

# IN USE: LONG-TERM OPERATIONS ENHANCEMENT AND MODERNIZATION TECHNOLOGY

## ISSUE STATEMENT

Capabilities available through advanced technologies and plant modernization approaches have not yet been fully integrated into nuclear plant operations. Enhancement and modernization technology projects undertaken in the Long-Term Operations (LTO) Program at EPRI focus on identifying and developing new technologies that can inform decisions regarding long-term operations. Extending plant operation can provide the time required to justify investments in new technology. Such technologies could assist nuclear plant owners by improving process performance, addressing obsolescence issues, and reducing operating costs. For example, advanced computing hardware and more accurate, physics-based modeling can be used to assess plant safety margins and potentially provide added operational flexibility. Digital technology and systems offer potential performance and reliability improvements over older analog technology. Monitoring approaches applied to key components may provide cost-effective alternatives to traditional periodic inspections.

## DRIVERS

The utility decision making to pursue long term operation for a specific nuclear plant will clearly include economic considerations. Advanced technology can clearly drive economics in two significant areas: 1) providing enhancements to existing plant operating and maintenance processes to reduce costs or increase performance; and 2) providing effective and efficient replacement options for older equipment. Projects in this technical area will investigate technology in both categories and develop the necessary technical bases and guidance for effective application in nuclear power plants. Project results are expected to provide utilities with a suite of tools and options to potentially improve the economics of long term operation.

## RESULTS IMPLEMENTATION

The LTO Program has been structured to build upon ongoing research and development efforts within the EPRI Nuclear Sector and assure that technical bases and results are available to support utility decision making regarding long-term operations. The project results in this technical area on enhancement and modernization technology are expected to provide:

- Advanced approaches and software tools for safety and risk assessments.
- Failure data and software tools for equipment life cycle management. (This project activity transitioned to Plant Engineering in 2015. In 2016–2017, product focus will be on utility implementation.)
- Advanced information, instrumentation, and control (II&C) technologies to enhance or replace existing approaches.
- Centralized on-line monitoring (COLM) technology to enhance equipment degradation diagnostics and management. (This project activity transitioned to I&C/ Software Development in 2015.)
- Passive component monitoring technologies to cost effectively detect and trend aging degradation that will augment or replace traditional periodic inspection processes.

The overall result will be a set of options for reducing costs and improving performance that plant owners can consider in their decision making on useful life for a specific plant.

## PROJECT PLAN

The LTO Program performs R&D project activities by combining existing EPRI technical program efforts with coordinated and collaborative research conducted by the U.S. Department of Energy (DOE) and national laboratories, commercial vendors, and international organizations such as the Materials Aging Institute. Specific collaboration on enhancement and modernization research activities with the DOE's Light Water Reactor Sustainability (LWRS) Program occurs in select technical areas, including risk and safety analysis and advanced information, instrumentation and control (II&C) technology. EPRI and DOE have created and maintain a joint R&D planning document that is updated annually.

Specific efforts related to enhancement and modernization are focused in three areas:

- Identify enabling technologies capable of reducing costs or improving performance relative to current approaches or equipment
- Develop the technical bases for evaluating and effectively applying the technology in a plant
- Demonstrate the achievable benefits via pilot applications

As appropriate, projects may need to address regulatory considerations in the application of new technology versus current license basis.

## RISKS

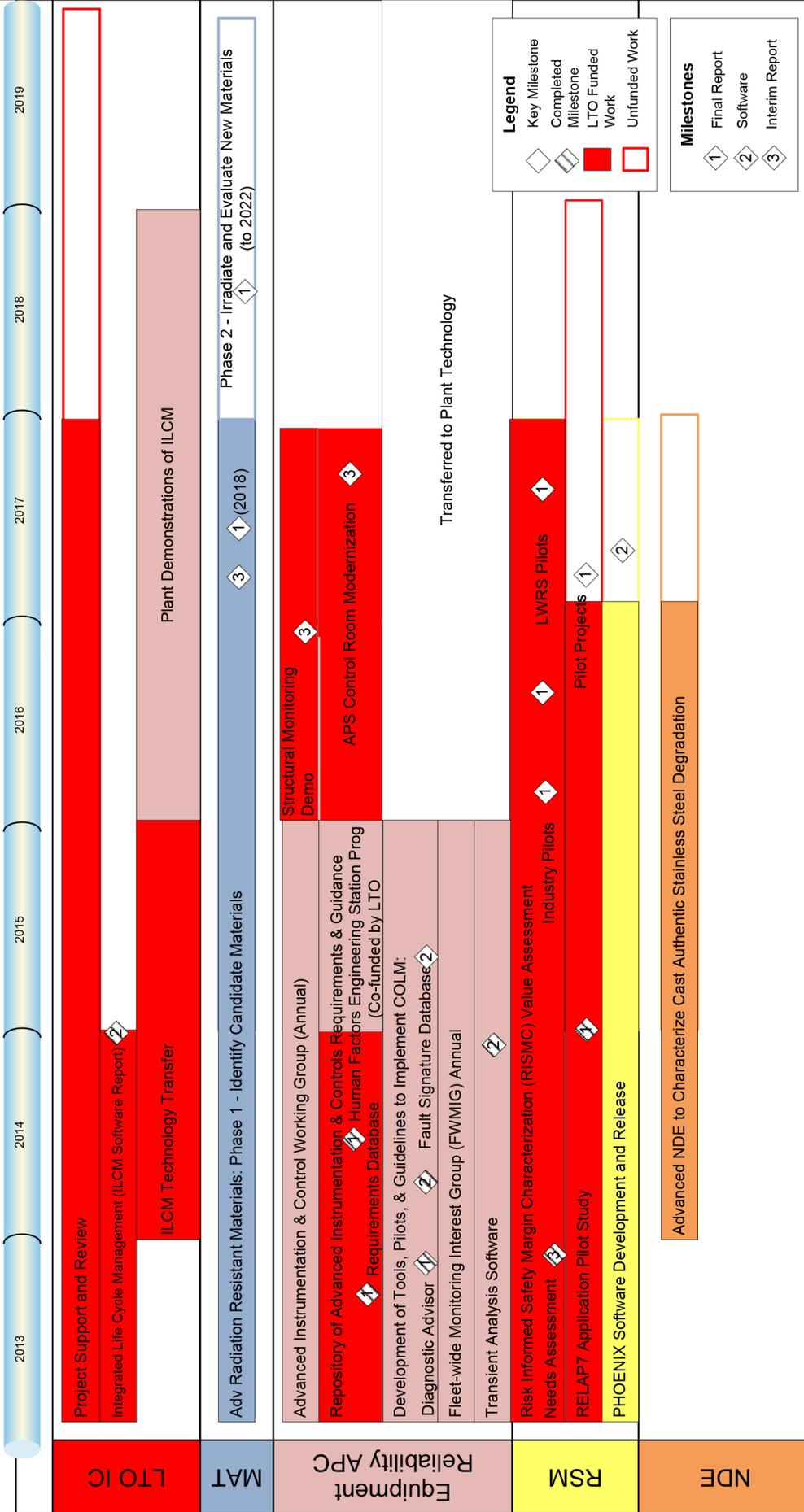
The issues and research plans inherently involve some risks in terms of actual results. The pursuit of projects involving implementation of new technologies and processes require significant time to gain utility and regulatory support and funding resources to sponsor pilot demonstrations. Reductions in costs and improvements in performance may not be sufficient to support licensing extensions for all current operating plants. Finally, this program is closely coordinated with the DOE LWRS Program such that key work scope and results are expected from this source. Failure to receive expected results or delays in the performance of planned work may similarly impact program results and timeliness.

## RECORD OF REVISION

This record of revision will provide a high level summary of the major changes in the document and identify the Roadmap Owner.

REVISION	DESCRIPTION OF CHANGE
0	<b>Original Issue:</b> January 2014 <b>Roadmap Owner:</b> Richard Tilley
1	<b>Revision Issued:</b> August 2014 <b>Roadmap Owner:</b> Richard Tilley  <b>Changes:</b> Update flowchart to reflect completed milestones. Update text to indicate integrated life cycle management project will transition to Plant Engineering in 2015.
2	<b>Revision Issued:</b> December 2014 <b>Roadmap Owner:</b> Richard Tilley  <b>Changes:</b> Update flowchart to reflect completed milestones and 2015 funding.
3	<b>Revision Issued:</b> August 2015 <b>Roadmap Owner:</b> Richard Tilley  <b>Changes:</b> Update text to reflect programmatic support change for COIM and to update milestones (completed and now planned).
4	<b>Revision Issued:</b> August 2016 <b>Roadmap Owner:</b> Richard Tilley  <b>Changes:</b> Updates to reflect work being moved to other Technical Programs and the additional of passive component monitoring to LTO activities.
5	<b>Revision Issued:</b> December 2016 <b>Roadmap Owner:</b> Richard Tilley  <b>Changes:</b> Update flowchart to reflect completed milestones and 2017 funding.

# Long-Term Operations Enhancement and Modernization Technology



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