



# EPRI Nuclear Plant Reliability and Resilience (PRR)

Program Overview



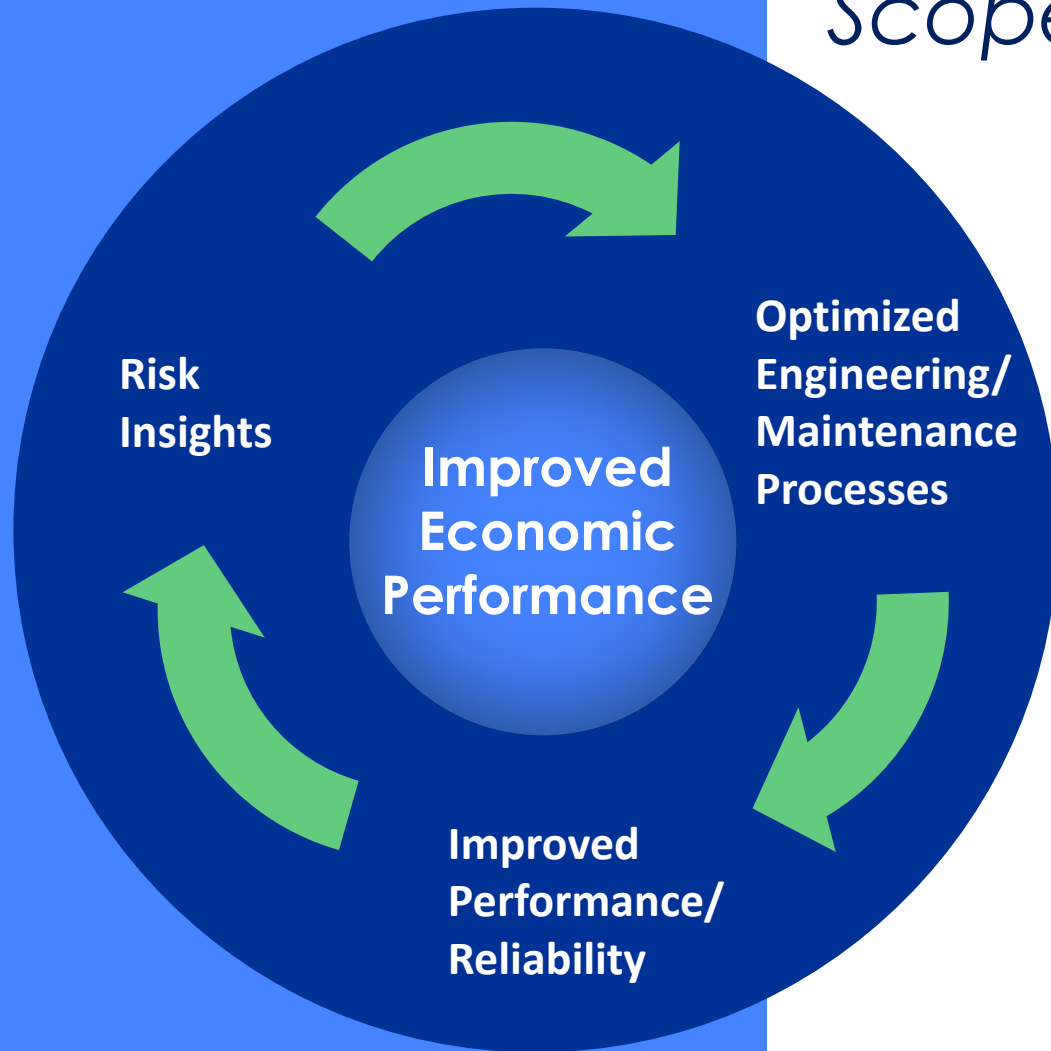
Andrew Mantey  
PRR Electrical Team Leader

National Shipbuilding Research Program Welding and Electrical  
Panel Meeting

September 17-18, 2024

# Plant Performance Department

## Scope of Research



**Plant Performance Cycle**



### **Plant Reliability and Resilience (PRR)**

Research supporting reliable and resilient operations of components, systems, and the nuclear plant, as a whole. This work covers mechanical, electrical, and I&C and addresses maintenance, engineering, programmatic guidance, and best practices.



### **Risk and Safety Management (RSM)**

Research addressing Probabilistic Risk Analysis (PRA/PSA), External Hazards, and Thermal-Hydraulic applications for nuclear plants.



### **Operating Plant Initiatives (OPI)**

Research supporting efficient and effective implementation of plant-level initiatives such as Plant Modernization, Long-Term Operations, Power Upgrading, and Digital Transformation.

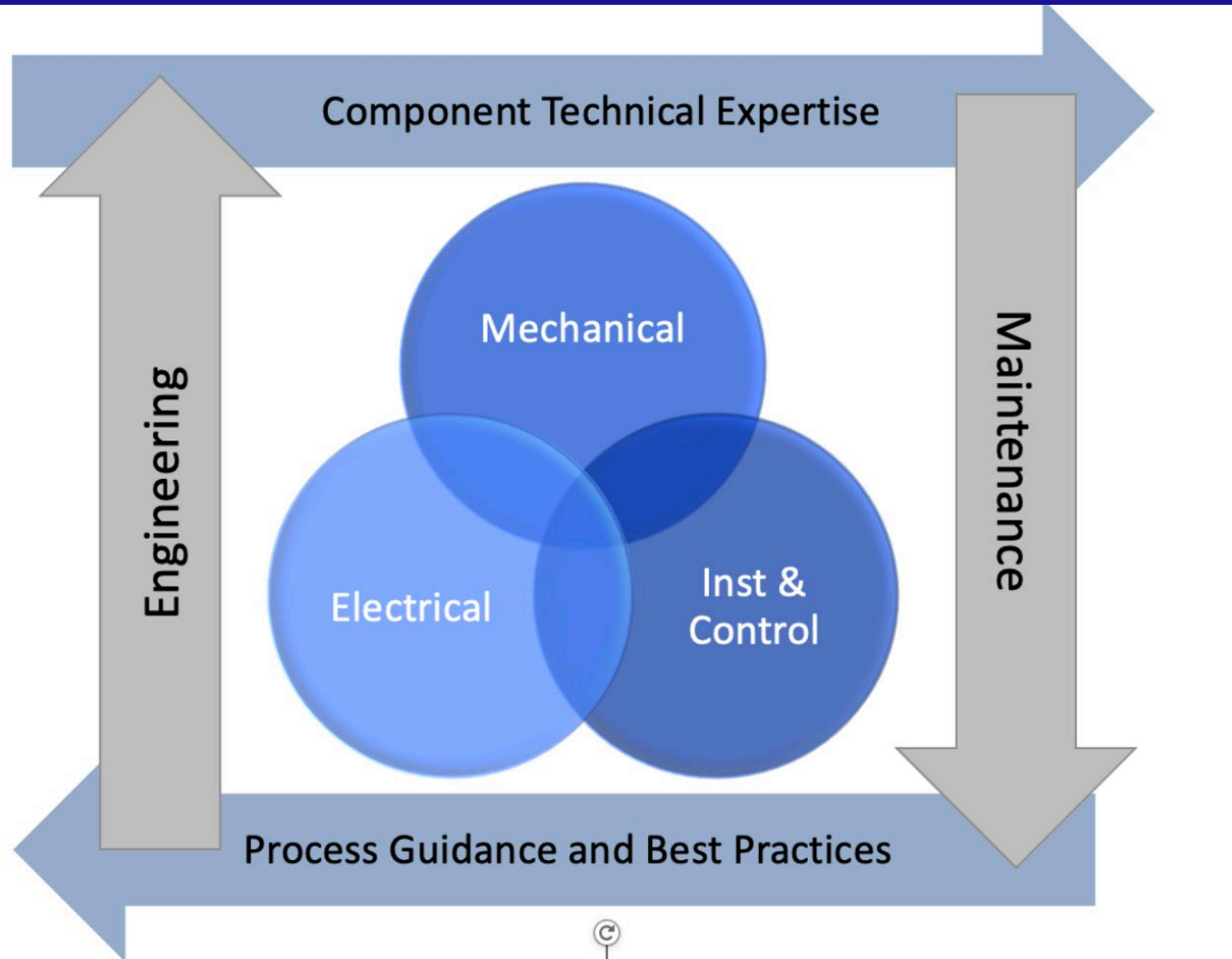
# EPRI - Member Support and Engagement





# **Plant Reliability and Resilience (PRR) Program**

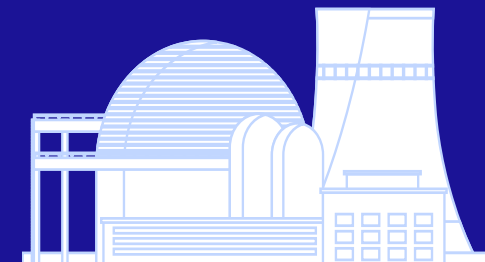
# Plant Reliability and Resilience Research



One program includes

- Maintenance/Active Mechanical
- BOP/Passive Mechanical
- Electrical
- Instrumentation & Control (I&C)
- Engineering & Maintenance Processes (e.g., ER, SPV, Procurement, etc.)

*Includes research scope of former EPRI programs: NMAC, PE, and I&C*



# Research Focus Areas (RFAs) in PRR

Projects across all technical align with these RFAs

Condition  
Monitoring  
Technology  
and Process

Optimized  
Maintenance

Highly Efficient  
and Effective  
Processes

Troubleshooting  
Repair and  
Mitigation

Maximizing  
Power  
Generation  
and Resilience

Managing  
Equipment and  
Plant Life Cycle

Effective  
Knowledge  
Transfer and  
Proficiency

A mix of tactical and strategic research projects addressing the breadth of industry priorities across Maintenance, Engineering and I&C

# Technical Scope of Research in PRR

Covers diverse technical areas spanning Maintenance, Engineering, and I&C

## ▪ Maintenance / Active Mechanical

- PMBD and Maintenance Strategies
- Rotating Components  
(Pumps, Valves, Compressors, Turbines, etc.)
- Maintenance Best Practices

## ▪ BOP/Passive Mechanical

- Erosion, Corrosion
- Buried Piping and Selective Leaching
- Intake Systems and Service Water
- Heat Exchangers and Thermal Performance
- Seismic Qualification Testing

## ▪ Equipment Reliability Processes

- Equipment Reliability (ER)
- Single Point Vulnerability (SPV)
- Maintenance Rule (MR)
- Plant and System Health Committees
- Outage and Online Work Planning

## ▪ Electrical

- AC Power and Components  
(Motors, Relays, Circuit Breakers, Transformers, etc.)
- DC/Emergency Power and Emergency Diesels (EDGs)
- Cable Aging
- Environmental Qualification (EQ)

## ▪ I&C

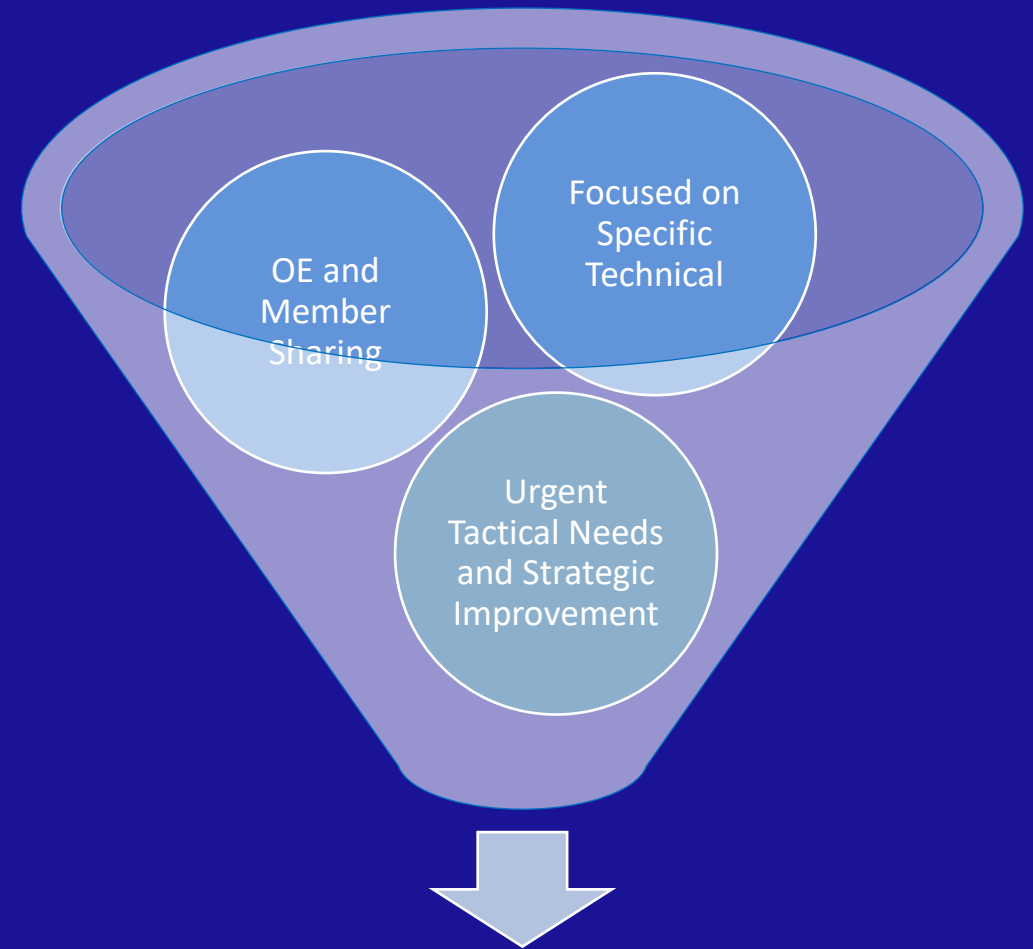
- I&C Components – Reliability and New Technology
- Digital I&C Design
- I&C Operations and Maintenance
- Cyber, EMI, Risk Informed – I&C Processes
- Monitoring and Diagnostics (M&D) Infrastructure

## ▪ Procurement Engineering

- Quality and Procurement Processes
- Obsolescence
- Use of Commercial Grade Components
- Equivalency Evaluation
- Critical Spares and Inventory Management

# In-Depth Topical Engagement

- Users Groups across PRR provide
  - Support for urgent plant issues
    - ☞ Focus on detailed and specific technical areas of responsibility
    - ☞ Sharing of operating experience, best practices, and new applications
    - ☞ Benchmarking and survey opportunities
    - ☞ Cohort of targeted contacts for peer-to-peer interaction



**Value of User Groups**



# Technical Scope of Research in PRR

Covers diverse technical areas spanning Maintenance, Engineering, and I&C



## Maintenance / Active Mechanical

- PMBD and Maintenance Strategies
- Rotating Components  
(Pumps, Valves, Compressors, Turbines, etc.)
- Maintenance Best Practices



## BOP/Passive Mechanical

- Flow Accelerated Corrosion & Erosion
- Buried and Raw Water Piping Corrosion
- Intake and Cooling Water System Performance
- Heat Exchangers and Thermal Performance
- Seismic Qualification Testing



## Equipment Reliability Processes

- Equipment Reliability (ER)
- Single Point Vulnerability (SPV)
- Maintenance Rule (MR)
- Plant and System Health Committees
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## Electrical

- AC Power and Components  
(Motors, Relays, Circuit Breakers, Transformers, etc.)
- DC/Emergency Power and Emergency Diesels (EDGs)
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## I&C

- I&C Components – Reliability and New Technology
- Digital I&C Design
- I&C Operations and Maintenance
- Cyber, EMI, Risk Informed – I&C Processes
- Monitoring and Diagnostics (M&D) Infrastructure



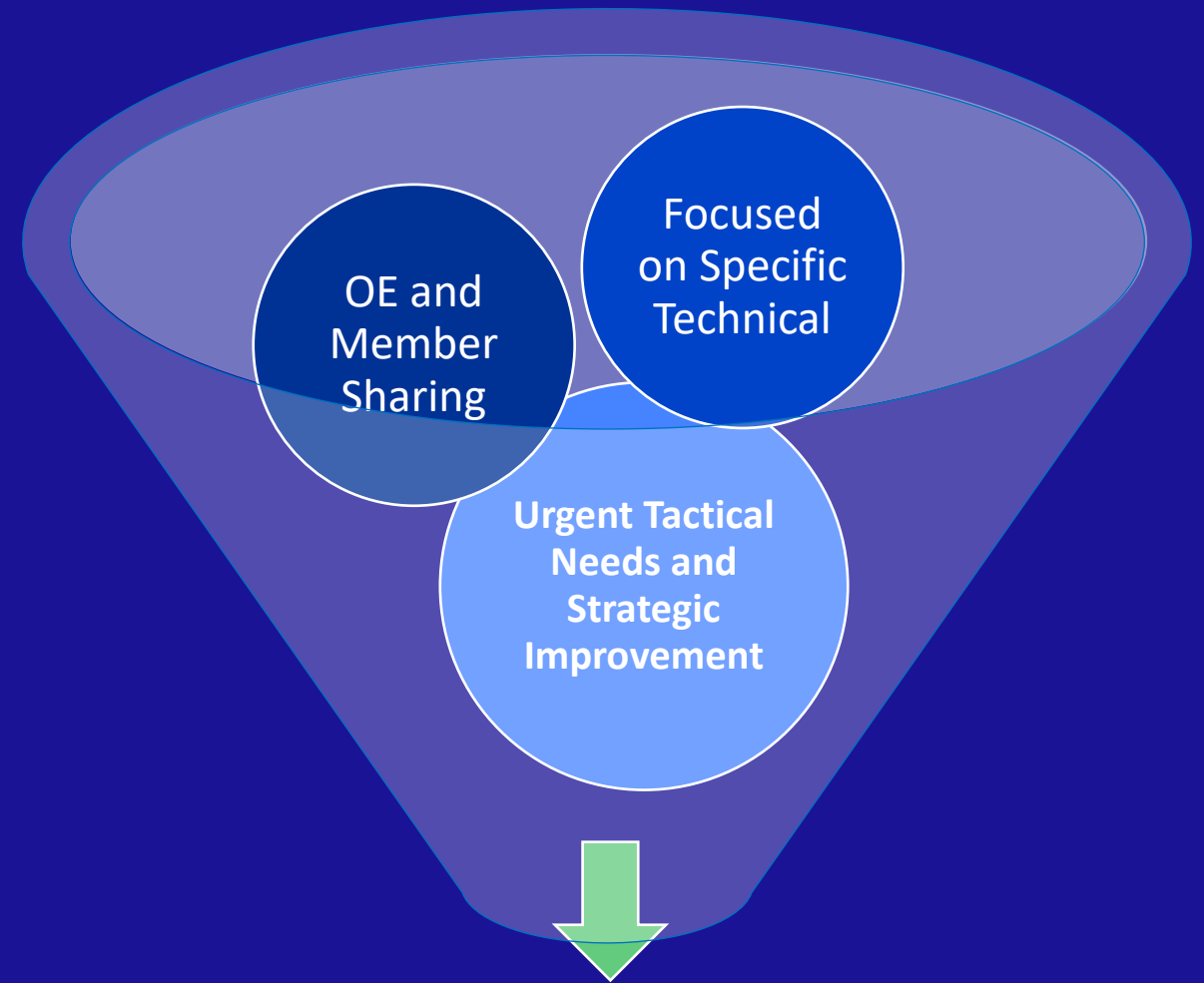
## Procurement Engineering

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# In-Depth Topical Engagement



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- Support for urgent plant issues
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**Value of User Groups**

# Electrical Users Groups

 <p><b>Cable Users Group</b></p>	 <p><b>Circuit Breakers Users Group</b></p>	 <p><b>Joint EDG Owners Group</b></p>
 <p><b>Relay Users Group</b></p>	 <p><b>Large Electric Motors Users Group (LEMUG)</b></p>	 <p><b>Transformer and Switchyard Users Group</b></p>

# I&C Users Groups

 <p><b>Monitoring and Diagnostics Users Group</b></p>	 <p><b>Electromagnetic Compatibility (EMC) Users Group</b></p>	 <p><b>Electrical and I&amp;C Reliability Users Group</b></p>
 <p><b>Digital Systems Eng Users Group (DSEUG) (Supp)</b></p>	 <p><b>Cyber Users Group</b></p>	 <p><b>Digital Operational Technologies Users Group</b></p>

## Maintenance/Active Mechanical Users Groups



Terry Turbine  
Users Group



Hoisting, Rigging,  
and Cranes  
Users Group



Condition Based  
Maintenance  
(CBM)  
Users Group



Work Planning  
Users Group



Buried Pipe  
Integrity Group  
(BPIG)



Checworks™  
(FAC)  
Users Group



Concrete  
Technical  
Advisory Group



Heat Exchanger  
Perf  
Users Group



Nuclear Utility  
Coatings Council  
(NUCC)











Plant Perf  
Enhancement  
Prog  
(Thermal Perf)



Service Water  
Assistance  
Program  
(SWAP)

# Maintenance and Engineering Processes Users Groups

 <p><b>Equipment Reliability Working Group (ERWG)</b></p>	 <p><b>Seismic Qual Reporting and Testing Standard (SQRSTS)</b></p>	 <p><b>Procurement Engineering and Related Topic (P<sup>E</sup>ARTS)</b></p>
 <p><b>International ERWG (IERWG)</b></p>	 <p><b>Maintenance Rule (MR) Users Group</b></p>	 <p><b>Long Term Operations (LTO) Forum</b></p>
 <p><b>LAMBDA - Life Cycle /Asset Mgmt Interest Group</b></p>	 <p><b>Robotics Interest Group (SUPP)</b></p>	

# PRR Contacts



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# New in 2024 - What Is the PRR WebApp?

The PRR WebApp is your gateway to an organized suite of EPRI PRR research products and resources covering the full breadth of NPP engineering and maintenance areas included in the PRR program. Here's what you can expect:

## **Comprehensive Resources:**

- Explore a diverse range of research activities covering mechanical, electrical, and instrumentation components. Explore maintenance and engineering processes that drive reliability.

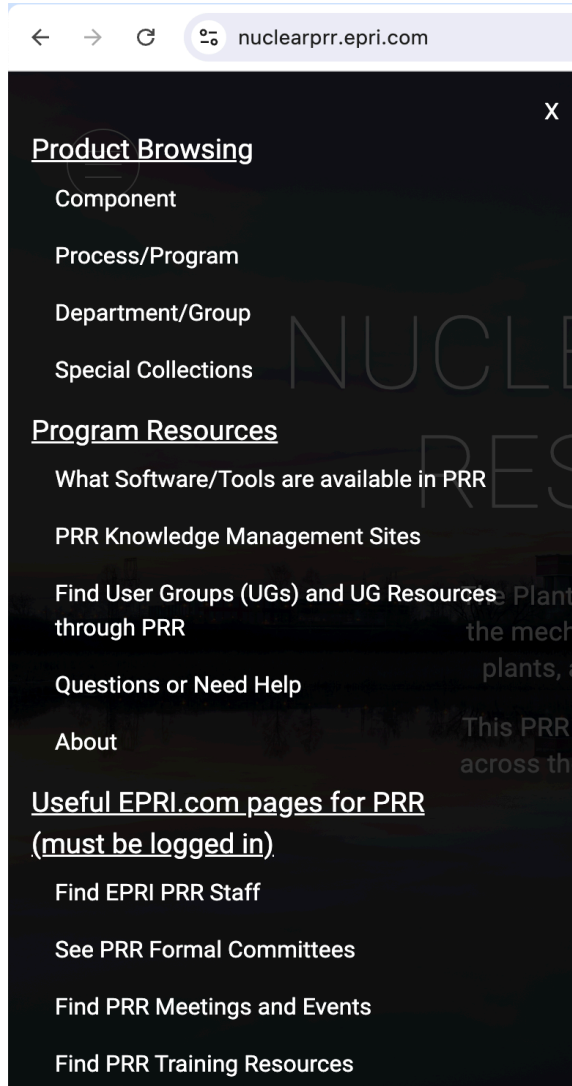
## **Research Product Discovery:**

- Easily find technical guides, user groups, software tools, and knowledge transfer mechanisms, such as technical forums or Wiki sites.

## **Multilingual Support:**

- The website is designed to be multilingual. You can conveniently switch to your preferred language within your internet browser.

# EPRI Nuclear PRR WebApp – Key Benefits



## Browse by Component:

- Explore EPRI technical products categorized by specific components (e.g., heat exchangers, turbines, control systems, pumps).

## Process/Program Insights:

- Access resources related to plant heat rate improvement, maintenance processes, engineering programs, and best practices.

## User Group Collaboration:

- Connect with fellow professionals through topical user groups and share insights, operating experience, and best practices, while learning how EPRI research has been implemented and NPPs.

## Software Tools and Knowledge Management Resources:

- Find software, tools, and knowledge management sites specifically designed to support and inform nuclear plant maintenance and engineering personnel.

## Stay Informed:

- Link to PRR events, meetings, training sessions, and committee updates.



# EPRI Nuclear PRR WebApp – Curated Output

nuclearpr.epri.com/process-program

**EPRI**

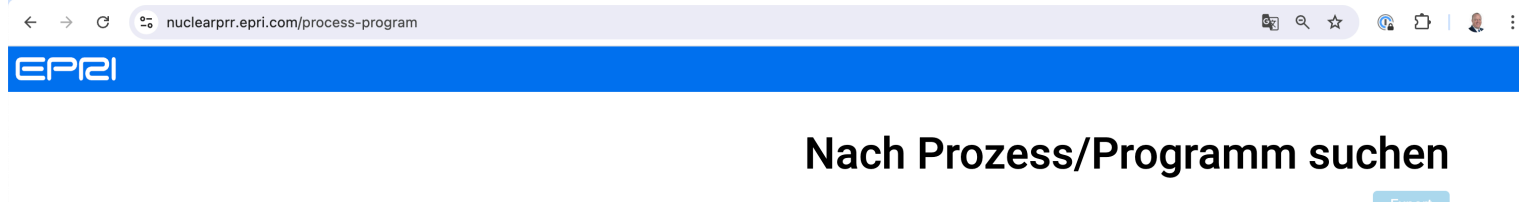
## Browse By Process/Program

Export

Product Browsing	Categories	Results						
By Component	Common Plant Programs	EPRI ID	Title	Link	Access	Pub Date	Type	Abstract
By Process/Program	Life Cycle Management	<input type="checkbox"/> 3002026348	Guideline for System Monitoring by System Engineers	<a href="#">View</a>	Member/Funder	2023-05-01	Technical Report	<a href="#">i</a>
By Department/Group	Integrated Reliability Processes	<input type="checkbox"/> 3002023780	Plant Health Committee Best Practices	<a href="#">View</a>	Member/Funder	2022-09-09	Technical Report	<a href="#">i</a>
Special Collections	Equipment Reliability (ER) Proces...	<input type="checkbox"/> 1022526	Plant Support Engineering: Generic Handbook for New System Engineers	<a href="#">View</a>	Public	2011-04-26	Technical Report	<a href="#">i</a>
PRR Program Resources	Maintenance Rule (MR)	<input type="checkbox"/> NP-3834-V1	Systems Interaction Identification Procedures, Volumes 1-5	<a href="#">View</a>	Public	1985-07-12	Technical Report	<a href="#">i</a>
What Software/Tools are available in PRR	Plant and System Health Monitorin...	<input type="checkbox"/> NP-3834-V2	Systems Interaction Identification Procedures, Volumes 1-5	<a href="#">View</a>	Public	1985-07-12	Technical Report	<a href="#">i</a>
PRR Knowledge Management Sites	Single Point Vulnerability (SPV)...	<input type="checkbox"/> NP-3834-V4	Systems Interaction Identification Procedures, Volumes 1-5	<a href="#">View</a>	Public	1985-07-12	Technical Report	<a href="#">i</a>
Find User Groups (UGs) and UG Resources through PRR	Reliability and Maintenance Strategies	<input type="checkbox"/> NP-3834-V5	Systems Interaction Identification Procedures, Volumes 1-5	<a href="#">View</a>	Public	1985-07-12	Technical Report	<a href="#">i</a>
Questions or Need Help	Maintenance Strategy Development	<input type="checkbox"/> Screenshot 34	System Monitoring by System Engineers: 37 System Monitoring	<a href="#">View</a>	Public	1998-03-30	Technical Report	<a href="#">i</a>
About	Condition Based Maintenance (CBM)							
Useful EPRI.com pages for PRR (must be logged in)	Work Planning/Management							
Find EPRI PRR Staff	Inspections, Assessments and Walkdowns							
See PRR Formal Committees								

## PRR Program Website

# EPRI Nuclear PRR WebApp – Multilingual Support



**Produkt suche**

- Nach Komponente
- Nach Prozess/Programm
- Nach Abteilung/Gruppe
- Spezialsammlungen
- PRR-Programmressourcen**
- Welche Software/Tools sind in PRR verfügbar?
- PRR-Wissensmanagement-Sites
- Finden Sie Benutzergruppen (UGs) und UG-Ressourcen über PRR
- Fragen oder Hilfe nötig
- Um
- Nützliche EPRI.com-Seiten für PRR (Anmeldung erforderlich)**
- EPRI PRR-Mitarbeiter finden
- Siehe PRR Formelle Ausschüsse
- Finden Sie PRR-Meetings und -Events
- Finden Sie PRR-

**Kategorien**

- Gemeinsame Anlagenprogramme
- Lebenszyklusverwaltung
- Integrierte Zuverlässigkeitsprozesse**
- Gerätezuverlässigkeitsprozess (ER)...
- Wartungsregel (MR)
- Anlagen- und Systemzustandsüberwachung
- Einzelne Punktschwachstelle (SPV) ...**
- Zuverlässigkeits- und Wartungsstrategien
- Arbeitsplanung/-management
- Inspektionen, Beurteilungen und Begehungen

**Ergebnisse**

EPRI-ID	Titel
3002023784	Überarbeitu Single Poin Vulnerabilit Prozesshar
3002026099	Single-Poin Vulnerabilit Wiki v2023
3002026160	Single-Poin Vulnerabilit Manager Tr (SPVAT) v3
3002013246	Single Poin Vulnerabilit Analysis To (SPVAT), Ve
3002019869	Scram-Dat (2015-2019)

Screenshot

**プロセス/プログラム別に関覧**

輸出

製品	カテゴリ	結果
コンポーネント別	共通プラントプログラム	EPRI ID
プロセス/プログラム別	ライフサイクル管理	EPRI ID
部門/グループ別	統合信頼性プロセス	EPRI ID
特別コレクション	PRR プログラム リソース	EPRI ID
PRR プログラム リソース	PRRで利用できるソフトウェア/ツール	EPRI ID
PRR ナレッジ管理サイト	PRRを通じてユーザーグループ (UG) と UG リソースを見つける	EPRI ID
PRRに役立つ EPRI.com ページ (ログインが必要です)	PRRの会議やイベントを探す	EPRI ID
EPRI PRRスタッフを探す	PRRトレーニングリソースを探す	EPRI ID
PRR公式委員会を参照		EPRI ID
PRRの会議やイベントを探す		EPRI ID
PRRトレーニングリソースを探す		EPRI ID

EPRI ID	タイトル	リンク	アクセス	出版日	タイプ	抽象的な
3002023784	シングルポイント脆弱性 (SPV) プロセスガイドの改訂	リンク	メンバー/資金提供者	2022-08-29	テクニカルレポート	🔍
3002026099	シングルポイント脆弱性 (SPV) Wiki v2023	リンク	メンバー/資金提供者	2023-08-17	ソフトウェア-eMedia	🔍
3002026160	シングルポイント脆弱性管理ツール (SPVAT) v3.0	リンク	メンバー/資金提供者	2023-07-26	ソフトウェア-eMedia	🔍
3002013246	シングルポイント脆弱性分析ツール (SPVAT)、バージョン 2.1	リンク	メンバー/資金提供者	2019-01-29	ソフトウェア-eMedia	🔍
3002019869	スクラムデータ分析 (2015-2019)	リンク	メンバー/資金提供者	2021-02-01	テクニカルレポート	🔍

Screenshot

## PRR Program Website

# Questions or Comments



Slide 2 of 2

**Contact Andrew Mantey – [amantey@epri.com](mailto:amantey@epri.com)**



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