1011924	2005	Generation Risk Assessment (GRA) at Cooper Nuclear Station
1008121	2004	Generation Risk Assessment (GRA) Plant Implementation Guide
1009112	2004	Trip Monitor Customization and Implementation Guideline
1007386	2004	Introduction to Simplified Generation Risk Assessment Modeling

**Risk Management**

1011761	2005	Risk Management Effectiveness Assessment Application Guide
1011204	2004	A Preliminary Investigation of Nuclear Power Plant Risk Management as a Complex Adaptive System
1008242	2004	Assessing Nuclear Power Plant Risk Management Effectiveness
1007969	2003	A Dynamical Systems Model for Nuclear Power Plant Risk Management

**Scram Reduction**

NSAC-99	1988	Reducing Scram Frequency by Modifying Reactor Set Points for a Westinghouse 3-Loop Plant
NSAC-94	1986	Reducing Scram Frequency by Modifying Reactor Set Points for a Westinghouse 4-Loop Plant
NSAC-93	1985	Scram Reduction by Relaxing Setpoints, An Analysis of C-E PWRs With Digital Controls Using RETRAN-02

**Security**

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1011767	2005	Nuclear Power Plant Risk Analysis and Management for Critical Asset Protection (RAMCAP) Trial Applications Summary Report
1007975	2004	Probabilistic Consequence Analysis of Security Threats - A Prototype Vulnerability Assessment Process for Nuclear Power Plants
TR-113787	1999	An Approach to Risk-Informed Changes to Physical Security

### Human Reliability Analysis (HRA) and Organizational Factors

#### Human Reliability Analysis (HRA)

3002020751	2021	Data to Support Human Reliability Assessment (HRA) for Digital Environments: Data and Analysis from Korean Simulator Studies
3002013018	2018	Human Reliability Analysis (HRA) for Diverse and Flexible Mitigation Strategies (FLEX) and Use of Portable Equipment: Examples and Guidance
3002008094	2017	Data and Modeling of Pre-Initiator Human Failure Events in Probabilistic Risk Assessment
3002008093	2016	An Approach to Human Reliability Analysis for External Events with a Focus on Seismic
3002003150	2016	A Process for HRA Dependency Analysis and Considerations on Use of Minimum Values for Joint Human Error Probabilities
3002001048	2013	Use of Simulator Data to Support Human Reliability Analysis - A Case Study
1023001	2012	EPRI/NRC-RES Fire Human Reliability Analysis Guidelines
1021081	2010	Establishing Minimum Acceptable Values for Probabilities of Human Failure Events
NP-7183-SL	1999	SHARP1-A Revised Systematic Human Action Reliability Procedure
TR-101711	1993	SHARP1-A Revised Systematic Human Action Reliability Procedure
TR-100259	1992	An Approach to the Analysis of Operator Actions in Probabilistic Risk Assessment
◆ NSAC-161	1992	Faulted Systems Recovery Experience
NP-6937	1980-91	Operator Reliability Experiments Using Power Plant Simulators, Volumes 1–3: Volumes 1–3
NP-6560-L	1990	A Human Reliability Analysis Approach Using Measurements for Individual Plant Examination
NP-3583	1984	Systematic Human Action Reliability Procedure (SHARP)

#### Organizational Factors

1016743	2008	Risk-Informed and Performance-Based Safety Culture Assessment Method for Nuclear Power Plants
1003322	2002	Guidance for Incorporating Organizational Factors Into Nuclear Power Plant Risk Assessments: Phase 1 Workshop
1003464	2002	Assessment of International Work on Organizational Factors: Cosponsor: U.S. Department of Energy
NP-1567-SY	1980	Human Factors Review of Power Plant Maintainability

### Internal Flooding and Piping

TR-101968	1993-6	Guidelines and Criteria for Nuclear Piping and Support Evaluation and Design: Volumes 1–9
NP-5531	1987	Evaluation of High-Energy Pipe Rupture Experiments
NP-4362	1985	Two-Phase Jet Modeling and Data Comparison

#### Probabilistic Risk Assessment for Internal Flooding

3002009993	2017	Pipe Rupture Frequencies for Internal Flooding Probabilistic Risk Assessments: Technical Update for High-Energy Line Piping
3002010673	2017	Investigation into the Use of Three-Dimensional Modeling Techniques to Assess Internal Flooding Scenarios
3002002787	2014	Piping System Failure Rates for Corrosion Resistant Service Water Piping
3002000079	2013	Pipe Rupture Frequencies for Internal Flooding Probabilistic Risk Assessments: Revision 3
1019194	2009	Guidelines for Performance of Internal Flooding Probabilistic Risk Assessment



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**Loss of Offsite Power (LOOP)****Double Sequencing**

1009110	2003	The Probability and Consequences of Double Sequencing Nuclear Power Plant Safety Loads, Revision 1
1007319	2002	Automatic Transfer of Safety Buses to Offsite Power: Additional Considerations for Boiling Water Reactors When Considering the Consequences of Double Sequencing
1007320	2002	The Probability and Consequences of Double Sequencing Nuclear Power Plant Safety Loads

**Historic Events**

3002010672	2017	Losses of Offsite Power at U.S. Nuclear Power Plants: Summary of Experience Through 2016
3002008101	2016	Losses of Offsite Power at U.S. Nuclear Power Plants: Summary of Experience Through 2015
3002005291	2015	Losses of Offsite Power at U.S. Nuclear Power Plants: Summary of Experience Through 2014
3002003115	2014	Losses of Offsite Power at U.S. Nuclear Power Plants: Summary of Experience Through 2013
3002000697	2013	Losses of Offsite Power at U.S. Nuclear Power Plants – 2012
1025749	2012	Losses of Offsite Power at U.S. Nuclear Power Plants – 2011
1023147	2011	Losses of Offsite Power at U.S. Nuclear Power Plants – 2010
1013239	2006	Loss of Offsite Power – 2005
1011764	2005	Loss of Offsite Power at U.S. Nuclear Power Plants – 2004 Update
1009889	2004	Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 2003
1000158	2000	Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 1999
TR-110398	1998	Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 1997
TR-106306	1996	Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 1995
NSAC-194	1993	Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 1992
NSAC-182	1992	Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 1991

**LOOP – Other**

3002002765	2014	Grid Reliability Using Risk and Safety Management Tools
3002000414	2013	Quantitative Assessment of Human-Induced Loss of Offsite Power (HHLOOP) Event Frequencies at U.S. Commercial Nuclear Power Plants (NPP)
1022658	2011	Single-Point Vulnerabilities in a Transmission and Distribution System
1020164	2009	Frequency Determination Method for Cascading Grid Events
1016746	2008	Assessing Transmission Grid Stability at Nuclear Plants
1015100	2007	Investigation of a Process for Estimating Conditional LOOP Probability
1013581	2006	Industry Support for NRC Issues of Loss of Off-Site Power (LOOP) and Grid Stability
1011759	2005	Frequency Determination Method for Cascading Grid Events
1009662	2004	Method to Monitor Nuclear Power Plant Risk from Transmission Grid Conditions
1009890	2004	Risk/Safety Management Technical Update: Analysis of Causes of Losses of Off-Site Power at Nuclear Power Plants
1008050	2003	Method to Monitor Nuclear Power Risk from Transmission Grid Conditions: Proof-of-Principle Study
NP-2849	1983	Nuclear Plant Response to Grid Electrical Disturbances

**Low Power and Shutdown (LPSD)****Low Power and Shutdown Analyses**

3002005277	2015	Shutdown Configuration Risk Management Guidelines: Color Aggregation and Treatment of Shared Equipment
3002005296	2015	EPRI Low Power and Shutdown Probabilistic Risk Assessment Standard Pilot: Palo Verde Self-Assessment

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### Low Power and Shutdown Analyses (continued)

3002003063	2014	A Survey of Current Shutdown Risk Evaluation Practices at Nuclear Power Plants: EPRI Configuration Risk Management Forum Research Task
1021176	2010	An Analysis of Loss of Decay Heat Removal and Loss of Inventory Event Trends (1990–2009)
1016231	2007	Development of a Shutdown Qualitative Risk Assessment Standard
1013501	2006	Qualitative Risk Assessment Methods for Shutdown Risk Management
1003465	2002	Low Power and Shutdown Risk Assessment Benchmarking Study

### Outage Risk Assessment and Management (ORAM)

1003113	2001	An Analysis of Loss of Decay Heat Removal Trends and Initiating Event Frequencies (1989–2000): Outage Risk Assessment and Management (ORAM) Technology
TR-105189	1995	Shutdown Risk Impact Assessment for Extended Containment Leakage Testing Intervals Utilizing ORAM
TR-102972	1994	Reflux Cooling: Application to Decay Heat Removal During Shutdown Operations: Outage Risk Assessment and Management (ORAM) Technology
TR-102973	1994	Contingency Strategies for BWRs During Potential Shutdown Operation Events: Outage Risk Assessment and Management (ORAM) Technology
TR-102971	1994	Generic Outage Risk Management Guidelines for BWRs: Outage Risk Assessment and Management (ORAM) Technology
TR-102970	1993	Generic Outage Risk Management Guidelines for PWRs: Outage Risk Assessment and Management (ORAM) Technology
TR-102981	1993	Outage Risk Management Guidelines for Diablo Canyon During Shutdown Operations: Outage Risk Assessment and Management (ORAM) Technology
NSAC-195L	1993	Safety Assessment of Diablo Canyon Risks During Shutdown Operations: EPRI Outage Risk Assessment and Management (ORAM) Program
NSAC-183	1993	Risk of PWR Inadvertent Criticality During Shutdown and Refueling: EPRI Outage Risk Assessment and Management (ORAM) Program
NSAC-175L	1992	Safety Assessment of BWR Risk During Shutdown Operations: EPRI Outage Risk Assessment and Management (ORAM) Program
NSAC-176L	1992	Safety Assessment of PWR Risk During Shutdown Operations: EPRI Outage Risk Assessment and Management (ORAM) Program
NSAC-174	1992	Survey of PWR Plant Personnel on Shutdown Safety Practices and Risk Management Needs: EPRI Outage Risk Assessment and Management (ORAM) Program
NSAC-164L	1992	Guidelines For BWR Reactivity Control During Refueling

### Probabilistic Risk Assessment (PRA) Methods

#### Common-Cause Failures (CCF)

3002020764	2021	Consideration of Common Cause Failures for RIDM purposes
1015096	2007	Investigation of Inter-System Common-Cause Failures
◆ NP-5613	1988–98	Procedures for Treating Common Cause Failures in Safety and Reliability Studies, Volumes 1 and 2
TR-100382	1992	A Database of Common-Cause Events for Risk and Reliability Applications
NP-5777	1988-9	Defensive Strategies for Reducing Susceptibility to Common-Cause Failures, Volumes 1 and 2

#### PRA Modeling

3002020760	2021	EPRI Probabilistic Risk Assessment (PRA) Maintenance Optimization: 2021 Industry Survey Results
1016738	2008	Development of Declarative Modeling Applications
◆ 1009187	2003	Treatment of Time Interdependencies in Fault Tree Generated Cutset Results
TR-114880	2000	Use of KB3 to Develop System Fault Trees for the TMI-1 PRA
◆ NSAC-154	1991	ISLOCA Evaluation Guidelines

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**PRA Modeling (continued)**

NSAC-167	1991	ISLOCA Prevention and Mitigation Measures
NP-5536	1987	Risk-Significant Functional Dependencies in PWRs

**Passive Safety Systems**

1016747	2008	Program on Technology Innovation: Comprehensive Risk Assessment Requirements for Passive Safety Systems
1015101	2007	Program on Technology Innovation: Probabilistic Risk Assessment Requirements for Passive Safety Systems

**PRA Methods and Standards**

3002022110	2021	Proof of Concept Software - PRA Newly Developed Methods Industry Information (2021+) Wiki version 1.0
1013492	2006	Probabilistic Risk Assessment Compendium of Candidate Consensus Models
TE-114815	2000	Technical Criteria for the ASME PRA Standard Rev. 12
TR-112159	1999	Guidelines for Condensed Documentation of a Probabilistic Risk Assessment

**PRA Quantification**

◆ 1013493	2006	Program on Technology Innovation: An Assessment of the Direct Probability Calculation Quantification Method
1010062	2005	Investigation of Binary Decision Diagram Quantification of Linked Fault Trees
1010068	2005	Aggregation of Quantitative Risk Assessment Results

**PRA Reliability Data**

3002000774	2013	EPRI Guidelines for PRA Data Analysis
TR-100381	1992	Nuclear Plant Reliability: Data Collection and Usage Guide

**Support System Initiating Events (SSIE)**

1016741	2008	Support System Initiating Events
1013490	2006	Support System Initiating Events: Identification and Quantification Guideline

**Uncertainty Analysis and Risk Aggregation**

3002003116	2015	An Approach to Risk Aggregation for Risk-Informed Decision-Making
◆ 1026511	2012	Practical Guidance on the Use of Probabilistic Risk Assessment in Risk-Informed Applications with a Focus on the Treatment of Uncertainty
◆ 1016737	2008	Treatment of Parameter and Modeling Uncertainty for Probabilistic Risk Assessments
1012900	2005	Program on Technology Innovation: Potential Mitigation Strategies for Beyond Design Basis Conditions
1009652	2004	Guideline for the Treatment of Uncertainty in Risk-Informed Applications: Technical Basis Document

**PRA – Other**

3002003151	2014	Incorporating Flexible Mitigation Strategies into PRA Models: Phase 1: Gap Analysis and Early Lessons Learned
3002000725	2013	Technical update describing the research performed in 2013 for the improvement in PRA methods, tools, and guidance
NP-7280	1991	An Approach for Evaluating Individual Plant Examination Insights
NSAC-159-V1	1991	Generic Framework for IPE Back-End (LEVEL 2) Analysis; Volume 1: Main Report
NSAC-159-V2	1991	Generic Framework for IPE Back-End (LEVEL 2) Analysis; Volume 2: PWR Implementation Guidelines
NSAC-159-V3	1991	Generic Framework for IPE Back-End (LEVEL 2) Analysis; Volume 3: BWR Implementation Guidelines
NP-3912-SR	1985	Proceedings: International Topical Meeting on Probabilistic Safety Methods and Applications, Volumes 2 and 3

# RSM Product Catalog

## Risk Management and Risk-Informed Applications

### Configuration Risk Management

3002018222	2020	CRMF Report - Equipment and Operator Terminology for Risk-Informed Programs
3002016065	2019	Guideline for the Development of Risk Monitors: EPRI Configuration Risk Management Forum Research Task
3002012995	2018	Application of Colors as Risk Metrics - Background and Effective Practices: 2018 Configuration Risk Management Forum Research Task
1025292	2012	Configuration Risk Management Risk Transition Thresholds
◆ 1022999	2011	Review of Current Practices for Configuration Risk Management at Nuclear Power Plants
1011762	2006	Treatment of External Events in Configuration Risk Management: An Implementation Guide
1009675	2005	A Framework for the Treatment of External Events in Configuration Risk Management: 2004 Configuration of Risk Management Forum Research Task
1008051	2003	Outage Configuration Risk Management Consistency Study
1003117	2002	Development of a Risk Monitor for Assessing Plant Trips

### Risk-Informed Engineering Program (10 CFR 50.69)

3002022453	2021	Alternative Approaches for Addressing Seismic Risk in 10CFR50.69 Risk-Informed Categorization
3002015999	2019	Enhanced Risk-Informed Categorization Methodology for Pressure Boundary Components
3002012990	2018	10CFR50.69 Alternative Treatment Case Studies
3002012984	2018	10 CFR 50.69 Categorization Guidance Document
3002013983	2018	Implementation of Risk-Informed Categorization and Alternative Treatment of Structures, Systems, and Components for Nuclear Plants
1015099	2007	Option 2, 10CFR50.69 Special Treatment Guidelines
1011234	2006	Program on Technology Innovation: 10CFR50.69 Implementation Guidance for Treatment of Structures, Systems and Components
1008905	2003	Parametric Uncertainty Impacts on Option 2 Safety Significance Categorization
TR-109646	1998	Guidelines for Preparing Risk-Informed Graded Quality Assurance Program Implementation Request Submittals
TR-105868	1995	Quality Assurance Grading Criteria for Plant Systems and Components: Results from a Pilot Plant Project at Grand Gulf Nuclear Station

### Maintenance and PRA

1022998	2011	Guideline for Addressing Fire Events in Maintenance Rule (a)(4) Risk Evaluations at Nuclear Power Plants
1023111	2011	Phased Approach for On-Line Maintenance
1022680	2011	On-Line Maintenance International Benchmarking
1019201	2009	Consideration of External Events in Maintenance Rule (a)(4) Risk Evaluations - Development Overview
1016744	2008	An Approach for Evaluating Heavy Load Lifts and Related Maintenance Tasks in Maintenance Rule (a)(4) Risk Evaluations
TR-108559	1997	The Work Control Process Module in Support of a Living Maintenance Program
TR-105995	1997	Permanent Lead Shielding for Nuclear Safety Piping Systems

**Note:** Additional technical information related to Maintenance Rule issues may be found through EPRI's Nuclear Maintenance Applications Center (NMAC) program.

### Risk Applications for New Reactors

1015102	2007	Risk-Informing Construction and Operating License (COL) Plants - A Scoping Study
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**Risk-Informed Applications – General**

3002020623	2021	2021 Technical Update: Leveraging Risk Insights for Aging Management Program Implementation
3001017746	2021	PRA Applications Wiki version 1.0
3002020763	2021	Practical Guidance for Consideration of Defense-in-Depth (DID) and Safety Margins (SM) in Risk Informed Decision Making (RIDM)
3002020744	2021	Investigation of Seismic PRA Quantification Simplification for Use in PRA Models Used to Assess Risk-Informed Completion Times
3002020756	2021	KHNP Experience and Feedback on Applicability of EPRI Multi-Unit PRA Framework to the Korean Industry
3002020765	2021	Framework for Assessing Multi-Unit Risk to Support Risk-Informed Decision-Making: General Framework and Application Specific Requirements
3002016869	2020	Applications of Probabilistic Risk Assessment: Republication of EPRI NP-7315
3002014783	2019	A Framework for Using Risk Insights in Integrated Risk-Informed Decision-Making
1015105	2007	Risk-Informed Evaluation of Protective Action Strategies for Nuclear Plant Off-Site Emergency Planning
1007970	2004	Integrated Decision Framework for Risk-Informed Regulation of Nuclear Power Plants
TR-109648	1998	Inventory Optimization in Support of the EPRI Work Control Process Module
TR-109930	1998	Use of Level 3 PSA in Risk Informed, Performance Based Regulation of Nuclear Power Plants
◆ TR-105396	1995	PSA Applications Guide
NSAC-105	1986	Guidelines for Design and Procedure Changes in Nuclear Power Plants

**Risk-Informed Safety Margin**

3002012967	2018	Insights on Risk Margins at Nuclear Power Plants: A Technical Evaluation of Margins in Relation to Quantitative Health Objectives and Subsidiary Risk Goals in the United States
1025291	2012	Pilot Application of Risk-Informed Safety Margins to Support Nuclear Plant Long-Term Operation Decisions
1023032	2011	Technical Framework for Management of Safety Margins Loss of Main Feedwater Pilot Application
1019206	2009	Framework for Risk-Informed Safety Margin Characterization

**Risk-Informed Seismic Applications**

1000896	2000	Planning for Risk-Informed Seismic Regulations
TR-103126	1993	Use of Probabilistic Seismic Hazard Results: General Decision Making, the Charleston Earthquake Issue, and Severe Accident Evaluations
NP-7498	1991	Industry Approach to Seismic Severe Accident Policy Implementation

**Risk-Informed Technical Specifications**

1016742	2008	Risk-Managed Technical Specifications - Lessons Learned from Initial Application at South Texas Project
1013495	2006	Risk-Managed Technical Specifications (RMTS) Guidelines [also published by NEI under NEI 06-09]
TR-111379	1999	Updated Template for the Submission of Revised Risk Based Technical Specifications
TR-105867	1995	Guidelines for Preparing Risk-Based Technical Specifications Change Request Submittals

**Risk-Informed Testing**

1018243	2008	Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals
1000094	2000	Lessons Learned From Implementing RHST Programs
TR-111204	1998	Template for Submission of Risk-Informed Inservice Testing Program for Pumps and Valves
TR-110381	1998	Risk-Informed Snubber Inservice Testing Guidelines: Pilot Project Studies
TR-105869	1995	Risk-Based In-Service Testing Pilot Project
TR-104285	1994	Risk Impact Assessment of Revised Containment Leak Rate Testing Intervals
NP-2726	1982	Containment Integrated Leak-Rate Testing Improvements

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## Seismic Assessment

### Seismic Anchorage

TR-105809	1996	Seismic Response of Unanchored and Partially Anchored Liquid- Storage Tanks
TR-103960	1994	Recommended Approaches for Resolving Anchorage Outliers
NP-5228	1991-4	Seismic Verification of Nuclear Plant Equipment Anchorage (Revision 1): Volumes 1 (with addendum) and 2

### Seismic Equipment Evaluation and Performance

3002020739	2021	Seismic Experience Database – Electronic SQUG (eSQUG) Database version 3.0
3002016331	2019	Study of Lift-Off Tests and Data Trending for Post Tensioned Tendons
3002012981	2018	Seismic Qualification Utility Group Guidance: Vertical Response Spectra for Use in Earthquake Experience-Based Evaluations
3002012992	2018	Seismic Qualification Utility Group Guidance: Methods for Converting Floor Response Spectra Damping
3002012999	2018	Seismic Qualification Utility Group Guidance: Kashiwazaki-Kariwa Response Spectra for Use in the ESQUG Database
3002009564	2017	Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation
3002009119	2016	SQUG Walkdown Screening and Seismic Evaluation DVD Training Course Revision 4.6
3002004396	2015	High Frequency Program: Application Guidance
3002002997	2014	High Frequency Program: Seismic Testing Summary and Application Guidance
3002000706	2013	High Frequency Program: Phase 1 Seismic Test Summary
1022682	2011	EPRI-SQUG Damage-Indicating Parameter Information
1019199	2009	Experience-Based Seismic Verification Guidelines for Piping and Tubing
1012022	2005	Experience Based Seismic Verification Guidelines for Overhead Crane Systems: Volume I - Seismic Review Procedure; Volume II - Performance of Overhead Cranes in Strong Motion Earthquakes
1014608	2006	Seismic Evaluation Guidelines for HVAC Duct and Damper Systems
TR-105988	1996-9	GERS Formulated Using Data from the SQRSTS Program
NP-7150-D	1998	The Performance of Raceway Systems in Strong-Motion Earthquakes
TR-101968-V10	1996	Guidelines and Criteria for Nuclear Piping and Support Evaluation and Design: Volume 10: Small Bore Piping Guidebook
NP-7149	1991-6	Summary of the Seismic Adequacy of Twenty Classes of Equipment Required for the Safe Shutdown of Nuclear Plants
NP-7146-SLR1	1995	Guidelines for Development of In-Cabinet Seismic Demand for Devices Mounted in Electrical Cabinets
NP-7147-SLV2	1993-5	Seismic Ruggedness of Relays: Volume 2 Addendum 1-2
TR-102470	1993	Analysis of High-Frequency Seismic Effects
NP-7148-SLV2 ADDEN	1993	Procedure for Evaluating Nuclear Power Plant Relay Seismic Functionality: Volume 2: Addendum
TR-102066	1993	Seismic and Dynamic Reliability of Eroded/Corroded Piping Components
TR-102180	1993	Guidelines for Estimation or Verification of Equipment Natural Frequency
NP-7146	1991-2	Guidelines for Development of In-Cabinet Amplified Response Spectra for Electrical Benchboards and Panels
NP-5223-SLR1	1991	Generic Seismic Ruggedness of Power Plant Equipment (Revision 1)
NP-7151-D	1991	Cable Tray and Conduit System Seismic Evaluation Guidelines
NP-7153-D	1991	Longitudinal Load Resistance in Seismic Experience Database Raceway Systems
NP-7148	1991	Procedure for Evaluating Nuclear Power Plant Relay Seismic Functionality
NP-6989	1990	Survey of Earthquake-Induced Fires in Electric Power and Industrial Facilities
NP-6472	1989	Relay Behavior at the Perry Nuclear Power Plant During the 1986 Earthquake in Leroy, Ohio
NP-6153	1989	Seismic Analysis of Multiply Supported Piping Systems
NP-6035	1988	Piping System Damping Evaluation

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**Seismic Equipment Evaluation and Performance (continued)**

NP-5617-V1	1988	Recommended Piping Seismic-Adequacy Criteria Based on Performance During and After Earthquakes, Volumes 1 and 2
NP-5617-V2	1988	Recommended Piping Seismic-Adequacy Criteria Based on Performance During and After Earthquakes, Volumes 1 and 2

**Seismic Fragility Analysis**

3002018218	2020	Guidance for Out-Of-Plane Shear Capacity of Reinforced Concrete Walls for Use in Fragility and Margin Calculations
3002015993	2019	Loss of Offsite Power Seismic Fragility Guidance
3002015988	2019	Seismic Fragility Guidance for Pressurized Water Reactor Nuclear Steam Supply System Components
3002015996	2019	Updated Equipment Seismic Capacities from Experience Data for Use in Fragility Calculations: Phase III Incorporation of Test Data Pilot
3002012994	2018	Seismic Fragility and Seismic Margin Guidance for Seismic Probabilistic Risk Assessments
3002013017	2018	Updated Equipment Seismic Capacities from Experience Data for Use in Fragility Calculations: Phase II
3002011627	2017	Updated Equipment Seismic Capacities from Experience Data for Use in the Fragility Calculations
3002010668	2017	Review and Compilation of SQRSTS Test Data for Use in Seismic Fragility Evaluations
3002010666	2017	Coupled Analysis of Primary-Secondary System to Generate Floor Response Spectra: Quantifying Reduction Factors for Coupled In-Structure Response Spectra Amplitudes
3002010665	2017	High Frequency Seismic Inelastic Effects on Equipment Anchorage: Quantifying Increase in Anchorage Acceleration Capacities at High Equipment Frequencies
3002010663	2017	Correlation of Earthquake Failures in Selected Categories of Equipment for Application to Seismic Probabilistic Risk Assessments
3002008099	2016	Seismic Fragility Strength Equation Recommendations for Embedded Anchors
3002008098	2016	Development and Application of a New Seismic PRA Methodology for Determining Seismic Fragilities Using Scenario Earthquakes
3002002804	2014	Assessment of Lumped Mass and Finite Element Structural Models for Seismic Analysis Applications
1022995	2011	Advanced Methods for Determination of Seismic Fragilities: Seismic Fragilities Using Scenario Earthquakes
TR-103959	1994	Methodology for Developing Seismic Fragilities

**Seismic Hazard Analysis**

3002020750	2021	Seismic Hazard Research: Kappa Effects on Hard-Rock Ground Motions
3002018217	2020	Fleet Risk Assessment for the Next Generation Attenuation East Ground Motion Model
3002018216	2020	Simplified Method for Estimating Mean Seismic Hazard for an Updated Ground Motion or Site Amplification Model: Application to the Central and Eastern United States
3002018215	2020	Updated Plant Level Fragility Estimates: Reassessment of IPEEE Data and SPRA Data
3002005684	2015	Central and Eastern United States Seismic Source Characterization for Nuclear Facilities: Maximum Magnitude Distribution Evaluation
3002005288	2015	Earthquake Catalog Corrections for Earthquakes in the South Carolina Region
3002000717	2013	EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project
3002000719	2013	EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project: Shear Wave Velocity Measurements at Seismic Recording Stations
1016736	2008	Assessment of Seismic Hazard at 34 U.S. Nuclear Plant Sites
TR-102261	1995	The Earthquakes of Stable Continental Regions: Assessment of Large Earthquake Potential (5 Volumes)
NP-6389	1989	Proceedings: Engineering Characterization of Small-Magnitude Earthquakes
NP-6395-D	1989	Probabilistic Seismic Hazard Evaluations at Nuclear Plant Sites in the Central and Eastern United States: Resolution of the Charleston Earthquake Issue

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### Seismic Non-Nuclear Historic Events

3002018233	2020	Seismic Ground Motion Estimates for the November 2018 Anchorage, Alaska Earthquake
3002018221	2020	The Anchorage, Alaska M7.1 Earthquake of November 30, 2018: Effects on Selected Power and Industrial Facilities
1021087	2010	Magnitude 6.7 Hawaii Earthquake of October 15, 2006
1010932	2004	The Gujarat, India Earthquake of January 26, 2001: Effects on Selected Power and Industrial Facilities
1003120	2001	Investigation of the 1999 Chi Chi Taiwan Earthquake
1003119	2001	Investigation of the 1999 Kocaeli Turkey Earthquake: Effects on Power and Industrial Facilities
TR-109928	1998	The Michoacan, Mexico Earthquake of January 11, 1997: Effects on Power and Selected Industrial Facilities
TR-107083	1998	The Great Hanshin - Awaji Earthquake of January 17, 1995: A Report on Electric Power and Other Impacts
TR-108478	1997	Earthquake of October 9, 1995: Effects at the Manzanillo Power Plant
TR-106635	1997	The January 17, 1994 Northridge Earthquake: Effects on Electric Power and Selected Industrial Facilities
TR-106213	1996	The Island of Guam Earthquake of August 8, 1993: Effects on Electric Power Facilities
TR-103477	1994	The Cape Mendocino Earthquake Sequence of April 25 and 26, 1992: Effects on Electric Power Facilities
TR-103454	1994	The June 28, 1992, Landers and Big Bear Earthquakes: Effects on Power and Industrial Facilities
NP-7500-SL	1991	The October 17, 1989, Loma Prieta Earthquake: Effects on Selected Power and Industrial Facilities
NP-7500-M	1991	The October 17, 1989, Loma Prieta Earthquake: Effects on Selected Power and Industrial Facilities
NP-7359-M	1991	The December 7, 1988, Armenia Earthquake: Effects on Selected Power, Industrial, and Commercial Facilities
NP-7126	1991	The October 1, 1987, Whittier Earthquake: Effects on Selected Power, Industrial, and Commercial Facilities
NP-6558	1989	The 1986 Leroy, Ohio, Earthquake: Performance of Power and Industrial Facilities
NP-5784	1988	Effects of the 1985 Mexico Earthquake on Power and Industrial Facilities
NP-5616	1988	Investigation of the San Salvador Earthquake of October 10, 1986, Effects on Power and Industrial Facilities
NP-5607	1988	The 1986 North Palm Springs Earthquake: Effects on Power Facilities

### Operating Basis Earthquake and Damage Assessment

3002005284	2015	Guidelines for Nuclear Power Plant Response to an Earthquake
1024889	2012	Seismic Instrumentation for Nuclear Power Plants
TR-104239	1994	Seismic Instrumentation in Nuclear Power Plants for Response to OBE Exceedance: Guideline for Implementation
NP-7305-SL	1991	Post-Earthquake Analysis and Data Correlation for the 1/4-Scale Containment Model of the Lotung Experiment

### Seismic Margins Assessment

1016125	2007	Experience Based Seismic Equipment Qualification
1014870	2007	Seismic Qualification Case Study for a New Inverter
1011783	2005	Risk Informed Safety Categorization (RISC-3) Seismic Assessment Guidelines
1009669	2004	RISC-3 Seismic Assessment Guidelines: Preliminary Report
1010998	2004	Applications Guide for Use of Seismic Margin Assessments in Quantitative Risk-Informed Decision-Making
1009648	2004	Methodology and Case Study for Use of Seismic Margin Assessments in Quantitative Risk-Informed Decision Making: A Revision to EPRI Report 1003121
NP-6041-SLR1	1991	A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1)

### Seismic Probabilistic Risk Assessment

3002020752	2021	Managed-scope Seismic Probabilistic Risk Assessment Feasibility Study: Risk-informed Equipment Selection
3002020749	2021	Seismic Hazard Research: Guidance for Simplified Risk Evaluation Updates
3002012980	2018	Methodology for Seismically Induced Internal Fire and Flood Probabilistic Risk Assessment
3002005289	2015	Seismically Induced Fire and Flood PRA - Phase I
3002000709	2013	Seismic Probabilistic Risk Assessment Implementation Guide
1020756	2010	Surry Seismic Probabilistic Risk Assessment Pilot Plant Review

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**Seismic Probabilistic Risk Assessment (continued)**

1003121	2001	Methodology for Probabilistic Risk Assessment Applications of Seismic Margin Evaluations
1000895	2000	Individual Plant Examination for External Events (IPEEE) Seismic Insights: Revision to EPRI Report TR-112932
TR-112932	1999	IPEEE Seismic Insights
NP-6496	1989	Lower-Bound Magnitude for Probabilistic Seismic Hazard Assessment

**Soil Properties and Ground Motion**

3002000722	2013	Soil Structure Interaction Effects on a Nuclear Safety-Related Structure in the Central Eastern United States
1018352	2008	Benchmarking for Seismic Housekeeping at Nuclear Power Plants
TR-108904	1998	Guidelines for Reduced Seismic Loads to Assess Temporary Conditions in Nuclear Power Plants
TR-102293	1993	Guidelines for Determining Design Basis Ground Motions: Volumes 1–5
TR-102631	1997	Soil-Structure Interaction Analysis Incorporating Spatial Incoherence of Ground Motions
TR-108854	1997	Soil-Structure Interaction of the Lotung Quarter Scale Structure: Sensitivity Studies
TR-102262	1995	Engineering Characterization of Strong Ground Motion Recorded at Rock Sites
TR-100463-T1	1992	Spatial Variation of Earthquake Ground Motion for Application to Soil-Structure Interaction
TR-100463-T2	1992	Spatial Variation of Earthquake Ground Motion for Application to Soil-Structure Interaction
NP-7496-V1	1992	LOTUNG Large-Scale Seismic Strong Motion Records
NP-7337	1991	Proceedings: NSF/EPRI Workshop on Dynamic Soil Properties and Site Characterization, Volumes 1 and 2: Volumes 1 and 2
NP-7395	1991	Guidelines for Soil-Structure Interaction Analysis
NP-6074	1988	Engineering Model of Earthquake Ground Motion for Eastern North America
NP-957	1979	An Endochronic Constitutive Model for General Hysteretic Response of Soils
NP-945	1978	Nonlinear Soil Structure Interaction
NP-865	1978	Study of Nonlinear Effects on One-Dimensional Earthquake Response

**Severe Accidents****Hydrogen and Combustible Gas Control**

TR-107517	1997	Generic Tests of Passive Autocatalytic Recombiners (PARs) for Combustible Gas Control in Nuclear Power Plants: Volumes 1–3
NP-3878	1988	Large-Scale Hydrogen Combustion Experiments: Volumes 1–2
NP-4354	1985	Large-Scale Hydrogen Burn Equipment Experiments
NP-2956	1984	Effectiveness of Thermal Ignition Devices in Lean Hydrogen-Air-Steam Mixtures
NP-2955	1984	Intermediate-Scale Combustion Studies of Hydrogen-Air-Steam Mixtures
NP-2953	1983	Hydrogen Combustion and Control Studies in Intermediate Scale

**Severe Accident Management**

3002015998	2021	Techniques for Making Radiological Release Estimates in Probabilistic Risk Assessments More Realistic
3002020761	2021	Severe Accident Management Guidance (SAMG) Technical Basis Report (TBR) - Update of 1025295
3002013019	2018	Evaluation of Boiling Water Reactor Severe Accident Management Guidance: MAAP5 Simulation – Insights to Enhance Training
3002012982	2018	Investigation of Strategies for Mitigating Radiological Releases in Severe Accidents: US BWR Mark III Studies
3002012983	2018	Investigation of Strategies for Mitigating Radiological Releases in Severe Accidents: European BWR Mark III Studies
3002003301	2015	Technical Basis for Severe Accident Mitigating Strategies: Volume 1
3002005300	2015	Technical Basis for Severe Accident Mitigating Strategies: Volume 2
3002003300	2014	Investigation of Strategies for Mitigating Radiological Releases in Severe Accidents: European BWR Mark III Evaluation

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### Severe Accident Management (continued)

1026539	2012	Investigation of Strategies for Mitigating Radiological Releases in Severe Accidents
TR-103412	1993	Assessment of Existing Plant Instrumentation for Severe Accident Management

### Severe Accident - Other

3002020762	2021	Severe Accident Uncertainty Quantification and Analysis using MAAP
3002008110	2016	Severe Accident Uncertainty Analysis in Real Time Using MAAP5
1023403	2011	Summary of EPRI Research Applicable to Nuclear Accident Scenarios
1022186	2010	Technical Foundation of Reactor Safety, Revision 1
1011037	2004	Iodine Behavior Within Confinement: Advanced Containment Experiments Extension (ACEX) Project
1003101	2001	Critical Heat Flux Experiments to Support In-Vessel Retention Feasibility Study for an Evolutionary Advanced Light Water Reactor
TR-108876	1998	In-Vessel Core Debris Retention Experiments
TR-108877	1998	In-Vessel Core Debris Heat Transfer Experiments
TR-103389-V1	1994	Experiments to Address Lower Plenum Response Under Severe Accident Conditions: Volume 1: Technical Report
TR-103389-V2P1	1994	Experiments to Address Lower Plenum Response Under Severe Accident Conditions: Volume 2: Data Report, Part 1: Tests 1–6
TR-103389-V2P2	1994	Experiments to Address Lower Plenum Response Under Severe Accident Conditions: Volume 2: Data Report, Part 2: Tests 7–10
TR-104052	1994	Modeling of Molten Core Concrete Interactions and Fission Product Release
TR-102371	1993	Instrument Performance Under Severe Accident Conditions: Ways to Acquire Information From Instrumentation Affected by an Accident
TR-103483	1993	Molten Corium Concrete Interactions: Advanced Containment Experiments (ACE) Project: Summary Report
TR-102816	1993	Thermal Hydraulic and Fission Product Release Behavior During Core/Concrete Interactions
NP-7156	1992	TMI-2 Postaccident Data Acquisition and Analysis Experience
NP-4890-LV3	1991	Scrubbing of Aerosols by Water Pools, Volume 3: Small-Scale Single-Orifice Experiments
NP-6344	1989	Studies on the Radiation Stability of Cesium Iodide
NP-5916	1988	Mixed Turbulent Convective Heat Transfer in Vertical Ducts
NP-3858	1985	Steam-Water Flooding in Debris Beds and Its Role in Dryout
NP-3677	1984	Comparison of the Calculation of HDR RPV-1 Blowdown Loads for Test V32 With the Experimental Data
NP-2161	1981	Heat Transfer above the Two Phase Mixture Level Under Core Uncovery Conditions in a 336-Rod Bundle
NSAC-30	1981	Iodine-131 Behavior During the TMI-2 Accident
NSAC-1	1980	Analysis of Three Mile Island – Unit 2 Accident
NP-1692-V1	1980	Heat Transfer Above the Two Phase Mixture Level Under Core Uncovery Conditions in a 336 Rod Bundle, Volume 1
NP-1692-V2	1980	Heat Transfer Above the Two-Phase Mixture Level Under Core Uncovery Conditions in a 336-Rod Bundle, Volume 2
NP-906	1978	Three-Dimensional Pool Swell Modeling of a Mark I Suppression Modeling
NP-672	1978	Spatial Distribution of Fission-Product Gamma-Ray Energy Deposition in Light Water Reactor Fuel Elements, Volumes 1–2

### Software Products

#### GOTHIC Thermal-Hydraulic Code

3002020724	2021	GOTHIC Code Benchmarking: iPWR Vessel Aerosol Deposition Modeling and Spent Fuel Cask Modeling
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**GOTHIC Thermal-Hydraulic Code (continued)**

3002020722 (Windows)	2021	Pre-SW GOTHIC Version 8.4 BETA
3002020723 (Linux)		
3002015323 (Windows)	2019	GOTHIC v8.3
3002015324 (Linux)		
3002015325	2019	GOTHIC v8.3 Molten Salt Library #1 – LiF-BeF <sub>2</sub>
3002015326	2019	GOTHIC v8.3 Molten Salt Library #2 – LiF-NaF-KF
3002015327	2019	GOTHIC v8.3 Molten Salt Library #3 – NaBF <sub>4</sub> -NaF
3002015328	2019	GOTHIC v8.3 Molten Salt Library #4 – NaCl-MgCl <sub>2</sub>
3002015329	2019	GOTHIC v8.3 Molten Salt Library #5 – NaF-ZrF <sub>4</sub>
3002015330	2019	GOTHIC v8.3 Molten Salt Library #6 – KF-ZrF <sub>4</sub>
TR-109612	1997	GOTHIC Analysis of Containment Fan Cooler Unit (CFCU) Cooling Water Response Following a LOCA with Loss of Offsite Power

**HRA Calculator**

3002010680	2017	Human Reliability Analysis (HRA) Calculator, version 5.2
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**Modular Accident Analysis Program (MAAP)**

3002016060	2021	Benefits and expected changes for plants upgrading from MAAP4 to MAAP5
3002020723 (Windows)	2021	Modular Accident Analysis Program (MAAP) Version 5.06
3002020733 (Linux)		
3002020766	2021	SMART-like Model Development and Validation in MAAPv5.06
3002015055 (Windows)	2020	Modular Accident Analysis Program for VVER reactor (MAAP5-VVER), Version 5.03
3002015056 (Linux)		
3002015058 (Check files)		
3002013291	2018	Modular Accident Analysis Program (MAAP5-CBT), version 1.0
3002012555	2018	Modular Accident Analysis Program (MAAP5) Enhancements for Fukushima Analyses: Japanese Fiscal Year 2017
3002012557	2018	Review of Japanese Core Team Cesium Chemistry Model: Japanese Fiscal Year 2017
3002013019	2018	Evaluation of Boiling Water Reactor Severe Accident Management Guidance: MAAP5 Simulation – Insights to Enhance Training
3002011601	2018	Passive Containment Cooling System Analytical Model Development for the Modular Accident Analysis Program 5 (MAAP5) Code
3002012973 (Windows)	2018	Modular Accident Analysis Program for CANDU Reactor (MAAP5-CANDU), Version 5.00a
3002012974 (Linux)		
3002009886	2017	Review of Japanese Core Team Cesium Chemistry Model: JFY 2016 Work
3002009885	2017	MAAP5 Benchmarking Against the CORA Severe Fuel Damage Experimental Program
3002009884	2017	Comparison of the Institute of Applied Energy/Korea Atomic Energy Research Institute Experiments for Boiling Water Reactor (BWR) Reactor Pressure Vessel (RPV) Lower Head Penetrations to the MAAP5 Model
3002010657	2017	Modular Accident Analysis Program (MAAP5-CBT), Version 1.0

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### Modular Accident Analysis Program (MAAP) (continued)

3002010658	2017	Modular Accident Analysis Program 5 (MAAP5) Applications Guidance: Desktop Reference for Using MAAP5 Software—Phase 3 Report
3002007528	2016	MAAP-APP Version 1.0 - A MAAP Parameter Search Database
3002007465	2016	Modular Accident Analysis Program (MAAP5) Boiling Water Reactor (BWR) Vessel and Core Thermal Hydraulic Model Improvements: Japanese Fiscal Year (JFY) 2015 Project
3002007466	2016	Modular Accident Analysis Program (MAAP5) Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) Lower Plenum Model Improvements: Japanese Fiscal Year (JFY) 2015 Project
3002007467	2016	Modular Accident Analysis Program (MAAP5) Containment Model Improvements: Japanese Fiscal Year (JFY) 2015 Project
3002007469	2016	MAAP5 Generalized Containment Model Fluid Stratification Enhancement: Verification and Validation
3002005025	2015	Modular Accident Analysis Program (MAAP5) Boiling Water Reactor (BWR) Vessel and Core Thermal Hydraulic Model Improvements: Japanese Fiscal Year (JFY) 2014 Project
3002005026	2015	Modular Accident Analysis Program (MAAP5) Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) Lower Plenum Model Improvements: Japanese Fiscal Year (JFY) 2014 Project
3002005028	2015	Modular Accident Analysis Program (MAAP5) Containment Model Improvements: Japanese Fiscal Year (JFY) 2014 Project
3002005029	2015	Modular Accident Analysis Program (MAAP5) Generalized Containment Model Enhancement-Fluid Stratification Models: Japanese Fiscal Year (JFY) 2014 Project
3002005030	2015	Modular Accident Analysis Program (MAAP5) Generalized Containment Model Enhancement-Fluid Stratification Verification and Validation Plan: Japanese Fiscal Year (JFY) 2014 Project
3002002671	2014	Modular Accident Analysis Program (MAAP) v5.03 Model Enhancements: Boiling Water Reactor (BWR) Core Models
3002002673	2014	Modular Accident Analysis Program (MAAP) v5.03 Model Enhancements: Boiling Water Reactor (BWR) Lower Plenum Models
3002002675	2014	Modular Accident Analysis Program (MAAP) v5.03 Model Enhancements: Ex-Vessel Debris Coolability Models
3002002672	2014	Modular Accident Analysis Program (MAAP) v5.03 Model Enhancements: Instrument Tube Failure Models
3002002674	2014	Modular Accident Analysis Program (MAAP) v5.03 Model Enhancements: Corium Spreading and Molten Core Concrete Interaction (MCCI) Models
3002002838	2014	Potential Improvements to Modular Accident Analysis Program (MAAP) Identified During the MAAP 5.03 Project
3002004449	2014	Modular Accident Analysis Program (MAAP) – MELCOR Crosswalk: Phase 1 Study
3002004450	2014	Modular Accident Analysis Program (MAAP5) Enhancement Priorities for Japanese Fiscal Years 2014–2015
3002003113	2014	Modular Accident Analysis Program 5 (MAAP5) Applications Guidance
3002002607	2014	XYPlot 2 Add-on for MAAP Code, v1.0 (Non QA)
3002001983 (Windows)	2014	Modular Accident Analysis Program (MAAP) Version 4.09
3002000260	2013	MAAP5 BWR Lower Plenum Model Enhancement Description
3002000261	2013	Modular Accident Analysis Program, Version 5, Molten Corium–Concrete Interaction and Debris Coolability Model Enhancement Description
3002000264	2013	MAAP5 BWR Vessel Penetration and Ex-Vessel Equipment Model Enhancement Description
3002000265	2013	MAAP5 BWR Primary System Thermal-Hydraulics Model Enhancement Description
3002000266	2013	MAAP5 BWR Core Melt Progression Model Enhancement Description
3002000279	2013	MAAP5 Lower Plenum Model Status
1020236	2010	MAAP4 Applications Guidance
1011756	2005	Modular Accident Analysis Program (MAAP5) Applications Assessment

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**Integrated Risk Technologies (IRT) and FTREX Software**

3002020691	2021	Pre-SW Phoenix Architect version 2.0 BETA
3002020737	2021	Phoenix Risk Monitor (PhoenixRM), version 3.0
3002020050	2020	Phoenix Architect version 1.0b
3002018234	2020	FTREX 2.0 Final
3002016222	2019	PRA DocAssist v4.7
3002014322	2019	PRE-SW: Tesseract v1.0 Beta
3002010659	2017	FRANX Version 4.4
3002010660	2017	System Importance (SYSIMP) Version 4.0
3002005282	2015	RRUtil v 1.2 (Alpha)
3002005279	2015	Risk & Reliability Interface (R&R Interface) Version 2.0

**Tornado Missile Strike Calculator (TMSC) Software**

3002020902	2021	Pre-SW Tornado Missile Strike Calculator (TMSC) Version 1.0 BETA 2
3002020904	2021	Verification and Validation of the Tornado Missile Strike Calculator Straight Line Winds Capability
3002015995	2019	Verification and Validation of the Tornado Missile Strike Calculator

**Source Term**

TR-105909	1995	Generic Framework for Application of Revised Source Term to Operating Plants
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**Spent Fuel Pool**

3002002691	2014	PWR Spent Fuel Pool Risk Assessment Integration Framework and Pilot Plant Application
3002000499	2013	Spent Fuel Pool Accident Characteristics
3002000498	2013	Spent Fuel Pool Risk Assessment Integration Framework (Mark I and II BWRs)

**Thermal-Hydraulic Analysis and Data Validation****Natural Circulation**

1003187	2001	Experimental Study of Natural Convection in Volumetrically Heated Pools Contained in a Cylindrical Cavity
TR-102815	1993	Natural Circulation Experiments for PWR High-Pressure Accidents
NP-7186-M	1991	Passive Plant Natural Circulation BWR Core Studies: Joint EPRI/CRIEPI Advanced LWR Studies: Joint EPRI/CRIEPI Advanced LWR Studies
NP-7186-SL	1991	Passive Plant Natural Circulation BWR Core Studies: Joint EPRI/CRIEPI Advanced LWR Studies: Joint EPRI/CRIEPI Advanced LWR Studies
NP-6324	1989	Natural Circulation Experiments for PWR Degraded Core Accidents
NP-4530	1986	Two-Phase Flow Regimes and Carry-Over in a Large-Diameter Model of a PWR Hot Leg
NP-1676-SR	1981	A Review of Natural Circulation Loops in Pressurized Water Reactors and Other Systems
TSA-0016	1989	Gamma-Ray Heating in Power Reactors

**Thermal-Hydraulic – Other**

SP-114318	1999	Technical Support to NEI on ECCS SUMP Issues – 1999
TR-103292	1994	Water Level Measurement Uncertainties During BWR Instability: Tests and Analysis
NP-5813	1988	Auxiliary Feedwater Spreading and Countercurrent Flow Flooding in a Model Once-Through Steam Generator
NP-5562	1987	Analysis of Anticipated Transients Without Scram in Severe BWR Accidents
NP-5058	1987	Testing of the ENDF/B-V Nuclear Data Library in Thermal Benchmark Experiments

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### Thermal-Hydraulic – Other (continued)

NSAC-107	1986	An Assessment of Eight Void Fraction Models for Vertical Flows
NP-4593	1986	Comparisons of COBRA-SFS Calculations With Data From Simulated Sections of Unconsolidated and Consolidated BWR Spent Fuel
NP-3989-SR	1986	A Full-Range Drift-Flux Correlation for Vertical Flows (Revision 1)
NP-4157	1985	Heat Transfer During Quench and Dryout in a Vertical Tube
NSAC-78	1984	RETRAN-02 Analysis of LOFT ATWS Experiments
NP-1708-R1	1983	Nuclear Steam Supply System Transient Tests at ANO-2 Revision 1
NP-3180	1983	Thermal-Hydraulic Characteristics of a Heat Generating Bed Under Forced-Flow Cooling Conditions
NP-2379	1982	Model Pump Performance Program Data Report
NP-2192	1982	Critical Flow Data Review and Analysis
NP-1709	1982	Reactor Transient Tests at ANO-2
WS-81-212	1981	Simulation Methods for Nuclear Power Systems
NP-1373	1980	RETRAN Analysis of Semiscale Tests S-02-8 and S-06-4
NP-743	1978	UC-B Reflood Program: Experimental Data Report
NP-294	1975	Mixing of Emergency Core Cooling Water with Steam: 1/3-Scale Test and Summary (2 Parts)

### Water Hammer

1003097	2002	Generic Letter 96-06 Waterhammer Issues Resolution: Technical Basis Report - Non Proprietary
1003098	2002	Generic Letter 96-06 Waterhammer Issues Resolution: Technical Basis Report - Proprietary
1006459	2002	Generic Letter 96-06 Waterhammer Issues Resolution: User's Manual - Non Proprietary
TR-108812	1997	Response of Isolated Piping to Thermally Induced Overpressurization During a Loss of Coolant Accident (GL 96-06)
NP-6766-V1	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 1: Plant Water Hammer Experience
NP-6766-V2	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 2: Root Cause Analysis for Plant Water Hammer Experience
NP-6766-V3	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 3: Experimental and Engineering Data
NP-6766-V4P1	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 4: Review of Analytic Models and Computer Codes Part 1: Sample Problems and Comparisons
NP-6766-V4P2	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 4: Review of Analytic Models and Computer Codes Part 2: Theoretical Bases
NP-6766-V5P1	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 5 Part 1: Water Hammer Assessment Guidelines
NP-6766-V5P2	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 5 Part 2: Water Hammer Prevention Guidelines
NP-6766-V5P3	1996	Water Hammer Prevention, Mitigation, and Accommodation: Volume 5 Part 3: Water Hammer Diagnostic Guidelines
NP-6766-V6	1996	Water Hammer Prevention, Mitigation, and Accommodation
TR-106438	1996	Water Hammer Handbook for Nuclear Plant Engineers and Operators

## AVAILABLE TECHNOLOGY TRANSFER

RSM is pleased to offer courses that cover a number of technical areas of interest to utility engineers and PRA practitioners. These include courses associated with EPRI's software products (for basic and advanced users) and training on specific topics, such as fire and seismic PRA. RSM also offers the six-module instructional program "Education of Risk Professionals" to accelerate the qualification time of new risk professionals. RSM offerings take place throughout the year in different locations in the US and in other countries with EPRI members. Many of these courses are also available for on-site implementation and can be customized for specific needs.

A schedule of our training courses and links to registration are available on the EPRI|U website at [www.epri.com/epri-u](http://www.epri.com/epri-u) or in the [EPRI|U - Course Catalog](#). Courses can be searched by date, product ID, keyword, title, or program area.

Some general areas of interest where established, formal RSM Training is available include:

- Education of Risk Professionals (Modules 1-6)
- Fundamental of PRA – Computer Based Training Modules (CBTs)
- Risk Fundamentals and Risk Applications for Non-PRA Practitioners
- Risk Insights for Executives
- Fundamentals of Fire PRA Training
- Fundamentals of HRA Training
- Wind Engineering and High Winds Training
- Seismic PRA Training
- Seismic Fragility Training
- SQUG Walkdown Training
- SQUG New and Replacement Equipment (NARE) Training
- PRA Level 2 – Advanced PRA Training
- Hands-on, needs-based software training for basic and advanced functions of EPRI's RSM software products



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