NUCLEAR SECTOR VALUE BRIEFING – Summer 2025

We are pleased to provide this summary of EPRI's recent nuclear R&D activities, showcasing several examples of the value our members are realizing. By applying EPRI research, members are seeing benefits worth millions of dollars.

As a reminder, we share this information twice annually before EPRI's Nuclear Power Council (NPC) advisory meetings.

Read on to learn more about several recent and ongoing projects. We encourage you to consider how these might be adapted for application in your plants. Share this document with your staff to generate ideas for implementation. Our team is ready to support you as you navigate the challenges and opportunities ahead for the nuclear industry.

Steve Swilley
Vice President, Nuclear
and Chief Nuclear Officer

Steve Chengelis
Vice President, Nuclear
Development and Fusion

By the Numbers

Leveraging approximately
~$200 million USD
in annual funding to support the industry through nuclear R&D

150+ Nuclear Deliverables Industry Committees issued annually that advance technology application and best practices

>80% of world's nuclear fleet across **25** countries participate in bi-annual meetings to facilitate R&D collaboration

250+ industry committees with EPRI technical representation shaping technology, codes, standards, and regulations – ANSI, ASME, ACI, NEI, IEEE, & IAEA)

More than **40,000** professional development hours (PDH) earned by Members through training interactions over the last two years

EPRI SOFTWARE MUST HAVES

Materials Management

BWRVIP Dynamic Ligament Length (DLL). Provides ability to evaluate whether BWR reactor internals components with known flaws are acceptable for continued operation. Recorded training webinars are available that inform members of expanded capabilities

Fuels & Chemistry

Radwaste Hub. Provides up-to-date information on accurate, efficient, and effective radioactive waste management strategies and assist sites with benchmarking and applying EPRI guidance for low and intermediate level waste (LILW).

Plant Support

Interactive Database Knowledge Visualization Platform (IDKVP). Digital twin tool applied to a generic WEC 4-loop PWR plant design. The tool enables the user to visualize the inspection information quickly and easily by simply selecting components from the 3D user interface.

Plant Performance

Phoenix Architect Software Suite. Suite of software includes a variety of robust capabilities that currently support key actions with respect to probabilistic risk models for nuclear reactors and beyond, such as model building, maintenance, calculating risk results and insights for a variety of risk applications.

Strategic Initiatives

Risk Analysis Methods and Tools for Advanced Reactors Wiki. RAMTAR wiki provides a centralized industry location to describe research for PRA methods in use, provide background on the underlying concepts, and point to new and future EPRI products

Training & Development

Use of Virtual Reality. Enhances learning retention through immersive, real-world simulations while improving safety consciousness and behaviors. It further reduces training costs and scales easily across locations.

Combined Funding Leverages Research Value

$89 – the additional leverage that an average full nuclear member gets for every $1 of funding towards *base* projects.

$49 – the additional leverage that an average full nuclear member gets for every $1 of funding towards *supplemental* projects.

RECENT VALUE REALIZED BY NUCLEAR MEMBERS

Full list of Technology Transfer Awards is available at: https://msites.epri.com/ms/sectors/044648/tta

SUMMARY DESCRIPTION	QUANTIFIED VALUE[1]	MEMBER	YEAR RECOGNIZED
Pioneering Aging Management for Neutron Absorbers Across Worldwide through use of i-LAMP (Industrywide Learning Aging Management Program)	The i-LAMP avoids the costs associated with alternative monitoring approaches. Reduces costs up to **$500K USD per campaign**, which does not include the site logistic support costs.	KHNP, EDF, Southern Nuclear, and TVA	2024
Innovative Advances in Chemistry and Radiation Safety Realized through Remote Monitoring and Smart Chemistry Applications	Member required **25% fewer RP contractors than the industry average with a 30% reduction in RP dose** during outage.	China National Nuclear Power Company Ltd. (CNNP)	2024
EPRI Research Guides Nuclear Conversion and Siting Feasibility for Future Projects	Member was able to rely on a process that has become the **de facto standard for siting and technology selection, saving time and resources** in developing a company-specific approach.	Salt River Project and Bruce Power	2024
AI Applications Streamline NDE Data Analysis for Reactor Vessel Head Examinations, Reducing Inspection Times, and Enhancing Reliability	**Reduced a four-day evolution down to an approximately three-hour evolution** providing significant time savings during refueling outage.	Constellation, Entergy, and TVA	2024
Innovative Use of EPRI's Failure Modes Approach for Continuous Online Monitoring of Large Vertical Pump/Motor Sets	Upwards of ~$500K USD in maintenance savings and avoided long part lead times. Projected lifetime cost savings using this approach is estimated at $3.85M USD through 2045.	Evergy	2024
Constellation's Industry-First Application of Non-Welded Pipe Fittings Highlights Substantial Cost Saving Opportunity	The pipe fittings use a patented compression-type, sleeve-coupled joint as an alternative to welding resulting in **shorter installation times, reduced person-rem radiation exposure, and fewer required resources during maintenance outages**.	Constellation	2023
KKL Expands on EPRI's Seismic Fire and Flood Guidance to Address New Regulatory Requirements	Use of EPRI guidelines and methodologies during a periodic safety review – from **fire, flooding, and seismic analysis to seismic secondary hazards analysis** – demonstrated an innovative approach to combining EPRI best practices in each individual area with plant-specific experience and data.	Kernkraftwerk Leibstadt AG (KKL)	2023

1 Savings are dependent upon an individual plant's or fleet's unique circumstances and may differ based on baseline conditions, extent of deployment, financial evaluation approach, and more. EPRI did not independently corroborate or validate the reported savings.

93% **of Nuclear members are very satisfied or satisfied with EPRI support and value (2024 member survey)**

EPRI PRODUCT MUST HAVES

Materials Management

The *EPRI Materials Degradation Matrix (MDM)*, 3002030559, is a living tool that summarizes the state of industry knowledge regarding degradation mechanisms and related research and development (R&D) activities across a variety of reactor designs including PWRS, BWRs, VVER, and CANDU pressurized heavy water reactor. Revision 5 includes updates to the MDM tables and explanatory text for all reactor types based on operating experience and R&D results since the previous revision.

Fuels & Chemistry

Extending Nuclear Power Plant Refuel Cycles, 3002029122, details the process, considerations, and barriers in extending BWR & PWR refueling cycles, **saving plants millions in fuel and outage costs**. The scope of this report includes the basic process and considerations for those reactors that have not transitioned from their original designed refueling cycle and includes the barriers and research needed to transition from 12/18-month cycles to 18- or 24-month cycles.

Plant Support

Risk-Informed Repair and Replacement Code Case N-752—Implementation Guideline, 3002015823, has **saved millions for members when applied to components and systems**. This report provides a brief history of the development and application of risk-informed methodology in the nuclear industry, a summary of nuclear regulatory requirements applicable to risk-informed activities, clarification on the requirements of Code Case N-752, identifies alternative treatment options available to users, and actions necessary for proper implementation.

Plant Performance

The analyses discussed in *Limitorque Actuator Fatigue Life Extension*, 3002020841, show that Limitorque motor-operated valve (MOV) actuators are generally capable of operating at higher-than-rated thrust and torque for more than 2,000 operating cycles (open-to-close-to-open or vice versa) for the actuator mechanical components. This report develops and justifies methods that can be used to evaluate the thrust and torque fatigue life of Limitorque actuators based on their specific stroking load-profile history. This research has been used by a US fleet to save **$24 million on deferred valve actuator replacements**.

Training

Energy companies face the dual challenge of building and maintaining a skilled workforce in a rapidly evolving industry today while developing the skills of employees who can tackle the challenges of tomorrow. EPRI offers training backed by the same deep experience and subject matter expertise behind our applied R&D that has solved real challenges for more than 50 years, with real impact – accelerating the timeline from idea to execution. **Hundreds of on-demand technical training modules used across EPRI membership are available** at www.epri.com/training.

Strategic Initiatives

An advanced reactor developer cited the EPRI topical report on TRISO fuel (3002019978) as part of its construction permit application to the Nuclear Regulatory Commission for a demonstration reactor. The fuel-related aspects of the **permit application were accepted as-is and no technical questions or requests for additional information were received**.

ADVANCED NUCLEAR TECHNOLOGY PROGRAM

The Advanced Nuclear Technology (ANT) program conducts research to minimize deployment and operational risks and uncertainties associated with new nuclear plants. R&D activities evaluate and address the challenges of deploying nuclear power plants of all generational designs, including large light-water reactors and advanced reactor technologies, which encompass light-water small modular reactors, microreactors, and non-water-cooled reactor designs. Our mission is to accelerate the deployment of nuclear power around the world.

Deciding to build a nuclear power plant is a complex process that involves several factors, including site suitability, technology type, construction optimization, deliberate commissioning, and efficient project management. EPRI has developed a range of guidelines to assist in decision-making across the project life cycle (*Owner-Operator Requirements Guide*, 3002015751; *Site Selection and Evaluation Guide*, 3002023910; *Reactor Technology Assessment Guide*, 3002025344; *Guide to Designing Structures for Constructability*, 3002015932; *New Nuclear Plant Project Development and Execution Guideline*, 3002026494) and can also provide hands-on assistance with the new plant deployment process.

In collaboration with the Nuclear Energy Institute, EPRI also maintains the Advanced Reactor Roadmap, which outlines an achievable path forward and the actions necessary for successfully deploying advanced reactors in North America. An update to the Roadmap will be published in 2025. The update is based on work accomplished, new opportunities being defined, and alignment on which entities are best equipped to tackle needed actions.

ONGOING BASE MEMBERSHIP VALUE EXAMPLES

- **NDE's Performance Demonstration (PD) Lab** maintains approximately $20M in samples for the industry that meet program requirements for the industry to comply with Appendix VIII and 10CFR50.55a requirements.
- The **Risk and Safety Management (RSM) Program** invests approximately $3M per year to develop and maintain multiple software tools used across the industry to provide savings through justifying a technical basis for risk-informed decision making, which routinely saves members from extending outage times or having overly conservative PRA models.
- **Plant Reliability and Resilience** provides 400 maintenance guides for nuclear equipment and systems, which can be used to enhance plant efficiency and reliability, leverage industry best practices, improve procedures, and support training.
- Technical guidance from **Fuel Reliability Program** improves fuel safety and reliability, thereby reducing economic risks associated with fuel failures, which have cost the global nuclear industry more than $500 million over the past 20 years.
- The **Materials Management** department continues to invest in solutions to address long-term aging management, ensuring that the global fleet of reactors can continue to operate their plants safely and efficiently, saving members millions of dollars.
- The **ANT Program** focuses on reducing the risk and uncertainty of building and operating new nuclear power plants by improving every stage of the deployment life cycle, including siting, licensing, construction, startup, and initial operations.

For More Information

Materials Management	**Randy Stark**, rstark@epri.com
Fuels and Chemistry	**Dan Wells**, dwells@epri.com
Plant Support	**Mike Ruszkowski**, mruszkowski@epri.com
Plant Performance	**Mark Woodby**, mwoodby@epri.com
Training & Development	**Heather Feldman**, hfeldman@epri.com
Strategic Initiatives	**Steve Chengelis**, schengelis@epri.com

Nuclear Value Website:
interactive.epri.com/nuclear-value

For more information, contact:
EPRI Customer Assistance Center
800.313.3774 • askepri@epri.com

August 2025

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 650.855.2121 • www.epri.com