NEI Codes and Standards Task Force

NRC Public Meeting 12-3-19

Discussion Items

- NEI Codes and Standards Task Force
- NEI 09-14 Underground Piping and Tank Integrity Guideline and ASME Section XI Proposed Changes
- 10CFR50.55a OM Condition: Valve Position Indication
- 10CFR50.55a Simplification and Changes

NEI Codes and Standards Task Force

Task Force Mission and Scope

Codes and Standards Task Force (CSTF)

Mission

Ensure licensee and regulatory activities implemented through codes and standards committees are consistent with nuclear industry policies and interests, and consistent with the Principles of Good Regulation

Codes & Standards Task Force Scope

- Advocate for utility representation on code and standards committees to improve industry engagement.
- Align utility representatives on changes to codes and standards by ensuring the best interest of the industry is known and understood.
- Communicate proposed or approved code and regulation changes that significantly benefit or impact the industry to garner requisite support or challenge.
- Facilitate collaboration on code and standards activities and review of regulatory changes, including application of risk-informed approaches.
- Primary task force interface with NRC on code items including emergent issues from inspections to ensure industry alignment.
- Promote retention and understanding C&S knowledge.

NEI 09-14 Underground Piping and Tank Integrity Program

Proposed ASME Section XI Changes

Background

- 2009 NEI Industry initiative on Buried Piping Integrity
- NRC/NRR Buried Pipe Action Plan initiated September 2010
    - Buried Pipe Action Plan closed December 2015 (ML15316A847)
- NEI 09-14, Rev. 0 "Guideline for the Management of Underground Piping and Tank Integrity" issued November 2010
    - CNO's formal commitment to initiative in NEI Letter dated November 20, 2009
- NRC TI 2515/182 Buried Pipe Temporary Instruction – Phase 2 Inspection Requirements issued May 2012
    - Buried Piping Inspection under TI completed March 2015
- SRM-SECY-12-0060 Commission approval of Staff proposed change to ASME Section XI for leakage testing of buried pipe in June 2012

Background (continued)

- NEI 09-14, Rev. 4 issued December 2015 transitioning from initiative implementation to engineering programs management including long term asset protection (NEI Buried Pipe Task Force disbanded)
  - NEI 09-14 scope is beyond ASME Section XI scope
- June 2016 NRC TI 2515/182 Phase 2 Inspections Summary Results (ML16174A032)
  - "The results of the phase 2 inspections indicate all sites perform effective risk ranking, all sites have programs and all sites have or are developing associated performance indicators and system health reports for buried assets. All sites are performing inspections of high risk buried assets. Many sites are making improvements to cathodic protection systems. These changes have enabled utilities to identify assets at risk for significant deterioration and implement inspection, maintenance, repair and replacement strategies to ensure long term reliability of safety related underground and buried piping and tanks that are safety related or that contain hazardous material."
- Sept 2016 NRC Update on Buried and Underground Piping and Tank noted; "Rates of significant leakage events have exhibited a decreasing trend consistent with improved maintenance and inspection practices over the span of the action plan."

Current Status

- Commitment to NEI 09-14 by utilities' Chief Nuclear Officers continues to be met through station programs and Asset Management Plans

- INPO Material Review Visits (MRV) assess the effectiveness of stations' Buried Pipe programs and compliance to NEI 09-14
  - INPO MRV general results show overall positive trend with reduction in number and severity of findings and recommendations

- EPRI Buried Pipe Integrity Group (BPIG) is active in pursuing assessment, maintenance, and rehabilitation technology and practices
  - Active and widespread utility involvement with these industry groups

Current State (continued)

- Industry data indicates positive trend in performance as evident by reduction in leaks from underground piping and tanks from 2009 through 2019

- ASME Task Group on Buried Components Inspection and Testing draft of new Section XI Appendix Z did not pass ballot and has been tabled

- Staff initiated changes to IWA-5244 are in process to revise the leakage testing of buried components

Licensee Examples of BP Program Implementation

Exelon Fleet
Buried Piping and Tanks
Program Overview

Nov 2019

Exelon Generation®

Program Background

- **Program Purpose:**
  - The Buried Piping & Tanks Program was established to provide reasonable assurance of structural and leakage integrity of in-scope underground piping and tanks with special emphasis on components that meet at least one of the below criteria:
    - are safety-related
    - contain licensed material
    - contain hazardous material
  - The program was implemented to satisfy the NEI 09-14 Initiative (Guideline for the Management of Underground Piping and Tank Integrity).
  - This program monitors and mitigates risks from in-scope piping and tanks
- **Implementing Procedure / Processes:**
  - The Buried Pipe & Tanks Program is implemented per Exelon management model governance.
  - The program utilizes one Site Piping Engineer at each of the 13 sites and two Fleet Program SMEs.
  - The program has annual health/indicator reporting requirements.
  - The Fleet Program Long Term Asset Management Plan is reviewed/updated annually by each site in the fleet.

Current Program Activities

- Raw Water / Buried Piping Pool
  - 20 high priority projects are funded through a specific budgetary pool for Raw Water / Buried Piping. This ensures funding stability and adds corporate oversight / support for projects from conceptualization to implementation.
  - In the next three years alone, Exelon will spend tens of millions of dollars across its fleet on these projects which will inspect, repair, and/or mitigate buried and raw water piping.
  - Outside of this pool, there are dozens of site-funded projects accomplishing similar programmatic goals.
- Long Term Asset Management (LTAM) Plan
  - The LTAM is broken into five issues where each site communicates/documents risk to Buried or Raw Water Piping assets and the Cathodic Protection assets that protect that piping.
  - With sites providing annual updates to the LTAM's content, this satisfies the committed and enduring aspect of the Exelon Buried Piping Program's continued adherence to NEI 09-14 guidelines and principles.
  - 81 projects are currently listed in the LTAM related to inspection, repair, and/or mitigation of those assets, with several dozen more identified to be added to the next LTAM revision.

Sampling of 2019 Buried Piping Site Activities

CPE

Inspections

- One site re-inspected its SX bisulfite piping to trend observed degradation / wall thinning.
- One site re-inspected its AFW and DFO piping for License Renewal commitments.
- One site inspected its CCSW piping to prove-up previous Guided Wave data and inform a proactive replacement strategy project.
- Three sites inspected their Oily Water Separator buried tanks per PM requirements.
- Two sites performed Guided Wave indirect inspection of buried piping to inform their direct UT inspection strategy.
- All sites with CP performed some form of CP testing/monitoring, whether they be monthly/annual PMs, CP tests for tanks, annual surveys, and/or other testing.

Repairs and/or Mitigations

- One site continued a multi-year, multi-phase project which has to-date repaired almost 3,000 linear feet of buried CD System piping with Carbon Fiber Reinforced Polymer.
- One site continued a multi-year, multi-phase project, with annual replacements of several hundred linear feet of pipe replacements for its CSCS/VY Systems, with buried portions being proactively upgraded from CS to SS.
- One site upgraded a portion of its FP piping to HDPE from Cast Iron due to OPEX of leakage.
- One site upgraded its Cathodic Protection system to add additional shallow ground bed anodes and monitoring stations.
- One site started Phase 1 (initial project phase) for whole-site replacement / upgrade of its FP header.






Duke Energy Buried Piping Integrity Program

Philip H. Kohn, P.E., Fleet Piping Integrity Team

DUKE ENERGY®

- Safety Related Diesel Fuel Oil Supply Lines
  - Direct examination of buried carbon steel piping revealed general corrosion.
  - Guided wave ultrasonics had medium indications of degradation.
- The entire system was replaced with double wall stainless steel piping in 2014 to remediate the condition.

- Safety Related Standby Shutdown Facility Auxiliary Service Water piping
  - Approximately 280 feet of piping was examined in 2016 using an in-line tool.
  - This tool performed a UT examination of the entire length from inside the pipe.
  - This examination detected some external pitting corrosion.
- This line and all parallel trains were replaced with coated stainless steel 2017 and 2018.

Examples of Buried Piping Program Successes

- The radiological Liquid Waste Processing System at one station included several buried fiberglass lines.
  - The fiberglass piping had experience several leaks.
  - Industry OE indicated fiberglass piping degradation elsewhere.
- All fiberglass piping in this system was replaced with High Density Polyethylene in 2015 to prevent further leaks.

- One station had a cathodic protection system that was no longer functioning.
  - A new cathodic protection system was designed and installed.
- The new system went into service in 2013.

PSEG Buried Piping Program (BPP)

James A. Melchionna Jr., Fleet Buried Piping Program Manager

PSEG We make things work for you.

Salem HopeCreek

Example of Buried Piping Program Successes

Salem Unit 1 Aux Feed Piping Planned Inspection Discovered Missing Pipe OD Coatings (2010)

- Direct examinations as a result of NEI 09-14 driven inspections revealed missing coatings and general corrosion
- Guided wave as well as Direct Ultrasonics revealed no structural integrity concerns

Entire Unit 1 Buried portion of the Aux Feed system was replaced in kind

Piping was epoxy coated and backfilled with Controlled Low Strength material (CLSM) which has a high pH and acts as a protective coating for piping

Example of Buried Piping Program Successes

Salem Unit 2 Aux Feed Piping Planned Replacement Activities due to Unit 1 Findings (2019)

- Inspections/Project driven as a result of Site program activities due to NEI 09-14 & Extent of Condition requirements
- Unit 2 Inspections found piping coated
- Replaced Aux Feed piping and Control Air Piping with Stainless Steel

Entire Unit 2 Buried portion of the Aux Feed system as well as Control Air piping was replaced with Stainless Steel

Station Air piping also in excavation was inspected & rewrapped

Entire area backfilled with Controlled Low Strength material (CLSM) which has a high pH and acts as a protective coating for piping

Example of Buried Piping Program Successes

Salem Safety Related Service Water System

- Inspections driven by Site program activities due to NEI 09-14 implementation. BPP credits NRC GL 89-13 program for internal inspections
- Degraded 24” Prestressed Concrete Cylinder Pipe (PCCP) joints discovered during inspections
- 412 Joints cleaned, epoxy coated & covered w/ Internal Pipe Protective Seals (2010 – 2018)
- Multi-Year/Multi-Million dollar project to install isolation valves to facilitate discharge (tidal) piping repairs (2011-2018)

Example of Buried Piping Program Successes

Site Soil Samples & Surveys

- Salem & Hope Creek samples were/are taken during any pipe excavations (Ongoing)
- Salem Site sampling project done as part of License Renewal
- Samples reveal soil characteristics are not highly corrosive in nature across site
- Salem Site is installing corrosion monitoring probes to continually assess conditions for tracking/trending purposes (2019-2020)
  - These will be used to check & adjust the Sites inspection plan

Hope Creek

- 144" Circ Water Piping (Multi-Year/Multi-Million Capital) project is in progress installing internal Carbon Fiber Wrap repairs for degraded PCCP spools (2010-2022)

Example of Buried Piping Program Successes

Hope Creek Safety Related Service Water System

- Inspections driven by Site program activities due to NEI 09-14 implementation. BPP credits NRC GL 89-13 program for internal inspections
- Degraded epoxy coatings noted in 36” PCCP joints during inspections
- 118 Joints cleaned via abrasive blasting, epoxy coated & covered w/ Internal Pipe Protective Seals as appropriate (2008 – 2011)

Energy Northwest

Underground Piping and Tank Integrity Program

Kevin Van Speybroeck, Technical Services Manager

NEI 09-14 guidance and License Renewal criteria led to the classification of 11 systems as "in scope" with 2 additional systems characterized as high risk under classification software. These additional systems were due to industrial safety and/or repair cost potential

In-scope piping replacement on Safety Related Service Water

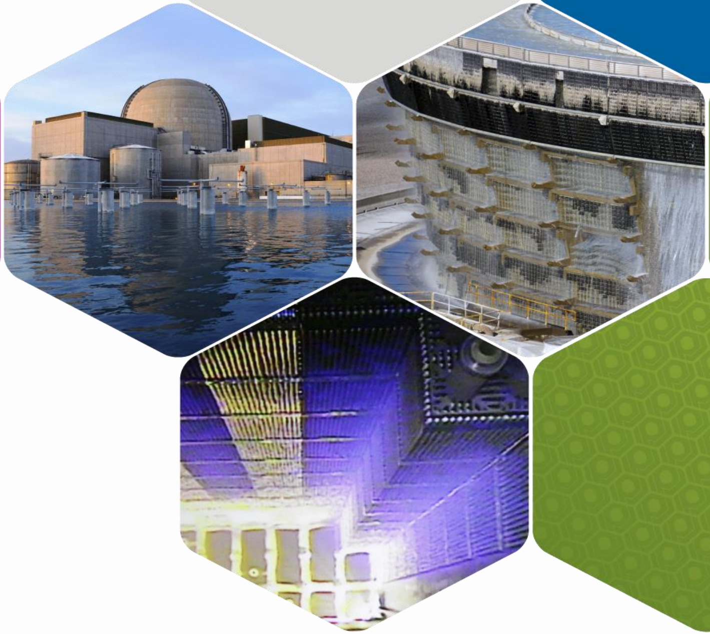
- 18 inch piping near restricting orifice with cavitation damage

Corrosion identified on Radioactive Floor Drain piping (July 2014)

- Guided Wave testing identified 1 medium and 2 minor indications
- Pipe wall thickness evaluation shows piping is well above the minimum required design wall thickness
- Next Scheduled Inspection is September 2023

- Fire Protection piping at a hydrant location experienced a non-corrosion related leak. During replacement, opportunistic visual inspections were conducted and identified that the protective coating had surface corrosion and when the coating was removed, the piping underneath was in good condition. (November 2014)
- In May 2016 one area of Service Water Piping (safety related) had a large coating flaw that led to a pit of 0.51”. This was evaluated and did not challenge minimum wall thickness in that area.
- Diesel Fuel Oil tanks and associated piping were inspected in January 2018. This testing included multiple methodologies including pressure testing and leak testing for some locations. All results were satisfactory.

Implemented SMART stacks for cathodic protection. After one year of data, 2 of 8 locations (at building/congestion points) show elevated corrosion rates (1.6 and 2.3 mpy) driving additional visual and UT inspections. Piping has been evaluated to be satisfactory for greater than 80 years in the most limiting case.



Palo Verde Generating Station

Buried Piping and Tanks Program

PVGS Buried Piping Program - Background

- Program initiated with 1st risk ranking conducted in 1998 and an original focus on station reliability (1998-2010)
- Advanced into an Underground Piping and Tank Integrity engineering program that remains compliant with the Industry Initiative - NEI 09-14 (2010-Present) including an active Asset Management Plan with inspection and remediation
- Asset Management Plan updates are presented at a minimum of once every two years to the Plant Health Committee

PVGS Buried Piping and Tanks Program – Inspections

- In 2014, PVGS is the 1st Nuclear utility to use in-line ultrasonic "smart" pig (Pipeline Inspection Gauge - common to the oil and gas industry) direct inspection to characterize the material condition of radioactive waste drain buried piping
- In 2016, based on PVGS/Industry OE, began implementation of in-line inspections (ILI) of Ultimate Heat Sink (UHS) buried piping to establish the material condition and remaining service life of this essential asset
  - Six inspections (100% or approx. 8000 feet) of 10" buried UHS piping inspected to date
  - In-line inspection of the 24" remaining buried UHS piping is scheduled for 2020-2022

PVGS Buried Piping and Tanks Program – Inspections

- In 2014, PVGS was the 1st to use underwater robotic phased array UT inspection (PAUT) technology on a tank floor (Unit 1 - and Unit 2 Condensate Storage Tanks 2014/2017).
- Five of the six Diesel Fuel Oil Storage Tanks inspected with PAUT (2013-2015)
- Two Liquid Radwaste Tanks PAUT inspected (2014-2019)
- In 1998, PVGS was the 1st to use electromagnetic inspection technology on pre-stressed concrete cylinder piping in the Circulating Water (CW) and Water Reclamation Supply Systems (WRSS).
    - Inspections continue on a 3 year frequency in each Unit
    - Data used to determine required remediation
- Pre-stressed Concrete Cylinder Piping (PCCP) Repairs -Circulating Water System
    - PVGS pioneered the repair priority engineering analysis and two repair methods (Internal Carbon Fiber Reinforced Polymers and External Post Tensioned Cable repairs) that are widely use today
    - Over 250 CW system pipe sections have been repaired since 1998

PVGS Buried Piping and Tanks Program – Remediation

- Cooling Tower Makeup and Blowdown
  - Approximately 5 miles of high density polyethylene pipe (HDPE) was installed to replace degraded concrete pipe in these systems
- Fire Protection System
  - 11,000 feet of buried ductile iron replaced with fiberglass reinforced polymer pipe
- Cathodic Protection System (Over 130 rectifiers and 500 test stations)
  - Capital Improvements (2020 completion) – Rectifier remote monitoring, 125 corrosion rate probes
- Other Repairs Currently in the Plant Modification Process
  - Safety Related UHS buried and vault piping
  - Plant Cooling Water buried piping
  - Chemical Waste buried piping

PVGS Buried Piping and Tanks Program – Remediation

Piping in Vaults (Normally Inaccessible)

- The vulnerability of piping in vaults that are normally not accessed by the plant staff was recognized (~2000)
  - At least 125 direct inspections of piping in normally inaccessible vaults have been completed including all safety related piping in vaults
  - Degradation from water intrusion has been found
  - Conditions have been remediated or being monitored for remediation per to the Asset Management Plan

Conclusion

- Utilities are committed to and are implementing NEI 09-14 as a living program to provide reasonable assurance of structural and leakage integrity of buried assets
- INPO assesses buried piping program implementation to standards of excellence and has noted overall improvement in the industry
- Industry performance has shown marked decrease in leaks since the implementation of NEI 09-14
- NRC Phase I and II inspections concluded that all licensees implemented the initiative, meeting established due dates, and implementation was effective
- NRC has noted significant decrease in rate of leakage events consistent with the improved maintenance and inspection practices
- NRC closed the NRR Buried Piping Action Plan in December 2015 noting:
    - “Licensees adequately implemented the Buried Piping Integrity and Underground Piping and Tanks Integrity Initiatives, and the initiative activities are effective in addressing degradation of buried piping.” Also, “Current regulations, codes, standards and industry activities continue to be adequate to ensure: a) leakage from buried piping has been of low safety significance with respect to structural integrity of the piping, and b) the amount of radioactive material that has been released has been a small fraction of regulatory limits.”

NEI Going Forward Recommendations

- Either minimally change the current IWA-5244, that was endorsed by the Commission, to provide alternate pressure testing guidance and not be prescriptive, or delete IWA-5244 entirely from ASME Section XI
    - Current ASME Section XI IWA-5244 “Buried Components” proposed revision to clarify underground piping inspections and testing will result in unnecessary prescriptive and complicated requirements for no additional safety benefit beyond that already provided by NEI 09-14
- Licensee underground piping and tank integrity programs should continue to be governed by NEI 09-14 and station programs and Asset Management Plans
- Consider revision of NEI 09-14 to incorporate lessons learned and/or new information

Questions and Discussion

10CFR50.55a OM Condition (b)(3)(xi)

Supplemental Position Indication (SPI)

Background

- Current edition of 10CFR50.55a Codes and Standards includes paragraph (b)(3)(xi) OM Condition: Valve Position Indication

- ASME OM Code 2012 Edition, subsection ISTC-3700 "Position Verification Testing" supplemental indication is a "should statement", includes "where practicable", and that the supplemental observation need not be concurrent

- Although intentions were good, the condition as written creates hardship in implementation for all required valves without commensurate increase in the level of quality or safety

Current In Service Test SPI Requirement

- 10CFR50.55a(b)(3)(xi) states that licensees shall verify that valve operation is accurately indicated by supplementing valve position indicating lights with other indications, such as flow meters or other suitable instrumentation, to provide assurance of proper obturator position. The NRC is requiring this condition for the implementation of the 2012 Edition of the OM Code. The Code requires SPI testing to be performed once every two (2) years.

- Some utilities have or are proposing relief from the Regulation and ASME OM Code that would require performing SPI once every two (2) years on all valves in the In-Service Testing Program.

- This Regulation and Code requirement is more restrictive than prior code requirements. Implementation of this condition for all required valves creates a hardship without a compensating increase in the level of quality and safety.

Supplemental Position Indication Hardships

Examples of SPI Hardships:

- Altered plant start-up sequence
- Non-typical system alignments and system alignment that cause inoperability
- Temporary removal of missile and security barriers
- Release of contaminated fluids during high pressure system venting
- Conflicts with Divisional Outage Strategy
- Creating an evolution with the potential to drain the vessel
- More frequent testing than required by other regulations (Appendix J LLRT) and code testing frequency criteria (ASME OM Mandatory Appendix III)

Overview of the CSTF Proposal

SPI requirements or frequency will be adjusted based on one of the following:

1. SPI crediting seat leakage testing to prove closure follows NRC approved performance based frequencies (Appendix J and PIV testing)

2. Component risk ranking results will dictate alternate SPI requirement or frequency.

The Process – SPI Risk Ranking

SPI Component Risk Ranking

- Consequence of failure ranked Low, Medium or High:
  - Determined via quantitative means when available (PRA or 50.69 as applicable)
  - Determined via qualitative means such as Maintenance Rule Expert Panel if not modeled
- Susceptibility of failure – Specifically stem-to-disc separation based on:
  - Part 21s past or present and actions taken to address
  - Failures as identified via Industry OE and Site OE
  - Site review of valve performance and design

    Note: Susceptibility will be continuously evaluated as new data becomes available

The Process - SPI Risk Ranking

The proposed Risk Rank SPI process provides an acceptable level of quality and safety by:

1. Only relaxing the testing requirement or frequency if the risk consequence or susceptibility to stem-to-disc separation are acceptably low
2. Applying predefined criteria for hardship in extending the test frequency.

Use governance to determine SPI testing hardships.

- Examples include, but are not limited to:
  - The potential to cause personal injury
  - Significant increase in dose or the spread of radioactivity
  - Potential to change reactivity
  - System inoperability specifically for SPI testing
  - Creating a potential to drain the vessel
  - Lifting leads, breaking air fitting, pulling fuses or any other activity that disrupts logic or motive force
  - Increasing the probability of failure of other components
  - Removal of missile barriers or security barriers

Conclusion

The proposed alternative appropriately reduces the hardship while maintaining the level of quality and safety:

- SPI testing effort will be focused on the most critical components susceptible to failure
- SPI testing will be commensurate with component risk
- Alternate required IST testing prescribed to detect and monitor component degradation remain unchanged
- Reduction in the potential to create undue risk to the personnel, plant, and/or components
- Preserve divisional outage strategy which reduces outage risk by maintaining one division/train operational

NEI Going Forward Recommendations

- Submit for relief to:
  - Modify the Supplemental Position Indication (SPI) testing requirement or frequency based on valve risk and susceptibility, and
  - Extend the SPI testing frequency for valves that have seat leakage testing frequency governed by an alternate NRC approved process

- Draft a new or revise the previous OM Code Case for an alternative to OM Code ISTC-3700 based on this risk based approach

- Consider further code and regulatory relief and/or changes to eliminate the SPI requirement based on results of valve performance from industry data

Questions and Discussion

10CFR50.55a Simplification

Industry Suggestions on Simplifying Rule and Proposed Changes

Background

- 10CFR50.55a has become complicated with many details beyond the level of applicable regulation
- 10CFR50.55a is difficult and cumbersome to follow with various elements and conditions associated with any specific code/standard spread throughout the rule
- 10CFR50.55a references code editions that licensed stations no longer implement

Suggested Simplification

- Simplify the identification of approved versions of the Code editions versus listing all of them
- Align approved code editions, conditions and code cases by applicable codes rather than scattered throughout the rule
- Maintain Regulatory Guide provision for implementing code cases
- Maintain relief request / impracticality provision
- Possibly create an Option B that provides these simplified requirements

Proposed Changes as Part of Simplification

- Eliminate or significantly extend the requirement for the 10-year Code update as required by the Licensee Containment Program, ISI Program, and IST Program (e.g. extend to 24 years)
  - Establish 3 – four year inspection/test periods over twelve year intervals, versus the current 3/4/3 year periods over 10 year intervals
- Permanent approval of Relief Requests until code incorporation
- Perform back-fit/forward-fit review for all existing conditions that are proposed to remain to ensure requisite safety benefit

Reason for Simplification and Proposed Changes

- Format the Rule in a manner that is easier to understand
- Minimize conflicts with code requirements and reduce the need for licensees to seek relief
- Reduce or eliminate the cost of an ISI or IST ASME Code update for dual unit or single unit site
  - Costs for each update has risen to approximately $1M per station
- 4-year inspection/test periods allow two outages per period to align with skip outages and divisional outages and not require inspections or tests to be done earlier than required
- Updating the Code program to a later edition each 10 years is no longer necessary to achieve an acceptable level of quality and safety

Reason for Simplification and Proposed Changes (cont.)

- From initial licensing of a plant,120-month update was a way to review code inspection requirements and their impact, and in some cases add or remove requirements based on newer code versions
- Licensees can adopt later NRC approved ASME Code editions, but should not be mandated to do so since they are following NRC approved ASME Code editions
- As plants have matured, the need for a “living” ASME Code has been reduced
- Licensees can implement other mechanisms to quickly react to emerging issues through industry groups to address safety or regulatory concerns as compared to a 120-month update
- Changes necessary for safety purposes can be specifically stated or conditioned in 10 CFR 50.55a

NEI Going Forward Recommendations

- Facilitate NEI member feedback on any 10CFR50.55a proposed simplifications and changes
- Develop a relief request to extend code updates to 24 years, with 12 year inspection intervals having three 4 year periods per interval
- Consider petitioning for rule making for the proposed changes and others changes that encompass previous industry wide reliefs or hardships that can be shown to not have commensurate safety benefit

Questions and Discussion