Plant Engineering

Program Overview

Program Description

Safe, reliable, cost-effective nuclear plant operation is supported by detailed, technically sound engineering practices. Engineering analysis, for example, is important in assessing the condition of plant components and whether they should be replaced or repaired. Engineering also is critical when investigating life-limiting conditions, evaluating plant performance improvements, and assessing component and vendor quality.

The Plant Engineering Program performs research to support the long-term, cost-effective operation of the nuclear fleet, addressing key equipment issues and enhancing the effectiveness of plant engineering programs. Issues addressed include equipment/component reliability, product and vendor quality, cable aging, buried piping, flow-accelerated corrosion, workforce and skills development, life-cycle management, and obsolescence. The program also supports technology transfer through technical assistance programs, training, and user group workshops.

Research Value

Research results from the Plant Engineering Program provide engineering-based guidance that enables nuclear plants to improve equipment reliability and reduce operations and maintenance costs. Participants gain access to the following:

- Strategic roadmaps outlining research gaps confronting key issues—such as cable aging and underground pipe integrity—and the collaborative actions needed to address these gaps
- Definitive cable condition assessment methods that enhance the ability to identify, assess, and manage aging
- Enhanced validation of procured item quality and improved procurement specifications to reduce procurement costs, solve obsolescence issues, and define needed engineering process changes
- Improved long-term planning on key components to avoid in-service failures and potential plant outages
- Enhanced workforce skills development tools to address gaps in utility training programs, validate worker skills prior to use, and facilitate worker movement between sites
- Technical results enabling the use of high-density polyethylene pipe as a replacement option for degraded metal pipe
- Risk-ranking software and inspection and mitigation technology to characterize and address buried pipe and buried pipe coating degradation
- Inspection and mitigation technologies for components susceptible to flow-accelerate corrosion

Approach

The Plant Engineering Program investigates engineering process improvements to more effectively inform and respond to plant, system, and component issues. The program targets issues such as unanticipated material degradation deficiencies that can reduce the inherent design margins in plant equipment and impact equipment reliability.

Base research encompasses equipment reliability, engineering processes, procurement, vendor quality, balance-of-plant corrosion, and workforce skills development.

- Equipment Reliability and Engineering Processes: Sustained equipment reliability at nuclear plants depends on attention to both near-term and long-term degradation mechanisms that can lead to failure, unacceptable performance, or premature replacement. This project develops guidance on generic and specific aging issues to support emergent and end-of-life component decisions. Both theoretical and practical guidance is developed, including aging models, data, and acceptance criteria for components
and cable; field guides for walkdowns and inspections; condition-monitoring techniques; and sourcebooks for gauging end-of-expected life.

- **Procurement and Quality Issues:** Procured item quality issues have negatively impacted plant reliability and costs for replacement items. Causes of poor product quality include loss of vendor expertise, lack of vendor understanding, and poor specification development. This research area consists of three elements: 1) Continued support of forums for sharing procurement-related concerns and experience through the Joint Utility Task Group and Nuclear Supply Chain Strategic Leadership Council; 2) Research on the root cause and corrective actions to enhance vendor quality, common procurement specifications, source surveillance templates, and guidance on detecting fraudulent and counterfeit items; and 3) Prioritization and management of obsolete items, including a pilot project to demonstrated methods being developed.

- **Workforce Skills, Knowledge and Assessment:** Substantial nuclear plant personnel turnover in the next 5-10 years will result in widespread training of new personnel to continue operating existing plants safely and to support new plant construction and operation. Moreover, the availability and skills level of supplemental workers for power plant outages is less certain. Computer-based training can improve the effectiveness of engineering training and reduce the associated costs. Plant Engineering has developed computer-based training for nine engineering fundamentals topics. For supplemental workers, EPRI continues to develop knowledge exams and skills proficiency demonstration exams that can be administered to verify skills competencies and make such competencies portable.

- **Balance-of-Plant Corrosion:** Corrosion in the secondary system of nuclear plants can negatively impact plant reliability and can result in annual costs of up to $25 million per plant related to flow-accelerated corrosion, degradation of service water systems, and degradation in raw water heat exchangers. Through guidance for effective underground piping programs, risk-ranking software, flow-accelerated corrosion, and interactive communications, this research area develops tools for addressing corrosion issues and improving the service life of balance-of-plant piping and components. This research area also investigates alternatives to steel pipe, such as high-density polyethylene, and develops improved inspection techniques for assessing the health of piping systems.

To address strategic objectives established for each of its programs, EPRI has developed roadmaps to plan, coordinate, and execute needed research among multiple entities. For the Plant Engineering Program, roadmaps have been developed to address cable aging management and the integrity of underground piping and tanks. Additional roadmaps will be developed as conditions warrant.

Through separately funded projects, participants can gain access to a wide range of engineering support programs, user groups, and additional training tools. The cable program, for example, provides up-to-date information on cable aging and cable aging management practices from both a technical and regulatory perspective. User groups address underground piping, heat exchanger performance, environmental qualification, and EPRI's CHECWORKS program for flow-accelerated corrosion. The Service Water Assistance Program provides a forum for sharing information pertinent to the operation and maintenance of nuclear plant service water systems.

**Accomplishments**

The Electric Power Research Institute's (EPRI's) Plant Engineering Program produces an array of guidance documents, training tools, and assessment methodologies that support safe, reliable nuclear plant operation and reduce risks associated with extended plant operation.

- Developed aging management guidance for low-voltage (less than 1 kV) and medium-voltage (2.3 kV - 34 kV) electrical cables at nuclear plants. These guides provide recommendations for establishing effective aging management programs that include data requirements, assessment criteria, health indicators, and management actions.
- Developed a reference guide to assist project teams responsible for replacing an existing large motor with a replacement that is not identical. The guidance addresses scenarios where changes in the motor design or design basis are so significant that a plant design modification would be necessary.
• Issued an updated reference guide that provides reference information on many of the tasks and technologies that plant owners may find useful evaluating and addressing the integrity of buried pipe.
• Formulated a 15-step process for implementing a critical spares program at nuclear power plants based on industry responses to a benchmarking questionnaire and in-depth reviews of successful critical spares programs at two nuclear plants.
• Developed engineering training modules on instrument uncertainty determination, seismic analysis, relief and safety valves, water hammer, valve actuators, and finite element analysis. Developed engineering fundamental courses on basic atomic/nuclear physics and core protection.
• Developed guidance for establishing an effective program for managing buried piping.
• Released BPWORKS™ Version 2.0, which performs risk ranking to help plant owners prioritize the inspections of buried piping and provides a database architecture for data retention.
• Compiled interim results of slow crack growth rate testing of high-density polyethylene piping to support technical justification for use of high-density polyethylene for safety and non-safety piping systems (American Society of Mechanical Engineers [ASME] Code Case N-755).

Current Year Activities

Plant Engineering Program research and development (R&D) for 2012 will focus on cabling, obsolescence, life-cycle planning guidance, secondary plant and buried piping corrosion phenomena, and training/qualification. Specific efforts will include the following:

• Develop and assess electrical cable aging management strategies
• Continue development of long-term planning products for identifying replacement needs associated with major plant components
• Initiate project to develop advanced heat exchanger performance analysis techniques
• Continue projects to understand and deal with electrical relay aging issues, both protective and control relays
• Conduct high-density polyethylene materials (HDPE) research supporting efforts to develop a regulator-accepted code case permitting the use of HDPE in ‘Code’ applications
• Support research to identify and develop technologies for interrogating buried pipe and buried pipe coatings to discern their condition
• Support research applicable to the mitigation of buried pipe corrosion such as cathodic protection and protective coatings
• Develop reference materials and calculation tools pertaining to pipe and component erosion phenomena involving liquid droplet impingement, flashing, and cavitation

Estimated 2012 Program Funding

$8.0 million

Program Manager

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## Summary of Projects

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Project Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>P41.05.02.01</td>
<td>Buried Pipe Integrity (Roadmap) (QA)</td>
<td>Provides a utility forum for sharing procurement-related concerns and experience. Conducts research on actions to enhance vendor quality, develop common specifications, establish vendor surveillance, and detect counterfeit items. Supports an industry-wide approach to prioritization and management of obsolete items.</td>
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<tr>
<td>P41.05.02.02</td>
<td>Cable Aging Management (Roadmap) (QA)</td>
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<tr>
<td>P41.05.02.03</td>
<td>Procurement and Quality Issues (base)</td>
<td>Provides a utility forum for sharing procurement-related concerns and experience. Conducts research on actions to enhance vendor quality, develop common specifications, establish vendor surveillance, and detect counterfeit items. Supports an industry-wide approach to prioritization and management of obsolete items.</td>
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<tr>
<td>P41.05.02.04</td>
<td>Workforce Skills, Knowledge &amp; Assessment (base)</td>
<td>Develop training tools for engineers that can be delivered via computer-based training methodologies. Develop a methodology to validate knowledge and skills competencies and record successful completion in an industry database.</td>
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<tr>
<td>P41.05.02.05k</td>
<td>Standardized Task Evaluations for Portable Qualifications (supplemental)</td>
<td>Standardized task evaluations can help reduce or eliminate industry's duplication of effort in assessing an individual's competency and subsequent tracking of their status, which is an important element in the industry's portable qualification efforts. This program also provides guidelines for administering practical qualifications.</td>
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<tr>
<td>P41.05.02.06a</td>
<td>Cable Program (supplemental)</td>
<td>The Cable Program provides the nuclear industry with up-to-date information on cable aging and cable aging management practices from both a technical and regulatory perspective.</td>
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<td>P41.05.02.06b</td>
<td>MV Cable Qualification (supplemental) (New)(QA)</td>
<td>The effort will establish a qualified life for the submergence of medium voltage cable starting with Kerite HTK insulation. Okonite Okoguard pink EPR insulation will be added to the program at a later date.</td>
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<tr>
<td>P41.05.02.06d</td>
<td>Heat Exchanger Performance Users Group (supplemental)</td>
<td>The Heat Exchanger Performance Users Group offers a forum for industry personnel to improve the reliability, availability, and operational capability of heat exchangers through user group meetings and reports.</td>
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<td>P41.05.02.06h-</td>
<td>Seismic Qualification Reporting and Testing Standardization (supplemental) (QA)</td>
<td>The Seismic Qualification and Reporting and Testing Standardization (SQURTS) program addresses nuclear plant replacement part obsolescence and attendant seismic qualification issues. Nuclear power plant members share equipment seismic testing costs and test results. A “library-only” membership option provides access to past completed component test reports, but without participation in the active testing program.</td>
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<td>P41.05.02.07a</td>
<td>Buried Pipe Integrity Group (supplemental)</td>
<td>The Buried Pipe Integrity Group (BPIG) provides a forum for exchanging plant experience and supporting the implementation of advanced buried pipe assessment and mitigation technologies.</td>
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<td>P41.05.02.08a</td>
<td>CHECWORKS User Group - CHUG (supplemental)</td>
<td>The CHECWORKS User Group (CHUG) applies experience from about 260 nuclear plants worldwide to address existing and emerging issues related to flow-accelerated corrosion. CHUG provides training to new and reassigned personnel, maintains and provides updates to the CHECWORKS software, operates a dedicated website, and sponsors related research as requested by members.</td>
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<tr>
<td>P41.05.02.09c</td>
<td>Service Water Assistance Program (supplemental)</td>
<td>This project provides several forums for acquiring or sharing information pertinent to the successful operation and maintenance of nuclear plant service water systems.</td>
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<tr>
<td>P41.05.02.10c</td>
<td>PSE Equipment Performance, Monitoring and Degradation (base) (QA)</td>
<td>This project develops guidance on resolution of generic and specific aging issues, including identification, evaluation, and resolution of equipment and system aging issues. Both theoretical and practical guidance is developed including aging models, data, and acceptance criteria for components and cables; field guides for walk-downs and inspections; and development of condition monitoring techniques.</td>
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<tr>
<td>P41.05.02.11</td>
<td>Balance-of-Plant Corrosion (base) (QA)</td>
<td>Through guidance for effective buried pipe programs, risk-ranking software, and industry dialogue including interactive web, industry conferences, and other communication, this project develops tools for organizing and prioritizing nuclear power plant approaches to code acceptance of degraded piping. Through guidance for effective flow-accelerated corrosion programs, comprehensive software, and member dialogue including interactive web, industry conferences, and other communication, this project helps nuclear power plants to maintain strong stewardship over generation assets.</td>
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<tr>
<td>P41.05.02.12c</td>
<td>Engineering Technical Training Modules (supplemental)</td>
<td>Engineering computer-based training modules help meet increasing industry needs for position-specific and continuing training as new personnel are brought on board and as seasoned personnel take on new assignments. Existing training modules are being converted to computer-based training format and made available to supplemental program participants.</td>
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**Buried Pipe Integrity (Roadmap) (QA)**

**Key Research Question**

Many of the world’s nuclear power plants have been operating for about 40 years. As such, aging mechanisms have had sufficient time to potentially challenge the structural and leakage integrity of some components such as buried piping and tanks.

Leakage from plant components has the potential to contaminate groundwater. For example, about one-third of U.S. plants have leaked some amount of liquids into the soils surrounding piping, tanks, and pipe vaults. Although these leaks and spills have not posed a hazard to human health, they have impacted public confidence. The lack of effective tools to monitor and control degradation mechanisms could degrade public and regulatory confidence and increase the likelihood of regulatory action.
**Approach**

Research activities are coordinated across EPRI’s Plant Engineering and NDE Programs.

The Plant Engineering Program will provide buried pipe program owner guidance documents, reference materials, and upgraded risk ranking software (BPWorks™), and also will support the development of various American Society of Mechanical Engineers (ASME) Code Cases for repair/replacement activities. Training courses will be offered for newly assigned Buried Pipe Program owners to help ensure buried pipe management guidance is appropriately deployed in the field. Reference materials on cathodic protection will be developed to address buried pipe coatings needs. Through the Buried Pipe Integrity Group, EPRI will provide a forum for information exchange among nuclear plant personnel, vendors, and other stakeholders to identify and transfer best practices for buried pipe inspection and assessment.

The NDE Program will focus on the identification and assessment of existing robotic and inspection technologies, as well as the development of new robotic inspection technologies using remote field detection technology. Efforts will continue to identify, demonstrate, evaluate, and qualify inspection technologies suitable for buried pipe applications, with special emphasis on guided wave ultrasonic technologies. Further development of guided wave will focus on modeling of defects using actual buried pipe mockup and plant removed specimens.

**Impact**

*Equipment Reliability and Public Confidence:* When contaminated effluent leakage events have been reported, some plants have been challenged with public confidence concerns and equipment reliability impacts.

*Regulatory:* The U.S. Nuclear Regulatory Commission issued a “Groundwater Task Force Final Report” in June 2010 which indicates that it is considering regulatory actions for leakage of licensed materials at U. S. nuclear facilities. Non-U.S. regulatory bodies are monitoring U.S. industry and regulatory activities on buried pipe and groundwater protection. The NRC has stated that non-U.S. regulators are recommending that their licensees establish actions to monitor integrity of their buried piping and other structures, systems, and components.

*Maintenance costs:* Significant portions of a nuclear plant’s buried infrastructure (piping systems) were designed and installed without regard for eventual inspection and repair needs. As a result, inspection and repair of buried components are complex tasks that can complicate outage planning and execution.

*Limitations of inspection technology:* The nondestructive evaluation (NDE) technologies that can be applied to inspecting buried piping are limited. Technologies available to the oil and gas industries are typically not immediately transferrable to a nuclear plant’s inspection needs.

*Limitations on the availability of Codes and Standards:* Codes and standards applicable for the design of buried pipe and for the “fitness for service” of buried pipe do not exist. Work is needed to support ASME development of appropriate Code Cases.

*Industry commitments:* In the United States, the nuclear industry’s chief nuclear officers have committed to two initiatives to address groundwater protection and buried piping. The 2007 initiative on groundwater protection and buried piping was expanded to include all underground, normally inaccessible piping and underground tanks.

**How to Apply Results**

EPRI buried pipe research will result in the availability of technologies for inspection, analysis, repair, and mitigation of ongoing corrosion in buried infrastructure. This includes the following:
- Development and delivery of appropriate reference documents and training to support broad knowledge awareness around buried piping
- Development and transfer of new buried pipe inspection technologies, such as remote field NDE inspection robotics
- Identification and evaluation of existing technologies that may be directly applied or easily adapted for nuclear plant buried piping inspection
- Improved understanding regarding the usefulness of guided wave acoustic NDE technologies for buried piping screening
- Availability of repair and replacement alternatives for buried pipe applications, including high-density polyethylene (HDPE)
- Enhanced buried pipe risk-ranking technologies through updates to existing software

Selected reports and products may be prepared in whole or in part in accordance with the EPRI Quality Program Manual that fulfills the requirements of 10CFR50 Appendix B, 10CFR21 and ANSI N45.2-1977. Reports and products developed under the EPRI QA program will be marked and identified as such.

**Cable Aging Management (Roadmap) (QA)**

**Key Research Question**

Concerns exist that nuclear plant safety and reliability are being adversely impacted by premature electrical cable aging-related failures resulting from exposure to localized adverse environments and service conditions. As a result, plant owners and regulators are requiring the implementation of electrical cable aging management programs and processes. Improvements to cable aging management processes, condition monitoring techniques, acceptance criteria, and aging models are necessary to support resolution of cable aging concerns. Without such improvements, cable aging management programs may have limited effectiveness.

**Approach**

_Ease of Cable Aging Management Activities_

Building on the two aging management program implementation guides already published for medium-voltage and low-voltage cable, a third guide will be issued for instrumentation and control cable. Implementation support will be provided under a 2011 to 2012 project to resolve issues that arise. In addition, a matrix linking failure mechanisms to the applicable test by insulation type will be developed in 2011 to support cable condition monitoring and troubleshooting needs.

Medium voltage separable connectors will be qualified for safety-related use during 2011 and 2012 to allow cables to be easily disconnected from their loads for testing.

_Advanced Test Practices and Aging Models_

Through a pilot project started in 2010, EPRI will produce age-accelerated medium-voltage cable specimens. These specimens will permit accelerated testing and forensics, accelerated development of aging models, and development of improved condition monitoring techniques.

For cable types from plants in service in the 1970s, forensic evaluation of failed cables will continue for 2 years. Results will provide insights into correspondence of condition monitoring to cable breakdown strength.

In 2011 and 2012, medium voltage test results will be gathered and assessed to develop improved acceptance criteria. Failure data also will be formally gathered and assessed.

To support the development of advanced testing practices/technologies, EPRI’s Nuclear Sector will coordinate activities and research with the Power Delivery and Utilization Sector.
Submerged Medium Voltage Cable Qualification

EPRI is initiating a submergence qualification project based on IEEE Std 323-1974 qualification methodology to provide a basis for allowing medium-voltage cables to be submerged. The qualification activities will be applied to modern cable types and those known to never have failed in submerged conditions. Manufacturer- and insulation-specific qualifications will be performed; generic insulation type qualification is not possible. Because certain cable types, such as most black ethylene propylene rubber (EPR) and butyl rubber, have experienced water related degradation at about 30 years, submergence qualification will not be attempted.

Susceptibility of Low-Voltage Cable to Wet Aging

Little information is available on longevity of low-voltage cable under wet and submerged conditions. In 2011, research will be performed that gathers existing information on submergence of low-voltage cable degradation and its effects on longevity.

Impact

Safety: A nuclear plant’s safety-related electrical cable infrastructure must be inherently reliable and maintained as such. Cable failures have challenged safety-related system readiness.

Equipment Reliability: Medium-voltage off-site feed cable and safety-related motor feed cable failures have caused outages of 2 to 3 weeks in duration. Medium-voltage cable replacement is costly and generally difficult.

Regulatory: Regulatory confidence has been eroded. The U.S. Nuclear Regulatory Commission (NRC) is requiring that cable condition monitoring be put in place. Non-U.S. regulators are following the NRC lead regarding aging cable systems. While some differences in cable materials and installation practices exist from country to country, deterioration of low- and medium-voltage cables is a concern to the world nuclear community.

Limitations of inspection technology: The design of nuclear plant cables limits the types of tests that may be used. While standardized, the tests provide limited information on long-term function of the cable and cannot estimate remaining life. Condition monitoring acceptance criteria is preliminary in nature and needs further improvement to assure failures are avoided and good cables are not replaced.

Limitations of applicable standards: The Institute of Electrical and Electronics Engineers (IEEE), the Insulated Cable Engineers Association (ICEA), and the Association of Edison Illuminating Companies (AEIC) have established cable testing and manufacturing standards, but these standards provide little information on aging management programs.

How to Apply Results

This research effort will result in knowledge and methodologies to effectively implement cable aging management programs. Specifically, the following will be provided:

- Aging management program implementation guidance for instrumentation and control cables. Medium- and low-voltage cable aging management program guidance has previously been provided.
- Recommended testing methodologies applicable to specific cable types and vintages.
- Advanced testing and predictive capabilities.
- Additional understanding of electrical cable failure modes allowing improved testing methodology and acceptance criteria to be developed.
- Useful research results/products aiding in the implementation of aging management programs. This includes test applicability matrices, qualification of separable connectors, and ongoing EPRI technical support.

Selected reports and products may be prepared in whole or in part in accordance with the EPRI Quality Program Manual that fulfills the requirements of 10CFR50 Appendix B, 10CFR21 and ANSI N45.2-1977. Reports and products developed under the EPRI QA program will be marked and identified as such.
Procurement and Quality Issues (base) (065801)

Key Research Question

Supporting procurement of spare and replacement items required for operation and maintenance involves a number of specialized engineering processes such as safety classification, commercial grade dedication, and equivalency evaluation. Existing processes must be adjusted occasionally to address considerations such as critical spares, obsolescence, and emerging regulatory expectations.

Issues directly related to the quality of procured items continue to impact plant reliability. Poor product quality may be due to deficiencies originating in both buyer and supplier organizations. Identified contributors to poor quality include loss of supplier expertise and understanding, inadequate specification development and communication of technical requirements, increasing reliance on foreign materials and manufacturers, and the vintage of operating plant equipment and its design. Additional focus and guidance are needed to better understand and address the root causes of poor product quality. In particular, repair and replacement of large equipment have been problematic. Collection and analysis of data related to failure of procured items is needed to more effectively identify and address problematic trends.

Approach

This project consists of three principal elements:

1. Continuing support of utility forums including the Joint Utility Task Group (JUTG) and the Nuclear Supply Chain Strategic Leadership (NSCSL) to identify and address technical procurement and supply chain concerns. Continued coordination with the Nuclear Procurement Issues Committee (NUPIC), Nuclear Utility Obsolescence Group (NUOG), and ASME NQA-1 Committees

2. Development of new guidance and information to address technical supply chain issues, such as mitigating the use of counterfeit and fraudulent items, adapting commercial grade dedication methodology for use in accepting commercial-grade software, defining and implementing processes to improve product quality and address obsolescence

3. Development and maintenance of technical procurement training courses and products

Impact

- Stay current with regulatory expectations and emerging regulatory positions and guidance
- Maintain current procurement engineering processes such as functional safety classification, commercial-grade item dedication, reverse engineering, and equivalency evaluation that permit spare and replacement item needs to be met in a timely and cost-effective manner
- Development of standard approaches to address emerging issues such as supplier foreign material exclusion practices
- Improve equipment reliability and performance through better understanding and improvement of product quality issues
- Enable implementation of programmatic solutions to prevent the use of counterfeit and fraudulent items, improve the quality of procured items, address obsolescence, and improve availability of critical spares
- Effective training in areas related to procurement such as warehousing, receipt inspection, procurement engineering, audit technical specialists, ASME procurement, and foreign material exclusion

How to Apply Results

Members use project information to enhance procurement engineering programs, improve communication with suppliers, improve specification development, identify and prioritize obsolescence issues, identify and address critical spares needs, and improve product quality.
Workforce Skills, Knowledge & Assessment (base) (065802)

Key Research Question

Turnover of nuclear plant technical staff will be significant in the next 5 to 10 years. During the same timeframe, nuclear utilities will be training personnel to support construction and operation of new nuclear plants. Pressures to reduce operations and maintenance costs often result in impacts to training budgets. Also, fewer and fewer skilled supplemental workers are available for working power plant outages. Often, as the supplemental outage workers travel from plant to plant, they receive the same training and examinations at each plant. In this environment, nuclear plants need cost-effective methods to develop and deliver high-quality, effective training and be able to quickly validate the skills competencies of the supplemental workers.

Approach

Computer-based training technology can improve the effectiveness of engineering training and reduce the costs associated with providing this training. Plant Support Engineering (PSE) is engaged in developing computer-based training for nine engineering fundamentals topics included in the Institute of Nuclear Power Operations (INPO) guidelines for orientation of new engineers. PSE also is transferring materials related to its Standardized Task Evaluations onto NANTeL; these knowledge examinations and skills proficiency demonstration examinations can be administered to supplemental workers to verify skills competencies. Any power plant with access to NANTeL can download the examination materials, administer the examinations, and record an individual's successful completion within the NANTeL system. This will serve as a basis for accepting prior qualification testing in lieu of re-administering knowledge and skills training and examination.

Impact

Stations are using the engineering computer-based training (CBT) modules in lieu of classroom-conducted training sessions to provide orientation training to new engineers. This results in fewer disruptions for engineering organizations and also frees up instructor time associated with class lecture and examination preparations.

By verifying prior completion of knowledge and skills qualification-related examinations using the NANTeL or EPRI databases, utilities are experiencing cost savings associated with streamlining the in-processing, training, and qualification of supplemental personnel.

How to Apply Results

The content of the engineering training modules will be available both from EPRI as well as an industry web-based training delivery system (INPO’s NANTeL system) where students can complete the CBT and take the course examination. For qualification of outage supplemental personnel, knowledge examinations and skills proficiency demonstration examinations can be accessed via NANTeL, administered, and results recorded within the NANTeL database. Once the record of successful completion is recorded in the database, the record of successful completion can be used by other utilities as a basis for exempting their examination requirements when the supplemental worker arrives at their station for outage work.

Standardized Task Evaluations for Portable Qualifications (supplemental) (005354)

Key Research Question

Utility and supplemental personnel are critical to a plant's ability to conduct quick-turnaround refueling outages. Recent trends show a disproportionate occurrence of events associated with supplemental personnel. EPRI's Standardized Task Evaluation program (formerly called the Task Proficiency Evaluation program) provides a proven knowledge and skills evaluation process to efficiently evaluate the capabilities of entry-level, incumbent, and contractor personnel. The program is working within the framework of the Nuclear Energy Institute's Workforce Issues initiative and with the Institute of Nuclear Power Operations' National Academy for Nuclear Training e-Learning (NANTeL) portable qualification project to establish an infrastructure that ensures the competency of the industry's craft and technician workforce. The standardized task evaluations are not
restricted to U.S. applications; utilities in France, South Africa, and Canada have expressed interest in adapting such evaluations to their own countries.

Additionally, the need to implement an industry consensus for standards for administering practical qualifications has been identified.

**Approach**

Standardized task evaluations are used to ensure that the workforce is competent to reliably perform the many tasks associated with operating and maintaining industry facilities. Program participants continue to collaboratively develop evaluation tests that support high-priority industry needs. More than 60 evaluations have been developed within the STE Program and are available on www.epri.com. These evaluations, which cover tasks performed by utility and supplemental workforce during outage work, include a task analysis and objectives, written test items, and performance (practical) evaluations. Additionally, the results from these evaluations are documented into a national registry of personnel who have demonstrated competency in specific task areas.

**Impact**

Participating organizations can use the STE evaluations to assess the competency of their workforce, thus eliminating unnecessary training or retraining. Further, because the modules were developed according to EPRI's Administration Protocol for Portable Practicals (AP3), they reflect industry consensus standards for administering practical evaluations.

**How to Apply Results**

Training and maintenance managers can directly access the STE modules through multiple channels:

- Identifying and downloading evaluations through www.epri.com for use by participating organizations with specific task needs
- Accessing evaluations available on INPO's NANTEL System (http://www.nantel.org) for use by participating organizations for on-line testing and for reporting results
- Accessing the registry of qualified personnel on www.epri.com
- EPRI Report 1021072, *Administration Protocol for Portable Practicals (AP3) in Standardized Task Evaluations*

**Cable Program (supplemental) (005614)**

**Key Research Question**

The aging of medium- (4160 V+) and low-voltage (<1000 V) cable systems has raised regulator interest in the ability of these systems to perform their safety and support functions. This program supports the industry by disseminating information on how cable systems age and the best means for detecting and mitigating aging effects.

**Approach**

This project offers a forum to the industry to address issues related to cable-system-aging management through the Cable User Group, which transfers cable research results to members in practical terms and supports the identification, discussion, and resolution of cable system issues. Feedback from the Cable User Group meetings is used to guide cable research on aging model and condition monitoring development. In 2012, the focus of meetings will continue to be on resolution of hurdles to the implementation of cable aging management.

As funding permits, technical reports will be generated on cable-aging-related topics of interest to program members. In 2012, the Cable Program will develop computer based training packages that describe cable aging management methods and technology. These will only be available to Cable Program members.
In addition, the Program provides access to Electric Power Research Institute (EPRI) personnel conversant in cable-aging management issues allowing utility personnel to discuss plant problems and their resolution.

Impact

Benefits accrue through direct access to experts in cable-aging management and cable condition monitoring. Participants also help shape the path of cable-aging management research to ensure its pertinence to nuclear plant applications.

How to Apply Results

Cable User Group attendees have direct access to EPRI and industry experts in condition monitoring, cable manufacture and installation, and the discussion of the latest industry issues and practices.

Research results are provided in EPRI research reports and meeting minutes from the Cable User Group meetings.

MV Cable Qualification (supplemental) (QA)

Key Research Question

Submergence of medium-voltage (4160 V+) cables has raised regulatory concern regarding the ability of these cables to perform their safety and support functions. EPRI is developing an environmental qualification program that could allow continued use of cables subjected to long-term submergence.

Cable failures in non-safety applications have caused plant shutdowns and trips, primarily traced to pre-1975 cables. While later-generation Kerite brown ethylene propylene rubber (EPR) cables and Okonite pink EPR cables have not experienced submergence-related failures, the Nuclear Regulatory Commission (NRC) has determined that submergence was not part of the original design. Accordingly, the NRC is requesting that nuclear plants licensees drain—and keep drained—all manholes, vaults, and ducts. For physical and economic reasons, not all plants can do so. Cable relocation into new ducts could cost $5 million or more for design and installation. The alternative is to develop an environmental qualification for energized cables that have been submerged either continuously or for long durations.

Approach

This project will develop an environmental qualification for submergence of non-shielded brown Kerite medium-voltage cable. A separate project will develop a similar qualification program for Okonite non-shielded pink EPR cable.

The qualification will be based on two methods described in IEEE Standard 323-1974: Operating Experience (Section 5.2) and Ongoing Qualification (Section 5.5). The methodologies defined in these sections are endorsed by the NRC in Regulatory Guide 1.89, Revision 1 without exception.

Environmental qualification of Kerite cable for harsh environment applications exists under the manufacturers’ environmental qualification. That qualification, however, does not cover long-term, normal condition submergence of energized cables. The proposed project, therefore, will develop a qualification for segments of energized cables subject to long-term submergence.

Although the submerged portions of cables do not experience a change in environment as a result of design basis accidents, it is possible that they would be de-energized by a loss-of-offsite power and re-energization concurrent with a design basis accident. The project will simulate re-energization and the associated switching surges to evaluate such scenarios.

The “operating experience” portion of the qualification will be based on assessment and testing of a 30-year-old cable removed from an operating power plant that has been submerged for a period of time. Once the condition of this cable is fully characterized, a qualification by “operating experience” will be established for 30 years. The tests will include breakdown testing to determine the ratio of the breakdown voltage to the operating voltage.
To establish “ongoing qualification,” the breakdown fault will be removed from the cable and 30-ft. specimens will be prepared and subjected to long-term energized accelerated aging.

The ongoing qualification and the operating experience qualification will determine the qualified life of the cable, which will be incremented for each year of satisfactory function and periodic test results under accelerated submerged conditions. For example, after the first year of laboratory aging, the qualification would result in a 32- to 40-year qualified life. After the second year, the qualified life would increase to 34 to 50 years, and so on.

Impact

Plants with non-shielded brown Kerite medium-voltage cable will gain access to a qualification demonstrating that the cables can withstand long-term submergence while subjected to operating voltage. Conversely, if the qualification program identifies end-of-life at some point during testing, nuclear plant owners will know when to plan for cable replacement.

Participation would enable nuclear plant owners to

- save millions of dollars in design and implementation costs for cable relocation if cable ducts and manholes cannot be drained,
- determine a qualified life for cables that can’t be tested using available condition monitoring techniques, and
- assess whether periodic or continuous submergence causes unacceptable shortening of cable life.

How to Apply Results

The results can be used to establish a period for which the cable can remain submerged without undue degradation. This will be the base report that will be followed by periodic reports on the accelerated, laboratory-based, submergence qualification that will extend the base period.

Selected reports and products may be prepared in whole or in part in accordance with the EPRI Quality Program Manual that fulfills the requirements of 10CFR50 Appendix B, 10CFR21 and ANSI N45.2-1977. Reports and products developed under the EPRI QA program will be marked and identified as such.

2012 Products

<table>
<thead>
<tr>
<th>Product Title &amp; Description</th>
<th>Planned Completion Date</th>
<th>Product Type</th>
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</thead>
<tbody>
<tr>
<td>Operating Experience Based Submergence Environmental Qualification of Kerite HTK Insulated</td>
<td>12/21/12</td>
<td>Technical Report</td>
</tr>
<tr>
<td>Cable: The results of the testing and assessment of a Kerite HTK insulated, non-shielded</td>
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<tr>
<td>cable will be provided that will form the basis of the submergence environmental qualification for the duration of the installed-operating period of the cable.</td>
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Heat Exchanger Performance Users Group (supplemental) (045060)

Key Research Question

This project offers a forum for industry personnel to improve the reliability, availability, and operational capability of heat exchangers (with the exception of steam generators). The project allows participants to share operational experiences and to resolve technical issues associated with heat exchangers.

Approach

- Information sharing with Heat Exchanger Performance User Group (HXPUG) members
- Technical investigations and research on issues related to heat exchangers that are a high-priority to the group
- Annual meetings and quarterly webcasts to share information and keep membership engaged
- Availability of information sharing through website and surveys to benchmark other utilities in the operation and maintenance of heat exchangers
- Collaboration on common industry problems and solutions as they relate to heat exchanger testing and performance

Impact
The project offers an estimated cost savings of $25,000 to $100,000 annually per plant using the information available through the HXPUG group facilitating the following:

- Improved testing methods through collaboration with industry personnel and use of EPRI guidelines
- Avoided costs through the reduction of unnecessary heat exchanger testing
- Improved plant performance through improved thermal performance of the feedwater heater, moisture separator reheater, and condenser
- Improved efficiency in heat exchanger program implantation and maintenance practices from guidance issued by the group
- Collaboration on common industry problems and solutions as they relate to heat exchanger testing and performance

How to Apply Results
Participating members in the Heat Exchanger Performance User Group can implement the lessons learned and information generated in this group. Examples include improved heat exchanger performance testing methods, guidance for heat exchanger program owners and system owners for maintaining exchanger reliability, and avoiding issues experienced at other plants.

Seismic Qualification Reporting and Testing Standardization (supplemental) (QA) (004414)

Key Research Question
Component obsolescence remains an industry challenge in the maintenance of nuclear plants, and with the prospect of even longer-term operation, replacement parts for existing facilities will continue to drive costs higher. Component qualification to individual utility design specifications constitutes a significant cost in the dedication of replacement parts. The Seismic Qualification and Reporting and Testing Standardization (SQURTS) program, conceived in the early 1990s to address nuclear plant component obsolescence issues, applies the economies of scale of member utility owners and operators to share component seismic testing specifications, costs, and test results.

Approach
Seismic testing conducted through the SQURTS program involves component testing at a service vendor facility nominally 8 weeks per year. Utility participation is critical in developing generic test specifications and component test procedures, witnessing test performance and approving test reports, and participating in user meetings.

Members also have access to a seismic test report database comprised of SQURTS-performed test results and individual member test reports (should they choose to enter them). EPRI provides project management for the program, including contracting test services, budget forecast, tracking and reporting, database management, test report distribution, user communication, initiative coordination, and member meetings.

EPRI provides an option for membership in the Library only; this provides access to past completed component test reports. However, participation in the active testing program is not permitted if only this option is selected.
Impact
The program enables members to reduce component seismic testing costs through economies of scale and the shared database that members can use for component evaluations.

How to Apply Results
Results are generally implemented immediately by participants. Testing is driven by the needs of the members, and the database is accessed on member demand. Design engineers, seismic subject matter experts, and procurement engineers are typical customers of the SQUIRTS program.

Selected reports and products may be prepared in whole or in part in accordance with the EPRI Quality Program Manual that fulfills the requirements of 10CFR50 Appendix B, 10CFR21 and ANSI N45.2-1977. Reports and products developed under the EPRI QA program will be marked and identified as such.

Future Year Products

<table>
<thead>
<tr>
<th>Product Title &amp; Description</th>
<th>Planned Completion Date</th>
<th>Product Type</th>
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<tbody>
<tr>
<td>SQUIRTS Database Enhancements: SQUIRTS Database Enhancements will be issued as a new release of the current v2.0. It will be QA. Enhancements include further functionality based upon user feedback and streamlining of new data input administrative requirements.</td>
<td>06/15/12</td>
<td>Technical Resource</td>
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Buried Pipe Integrity Group (supplemental) (068003)

Key Research Question
Buried piping has become a more visible issue with regulatory emphasis on material aging issues and plant life extension requirements. Due to aging of external protective coatings as well as a multitude of internal and external piping corrosion mechanisms, each nuclear plant’s buried pipe infrastructure is susceptible to leaks and failures. Leaks can be difficult to locate. Also, some may contribute to contamination of groundwater. All buried pipe leaks can be expensive to repair due to accessibility issues. Some leaks may require a plant shutdown for repair. A broad-based and comprehensive program is needed to support plant efforts to reduce the probability and consequences of failure to an acceptable level.

Approach
The Buried Pipe Integrity Group (BPIG) provides a forum for exchanging plant experience and provides counsel and recommendations as to the implementation of advanced buried pipe assessment and corrosion mitigation technology.

Impact
- Assess the health of existing piping and determine remaining service life.
- Develop methods to repair buried piping in situ.
- Select and qualify alternate materials and service environments (for example, high-density polyethylene, water treatment, and cathodic protection).
- Provides a forum for the buried pipe services industry to interface with buried pipe engineers from participating utilities.
- All United States Nuclear utilities and several international participants were members of the BPIG in 2011.
How to Apply Results

Members will apply the results of this project in developing effective buried pipe integrity programs and in assessing and maintaining existing buried piping systems.

2012 Products

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<tbody>
<tr>
<td>Buried Pipe Integrity Group Meeting</td>
<td>02/29/12</td>
<td>Workshop, Training, or Conference</td>
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<tr>
<td>Buried Pipe Integrity Group Meeting</td>
<td>07/31/12</td>
<td>Workshop, Training, or Conference</td>
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CHECWORKS User Group - CHUG (supplemental) (052460)

Key Research Question

Although industry efforts have been effective in reducing the number of piping and equipment failures caused by flow-accelerated corrosion (FAC), piping and components remain susceptible to degradation as plants age. Refined guidance on where to inspect, chemistry improvements to reduce damage rates, and material upgrades for replaced components is needed to offset challenges posed by economic considerations, short outages, and personnel turnover.

Mechanical pipe degradation caused by cavitation, liquid droplet impingement, flashing, and solid particle erosion can affect personnel safety and cause power losses. Damage caused by these mechanisms is nonlinear with time and often results from off-normal operations.

Approach

The CHECWORKS User Group (CHUG) applies experience from approximately 260 nuclear plants worldwide to address existing and emerging issues related to flow-accelerated corrosion. CHUG provides training to new and reassigned personnel, maintains and provides updates to the CHECWORKS software, operates a dedicated website, and sponsors related research as requested by members. This includes research and guidance to address detection of erosion damage in high-energy piping systems.

Impact

- Minimize risk to personnel by reducing the probability of large-bore pipe ruptures
- Reduce forced power reductions through FAC mitigation
- Reduce the number of piping inspections through improved guidance, predictive software, and piping replacements (some plants have observed a 25% reduction over a 6-year period with average estimated savings of $2,150,000 per outage per plant)
- Develop practical tools to optimize FAC programs, such as NDE data evaluation techniques and application guidance for material alloy analyzers that can be used to reduce the number of inspections
- Identify new FAC vulnerabilities before leaks occur
- Train new and reassigned plant engineers on FAC identification, monitoring, and mitigation
- Facilitate interaction with industry peers and ease access to reports and other information
How to Apply Results

Members use CHECWORKS to predict plant degradation and reduce unneeded piping inspections. Technical guidance related to pipe alloy analyzers, erosion, and low-temperature FAC provide members with information to optimize inspection locations. Members can access training for new and reassigned personnel and can use the CHUG website to facilitate communications between FAC personnel at member plants.

2012 Products

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<tr>
<td><strong>Demonstration of New Multiple Inspection Data Evaluation Methods:</strong> The evaluation of inspection data is an important part of a FAC program. Recently, EPRI has developed several methods that appear to be improvements on the current ways of evaluating data from two or more inspections. It is planned that some of these methods will be included in CHECWORKS™ Version 4.0 - next major release. This project will compare the predictions of the currently used methodologies with the Least Squares Slope method and the Slope of the Minima method using selected lines from one or more plant databases.</td>
<td>01/01/12</td>
<td>Technical Resource</td>
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<tr>
<td><strong>Update on FAC Weld Attack:</strong> This project should provide the knowledge and expertise to help protect against failures caused by preferential weld attack and help to design inspection programs to protect against this form of degradation. It also will increase the store of knowledge related to weld attack and increase the visibility of a BOP-wide vulnerability to leaks and ruptures.</td>
<td>01/01/12</td>
<td>Technical Update</td>
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<td><strong>Review of the CHECWORKS/SFA Line Correction Factor Methodology:</strong> The determination of the Line Correction Factor (LCF) is a key element in performing the CHECWORKS™ Pass 2 predictions. This methodology used has been unchanged since the late 1980s and has never been challenged by other possible methods. This project will provide a detailed description of the current methodology used to calculate the LCF, define other possible methodologies for making this calculation, compare the results of predictions using the current method with the newly defined methods for one or more plant databases, and recommend the methodology that will be used in Version 4.0.</td>
<td>01/01/12</td>
<td>Technical Resource</td>
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<td><strong>2011 State of the Fleet FAC Program Assessments:</strong> This project provides insight from a variety of plants as to the status and overall effectiveness of FAC program implementation and the associated challenges by performing an overall program review, analogous to a detailed self-assessment, at five sites in 2011 and 2012. The consolidated report would assist FAC engineers in the development of long-range plans, identifying industry “best practices”, implementation of program process improvements, and identification of declining program trends.</td>
<td>03/31/12</td>
<td>Technical Update</td>
</tr>
<tr>
<td><strong>Revision of CHECWORKS/SFA to version 4.0:</strong> The revision of CHECWORKS/SFA to version 4.0 will include the expanded use of the component connectivity feature, the incorporation of new data evaluation methods, additional custom report options, and the new erosion analysis module.</td>
<td>12/31/12</td>
<td>Software</td>
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<td><strong>Study of the Material Form Effects on FAC:</strong> Understanding the role of material form will help better focus FAC inspection programs. It also would open the possibility of developing methods to reduce the susceptibility of carbon steel components to FAC.</td>
<td>12/31/12</td>
<td>Technical Update</td>
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Service Water Assistance Program (supplemental) (070808)

Key Research Question
Nuclear plant service water systems are complex systems that can occasionally provide engineers with day-to-day challenges. Service water system performance can be improved by providing engineers with access to a collaborative environment where thoughts, ideas, and solutions can be readily available and shared.

Approach
Project participants gain access to the Service Water Assistance Program (SWAP) web page, which includes the SWAP technical library, SWAP surveys, a listing of SWAP coordinators, and easy access to SWAP products. Members also can query the nuclear industry on service water problems through industry SWAP surveys. Members also can obtain personal assistance from EPRI personnel via phone or email. EPRI also sponsors an annual meeting of SWAP coordinators for sharing operating experience and discussing solutions to field problems. Training courses for service water engineers are available on heat exchangers, piping, and corrosion mechanisms.

Impact
The SWAP technical library, which contains more than 2350 documents on 300 subjects, can be searched by subject, author, and/or date. Many of the titles are available for download as PDF files. The annual meeting and access to EPRI experts provide opportunities to discuss plant issues and identify potential solutions.

How to Apply Results
The SWAP coordinators serve as the point of contact between the EPRI SWAP program and the plant. Active participation facilitates technology transfer and maximizes benefits received. A SWAP Coordinator’s Manual helps guide access to SWAP resources and services.

2012 Products

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<tbody>
<tr>
<td>Annual Service Water Assistance Program Meeting</td>
<td>08/31/12</td>
<td>Workshop, Training, or Conference</td>
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Future Year Products

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<td>Annual Service Water Assistance Program Meeting</td>
<td>08/30/13</td>
<td>Workshop, Training, or Conference</td>
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PSE Equipment Performance, Monitoring and Degradation (base) (QA) (065799)

Key Research Question
Material degradation reduces the inherent design margins in plant equipment. Unanticipated or unaccounted for degradation has led to equipment failures, affecting critical plant functions and representing a major threat to achieving equipment reliability goals. In many cases, aging models and condition monitoring techniques do not exist, and where they do they exist, readily understandable acceptance criteria may not exist. When
replacements are necessary, superior materials or components may not have been identified or recognized as acceptable for nuclear service.

**Approach**

This project develops guidance on resolution of generic and specific aging issues, including identification, evaluation, and resolution of equipment and system aging issues. Both theoretical and practical guidance is developed including aging models, data, and acceptance criteria for components and cables; field guides for walk-downs and inspections; and development of condition monitoring techniques. New materials such as plastic piping are evaluated for use in nuclear applications. Information is disseminated through industry meetings such as the Equipment Reliability Forum.

**Impact**

- Avoid in-service failures and potential plant outages through improved detection of component degradation
- Predict remaining life and evaluate the seriousness of equipment degradation through access to aging data, interpretation of that data, and acceptance criteria
- Enhance ability to identify, assess, and manage aging through field guides and aging management guidance
- Assure broad distribution degradation research results and information through meetings such as the Equipment Reliability Forum
- Improve assessment techniques to identify components and materials prone to early aging

**How to Apply Results**

Because multiple tasks are performed under this project, member applications vary. Field guides and aging management guides are applied directly. In other cases, information is provided in the Equipment Reliability Forum to promote understanding and availability of research results, or incorporated into training courses.

Selected reports and products may be prepared in whole or in part in accordance with the EPRI Quality Program Manual that fulfills the requirements of 10CFR50 Appendix B, 10CFR21 and ANSI N45.2-1977. Reports and products developed under the EPRI QA program will be marked and identified as such.

**Balance-of-Plant Corrosion (base) (QA) (052459)**

**Key Research Question**

Corrosion in the secondary systems of nuclear plants can result in annual costs of up to $25 million per plant. These costs are primarily associated with corrosion product transport in boiling water reactors, flow-accelerated corrosion in steam and feedwater systems of all types of nuclear plants, degradation in service water systems, and degradation in raw water heat exchangers, including the main condenser. Without intervention, these costs will increase as plants age. A specific issue impacting plants considering life extension is the health of buried piping. Inspection, repair, and replacement of these lines can be extremely expensive, particularly in buried lines that pass beneath buildings and equipment.

**Approach**

The Balance-of-Plant Corrosion (BOP) program develops the technology, tools, and software to cost-effectively address corrosion issues in the BOP portions of nuclear power plants. BOP corrosion has spearheaded the development of improved inspection technology to assess the health of secondary systems and the use of alternate materials to reduce cost and improve the service life of BOP piping and components.

**Impact**

- Data and methodology to allow use of high-density polyethylene as an option to repair or replace corroding steel pipe in Class 3 service water systems.
Computer-based modules to train new and reassigned plant personnel on the most common forms of corrosion in the secondary systems of nuclear plants.

Mitigation technologies to address buried pipe degradation.

Risk-ranking software tool to prioritize buried pipe inspections. This tool calculates the probability of a leak occurring in each segment of buried piping, considers the consequences of a leak at each specific location, and derives a calculated “risk.”

Robust inspection technology and guidance to assess the health of large-diameter and intermediate-diameter buried piping. The “proof-of-concept” of a large-bore pipe inspection tool (3-foot to 12-foot diameter) was completed in 2008. An intermediate pipe diameter tool is currently in development and scheduled for “proof-of-concept” testing at a nuclear power plant during the spring 2011 outage season.

Research to support the American Society of Mechanical Engineers (ASME) in developing “design rules” and “fitness-for-service” rules for buried pipe.

How to Apply Results

Data supporting the use of high-density polyethylene as a repair and replacement option for corroded steel service water systems has been provided to ASME and is available for members to incorporate into code cases. Computer-based training modules are available to members and can be modified for plant-specific information.

Selected reports and products may be prepared in whole or in part in accordance with the EPRI Quality Program Manual that fulfills the requirements of 10CFR50 Appendix B, 10CFR21 and ANSI N45.2-1977. Reports and products developed under the EPRI QA program will be marked and identified as such.

Engineering Technical Training Modules (supplemental) (005556)

Key Research Question

As new engineering personnel are brought into the workforce and as individuals are moved into different assignments, position-specific training modules can accelerate their acclimation and value to the nuclear industry. If training modules are not readily available to meet the needs in these cases, organizations typically have to develop specialized courses (not cost effective in most cases) or find course offerings available elsewhere in the industry. Unless the topic is one that is routinely offered, the availability of a course will not likely meet scheduling needs.

Approach

EPRI’s computer-based training (CBT) modules can be used for position-specific and continuing training needs for selected topics. Forty-five modules were developed several years ago using PowerPoint™ slides and companion Word™ documents. This information is being used as a basis for the new modules; however, the content is being updated and photographs and graphics are being used along with interactive features to enhance the training. The CBT modules are much more in line with expectations of new engineers entering the workforce. Twenty-two modules were previously converted, and more will be converted in 2011. Modules are being selected on a priority basis to meet industry needs.

Impact

Based on today’s demographics, personnel turnover in the nuclear power industry will be quite significant in the coming years. The need for this training is increasing as new personnel are hired and seasoned employees are reassigned as a result of personnel turnover. These CBTs have the following attributes:

- Can be downloaded for use when needed from http://www.epri.com
- Provide basic position-specific training for new hires and individuals reassigned to new jobs
- Can be used for continuing training

How to Apply Results

Engineering supervisors and training personnel should be aware of these modules and use them for position-specific and continuing training as appropriate.