



NUCLEAR ENERGY INSTITUTE

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November 3, 2010

Mr. Eric J. Leeds  
Director, Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**Subject:** NEI 09-14, *Guideline for the Management of Buried Piping Integrity*

**Project Number: 689**

Dear Mr. Leeds:

The NEI Nuclear Strategic Issues Advisory Committee (NSIAC) approved the Buried Piping Integrity Initiative in November 2009. Since then, the NEI Buried Piping Integrity Working Group and Task Force developed NEI 09-14, *Guideline for the Management of Buried Piping Integrity*, to explain the intent of the Initiative and facilitate its implementation. A copy of Revision 0 of the document (Attachment 1) is attached for your information. The guidance addresses the following items:

- Documentation of the text of the Initiative
- Roles and responsibilities
- Explanation of the intent of the Initiative
- Description of the process for collecting the information that will be used to periodically report the status of implementation of the Initiative to NSIAC

NEI will prepare semi-annual reports to NSIAC on the implementation status of the Initiative, operating experience related to buried piping, and developments in NDE technology. The first report on these matters was prepared last summer and presented to NSIAC during its meeting last August. A summary of the NSIAC report (Attachment 2) is attached for your information. You will note that as of the time we completed the implementation survey (last July), all 104 plants were on schedule for implementation of the Initiative milestones. Also note that we are in the early stages of implementing this comprehensive program and progress toward future milestones may change over time.

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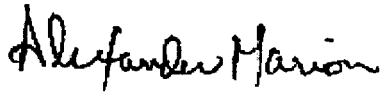
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As you know, the NSIAC approved a revision to the Buried Piping Integrity Initiative in September 2010. The new Initiative is entitled the "Underground Piping and Tanks Integrity Initiative". NEI 09-14 is presently being revised to incorporate the changes associated with the revised Initiative. A copy of NEI 09-14, Revision 1 will be transmitted to you when it is published.

We will continue to keep you and your staff informed of the status of industry activities associated with this important program.

If you have any questions, please contact me at (202) 739.8080; [am@nei.org](mailto:am@nei.org) or Jim Riley at (202) 739.8137; [jhr@nei.org](mailto:jhr@nei.org).

Sincerely,

A handwritten signature in black ink that reads "Alexander Marion". The signature is written in a cursive, slightly slanted style.

Alexander Marion

Attachments

c: Mr. Jack Grobe, NRR, NRC  
Ms. Michele G. Evans, NRR/DCI, NRC  
Mr. Robert O. Hardies, NRR/DCI, NRC

NEI Buried Piping Integrity Working Group  
NEI Buried Piping Integrity Task Force

**NEI 09-14 [Rev 0]**

# **GUIDELINE FOR THE MANAGEMENT OF BURIED PIPING INTEGRITY**

**January 2010**

**NEI 09-14 [Rev 0]**

**Nuclear Energy Institute**

**Guideline for the  
Management of  
Buried Piping Integrity**

**January 2010**

## **ACKNOWLEDGEMENTS**

NEI appreciates the efforts of the members of the NEI Buried Piping Integrity Task Force, EPRI's Equipment Reliability Action Plan Committee, and the EPRI Balance of Plant Corrosion Integration Committee for their support and direct participation in the development of this guideline.

## **NOTICE**

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## **GUIDELINE FOR THE MANAGEMENT OF BURIED PIPING INTEGRITY**

### **1 BACKGROUND**

The Industry Guideline for the Management of Buried Piping Integrity describes the policy and practices that the industry commits to follow in managing buried piping. These guidelines support the Industry Initiative on Buried Piping Integrity adopted by the NEI Nuclear Strategic Issues Advisory Committee (NSIAC) on November 18, 2009. Utility implementation of the Initiative will be verified as directed by the NSIAC. This guideline:

- Documents the scope of the formal Industry Initiative on Buried Piping Integrity (the "Initiative").
- Sets the goals that drive the Initiative.
- Defines the roles and responsibilities established to ensure implementation of the Initiative.
- Defines the content and responsibilities for creating reports to NSIAC on Initiative implementation.

The approach to addressing buried piping issues embodied in this Initiative is in addition to the expectations in place under the Ground Water Protection Initiative, which was approved by NSIAC in 2007 and which remains fully in effect.

## 2 INTRODUCTION

It has become evident that additional industry action is warranted regarding the performance of buried piping systems within the nuclear fleet. Buried pipe is used in several applications at plants with different governing requirements:

- safety related pipe
  - governed by plant Technical Specifications and ASME Code,
- non-safety related pipe conveying radiologically contaminated fluid
  - governed by local, State and EPA regulations and subject to NEI's Ground Water Protection Initiative
- other pipes conveying non-safety related water systems, fuel oils, gasses or other media
  - may be governed by local, State and EPA regulations.

The scope of the Buried Piping Integrity Initiative includes all buried piping on the site.

The material condition of the majority of buried piping is not fully characterized, and one of the means of protecting buried piping, cathodic protection, may not have been adequately maintained across the industry. In the past several years, a number of self revealing leaks have occurred that are impacting public confidence, regulatory margin, and in some cases plant operation. Potential impacts that could occur if performance is not improved could be:

- safety and operational challenges
- negative environmental impacts
- additional regulatory requirements
- EPA violations with adverse industry publicity
- license renewal delays
- heightened opposition to new plant construction

Implementation of an assessment program for buried piping will minimize unexpected failures and their impact. The industry's goal is to proactively address buried piping integrity and where possible, prevent leakage before it occurs using available technologies and other control and evaluative processes.

To assure consistent and measured progress in this area an NSIAC Initiative was approved to commit to specific buried pipe program elements. The required elements and attributes specified in Section 3 below shall be incorporated into each site's buried piping program. The EPRI Document "*Recommendations for an Effective Program to Control the Degradation of Buried Pipe*" (Reference 6.1) provides additional information and recommendations for implementation of the Initiative.



### **3 INDUSTRY INITIATIVE ON BURIED PIPING INTEGRITY**

The actual text of the Buried Piping Integrity Initiative approved by NSIAC is repeated in Sections 3.1 and 3.2 below. Section 3.1 lists the goal of the Initiative and section 3.2 lists the required actions.

#### **3.1 INITIATIVE GOAL**

The goal of the Buried Piping Integrity Initiative is to provide reasonable assurance of structural and leakage integrity of all buried piping with special emphasis on piping that contains radioactive materials.

Building upon the existing Ground Water Protection Initiative, the Buried Piping Integrity Initiative will:

- Drive proactive assessment and management of the condition of buried piping systems.
- Ensure sharing of industry experience.
- Drive technology development to improve upon available techniques for inspecting and analyzing underground piping.

#### **3.2 INITIATIVE ACTIONS**

In order to meet these goals, every utility shall implement a Buried Piping Integrity Program that incorporates the elements and associated key attributes in this section. The EPRI document "*Recommendations for an Effective Program to Control the Degradation of Buried Pipe*" (1016456) provides additional details on the Initiative's elements and attributes.

##### **Procedures and Oversight** – By June, 30, 2010:

- Ensure clear roles and responsibilities including senior level accountability for the Buried Pipe Integrity Program.
- Develop a Buried Pipe Integrity Program document and implementing procedures.
- NSIAC will provide oversight of industry implementation, reports will include:
  - Progress on implementation of the commitments within this initiative and any exceptions
  - Industry experience and learning
  - Progress with technology development

**Risk Ranking** – Risk Rank buried piping segments by December 31, 2010. Risk Ranking shall incorporate the following attributes:

- Pipe function
- Pipe locations and layout

- Pipe materials and design
- Health of cathodic protection systems, if applicable
- Based on the above data and other information:
  - The likelihood of each piping segment to not meet the applicable code criteria
  - The consequences of failure of each piping segment
- A means to update the risk ranking as necessary
- A database to track key program data, inspection results, and trends

**Inspection Plan** – By June 30, 2011, develop an inspection plan to provide reasonable assurance of integrity of buried piping. This plan shall include the following key attributes:

- Identification of piping segments to be inspected
- Potential inspection techniques
- Inspection schedule for buried piping segments based on risk ranking
- Assessment of cathodic protection, if applicable

**Plan Implementation** – Implementation of the Inspection Plan shall start no later than June 30, 2012. The condition assessment of buried piping containing radioactive material shall be completed by June 30, 2013.

**Asset Management Plan** – Inspection results shall be used as input to the development of an asset management plan for buried piping. This plan shall receive a high level of review and approval and will be in place by December 31, 2013.

### **3.3 SCOPE**

The Industry Initiative applies to all NEI U.S. member utilities and to all buried piping associated with each of their nuclear power plant sites.

### **3.4 EXPECTATIONS**

The intended outcome of the Initiative will be demonstrated by an improving trend in consequential leaks from buried piping across the industry.

It is expected that every utility will participate in the industry organizations that support and oversee implementation of the Buried Piping Integrity Initiative and will ensure that the buried piping activities are implemented at its plants in accordance with the intent of the Initiative and the implementation dates specified therein.

Industry organizations will cooperate in the manner described in this guideline to assemble the information necessary to provide periodic updates to NSIAC as requested.

## **4 INDUSTRY ROLES AND RESPONSIBILITIES**

This guideline will be implemented through the activities outlined below. These activities have the following intended purpose:

- Implementing the Buried Piping Integrity Initiative
- Supporting the intent of the industry Initiative
- Verifying implementation of the Initiative through maintenance and monitoring of a set of performance metrics described in Appendix A
- Ensuring that operating experience related to buried piping issues is communicated to utilities
- Continuing research to identify and develop new techniques for inspection and maintenance/replacement of buried piping

### **4.1 UTILITIES**

Utilities will perform the following functions in support of the Initiative:

- Implement the actions required by the Initiative (Section 3.2)
- Report to NEI the status of meeting the Initiative Implementation dates and any active deviations from Initiative elements as required for the report to NSIAC (Appendix A)
- Report to INPO (EPIX) occurrences of leakage in buried piping and adverse inspection findings as required for the report to NSIAC (Appendix A)

In order to meet the intent of the Initiative, utilities should:

- Participate in the industry programs that support the Initiative
- Contribute technical resources and executive leadership to industry efforts

### **4.2 EPRI**

EPRI will perform the following functions in support of the Initiative:

- Manage the research necessary to improve inspection technology for buried piping
- Support repair/replacement technology as appropriate
- Provide a venue for identifying research and development needs, sharing operating experience, and other issues that have the potential for impact on the industry
- Assemble and report to NEI the information necessary to make periodic reports to NSIAC (Appendix A) on progress in the development of inspection technology

### **4.3 INPO**

INPO will perform the following functions in support of the Initiative :

- Incorporate within their evaluations a review of plant Buried Piping Programs, including piping that may not be safety related but is important to plant safety or contains potentially radiologically contaminated fluids.
- Communicate operating experience relative to buried piping issues and other relevant information to the industry.
- Assemble and report to NEI the information necessary to make periodic reports to NSIAC (Appendix A) on operating experience.

### **4.4 ANI**

ANI will perform the following function in support of the Initiative:

- Report significant recommendations from inspections to NEI in support of the periodic report to NSIAC (Appendix A).

### **4.5 NEI**

NEI will perform the following functions in support of the Initiative:

- Manage the industry's regulatory interface on buried piping issues of generic regulatory significance.
- Communicate information relative to the buried piping initiative to the industry.
- Assemble the information necessary to make periodic reports to NSIAC (Appendix A) on implementation of the Initiative.
- Create and communicate the periodic report to NSIAC on implementation of the Buried Piping Integrity Initiative, industry operating experience, and inspection technology developments (Appendix A).
- Coordinate activities with EPRI, ANI, and INPO.

## **5 INTENT OF THE BURIED PIPING INTEGRITY INITIATIVE**

The following sections describe, where additional description is necessary, the activities and commitments that are required to implement the Initiative presented in section 3.0 of this document. Additional activities may also be required as industry experience and technology evolve. Further information is provided by EPRI document 1016456, "Recommendations for an Effective Program to Control the Degradation of Buried Pipe" (Reference 6.1). References to the applicable sections of the EPRI document, where applicable, are provided in the descriptions below.

### **5.1 BURIED PIPING INTEGRITY INITIATIVE IMPLEMENTATION**

#### **5.1.1 Procedures and Oversight**

The necessary procedure and oversight responsibilities shall be in place by June 30, 2010. These include the following items.

- Clear lines of responsibility  
The Buried Piping Integrity Program shall be established including the identification of a responsible executive who will carry out the senior level functions specified in the Initiative and this guideline.
- Process for justifying and approving exceptions to the provisions of the Initiative  
When a utility determines that a required element of the Initiative cannot be met, a technical justification for deviation shall be developed and retained with the utility's program documentation. The technical justification should provide the basis for determining that the proposed deviation meets the same objective, or level of conservatism exhibited by the original work product, and should clearly state how long the deviation will be in effect. Justifications for deviation shall be reviewed and approved in accordance with the applicable plant procedures with concurrence from the responsible utility executive.

Each utility shall report all approved justifications for deviation that are currently active at each of its plants to NEI semi-annually as part of the utility's input to the NSIAC report.

- Buried Pipe Integrity Program Documents and Implementing Procedures  
The program documents and implementing procedures shall implement, as a minimum, the key elements of the Buried Piping Integrity Initiative. Guidance for the specific content of the document may be obtained from sections 1.4.1 and 1.4.2 in the EPRI document on buried piping, "Recommendations for an Effective Program to Control the Degradation of Buried Pipe (reference 6.1)."

- Report to NSIAC

The activities required to prepare the periodic report to NSIAC are described in section 4 and Appendix A.

### **5.1.2 Risk Ranking**

A risk ranking process shall be used to understand site vulnerabilities and to help prioritize the selection of inspection locations. It is performed by determining the likelihood of failure of each segment of applicable piping systems and the consequences of failure of that segment. Segments with high likelihood of failure and high consequences of failure would receive more attention than low ranked segments. Risk Ranking may be performed using software tools. The description of a risk ranking process is provided in Section 2 of Reference 6.1. The risk ranking process shall incorporate the attributes listed in section 3.2 of this document as a minimum and shall be complete by December 31, 2010.

The risk ranking process should consider the following as a minimum:

- The Initiative places special emphasis on piping containing radioactive fluids. The risk ranking process, which applies to all buried piping, should place sufficient priority on this piping such that the intent of the Initiative is met.
- The NEI Ground Water Protection Initiative also contains a risk ranking process for buried piping containing radioactive materials.

### **5.1.3 Inspection Plan**

The results of risk ranking along with other inputs such as plant and industry experience, plant licensing commitments, and trending of past inspection data are used to define inspection locations, inspection methods, and inspection schedules (see sections 2.8 and 3.0 of reference 6.1). The inspection plan shall incorporate the attributes listed in section 3.2 of this document as a minimum. The inspection plan shall be in place by June 30, 2011.

The goal of the inspection plan is to support an assessment of the pipe's structural and leakage integrity and provide reasonable assurance that a piping segment will maintain this integrity between successive inspections. Development of an inspection plan should consider the following inputs:

- the capabilities of the inspection techniques used
- industry and internal operating experience
- piping design characteristics
- the condition of the piping inspected (if inspected previously)

Cathodic protection systems, if installed, shall be assessed as part of the inspection plan.

Sampling techniques and engineering evaluations based on known conditions of piping are an acceptable means of achieving reasonable assurance.

#### **5.1.4 Plan Implementation**

Plan implementation consists of performing a condition assessment based on both inspection results and engineering evaluations. The inspections should be conducted at the most vulnerable locations determined using methods such as the risk ranking, results of cathodic protection and coating surveys, plant experience, etc. The combination of evaluations and inspections performed should provide reasonable assurance that the piping segment will maintain structural and leakage integrity until the next planned inspection. Implementation of the inspection plan shall start no later than June 30, 2012. The condition assessment of buried piping containing radioactive materials shall be completed by June 30, 2013.

Results of condition assessments shall be an input to a utility's Asset Management Plan.

#### **5.1.5 Asset Management Plan**

An asset management plan addressing buried piping shall be developed and maintained. An asset management plan is a long range plan for managing the structural and leakage integrity of buried piping. Key elements of the plan include:

- Inspection plans
- Planned maintenance activities
- Plans for repair
- Anticipated replacement

The asset management plan for buried piping may be part of the overall site or fleet asset management plan.

The Asset Management Plan for buried piping shall be in place by December 31, 2013.

One method to develop an asset management plan would be to categorize each buried line based on its risk rank, contents (tritium, diesel oil, raw or minimally treated water, hazardous chemicals, off gas, etc), importance to power generation, results of cathodic protection testing, and coating surveys, plant experience, etc. For example, each line would then be placed into categories such as:

- Lines to be repaired or replaced with a planned schedule within an implementation plan.
- Lines that need to be periodically inspected or monitored with a planned schedule.
- Lines that are acceptable to run to leak and then repaired as needed (e.g., piping with low risk or low environmental impact. Plants should also consider public confidence concerns in applying this categorization.).

The plan could identify additional actions for a line such as:

- Inspect to determine the need to repair or replace.
- Add or enhance the cathodic protection.
- Add or enhance coating protection.
- Actions to minimize the degradation of the inner surface of the piping.
- Add protection against heavy surface loads.

The asset management plan shall be a living document that will be periodically reviewed as more plant data becomes available through physical assessments and other means and as industry knowledge and technology evolve.

Revisions to the asset management plan shall be reviewed by an appropriate high level organization within the utility (such as the plant health committee).



## 6 REFERENCES

1. EPRI document, *Recommendations for an Effective Program to Control the Degradation of Buried Pipe* (1016456), December 2008
2. NACE (National Association of Corrosion Engineers) documents
  - a. SP0502-2008 (formerly RP0502), Pipeline External Corrosion Direct Assessment Methodology
  - b. SP0169-2007 (formerly RP0169), Control of External Corrosion on Underground or Submerged Metallic Piping Systems
  - c. RP0102-2002, In-Line Inspection of Pipelines
  - d. SP0207-2007, Performing Close-Interval Potential Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Metallic Pipelines
3. NEI 07-07, *Industry Ground Water Protection Initiative*
4. INPO 98-001, *Equipment Performance and Information Exchange System (EPIX) Reporting Requirements*

## **APPENDIX A**

### **REPORT TO NSIAC**

A report to NSIAC will be prepared semi-annually addressing the following four items:

1. Overview – developed by NEI semi-annually on the following topics as appropriate:
  - Notable information:
    - Incidents that attract media or stakeholder attention
    - INPO feedback from plant evaluations
    - Important ANI feedback from plant evaluations –
    - Major piping replacements and repairs as determined by NEI Buried Piping Integrity Task Force. Examples are the major replacement projects implemented at Catawba or Callaway
  - Assessment of availability of technology to support inspections
  - Overall status of Initiative implementation, including the effect of active approved deviations to Initiative elements.
2. Progress on Initiative implementation and exceptions – utilities will report to NEI the status of implementation of each Initiative element at each of their plants using the approach described below. The report will be made semiannually (by January 31 and July 31) to <http://atom.nei.org/bp>. NEI will collect and assemble the information.
  - Report implementation status for each Initiative element and for each plant. The elements and the expected implementation dates are repeated below:
    - Procedures and oversight in place by 6/30/10
    - Risk ranking complete by 12/31/10
    - Inspection plan in place by 6/30/11
    - Inspection start by 6/30/12
    - Condition assessment of piping containing radioactive materials complete by 6/30/13
    - Asset management plan in place by 12/31/13

Status will be identified by the use of a status response for each implementation date. The responses are as follows:

  - Will extend the implementation date or have extended
  - Implementation by the due date is at risk
  - On schedule to meet date
  - Complete
  - Describe each deviation to the Buried Piping Integrity Initiative that is active at the time the report is made. Note that the existence of an approved deviation to an implementation date does not change the fact that the date will not be met. If

an implementation date is not going to be met, it shall be reported as such until the implementation is completed.

3. Industry experience and learning – Utilities will report the information below to INPO. INPO will collect the information and report the results to NEI.
  - Utilities will enter operating experience related to the items below into INPO's EPIX database when instances occur. Entries shall be made in a timeframe consistent with EPIX timing requirements (Reference 6.4).
    - Leaks from buried piping
    - Significant leaks from buried piping: defined as those which meet either of the following criteria
      - Reportable under NRC, EPA, or state regulation or the Ground Water Protection Initiative, or
      - Result in the system or component being out of service
    - Adverse inspection findings: defined as indications from inspections that require a major repair within one cycle
  - Each instance will be categorized into one of the following five areas depending upon the piping affected.
    - Piping contains radioactive material
    - Safety related piping
    - Piping contains environmentally sensitive fluids (e.g., oils, chemicals, non-radioactive fluids)
    - Other piping that is in the buried piping program (excludes piping categorized as "run to failure" under utility programs)
    - Leaks from piping categorized as "run to failure"
4. Progress on inspection technology development – EPRI will assemble the information below and report the results to NEI.
  - Identify each technology that is being researched for possible use in inspections
  - Indicate, for each technology being pursued, a timeline indicating when it will be ready for commercialization.

Information on leakage from applicable buried piping using the above criteria will be collected beginning for events that occurred in 2009. Information on Initiative implementation and inspection technology will be collected beginning in 2010.

Information will be collected from utilities, INPO, ANI, and EPRI and sent to NEI semi-annually. NEI will assemble a report for Buried Piping Integrity Task Force review and assessment. The objective is to:

- Prepare an NSIAC presentation.
- Share the status with the EPRI Balance of Plant Corrosion Group (BOPC) and the Buried Piping Integrity Group (BPIG).

## **Report to NSIAC - Summary**

### **Status of Implementation of Buried Piping Integrity Initiative Milestones**

- Procedures and oversight by June 30, 2010
  - 104 plants complete
- Risk ranking by December 31, 2010
  - 47 plants complete
  - 57 plants on schedule
- Inspection plans by June 30, 2011
  - 1 plant complete
  - 103 plants on schedule
- Inspection start by June 30, 2012
  - 6 plants complete
  - 98 plants on schedule
- Complete condition assessment of piping containing radioactive material by June 30, 2013
  - 2 plants complete
  - 102 plants on schedule
- Complete asset management plan by December 31, 2013
  - 104 plants on schedule
- No plants have identified any deviations to the Buried Piping Integrity Initiative

### **Industry Buried Piping Leakage Trends (source INPO EPIX data base)**

- Less than 10 leaks per year reported from 2000 to 2008
- 67 leaks reported in 2009
- 28 leaks reported in 2010 as of July
- The spike in reported leaks in 2009 and 2010 is a direct result of an NEI letter to the CNOs dated February 4, 2010 which requested that all leaks from buried piping be reported beginning in 2009.
- Of the 130 buried piping leaks reported from 2000 to the present:
  - 10% were in safety-related systems
  - 13% were in systems containing radioactive materials
  - 10% were in systems containing environmentally sensitive fluids
  - 57% were in low priority systems categorized as "run to failure" under the applicable program
  - 10% were in other systems
  - The number of leaks in safety related systems and in piping containing radioactive materials in 2009 and 2010 was about 11%.

## **NDE Technology Development**

- Currently available technology
  - Direct excavation
  - Guided wave UT (screening only)
  - Internal “PIGs” and robotic vehicles if piping ID is accessible
- EPRI identifying and investigating other commercially available technologies

## **Overall Observations**

- All plants have met the first Initiative milestone and there are no deviations to Initiative elements
  - Positive impact on program and processes is evident
  - OE and inspection results indicate that plants are implementing the Initiative expectations
- Too early to assess the impact of the Initiative on leakage trends or piping integrity
- Communication among ground water protection staff, NDE, and buried piping staff is important, expected, and improving
- Continued attention is needed in the following areas:
  - New inspection technologies as alternatives to direct inspection by excavation
  - Better source identification of water samples with low tritium levels below reporting threshold
  - Improved operation and maintenance of installed cathodic protection systems