

Nondestructive Evaluation Program

Program Overview

Program Description

The Nondestructive Evaluation (NDE) Program develops technologies and procedures to quickly, accurately, and cost-effectively inspect and characterize nuclear component condition and guide strategic decisions on whether and when to replace, repair, or continue operation. Research results also inform regulatory actions related to pre-service and in-service inspections.

Industry Needs and Issues Addressed

- Nondestructive evaluations capabilities that can characterize and analyze nuclear plant materials and component condition over a plant's lifetime in response to changing operational conditions
- Technical support to guide regulatory and code activities related to pre-service and in-service inspections
- Reliable inspection and evaluation techniques that can inform strategic decisions on whether and when to replace, repair, or continue operation of components
- Technical support and resources to expand and improve the supply of qualified NDE workers in the nuclear industry

Impact

- Technical support to multiple industry and Electric Power Research Institute (EPRI) materials analysis programs
- Cost savings based on enhanced NDE inspection, training, and field support
- Shortened plant outages through application of NDE technologies, training, and regulatory/code support, leading to savings of \$1 million or more per plant per day saved
- Increased confidence in NDE diagnostic capabilities during extended plant operation, supporting regulatory approval of license renewal or extension
- Strengthened NDE workforce through industry-focused training and central qualification resources

Key Accomplishments

- Application of phased array technology to in-service inspection applications
- NDE technology for nickel alloy dissimilar metal butt welds
- World leader in qualification of NDE personnel, equipment, and procedures for nuclear applications
- Training products uniquely focused to nuclear power plant applications
- Development and application of risk-informed/in-service inspection methodology
- Rapid response to emerging NDE and materials issues

Current Year Objectives

- Condition assessment and examination guidance of dissimilar metal welds with advanced ultrasonic testing and eddy current testing sensor technology
- Qualification program for NDE of reactor pressure vessel head penetrations
- Inspection methods and procedures for examining overlaid cast stainless steel
- Remote visual examination technique reliability
- Evaluation of ultrasonic-guided wave technology
- NDE for groundwater protection issues, buried piping, and selective leaching
- Conversion of risk-informed programs to applicable engineering code standards
- Collaboration with educational institutions to build NDE workforce and provide hands-on inspection experience

Industry Involvement

- Estimated 2009 funding: \$8.6

Program Technical Lead

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Summary of Projects

| Project Number | Project Title | Value |
|----------------|-------------------------------------|--|
| | NDE Core Competencies | The NDE Program core competencies are a key central resource to all industry segments. Specific activities in the NDE program work plan sustain and coordinate the resources with industry initiatives. These initiatives include the Materials Reliability Program, the Boiling Water Reactor Vessel and Internals Project, the Steam Generator Management Program, and the Performance Demonstration Initiative (PDI). |
| | Industry Material Issues | Aggressive NDE research and development is essential to address certain materials and certain conditions of access and geometry that now preclude nondestructive evaluation from achieving its objectives. |
| | NDE Subscriber Requested Assistance | The subscriber-requested assistance (SRA) program provides technical assistance to NDE program members in the application of EPRI NDE technology as well as documenting member experiences using EPRI NDE technology. |
| | Risk Informed Inspection | A comprehensive program of products and activities has been organized to address this critical barrier. Risk-informed in-service inspection products within the NDE target are complementary to NDE and structural integrity elements of other issue programs such as the Materials Reliability Program (MRP), the Boiling Water Reactor Vessel and Internals Project (BWRVIP), the Steam Generator Management Program (SGMP), and the Materials Initiative. |
| | Regulatory and Codes | EPRI staff develops and supports American Society of Mechanical Engineers (ASME) code changes and ASME code cases together with adequate supporting technical bases that bring realistic, opportune, and effective implementation of beneficial code improvements for pre-service and in-service inspection. |
| | Regulatory and Codes | |
| | NDE Training and Qualification | Reliable application of nondestructive evaluation technology is dependant upon the availability of a properly trained and qualified workforce. The EPRI NDE program, therefore, develops and maintains NDE training and qualification products specifically developed for the electric power generation industry. |

| Project Number | Project Title | Value |
|-----------------------|--------------------------------------|--|
| | Performance Demonstration Initiative | Through the Performance Demonstration Initiative (PDI) program, NDE personnel, NDE procedures, and equipment are qualified in accordance with ASME Section XI, Appendix VIII. The PDI project includes the oversight, operation, and member support of the program by EPRI in accordance with quality assurance (QA) procedures and instructions. The costs and revenues associated with conducting performance demonstrations are not included in this project. |
| | Equipment Reliability Issues | As plants age, there is an increasing awareness of the role nondestructive evaluation (NDE) has in the equipment reliability (ER) process. For the most part, the NDE technology used is well understood and readily available. However, as utilities are now starting to address license renewal commitments, there is increasing awareness that NDE technology must be adapted to fulfill the licensing renewal commitments. |
| | Equipment Reliability Issues | |

Project Descriptions

NDE Core Competencies (061384)

Issue

Nondestructive evaluation (NDE) plays many and varied roles. NDE is customarily used to accomplish pre-service and periodic in-service inspection of components to satisfy regulatory requirements; to characterize component condition; and to guide strategic decisions on whether and when to replace, repair, or continue operation of components. Each NDE activity generates important information that, in addition to meeting the immediate needs, benefits other nuclear power plants in dealing with emergent material- and inspection-related issues. Maintaining EPRI as an independent NDE resource to the industry ensures that valuable NDE information, experience, and resources are maintained centrally and are readily available to solve emergent materials issues where NDE has a significant role.

Description

Nondestructive evaluation includes developing and implementing advanced inspection technology as well as using performance-based and risk-informed methodologies to improve inspection reliability, increase the accuracy of information used to assess material condition, lower operating costs, lower radiation exposures to workers, and assist plant owners with meeting their regulatory commitments. This project ensures the EPRI NDE core resources are readily available to all industry segments. Specific activities in the NDE Program work plan sustain and coordinate the resources with industry initiatives, including the Materials Reliability Program, the Boiling Water Reactor Vessel and Internals Program, the Steam Generator Management Program, and the Performance Demonstration Initiative.

Value

- Supports EPRI's \$34 million annual materials programs
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration

- Supports extended plant operation
- Sustains NDE workforce through industry focused training and central qualification resources

How to Apply Results

Application of the core competencies of project products is achieved through the direct use of NDE program resources by members. Members participate in the annual NDE Issues Meeting or make use of EPRI NDE program resources such as test specimens to evaluate an inspection issue. Alternatively, a member utility may indirectly apply the NDE program resources via a vendor organization using the same resources.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|--------------------|
| NDE Target Management: This product encompasses management and administrative support of the NDE Program, including coordination and expansion of NDE activities with issue groups and sustained NDE Program membership participation. | 12/31/2009 | Technical Update |
| NDE Program Publications: This product addresses the periodic communication of NDE project updates and results. Deliverables in this product include regular communications and other program information, such as monthly newsletters, updates to mockup catalogs, and product catalogs. | 12/31/2009 | Technical Resource |
| Topical NDE & User Group Meetings: This product includes EPRI NDE Program conferences, workshops, and annual issues meeting. | 12/31/2009 | Technical Update |
| NDE Mockup Catalog: This catalog provides NDE Program participants with a resource to identify mockups available for NDE qualification and training. | 12/31/2009 | Technical Report |

Industry Material Issues (061730)

Issue

Certain materials and certain access and geometry conditions preclude nondestructive evaluation from achieving its objectives. For example, austenitic welds impose a technical challenge for nondestructive evaluation, and geometric conditions often prevent adequate contact with the surface for adequate nondestructive evaluation. As plants age, degradation is becoming more evident, challenging nondestructive evaluation technology even more to address newly discovered damage forms, and introducing more pressure to address emerging issues. Even if nondestructive evaluation could meet all current code and regulatory criteria, these may not be adequate to address aggressive damage mechanisms such as primary water stress corrosion cracking. When these aggressive degradations form active areas, degradation can progress at such a rapid rate that nondestructive evaluation is challenged to detect and accurately size degradation when it is very small, allowing adequate time for corrective actions.

Description

Aggressive research and development is planned to address these limitations. Specific activities include development of innovative ultrasonic examination technology of dissimilar metal welds and other welds with rough or wavy surface conditions; development of inspection methods and procedures for examining overlaid cast stainless steel; application of ultrasonic-phased array technology for ASME Section XI inspections; and evaluation of different NDE methods such as ultrasonic-guided wave technology, digital radiographic techniques, and remote visual examination technique reliability.

Value

- Supports EPRI's \$34 million annual materials programs
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support.
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration

How to Apply Results

The primary method of delivering the results of this research is through EPRI technical reports and guidance documents. These documents include recommended practices for in-service inspection services. Research results also include test specimens available to members and their vendors to develop or evaluate NDE technology.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|--------------------|
| Procedure for Manual Phased Array UT of Piping: Through the Performance Demonstration Initiative, EPRI will develop and qualify a set of standard manual techniques using the common features of currently available portable ultrasonic-phased array instruments. These techniques will be applied to piping components including dissimilar metal welds and weld overlays. EPRI also will issue technical updates addressing qualified procedures for field use. | 12/31/2009 | Technical Resource |
| Field trial of Technology for Assessment of Bolt Stress Relaxation | 12/31/2009 | Technical Resource |
| Nickel Alloy Weld Examination for Subsurface Cracks | 12/31/2009 | Technical Report |
| Ultrasonic Phased Array Techniques for CRDM Housing Penetrations | 12/31/2009 | Technical Update |
| BMN Qualification Program (Personnel) | 12/31/2009 | Technical Resource |
| Evaluation of Cast Stainless Steel Components | 12/31/2009 | Technical Report |

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|------------------|
| PWR stainless steel NDE capability and performance demonstration initiative | 2010 | Technical Update |

| Product Title & Description | Planned Completion Date | Product Type |
|--|--------------------------------|---------------------|
| Remote VT initiative | 2010 | Technical Update |
| RPV Wastage Assessment | 2010 | Technical Update |
| Cast Stainless Steel Inspection | 2010 | Technical Resource |

NDE Subscriber Requested Assistance (100014)

Issue

As plants age, new and emerging issues may occur in advance of scheduled EPRI NDE research and development activities that need to be addressed. Subscriber Requested Assistance enables members to engage EPRI NDE for providing an effective vehicle for rapid identification of, and engagement with, emergent issues; keeping the NDE Program staff and Program membership fully informed and engaged with industry operational experience; and collecting field experience to facilitate EPRI technology transfer.

Description

The Subscriber Requested Assistance program provides technical assistance to NDE program members in the application of EPRI NDE technology, as well as documenting member experiences using EPRI NDE technology. The Nondestructive Evaluation Product Group Steering Committee has determined that a portion of each subscriber's NDE Program subscription fees shall be reserved for Subscriber Requested Assistance.

Value

- Supports EPRI's \$34 million annual materials programs
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration
- Supports extended plant operation

How to Apply Results

Subscriber Requested Assistance provides subscribing NDE Program members with the opportunity to direct up to 25% of their annual subscription dues to specific tasks nominated by the member or subset of the members. These funds can be used to fund a project of mutual interest either by initiating a new project or by augmenting the funding of an existing NDE program work plan project. Subscriber Requested Assistance also may be used toward technical assistance within the scope of the NDE Program.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|--------------------|
| NDE SRA Activities: Technical assistance to members in the application of EPRI NDE technology and documentation of member experiences using EPRI NDE technology | 12/21/2009 | Technical Resource |

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|-----------------------------|-------------------------|--------------------|
| NDE SRA Activities | 2010 | Technical Resource |

Risk Informed Inspection (055680)

Issue

The viability of existing and future plant operation is based on low-cost and reliable generation. Risk-informed in-service inspection (RI-ISI) has been successfully applied at nuclear power plants, but there are associated implementation and inspection costs in applying this technology. Some RI-ISI applications, for example, have received a number of requests for additional information (RAIs) from the Nuclear Regulatory Commission due to inconsistent application, thereby increasing the cost of implementation. This project will reduce existing and future costs of these applications, as well as extend the benefits to other plant programs.

Description

Existing NDE requirements are not currently focused on plant reliability/availability as a major decision metric. This project will provide evidence of the plant reliability gains obtained by NDE. Additionally, this project will provide a technically defensible and transparent process for using risk technology for ISI and repair/replacement programs. This will be of benefit to plants that have not implemented RI-ISI programs, that have implemented partial scope RI-ISI programs, as well as full scope RI-ISI applications.

Value

- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration
- Supports EPRI's \$34 million annual materials programs (BWRVIP, MRP, SGMP)
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Supports extended plant operation

How to Apply Results

This project develops a risk-informed methodology to address plant, system, and component issues, building upon existing risk-informed technology, but focused on operational reliability and economic issues. NDE Program members take delivery of the EPRI research and may apply the methodology independently. Additional technical support is available via a number of commercial sources familiar with the EPRI methodology. Of particular note, this project is coordinated with the industry's equipment reliability initiative, in particular Institute of Nuclear Power Operations's (INPO's) AP-913, as well as a

Nuclear Regulatory Commission project on Risk-Informed Classification and Treatment (NRC Rule 10CFRPart50.69).

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|--------------------------------|---------------------|
| RI-ISI Status, Extensions and Resolution of Implementation Issues | 12/31/2009 | Technical Update |
| Conversion of RI-ISI Programs to Code Case N716 | 12/31/2009 | Technical Update |

Regulatory and Codes (061733)

Issue

Many regulatory and code processes are reactive in nature and are only put in motion after significant events have impacted utilities. Proactive technology development that might identify a situation before it occurs is seldom pursued. In addition, although progress is being made in both the regulatory and code arenas for expediting adoption of new NDE technology, reaching a solution is slow, often requiring several years for approval. The process also is hindered by the fact that there is not always a consensus on how to judge the benefits, costs, and risks of alternatives.

Description

This project supports NDE Program staff participation in the American Society of Mechanical Engineers (ASME) code activities as members of key committees and working groups related to NDE and other strategic areas such as RI-ISI.

Value

- Supports EPRI's \$34 million annual materials programs
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration
- Supports extended plant operation

How to Apply Results

The results of this work are applied by members through regulatory requirements to update 10-year in-service inspection programs to comply with the most recent version of the ASME code, deliberate application of authorized ASME code alternatives, and application of EPRI-developed inspection procedures.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|------------------|
| ASME Code and Technical Support: This project provides a means for EPRI representation at ASME Code meetings, particularly for Section XI (Nuclear In-service Inspection). Other Code activities support EPRI NDE technology developments and the NDE-related activities of Materials Initiative Issues Programs. | 12/21/2009 | Technical Update |

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|------------------|
| ASME Code and Technical Support | 2010 | Technical Update |
| Plant-Specific Applications of Qualified Nozzle Inner Radius and Nozzle-to-Shell Weld UT Procedures | 2010 | Technical Update |
| RPV Nozzle Manual Phased Array Procedures | 2010 | Technical Update |

Regulatory and Codes (061732)

Issue

Many regulatory and code processes are reactive in nature and are only put in motion after significant events have impacted utilities. Proactive technology development that might identify a situation before it occurs is seldom pursued. In addition, although progress is being made in both the regulatory and code arenas for expediting adoption of new NDE technology, reaching a solution is slow, often requiring several years for approval. The process also is hindered by the fact that there is not always a consensus on how to judge the benefits, costs, and risks of alternatives.

Description

The project includes research and development to support ASME code changes where NDE is a primary input for technical information supporting plant compliance with regulatory and ASME code requirements for in-service inspection. The project also will work towards changing the code for future generation needs.

Value

- Supports EPRI's \$34 million annual materials programs
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration
- Supports extended plant operation

How to Apply Results

The results of this work are applied by members through regulatory requirements to update 10-year in-service inspection programs to comply with the most recent version of the ASME code, deliberate application of authorized ASME code alternatives, and application of EPRI-developed inspection procedures that comply with code requirements.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|------------------|
| Incorporate NDE Enhancements into ASME Section XI: This project will identify Code areas requiring revision/enhancement. In addition to the actual Code inquiries, relief requests, Code cases, Code changes, and supporting white papers, EPRI will produce an annual report summarizing activities. | 12/31/2009 | Technical Update |
| Guideline for Design of Inspectable Components for New Reactors | 12/31/2009 | Technical Update |

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|------------------|
| Incorporate NDE Enhancements into ASME Section XI: Annual updates describing the progress and enhancements to ASME section XI | 2010 | Technical Update |

NDE Training and Qualification (061734)

Issue

Predictions indicate that less than 50% of existing inspection staff will be available to meet plant needs within five years. Therefore, regardless of how well nondestructive evaluation (NDE) technology can address strategic goals, the lack of a qualified workforce to apply the technology could negate any benefits. In addition, new requirements for qualifying inspection procedures and personnel can adversely affect personnel when the requirements are unnecessarily burdensome and not well connected to strategic objectives.

Description

While NDE technology development may only have a limited impact on workforce concerns, the NDE Program is pursuing a three-part strategy. The first is to accurately project the gap between supply and demand for qualified NDE personnel and to use this analysis to elevate the issue to policy makers in the industry. The second part of the strategy consists of using advanced NDE technology to simplify application and qualification requirements, facilitating use by a wider range of individuals. The third is to provide and maintain NDE training and qualification products specifically developed for the electric power generation industry.

Value

- Provides up to \$500,000 savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Supports EPRI's \$34 million annual materials programs

- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support
- Supports extended plant operation
- Sustains NDE workforce through industry-focused training and central qualification resources

How to Apply Results

EPRI offers NDE training courses at its Charlotte, North Carolina, facility and at member facilities. In many cases, the NDE training includes practical exercises using plant component test specimens that contain typical failure conditions. NDE training materials can be used to satisfy regulatory or code requirements for NDE training.

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|--------------------|
| Update Identified NDE Course Materials & Exam Banks | 2010 | Technical Resource |
| Update and Conduct of NDE Training Courses, Exams, HRD activities: The NDE Program will continue offering and maintaining NDE training. Also, a new NDE training initiative is planned that will deliver an intensive training package to allow new people to efficiently enter the workforce. | 2010 | Technical Resource |

Performance Demonstration Initiative (061738)

Issue

Regulatory standards ensure nuclear power plant compliance with the NDE performance demonstration requirements within ASME Section XI, Appendix VIII. The capital investment alone for each nuclear utility to purchase the test specimens and other resources necessary to meet this requirement would be more than \$15 million. Additional costs to maintain the resources as part of the licensees' in-service inspection programs also would be significant.

Description

The Performance Demonstration Initiative (PDI), comprised of all U.S. nuclear utilities, facilitates efficient, cost-effective, and technically sound implementation of ASME Section XI, Appendix VIII performance demonstration requirements. The NDE Program is the Performance Demonstration Administrator (PDA) for PDI. Under the guidance of the PDI, and in compliance with the EPRI quality program, the NDE program provides technical support and administers the qualifications, including specimen design, sample fabrication, qualification testing, and registry maintenance.

Value

- Supports EPRI's \$34 million annual materials programs
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration

How to Apply Results

Through PDI, NDE Program members are able to comply with regulatory requirements and qualify NDE personnel, NDE procedures, and equipment in accordance with ASME Section XI, Appendix VIII. This project includes costs associated with quality assurance, document control, and database maintenance, but not the actual costs associated with conducting performance demonstrations.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|--------------------|
| PDI Program: The project will remain operational in 2009 to support regulatory compliance. | 12/21/2009 | Technical Resource |

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|--------------------|
| PDI Program: The project will remain operational in 2010 to support regulatory compliance. | 2010 | Technical Resource |

Equipment Reliability Issues (063221)

Issue

Inspection results obtained using reliable NDE methods are key contributors to high equipment reliability. However, the equipment reliability process often must deal with unique situations where there are no obvious NDE solutions and additional NDE research and development is needed, such as selective leaching and buried piping. Innovative research and development is needed to apply NDE technology to these and other emerging issues.

Description

In support of emerging equipment reliability issues, this project is aimed at coordinating and providing innovative NDE solutions to unique inspection challenges. In addition, the project targets the evaluation of NDE technology in support of aging plant and plant license renewal commitments and activities.

Value

- Supports extended plant operation
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration
- Supports EPRI's \$34 million annual materials programs

How to Apply Results

The primary method of delivering the results of this research is through EPRI technical reports and guidance documents. These documents often include recommended inspection practices that may be used directly by the member or by organizations providing in-service inspection services. In some cases, the research results also include test specimens available to members or their vendors to develop or evaluate NDE technology.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|------------------|
| GW Tech Applications for BOP HX Tubes & TSP Degradation: The guided wave ultrasonic method based on magnetostrictive sensor technology will be evaluated on an installed heat exchanger tube bundle to rapidly identify tubing and tube support plate degradation. | 12/31/2009 | Technical Update |

Equipment Reliability Issues (063223)

Issue

Inspection results obtained using reliable NDE methods are key contributors to high equipment reliability. However, the equipment reliability process often must deal with unique situations where there are no obvious NDE solutions and additional NDE research and development is needed, such as selective leaching and buried piping. Innovative research and development is needed to apply NDE technology to these and other emerging issues.

Description

In support of emerging equipment reliability issues, this project is aimed at coordinating and providing innovative NDE solutions to unique inspection challenges. In addition, the project targets the evaluation of NDE technology in support of aging plant and plant license renewal commitments and activities.

Value

- Supports extended plant operation
- Provides significant cost savings per plant per year based on improved NDE technologies in the areas of inspection, training, and field support
- Reduces outage costs by \$1 million per day by application of NDE technologies, training, and regulatory/code support to reduce outage duration
- Supports EPRI's \$34 million annual materials programs

How to Apply Results

The primary method of delivering the results of this research is through EPRI technical reports and guidance documents. These documents often include recommended inspection practices that may be used directly by the member or by organizations providing in-service inspection services. In some cases, the research results also include test specimens available to members or their vendors to develop or evaluate NDE technology.

2009 Products

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|------------------|
| Development of Intermediate Diameter Buried Piping Examination Technology: This project addresses the development of technology for determining the condition of buried piping by deploying an instrumented vehicle inside the pipe. The project divides buried pipes into large diameter (greater than 36 inches), intermediate diameter (12 to 36 inches), and small diameter (4 to 12 inches), and addresses the design of a common instrumentation platform. | 12/31/2009 | Technical Report |

| Product Title & Description | Planned Completion Date | Product Type |
|---|-------------------------|------------------|
| NDE Application to Address Groundwater Contamination Issues: This project examines NDE methodologies (guided wave ultrasonic testing [UT] technology, UT phased array, tracer systems, crawler UT) for small-diameter piping and other innovative technologies to address materials degradation issues on buried and embedded piping and components. | 12/31/2009 | Technical Update |
| Plant Aging / License Renewal NDE Gap Solutions and Strategies: This project applies existing solutions or develops new strategies to close specific NDE gaps associated with plant aging. These solutions and strategies will be documented in technical updates. | 12/31/2009 | Technical Update |

Future Year Products

| Product Title & Description | Planned Completion Date | Product Type |
|--|-------------------------|--------------------|
| Field Trial of Intermediate Diameter Piping Examination Technology: Evaluation of intermediate-diameter NDE technologies at a host nuclear power plant | 2010 | Technical Resource |
