



**U.S. NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

# **Overview of NRC/EPRI NDE MOU**

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## Purpose of MOU

- NRC/EPRI Memorandum of Understanding
  - Allows and encourages cooperation in nuclear safety research which provides benefits for both NRC and industry
  - Enables technical information exchange and cost sharing in a mutually beneficial manner



## Coordination

- Under NRC/EPRI MOU
  - Independence is to be maintained
  - Cooperation or approval does not constitute a binding obligation and does not create an enforceable right of action on the part of either party
  - Parties are not to function as an advisory entity
  - Coordination of research activities and information sharing is one of the primary benefits of MOU



## NDE Addendum

- In-service inspection (ISI) is one of the primary tools in the management of age-related degradation in nuclear power plants
  - Purpose of ISI is to verify that no known or unknown damage mechanisms are compromising reactor safety, operational safety and personnel safety
  - As plants have aged, operating plant materials and components have experienced varying levels of degradation
    - New degradation mechanisms have emerged
    - Increasing number of components have required repair for the first time in operating history



## NDE Addendum

- Established March 22, 2011 with 5 SOWs
- SOW addressing HDPE added in 2013
- Renewed in 2014 adding SOW addressing modeling
- Current period of performance March 24, 2014 – April 30, 2018
- Identified Greg Selby, EPRI, and Wallace Norris, NRC as Project Managers. The NRC PM is being transitioned to Carol Nove due to Wally Norris' upcoming retirement.



## NDE Addendum

- Attachments (Statements of Work) in current Addendum
  1. Visual Testing - active
  2. CASS – expected to begin in CY15
  3. UT in Lieu of RT – expected to begin in CY15
  4. Document history/basis of Appendix VIII - complete
  5. RMSE - complete
  6. HDPE – recently begun
  7. UT modeling and simulation (new) - active



# NDE Addendum

## Attachment 1 - Visual Testing

- Cooperative research to assess capabilities and limitations of remote visual examination to detect cracking
- Phase 1 – complete – mini round-robin VT exercise
- Phase 2 – Round-robin study using 5 vendor teams using their equipment and procedures as they would be used in the field. Data analysis complete.
- Phase 3 – A follow-up round-robin exercise is being developed to address certain important unresolved questions raised in Phase 2



# NDE Addendum

## Attachment 1 - CASS

- PNNL and EPRI have exchanged piping specimens and data primarily for the purpose of EPRI verifying the work on thin- and thick-walled CASS pipe
- EPRI is planning a round-robin study to evaluate UT methods for CASS inspection.
- Depending on the approach taken, NRC/PNNL may participate in the round robin testing and evaluation.
- No joint planning to support MOU-related activities has occurred to date.



## **NDE Addendum**

### Attachment 1 – UT in lieu of RT

- NRC/PNNL actively evaluating the effectiveness and reliability of UT in lieu of RT for repair and replace activities in carbon steel piping. A NUREG/CR will be issued in the 2<sup>nd</sup> or 3<sup>rd</sup> quarter of FY 15.
  - Key outcome - PAUT has the ability to successfully detect flaws in carbon steel welds to performance levels comparable to, or even greater than, that achievable with RT; however, open issues remain.
- EPRI currently revising the MOU SOW for UT in lieu of RT.
- Discussions between NRC and EPRI staff under way to establish tasks, responsibilities, and deliverables for this SOW.



## NDE Addendum

### Attachment 4 - Document the basis of Appendix VIII

- The purpose of this SOW was to document the thinking and technical basis behind Appendix VIII, while the original developers are still available.
- The status is complete.
- Deliverable: NUREG/CR-7165, “The Technical Basis Supporting ASME Code, Section XI, Appendix VIII: Performance Demonstration for Ultrasonic Examination System.” (ADAMS ML13144A107)

## **NDE Addendum**

### Attachment 5 – RMSE – ID pipe examination depth sizing

- Establishes an alternative acceptance criterion for crack depth sizing accuracy when performing UT from the pipe ID
- EPRI developed a white paper to address the difficulties that vendors have with meeting the Appendix VIII acceptance criteria for depth sizing and propose a technical basis for an alternative root-mean-squared-error (RMSE) based criterion.
- NRC reviewed the white paper/technical basis.
- ASME Code actions approved.

# NDE Addendum

## Attachment 6 – HDPE piping

- ASME Code actions are in process to allow the use of HDPE materials to be used for Class 3 safety related piping system applications.
- Technical issues include:
  - Controlling the joining process
  - NDE on the completed joint
    - The flaw types and sizes of interest
    - Fabricating mockups with controlled flaws
- NRC and EPRI will determine an appropriate matrix of samples to assess the effectiveness associated with detection and characterization of flaws for visual and volumetric examination methods.



# NDE Addendum

## Attachment 7 – Modeling and Simulation

- NRC and EPRI cooperatively developing a framework for assessing UT models in three areas:
  - Simulation of the transmitted sound fields
  - Ability of the models to address all waveforms present (i.e., mode converted signals)
  - Address back scattered energies – assess received sound fields
- NRC and EPRI have begun collaborating to develop modeling best practices so that conclusions reached using models will be acceptable to both industry and the NRC