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Coordination of the Enhanced Inspection and Environmental Monitoring Initiatives (Ground Water Protection Initiative and Underground Piping and Tanks Integrity Initiative)

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Nuclear Energy Institute

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COORDINATION OF THE ENHANCED INSPECTION AND ENVIRONMENTAL MONITORING INITIATIVES (GROUND WATER PROTECTION INITIATIVE AND UNDERGROUND PIPING AND TANKS INTEGRITY INITIATIVE)

1 INTRODUCTION

The Ground Water Protection Initiative (GPI) and Underground Piping and Tanks Integrity Initiative (UPTI) (the two Initiatives are referred to as the "Enhanced Inspection and Environmental Monitoring Initiatives") are both formal industry commitments by the Chief Nuclear Officers (CNO). Both are intended to enhance public and regulatory confidence by minimizing unintended leaks on-site. The two Initiatives are complementary and their implementation should include a high level of coordination and mutual participation. The goal of this paper is to describe the two Initiatives, their similarities and differences in scope and/or approach, and how utilities can enhance the efficiency of their implementation.

2 INITIATIVE DESCRIPTIONS

2.1 GROUND WATER PROTECTION INITIATIVE

General
The Ground Water Protection Initiative (GPI) was approved unanimously by NEI's Nuclear Strategic issues Advisory Committee (NSIAC) in May 2006. The GPI builds on regulatory requirements established by the U.S. Nuclear Regulatory Commission (NRC) for control of radioactive materials, environmental monitoring and reporting.

The goals of the GPI are to:

1. *Improve management of situations involving inadvertent radiological releases that get into ground water.*
2. *Improve communication with external stakeholders to enhance trust and confidence on the part of local communities, States, the NRC, and the public in the nuclear industry's commitment to a high standard of public radiation safety and protection of the environment.*

The GPI established several milestones:

- Action plan to implement the interim Groundwater Protection Initiative in place by 7/31/06
- Program(s) for voluntary or informal reporting of unintended leaks in place by 7/31/06

- Initial actions to implement NEI 07-07 acceptance criteria scheduled or completed by 12/31/07
- Initial independent self-assessment of implementation complete by 12/31/08
- NEI-sponsored peer assessment of implementation complete by 12/31/09
    - Update site characterization of hydrology and geology
    - Assess site risk of SSCs and work practices
    - Establish on-site ground water monitoring program
    - Establish remediation process
    - Establish record-keeping procedure
    - Perform stakeholder briefing
    - Establish voluntary communication protocol
    - Establish 30-day reporting process
    - Establish annual reporting process
    - Establish program oversight process

The objectives of the GPI and acceptance criteria for its implementation are described in NEI 07-07, *Industry Ground Water Protection Initiative.*

Scope
The scope of the GPI includes any system, structure, component, or work practice that can credibly result in unintended leakage of licensed material to subsurface (ground) water or soil. This includes above and below ground components, structures, pools, ponds or retention basins, and operational processes.

2.2 UNDERGROUND PIPING AND TANKS INTEGRITY INITIATIVE

General
The Underground Piping and Tanks Integrity Initiative (UPTI) was unanimously approved by NSIAC in September 2010. This Initiative incorporates and extends the scope of the Buried Piping Integrity Initiative which was unanimously approved by NSIAC in November 2009.

The goal of the UPTI Initiative is:

"to provide reasonable assurance of structural and leakage integrity of in-scope underground and buried piping and tanks. The Initiative places special emphasis on components that contain licensed radioactive materials."

The UPTI contains a series of milestones that define implementation deadlines:

- Buried piping procedures and oversight in place by 6/30/10
- Buried piping risk ranking complete by 12/31/10
- Buried piping inspection plan in place by 6/30/11
- Underground piping and tanks procedures and oversight in place by 12/31/11

- Buried piping inspection start by 6/30/12
- Underground piping and tanks prioritization complete by 6/30/12
- Underground piping and tanks condition assessment plan in place by 12/31/12
- Condition assessment of buried piping containing radioactive materials complete by 6/30/13
- Underground piping and tanks inspection start by 6/30/13
- Buried piping asset management plan in place by 12/31/13
- Condition assessment of underground piping and tanks containing radioactive materials complete by 6/30/14
- Underground piping and tanks asset management plan in place by 12/31/14

The intent of the UPTI and expectations for its implementation are described in NEI 09-14, *Guideline for the Management of Underground Piping and Tank Integrity.*

Scope
Components that fall within the scope of the Underground Piping and Tanks Integrity Initiative include:

A. Those within the scope of the original Buried Piping Integrity Initiative:
    - All piping that is below grade
    - Contains any fluid
    - Is in direct contact with the soil

B. And the following additional components:
    - Underground piping and tanks that are outside of a building and below grade (whether or not they are in direct contact with the soil) if they
        - Are safety related

          \- Or -

        - Contain licensed material or are known to be contaminated with licensed material.

3 COMPARING INITIATIVE ELEMENTS

The table below provides a general comparison of the main elements in both Initiatives.

Element	GPI	UPTI
General Approach	Proactive (identify potential for leaks, enhance containment & detection) Reactive (find leaks while small)	Proactive (inspect, avoid leaks)
Main Elements	Risk assessment, site characterization of hydrology, monitoring, remediation, and communication	Risk assessment, inspection/examination, condition assessment, and asset management
Objective	Public and regulatory confidence	Public and regulatory confidence
Level of Commitment	CNO	CNO
Regulatory Basis	Control of radioactive material and effluents required in 10 CFR 20 and 10 CFR 50 (See 10 CFR 50.36a and 10 CFR 50 App A, and the ALARA standards in 10CFR50 Appendix I)	Exceeds requirements in 10CFR50 App A (GDC), and 10CFR50.55a
Scope	Introduction of licensed material from any source (equipment or work practices) into the subsurface soil or ground water	Most subsurface piping and tanks on site that are outside of buildings and all that are safety related or contain licensed material.
Typical Owner	Chemistry, Radiation Protection, or Environmental Protection	Engineering
Components	SSCs and work practices involving licensed material or that could contain licensed material	• Buried piping containing any fluid, and, • Underground piping or tanks that are outside of buildings, below grade, and safety related or contain or are contaminated with licensed material
Prioritization Method	Risk ranking with the goal of prioritizing mitigation efforts and sentinel well placement. Uses some different parameters than UPTI method (see Appendix and Reference 5.3): • History (maintenance and leakage) • Condition	Risk ranking with the goal of developing inspection priorities. Uses some different parameters than GPI method (see Appendix): • Design information • Fabrication data • Pipe linings and coatings • Fluid information • Soil condition

Element	GPI	UPTI
	• Design • Inventory • Hazard • Mobility • Leakage and maintenance history • Component condition • Component design and enhancements • Radiological inventory, hazard and mobility • Leak detection capability	• Cathodic protection • History • Safety class • Failure effects • Leak mitigation
Reporting	• Periodic and per occurrence • To NRC, local, state, and NEI	• Semi-annual and per occurrence • To NEI, INPO, and EPRI
Deviation Process	Limited voluntary communication described in NEI 07-07. Requires documented justification	Described in NEI 09-14. Requires executive approval and report to industry
Program Assessments	Initial and periodic independent self-assessment and NEI-sponsored peer assessment at least every 5 years	None

4 INITIATIVE COORDINATION

4.1 GOAL

The overall objective of the GPI and UPTI Initiatives is to:

- Prevent unintended release of fluids, especially fluids containing licensed material, into the environment.
- Detect leakage as soon as possible if it does occur.
- Demonstrate the industry's commitment to high standards of radiation safety, environmental protection, and safe, reliable plant operation.

The intent of addressing the coordination of the GPI and UPTI in this document is to enhance the efficient, effective implementation of each initiative.

4.2 INTERFACE BETWEEN THE GPI AND UPTI

The GPI and UPTI must be coordinated and the organizations responsible for their implementation must communicate to ensure that related activities are mutually supportive, efficiently utilize site resources, and do not conflict. Examples:

- Scope: Simplistically expressed: the UPTI scope extends from the component pressure boundary and any exterior coatings inward into the system or component; the GPI scope extends from the component pressure boundary outwards to the environment (subsurface soil or water) and then to the site property boundary and off-site. (GPI scope also includes processes or work activities that involve licensed material that are not addressed by UPTI) The UPTI provides reasonable assurance of the integrity of in-scope (below grade) components. The GPI identifies leak potential, monitoring measures, and identifies actions to mitigate or manage the potential for off-site migration.
  The components addressed under each Initiative overlap but are not the same – the UPTI includes a subset of the SSCs considered under the GPI and also considers components that are not covered by the GPI. The UPTI addresses most underground piping and tanks on site, irrespective of what fluids they contain. The GPI addresses SSCs and work practices, but only if they contain or could potentially contain licensed material.
- Organizational Responsibilities: Radiation protection / chemistry personnel are typically responsible for GPI implementation. Engineering personnel are usually responsible for UPTI implementation. These groups must understand each other's roles and responsibilities and coordinate activities. Engineering assistance in performing the GPI risk assessment of SSCs is critical to a robust evaluation.
- Risk Ranking Process: The two risk ranking processes have a similar objective (the establishment of appropriate surveillance and mitigation activities to reduce the potential for a leak) but use somewhat different methods and parameters which apply to

overlapping (but not identical) populations of components. The two risk ranking processes may lead to apparently different results and program owners must fully understand those differences and manage seemingly conflicting priorities properly. The goal of the UPTI risk ranking is to inform program activities such as mitigation, inspection, and asset management. The goal of the GPI risk ranking is to identify those SSCs or work practices with the greatest potential for unintended leaks of licensed materials. See the Appendix to this document for a more detailed comparison of the risk ranking methodologies.

- Leakage Events: If leakage of licensed material does occur, it may be discovered by personnel responsible for the GPI first. Personnel responsible for the UPTI should assist in both the location and evaluation of the source by using information collected through the UPTI program implementation. Information related to the event should then be factored in to the UPTI risk ranking process for future inspections. Conversely, the results of UPTI risk assessment or inspection may identify a system or component that has leaked or has a higher likelihood of leakage and that has not yet been detected in the GPI groundwater monitoring wells. Such information should be used by GPI program owners to update their groundwater monitoring programs. Timely and frequent communication between GPI and UPTI owners is necessary when significant unexpected results occur in either program.
- Non Destructive Examination: NDE is an essential part of the inspections that are performed under the UPTI, and provides needed information in support of the GPI. It is a tool that may help determine the potential for leakage, the need for inspection, and the source of leakage, should it occur. Other techniques such as pressure testing or flow testing are also useful in evaluating the integrity of the component/system.
- EPA Regulations: Activities expected under the UPTI exceed those required by the EPA for applicable underground piping. The UPTI does not address above ground piping, but relies on utility implementation of EPA regulations to minimize the possibility that underground or above ground components containing environmentally hazardous fluids do not leak into the soil. The GPI only addresses work practices involving radioactive fluids or components that contain (or could be contaminated with) licensed material.

4.3 Recommendations for Efficient Implementation of the GPI and UPTI

The following thoughts on efficient implementation of the GPI and UPTI are organized in accordance with the activities to which they relate. This information was developed by compiling ideas and work practices communicated by various utilities during the development of this document. Adoption of any of these items is at the discretion of the utility.

4.3.1 Program Content and Oversight

- Governance procedures should be established to ensure roles and responsibilities under each Initiative are clearly understood and to facilitate efficient and effective use of site and corporate resources. The governance procedures or charter should promote implementation of these initiatives in a committed and enduring fashion.

- A multi-disciplinary steering committee that meets periodically and provides for the coordinated implementation of the Initiatives is strongly encouraged. Consider assigning the following responsibilities to this group:
    - Facilitation of communication between GPI and UPTI program owners
    - Agreement on high risk SSCs that contain or could contain licensed material
    - Review of ground water samples and piping inspection or testing results
    - Review of GPI and UPTI program health reports - GPI and UPTI program health reports should be aligned so that they use consistent input and arrive at consistent recommendations.
    - Periodic communications with applicable system engineers and affected departments (e.g., Operations, Chemistry, RP, Environmental, Design Engineering, etc.)
    - Communication of program priorities to site management
- Groups represented on the steering committee are expected to vary from company-to-company but consider including the following organizations that may not have specific responsibilities related to the programs.
    - Communications – Information from or activities undertaken by the GPI or UPTI may cause public interest or change previous public communications.
    - Off-site Emergency Planning – Stakeholder communications including voluntary communication of unintended leaks or spills would likely involve outreach to local cities, counties, and the state.
    - Training
    - Licensing
    - Organizational Effectiveness / Assessment / Oversight
- Depending on the programmatic controls, this steering committee may be in place for a fixed duration or an indefinite term and it may operate at a fleet or site level.
- Provide an executive sponsor for the steering committee to champion the program with other site management, resolve differences between program owners, and facilitate application of resources.
- Plant configuration and design control procedures should include screening guidance to determine when GPI or UPTI program owners should be included in the review for changes that add or remove in-scope components or affect the potential for component leakage or risk ranking results.
- Establish rules for abandoning buried or underground pipes or tanks to avoid future confusion and unnecessary or inefficient activities (such as inspection of abandoned piping because it is still connected to an active system).

4.3.2 Routine Program Operations

- Engineering, Operations, Radiation Protection, Chemistry, Maintenance, and Environmental Protection involvement in performing the GPI risk ranking may be helpful

in ensuring a robust, defensible evaluation. The UPTI risk ranking process is typically more structured than the GPI, but input from these groups may help to ensure consistency between both risk ranking processes.

- Personnel responsible for risk ranking under the GPI and UPTI must communicate, share information and interpretation of data, consolidate or reconcile activities resulting from conflicting risk ranking results, and resolve conflicting priorities.
- Risk ranking results from both programs should be periodically reassessed for changing conditions and age related effects.

- The following information could affect both programs and should be shared.
  - Design, maintenance, and integrity information about the components
  - Leak prevention activities –will affect risk ranking.
  - Long-term strategies
  - Availability of new technologies - could affect program performance in areas of mutual interest.
  - Placement of ground water monitoring wells – The wells indicate locations where GPI program owners consider leakage risk the highest. Information from the risk ranking of both UPTI and GPI can assist in the placement of such groundwater monitoring wells and the management of any groundwater contamination events. Conversely, any contamination that is detected in the groundwater wells will signal the need to identify the source – which could be an underground component included in the scope of the UPTI. Utilities may choose to credit early detection as part of attaining reasonable assurance of structural and leakage integrity.
  - Plant hydrology/geology -if a leak occurs, where will the leak go and will a monitoring well detect it
  - Changes in ground water flow due to new construction or soil compaction
  - UPTI inspection sampling plans and monitoring frequency –could affect GPI program's understanding of the probability of leakage
  - Deviations from Initiative requirements – GPI and UPTI programs may depend upon the existence of certain data or activities within the other program that are affected by deviations to program guidance.
  - Interpretations of guidance requirements affecting components within the scope of the other Initiative –may be especially important when the interpretations affect program scope boundaries
  - SSCs in scope for UPTI vs. GPI – The UPTI covers selected underground piping and tanks. Spent fuel pools, contaminated sumps, lagoons/pools/retention basins, and aboveground tanks are outside the scope of the UPTI. The GPI covers these components if they contain licensed material as well as initial holdup pond, waste collection pond, nuclear service water tanks, fire protection system (when its water source contains licensed material), refueling canal, buildings sumps, etc.
  - SSCs identified as "run to failure" under UPTI that will not be inspected.
  - Susceptibility of components to external and/or internal fouling or degradation, especially when the susceptibility is due to contained fluid or soil conditions –will affect the probability of leakage

  - Risk ranking inputs and results – UPTI risk ranking results for piping containing licensed material could influence GPI leakage probability assumptions. Also UPTI risk ranking by piping segment may influence monitoring well placement (UPTI ranks by piping segment vs. system). Note that the risk ranking of components containing licensed material is evaluated under NEI 07-07 independent self-assessments and NEI-sponsored peer assessments. Appendix B of NEI 07-07 identifies those objectives and acceptance criteria that will be evaluated.
  - Program and system Health Report status, including the health of the cathodic protection system (if present)
  - Budgetary needs
  - Operating experience (internal and external) including applicable regulatory activities, industry information, and self-assessment results
  - GPI information on system radioactive material inventory, hazard, and mobility will affect the consequence of leakage and may affect the input used for UPTI risk ranking.
  - Upcoming industry events/meetings
  - Dialog from industry interfaces (workshops, meetings, etc.)

- Snow in certain areas of the site may contain licensed materials (tritium, for one) well above the background content of snow in other areas. Snow removal activities and storage locations for snow piles can result in detectable concentrations of licensed material in ground water or soil in areas away from the power block or distant from systems and components containing licensed material. GPI program owners should be aware of snow removal activities.

- Storm drains are typically low risk systems, but they are not typically designed to be leak-tight. The integrity of storm drain piping can be important from a licensed material perspective. Leakage (both into and out of storm drain piping) of fluids that contain licensed material can be a pathway for unintended releases.

4.3.3 Inspections and Surveys

- Timely communication between program owners of inspection results, especially significant unexpected results (e.g. indications of licensed material, leaks or failure of components, inspection/test results indicating earlier than expected failure) is essential since much of the information used by one group will be relevant to the other. Information that would be useful to both program owners includes:
  - The location of any digging performed to access piping or tanks for inspection/examination. Digging will affect local hydrology (subsurface water movement), may lead to pipe damage, and may affect soil conditions.
  - Leaks in subsurface piping or tanks and leakage source information. This may affect contamination survey locations, monitoring well location, and response to leakage events.
  - Ground water monitoring well data – This will inform both program owners as to the potential source of leakage. Engineering will be asked to assist in determining potential sources of licensed material to the affected well(s).

- Results of radiation and contamination surveys, especially when the surveys indicate contamination where it was previously not seen, may be an input to the scope of the UPTI.
    - Note that the interpretation of licensed material and minimum detectable activity may vary between sites. "Licensed material" is defined in 10 CFR 20 and NEI 07-07 describes the threshold for determining whether a pipe or component contains or could potentially contain licensed material. UPTI program owners must seek the assistance of radiation health/protection or chemistry personnel to assess this information.
- Condition/integrity of components (aboveground or subsurface) affects the probability of leakage.
    - Significant changes in material condition that could change the possibility of release to the environment or which may result in a decision to change sampling frequency.
    - Results of inspections/assessments - Inspections performed under the UPTI will affect the GPI risk ranking parameters "Condition" and "History".
    - Health of underground/buried pipe and tank corrosion mitigating systems such as coatings and cathodic protection systems or CP system changes – will directly affect probability of leakage.
    - The voltage potential established by cathodic protection systems can affect the flow of groundwater.
    - Secondary containment structures - affects the likelihood of licensed material being able to reach the environment.
- Estimates of fitness for service, future degradation, or remaining life developed by the UPTI program will affect the probability of leakage.

- Consider the need for additional sentinel wells or some other means of early detection if UPTI risk ranking results or inspection findings indicates new high risk locations or potential degradation of components that contain licensed material. Wells are not a risk prevention method – sampling of wells provide timely detection of unintended leaks after the licensed material has been released to the environment.

4.3.4 Incident Response

- Consider using the steering committee or establishing another multi-disciplinary team to respond to leaks or unexpected increases in licensed material concentrations in ground water well samples when they are identified. The experience associated with both programs can assist with leakage source identification and remediation.

5 REFERENCES

5.1 NEI 07-07, INDUSTRY GROUND WATER PROTECTION INITIATIVE (latest revision)

5.2 NEI 09-14, GUIDELINE FOR THE MANAGEMENT OF BURIED PIPING INTEGRITY (latest revision)

5.3 EPRI GROUNDWATER PROTECTION GUIDELINES FOR NUCLEAR POWER PLANTS (latest revision)

5.4 EPRI RECOMMENDATIONS FOR AN EFFECTIVE PROGRAM TO CONTROL THE DEGRADATION OF BURIED AND UNDERGROUND PIPING AND TANKS (latest revision)

5.5 COORDINATION OF EPRI RISK RANKING METHODOLOGIES FOR NUCLEAR POWER PLANT GROUNDWATER PROTECTION & UNDERGROUND PIPING PROGRAMS (EPRI REPORT 1023022)

APPENDIX
RISK RANKING COMPARISON

EPRI has provided technical guidance for implementing the industry initiatives related to groundwater protection and underground piping and tank degradation. Strong coordination at the plant level among personnel responsible for these areas is needed to meet the expectations of the industry initiatives and help address public concerns. The two risk assessment processes have similar objectives but use different methods and parameters and apply to overlapping but not identical populations of systems and components. The individual risk assessment methodologies for groundwater protection and buried pipe degradation management can provide complementary data and insights to inform plant decision-making, and while there are many parameters in common there are also some differences. Users must be aware that risk ranking results may lead to apparently differing results and be prepared to address and explain any seemingly conflicting priorities.

The following sections compare the two risk ranking methods. A detailed comparison is documented in the EPRI Report 1023022 (published December 2011), "Coordination of EPRI Risk Ranking Methodologies for Nuclear Power Plant Groundwater Protection & Underground Piping Programs."

EPRI Groundwater Protection Guidelines (1015118)
The objective of the Groundwater Protection Initiative (NEI 07-07) is to "help licensees…improve management of situations involving radiological releases that get into groundwater." Per this initiative, each nuclear power plant must implement a groundwater protection program to better understand and quickly identify any existing or potential radiological contamination of groundwater. The *EPRI Groundwater Protection Guidelines* (1015118) provide technical guidance for implementing groundwater protection programs at nuclear power plants.

The risk assessment conducted per the Ground Water Protection Initiative and the EPRI Groundwater Protection Guidelines includes any "systems, structures, and components (SSCs) that contain or could contain radioactive liquids, whether above or below grade…" This includes any subsurface piping that contains or could contain licensed material. The purpose of the ground water risk assessment is to understand the potential of each SSC to have an unintended leak of licensed material to subsurface soil or water and to implement provisions to quickly detect any unintended leaks, should they occur. These provisions may include the installation of sentinel monitoring wells around the high risk SSCs or other leak detection systems in addition to monitoring wells that provide for early detection of unintended leaks. Users may choose to implement mitigating actions on SSCs (e.g., repair buried piping or replace it with above ground piping, replace metal piping with HDPE piping, repair or replace valves, etc.) to reduce the risk of an unintended leak from the SSC and therefore lower its priority in the ranking during the risk assessment process. The risk ranking systems use a risk calculated by likelihood of leak or spills and the consequence of the leak of spill. The likelihood is calculated using information about the history of leaks or spill, condition, and design of the system or

component. The consequences are focused on the unintended release of licensed materials and include considerations for the inventory, hazard, and mobility of fluids and radionuclides in the system or components and how quickly they would be detected.

EPRI Recommendations for an Effective Program to Control the Degradation of Buried Piping

The Underground Piping and Tanks Integrity Initiative (as described in NEI 09-14) references the recommendations in EPRI Report, *Recommendations for an Effective Program to Control the Degradation of Buried Pipe,* as a means to achieve the goals of the initiative. This report provides technical guidance for the implementing programs for controlling the degradation of buried piping at nuclear power plants. Specifically, it "…provides methods and recommendations to develop a sound and effective program to achieve safe and reliable operation of buried piping systems in nuclear power plants …….. it provides comprehensive yet succinct guidance in order to facilitate its practical implementation. The document identifies the data necessary for developing a safe and cost-effective Buried Pipe Integrity Program, in many cases in the form of checklists and tables with applicable references for further details."

The recommendations are organized in a six-step process: (1) developing a program plan, (2) risk ranking, (3) performing direct inspections, (4) evaluating degraded pipe for fitness-for-service, (5) repairs, and (6) preventive actions. Risk ranking is done on a piping segment basis to understand local vulnerabilities, identify high risk locations, prioritize inspections, and evaluate mitigation options. Risks to evaluate include degradation emanating from the fluid side as well as the soil side, and mechanisms that can cause leaks (e.g., pits, cracks), result in a break of the cross section, or inhibit flow (e.g., tuberculation). Consequence considerations include release of both radioactive and non-radioactive contaminants, effects to nuclear safety (e.g., core damage frequency), personnel safety, and economic issues (e.g., loss of generation, cost of repairs, and damage to adjacent components).

Coordination

There is an obvious link between ground water protection and underground piping and tank issues: controlling leaks from underground components is important for ground water protection. The risk assessment results from the ground water and underground piping and tanks programs at each nuclear site should be used to inform the objectives of the other program. For example, risk assessment results can enable nuclear plants to prioritize the application of program resources to higher risk situations.

Plant-level coordination among ground water and underground piping and tank program owners can potentially reduce overall plant risk and ensure inspection and mitigation activities are appropriately integrated. Understanding the synergy between the two methodologies could potentially avoid duplication of site efforts, minimize the chances of the methodologies, and result in more informed risk assessment results. Understanding should also avoid the misuse of the results of the risk rankings.

Within EPRI, coordinated research activities across ground water and underground piping and tank disciplines will ensure technical guidance is effectively integrated into nuclear plant

practices. For example, coordinated workshops are being conducted to capture operating experience from both areas and incorporate such experience into future guidance documents.

The table below compares the risk assessment methodologies for ground water and buried piping.

Table 1
Properties of the Risk Assessment Guidance provided per Groundwater Guidelines and Buried Piping Recommendations

	Groundwater Guidelines	Buried Piping Recommendations
Objective	Inform implementation of ground water protection program elements for quick and effective detection of unintended leaks of licensed material.	Identify and prioritize actions related to the mitigation of buried pipe degradation and failure.
Scope	All systems, structures, and components (SSCs) and work practices (WP) that contains / involves or could contain / involve licensed material. Includes SSCs both above and below grade.	• Both safety-related and non-safety-related piping systems. • Piping designed to the ASME B31.1, B31.7, Section III, NFPA and AWWA piping Codes. • Ferrous, non-ferrous, and non-metallic pipe. • Systems conveying a variety of fluids: (1) Liquids (water supply and return, fuel and lube oil, etc.), (2) Gases (off-gas, air, vacuum, hydrogen, argon, helium, oxygen, nitrogen, etc.), and (3) Vapors (steam)
Exclusions	Systems or components that do not and cannot potentially contain licensed material.	• Piping and tanks that are located wholly within building or a structure • Piping and tanks that are below grade but are accessible for direct inspection • Piping and tanks that are contained within building walls or basemats • Piping that is owned by others that runs inside the owner controlled area • Owner's piping located outside of the owner controlled area (unless it is safety related or contains licensed materials) Buried piping segments whose failure is inconsequential, and would cause no

		direct or collateral damage (as described under Section 2.6Consequence Assessment), may also be excluded from the scope of the buried piping integrity program.
Methodology	Risk ranking based on likelihood & consequence. Likelihood & consequence factors are given numerical values. An equation for calculating the Priority Index (relative risk ranking number) is provided. Methodology is typically system based and considers only radioactive releases.	Risk ranking based in likelihood & consequence. Likelihood assessment (e.g. high, med, low) given for each segment and each failure mode (leak, break, occlusions, mechanical damage). Consequence of failure (e.g. high, med, and low) for each segment and each failure mode determined considering common degradation mechanisms. Methodology is line and segment based.
Likelihood	Takes into account: History: • Has there been a history of leaks or spills from this SSC or WP? Also considers maintenance history • Condition: • What is the current condition (integrity) of the SSC? • Are there any known defects or maintenance issues that may lead to leaks, spills, or unanalyzed pathways from this SSC or WP? Design: • Takes into account material of construction, design and operating conditions, barriers between SSC to the environment, active protection tools (i.e. CP, secondary containment.)	Takes into account: • Design (materials of construction, wall thickness, etc.), • Operating conditions (temperatures, loads, pressures, etc.), • Inner fluid chemistries, • Soil chemistries, • Cathodic protection, • Leak history, etc.
Consequence	Radionuclide inventory, hazard of radioactivity, mobility of radionuclides	Nuclear safety, radiological impact, industrial safety, environmental damage, cost consequences and financial losses.
Tools	EPRI Priority Index Spreadsheet or other utility-specific methods	Software tools (e.g. EPRI's BPWorks)