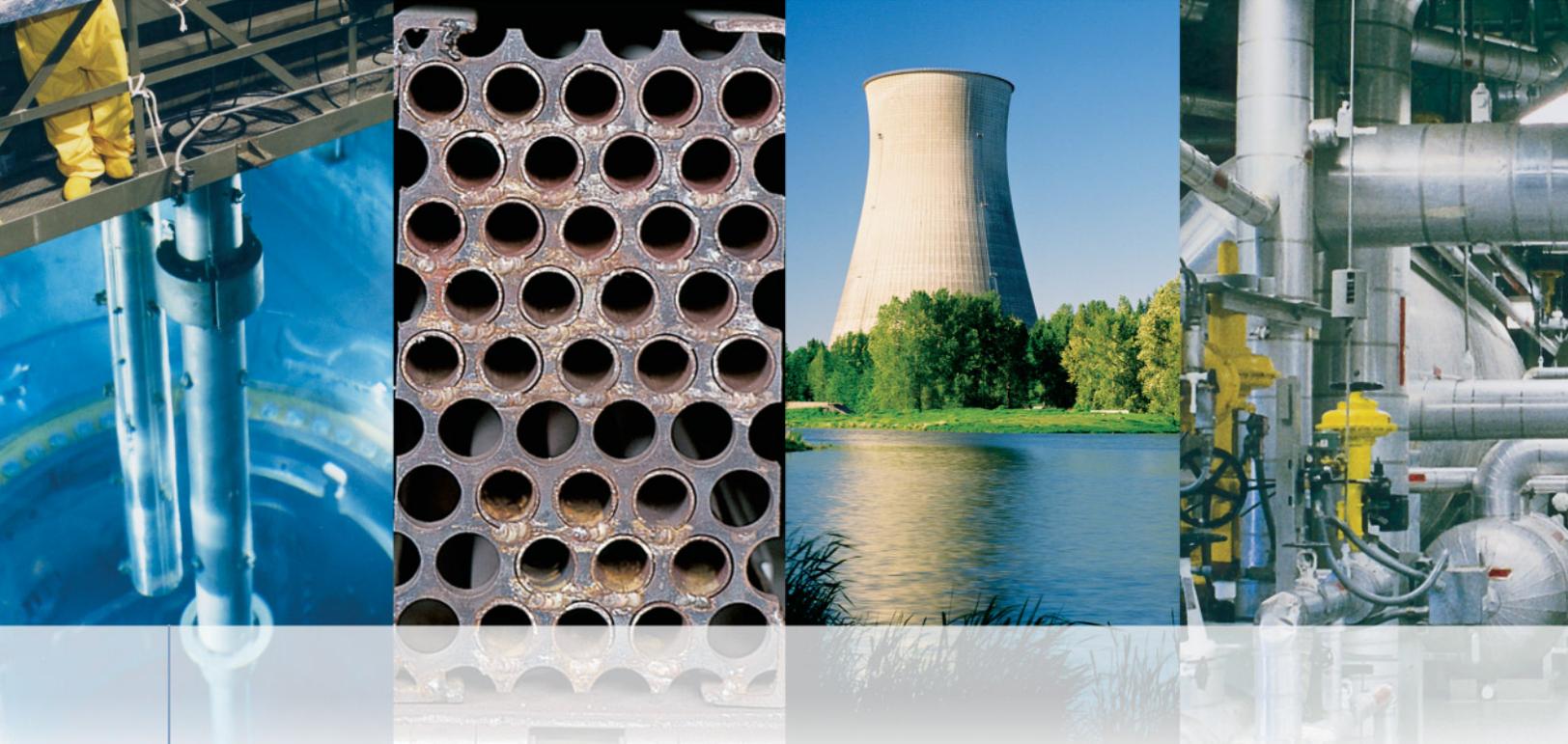


An EPRI Nuclear Power Action Plan



Materials Degradation and Aging

Materials Degradation and Aging Action Plan

Better understanding of nuclear power plants is key to improving performance, reliability, and profitability. EPRI's Materials Degradation/Aging Action Plan encompasses R&D in corrosion research, water chemistry, and plant management.

The research helps operators:

- ▶ **Maximize useful plant life**
- ▶ **Employ cost- and risk-focused decision making**
- ▶ **Develop technologies to address materials degradation and aging**
- ▶ **Preclude unanticipated safety events**
- ▶ **Improve plant capacity, reliability, and availability**

The Challenge of Degradation and Aging

Managing materials degradation and aging is one of the major technical and economic challenges facing the nuclear power industry:

- ▶ Most modern plants should operate for 60 years
- ▶ Plant availability is approaching its maximum
- ▶ Reductions in production costs are difficult to achieve

At a time when plants are pushed to attain higher capacity factors, degradation and aging increase the potential for:

- ▶ Component failures
- ▶ Derating
- ▶ Outages
- ▶ Greater O&M costs

Assuring regulators of the continuing reliability and safety of in-service materials is an additional obstacle facing plants approaching license renewals.

The nuclear power industry needs:

- ▶ Improved understanding of how flaws in component materials initiate and grow
- ▶ Better information on how environmental variables impact materials performance and aging:
 - Temperature
 - Operating stress
 - Fluence
 - Water chemistry

- ▶ An integrated management approach for handling materials performance issues in boiling water reactors (BWR) and pressurized water reactor (PWR) steam generators
- ▶ To promote the development and adoption of advanced methods for predicting materials behavior while addressing regulatory concerns that such methods imply reduced nuclear safety
- ▶ Comprehensive water chemistry-based degradation mitigation strategies that can greatly reduce the need for costly repairs and replacement

The EPRI Action Plan

To achieve these needs, EPRI's Materials Degradation/Aging Action Plan encompasses the following nuclear power programs:

- ▶ **The Boiling Water Reactor Vessel and Internals Project (BWRVIP)**—develops strategies for major internal components of reactor vessels and primary-pressure-boundary piping and enables plant operators to:
 - Inspect
 - Assess
 - Mitigate
 - Repair stress corrosion cracking
- ▶ **The Corrosion Research Program**—works to:
 - Improve the useful life of in-reactor components
 - Gain a greater understanding of crack initiation
 - Achieve superior knowledge of early propagation processes

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- ▶ **The Materials Reliability Project (MRP)**—provides the technical basis for resolving key issues related to:
 - Nozzle cracking in reactor vessel head and piping penetrations
 - Internal cracking
 - Reactor pressure vessel integrity
 - Piping environmental and thermal fatigue
- ▶ **The Steam Generator Management Program (SGMP)**—works to:
 - Determine root causes of steam generator degradation
 - Mitigate the impact of degradation
 - Provide input to replacement steam generator specifications
 - Establish plant management guidelines and nondestructive evaluation methods
- ▶ **The Water Chemistry Control (WCC) Program**—develops and tests advanced tools and guidelines for improving:
 - Water chemistry control to reduce corrosion damage
 - Release of corrosion products into coolant systems
 - Impact of chemistry-related problems on plant operation and profitability

For materials in service, knowing how to practically manage and modify the operating environment can be essential to mitigating problems associated with degradation. For new and replacement components, the anticipated operating environment is a critical determinant of materials selection. A comprehensive, integrated

understanding of materials issues and management options is fundamental to effective business and operating strategies.

EPRI's Materials Degradation/Aging Action Plan meets those needs. In addition, the plan indirectly supports other important strategic objectives:

- ▶ Adding cost-effective innovation to existing plants
- ▶ Allaying public safety concerns
- ▶ Evaluating evolutionary and new designs
- ▶ Optimizing technology transfer and collaboration

EPRI's Nuclear Sector drew upon its experience working closely with public and private-sector stakeholders including:

- ▶ Utilities
- ▶ Vendors
- ▶ Engineering firms
- ▶ The U.S. Nuclear Regulatory Commission
- ▶ Research laboratories
- ▶ Universities

This group of stakeholders developed a suite of more than 150 deliverables:

- ▶ EPRI technical reports
- ▶ Demonstrations
- ▶ Guidelines
- ▶ Software packages
- ▶ Training courses
- ▶ Workshops

These deliverables provide practical, pertinent information to help nuclear

power plant operators understand and manage materials degradation and aging phenomena in their plants' major metallic components.

EPRI's Nuclear Program

The EPRI Nuclear Power Program's vision for the 21st century is to increase the worldwide supply of cost-competitive, environmentally friendly nuclear energy. To achieve that vision, EPRI's mission is to develop cost-effective technology for safe and environmentally friendly electricity generation, which maximizes the profitable utilization of existing nuclear assets and supports the promotion and deployment of new nuclear technology. Inherent in this mission is the need to deliver innovative technology of indispensable value that allows our members to reduce O&M costs, to improve plant reliability, and to maintain or improve safety margins.



About EPRI

EPRI creates science and technology solutions for the global energy and energy services industry. U.S. electric utilities established the Electric Power Research Institute in 1973 as a nonprofit research consortium for the benefit of utility members, their customers, and society. Now known simply as EPRI, the company provides a wide range of innovative products and services to more than 1000 energy-related organizations in 40 countries. EPRI's multi-disciplinary team of scientists and engineers draws on a worldwide network of technical and business expertise to help solve today's toughest energy and environmental problems.

EPRI. Electrify the World

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