

# NRC Workshop on Structural Materials

Research for Long Term Operation



EPRI Introductory Remarks  
October 1, 2024

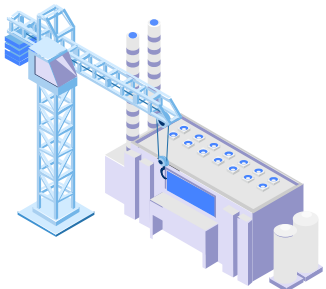
# Importance of Long-Term Asset Preservation

- Global energy demand rising > 20% by 2050, while the **global electricity demand** will increase nearly 100%. [International Energy Agency, [World Energy Outlook 2023](#)]
- **Decarbonization** of energy generation remains an imperative for most countries, while maintaining equitable access and sustainable development.

## Urbanization



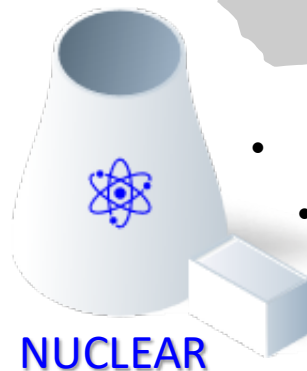
## Onshoring of Manufacturing



## Increasing Population [United Nations, [World Population Prospects 2024](#)]



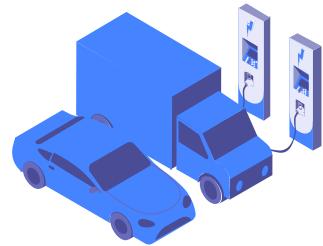
2024: 8.2 billion people  
2050: 9.7 billion people  
2075: 10.3 billion people



NUCLEAR

- Upgrading
- New Construction
- **Life Extension**

## Transport Electrification

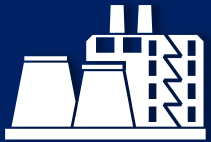


## Data Centers

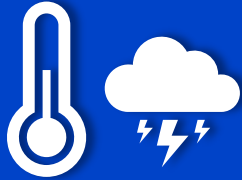


# EPRI's Nuclear Research Focus

**MORE  
MEGAWATTS**



**CLIMATE  
RESILIENCE**



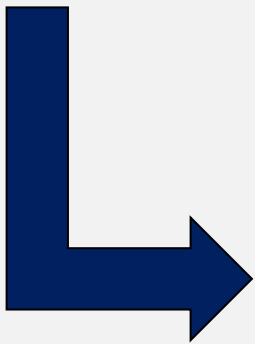
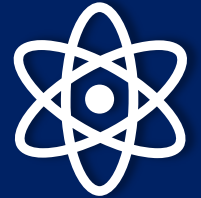
**WORKFORCE  
DEVELOPMENT**



**ADVANCED  
REACTORS**



**FUSION**



**Power  
Upgrades**

**Long Term  
Operation**

**Outage  
Optimization**

**Leveraging  
New  
Technologies**

# Operation Beyond License Renewal



- Extended Life Operating Licenses Issued



- Regulatory Guidance Issuance
- Extended Life Operating License Applications



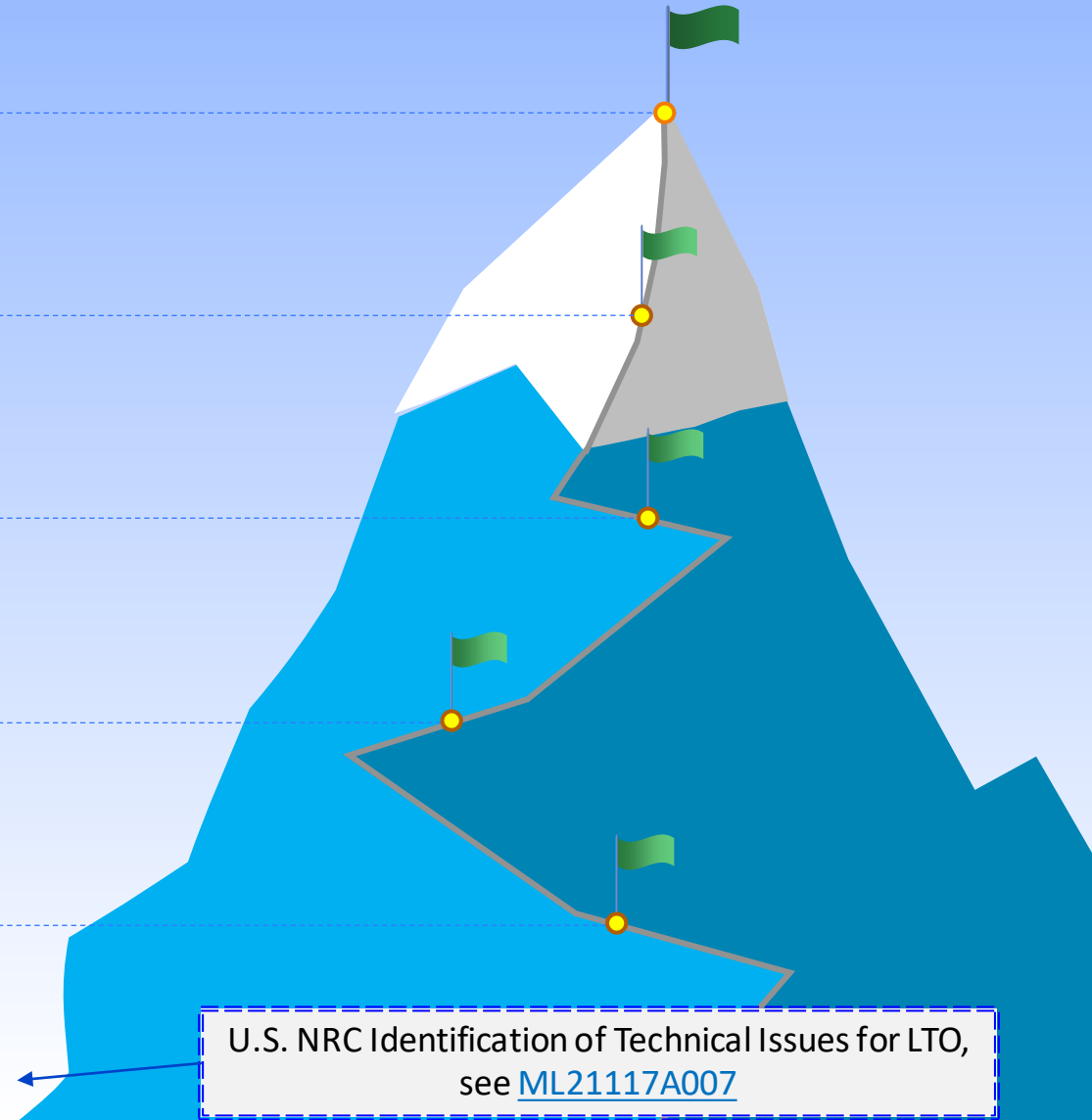
- Regulatory Guidance Development
- Public Meetings



- Aging Management Effectiveness Audits
- Research and Strategic Maintenance Activities



- Workshops on Life Extension [October 2024]
- Expert Panels for Technical Issues



Early Research Focus: Long-term Exposure for Major Aging Management Issues

U.S. NRC Identification of Technical Issues for LTO, see [ML21117A007](#)

# EPRI Materials Ageing Management Process

## 1. Collect Operating Experience

EPRI SMEs collect data from field reports and inspection results and assess the efficacy of corrective actions (mitigation, repair, replacement).

## 2. Review Research Results

Updated research results from EPRI programs, technical literature, and conferences are reviewed by EPRI SMEs.

Materials Degradation Matrix (MDM) Revision 5 (3002030559; Q4 2024)

## 3. Evaluate Technical Gaps

Review gaps from previous IMT (close, keep open, re-rank); define new gaps based on OE; prioritize gaps with utility members.

BWR Issue Management Tables BWRVIP-167 Rev. 4 (3002018319; June 2020)  
PWR Issue Management Tables MRP-205 Rev. 4 (3002018255; September 2020)  
VVER Issue Management Tables MRP-471 (3002021033; September 2021)  
CANDU Issue Management Tables IMR-101 (3002031002; Q4 2024)

## 4. Address High-Priority Gaps

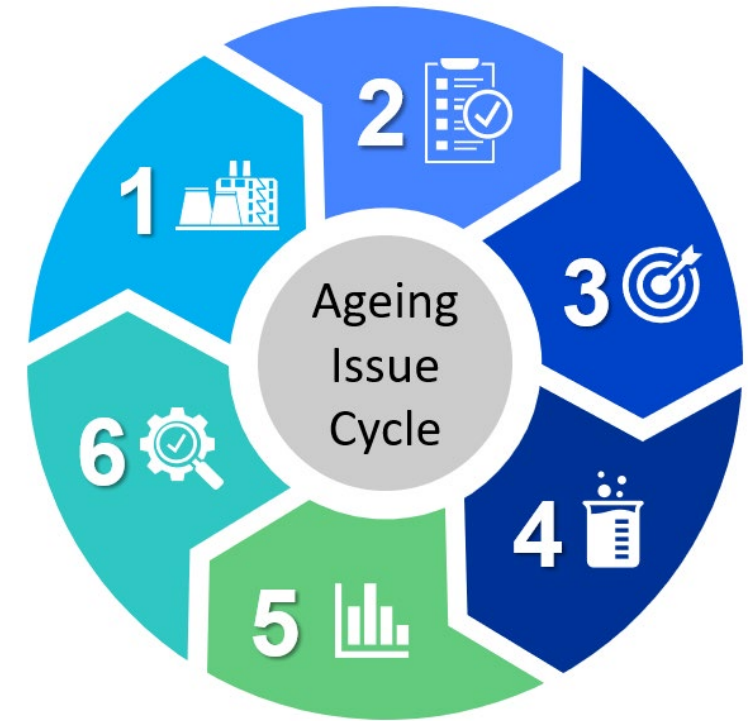
Conduct research on representative materials, perform simulations, develop new models to address high-priority assessment and degradation mechanism gaps.

## 5. Calibrate Models

Improve accuracy and technical robustness of databases that provide inputs to materials models; calibrate conservatism applied to ageing management strategies.

## 6. Optimize Inspections

Increased confidence in ageing management strategies leads to optimized inspection requirements with respect to scope and frequency.



# Important Considerations for Continuing License Renewal



## Regulatory Engagement

- Leverage existing LTO operating experience
- Ongoing support of workshops
- Engagement with codes & standards



## Key Research Activities

- Concrete
- Reactor Vessel, Supports and Internals
- Other Systems, Structures & Components



## Non-destructive Examination

- Integrity of concrete structures
- Resolution in advanced materials
- Resolving equipment access issues



## Repair & Replacement

- Modern welding solutions
- Concrete repair options
- Reactor internals replacement



## Global Fleet

- Research collaborations (e.g., MAI)
- Transfer lessons learned from lead U.S. plants
- Support CANDU and VVER fleet needs



## Harvesting & Surveillance Data

- RPV - integrated and supplemental capsules
- Internals – potential sampling; surveillance
- Data validation for degradation models





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