

# Aging Management of Nuclear Fuel Cycle Facilities and Power Reactors

Brian Smith

Director, Division of New and Renewed Licenses  
Office of Nuclear Reactor Regulation

DNFSB Public Hearing

Benchmarking Best Practices in Management of Aging Safety Infrastructure

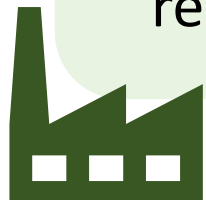
August 14, 2024

---

# Aging Management Frameworks

## Fuel Cycle Facilities

- **Risk-informed, performance-based** regulations and guidance **implicitly** address aging management
- **Management Measures** for items relied on for safety (IROFS)
- Requirements continue for license extension (no additional actions for renewal)



10 CFR\* Part 70

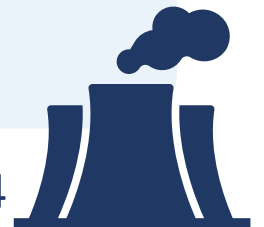
## Power Reactors

- Often, **explicitly defined** regulatory expectations on aging management
- **Maintenance Effectiveness** and other aging-related requirements for the entirety of plant life
- Additional **Aging Management** required for license renewal

NRC Inspector  
Oversight



Parts 50 & 54



\*10 CFR: Title 10, "Energy," Code of Federal Regulations

# Fuel Cycle Facilities

## Licensee **Safety Program** and supporting **Integrated Safety Analysis (ISA)**

- Identify and limit risk of high and intermediate-consequence events
- Limit risk of criticality accidents
- **Ensure items relied on for safety (IROFS) are “available and reliable” to perform their function**

*10 CFR 70.61, Performance requirements*

*10 CFR 70.62, Safety program and integrated safety analysis*



*NRC staff at Honeywell uranium conversion plant before a public meeting on the facility's safety performance*

# Fuel Cycle Facilities – Aging Management

## *Ongoing activities: Entire life of facility*

### **Performance Requirements** (70.61)

- Accident risk minimized/ limited by applying IROFS

### **Safety Program** (70.62)

- Process safety information
- Integrated Safety Analysis
- Management measures

### **New Facility Requirements** (70.64)

- Baseline design criteria
- Defense-in-depth
- IROFS hierarchy

### **ISA Summary**

- Compliance with performance requirements
- Living document
- NRC review

*10 CFR Part 70 Subpart H*

## *License renewal*

- ❖ No additional aging-related requirements
- ❖ Aging continuously addressed by ***maintaining ISAs current*** and ensuring ***IROFS are available and reliable***

*10 CFR 70.73*

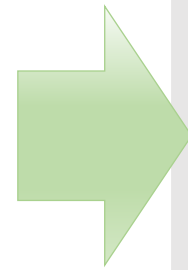
Oversight

---

# Management Measures

## Maintain IROFS commensurate with contribution to risk reduction

- Preventive Maintenance
- Corrective Maintenance
- Surveillance and Monitoring
- Functional Testing



## Unique to each facility

- Expectations defined in NRC guidance (NUREG-1520)
- Licensees propose specific details, such as surveillance methods and frequency
- NRC licensing review & oversight verify effectiveness

*NUREG-1520, Rev 2, Standard Review Plan for Fuel Cycle Facilities License Applications*  
*NUREG-1513, Integrated Safety Analysis Guidance Document*

# NRC Fuel Cycle Facility Inspection Program



*NRC inspector at URENCO USA centrifuge plant*

- Licensee configuration management and change control programs
- Risk significance of events and degraded conditions
- Maintenance of IROFS
- Equipment conditions and items that may degrade plant performance

*Inspection Manual Chapter 2600, NRC Fuel Cycle Facility Operational Safety and Safeguards Inspection Program*

# Power Reactors

## Aging management scope:

1. Safety-related systems, structures, & components (SSCs)
2. Nonsafety-related SSCs whose failure could affect safety-related functions
3. SSCs relied on to support other specific regulations (*e.g., fire protection, loss of offsite power*)



### “safety-related” SSCs

- ✓ Integrity of reactor coolant pressure boundary
- ✓ Shut down reactor & maintain in safe shutdown
- ✓ Prevent/mitigate consequences of accidents with potential off-site exposure

# Power Reactors – Aging Management



## Ongoing activities: Entire life of plant

## License Renewal

### Quality Assurance (Appendix B)

- Corrective actions
- Control of design, special processes

### Maintenance Rule (50.65)

- Monitoring of component performance/condition

### Codes & Standards (50.55a)

- ASME inservice testing and inspection; others

### Topic-specific regulations

- Reactor vessel material surveillance (embrittlement)
- Containment leak testing

### Re-evaluate time-based aging analyses

- Calculations from the original license (e.g., fatigue)

### Aging Management

- Enhance the management of components that are of lesser focus under the Maintenance Rule

Active Components

Passive Components (no moving parts or change in state)



# Generic Aging Lessons Learned (GALL) Report

*Explicit aging management guidance*

## Aging Management Review

material + service environment



aging effects requiring management

## Aging Management Programs

acceptable approaches to manage aging

- ✓ *preventive actions*
- ✓ *inspections & tests*
- ✓ *monitoring activities*

## Steel pipe buried in soil

Corrosion → loss of wall thickness



## Buried Piping Program

- ✓ Cathodic protection
- ✓ Protective coatings
- ✓ Periodic visual and volumetric (ultrasonic) inspections of excavated pipe

*NUREG-1801, initial renewal: 40-60 years*

*NUREG-2191, subsequent renewal: 60-80 years*

# NRC License Renewal Inspection Program



*NRC inspection of the Surry Power Station buried piping aging management program*



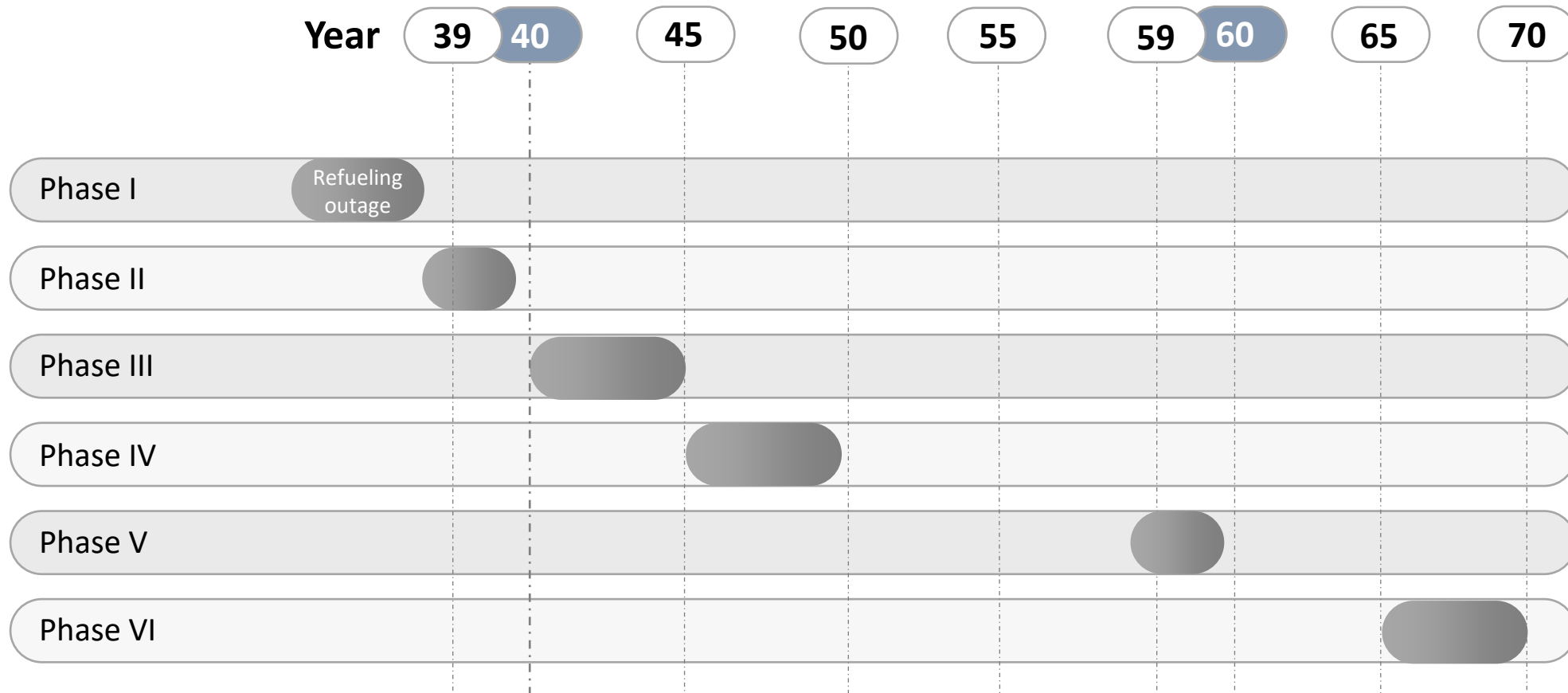
*NRC staff on the job*

- Plant implementation of approved aging management activities
- Enhancement of aging management programs due to operating experience
- Compliance with corrective actions regulations
- Complements other (non-renewal) baseline inspections of plant operations

*Inspection Manual Chapter 2516, NRC License Renewal Inspection Program*

# NRC Inspection Procedure 71003

## *Post-Approval Site Inspection for License Renewal*



# Operating Experience

*examples*

**NRC inspections**



*NRC renewal inspection of Diablo Canyon plant's electrical cable box*

**Institute for Nuclear Power Operations  
Industry Reporting and Information System (IRIS)**

## **IAEA Incident Reporting Systems**

- Power Plants - International Reporting System for Operating Experience (IRS)
- Fuel Cycle Facilities - Fuel Incident Notification and Analysis System (FINAS)
- Research Reactors - Incident Reporting System for Research Reactors (IRSRR)

**Technical exchanges** – industry, international

## **Industry Reports**

- Licensee event reports
- Plant status reports, etc.

- 
- ✓ Communications to industry
  - ✓ Oversight of industry response
  - ✓ Adjust regulatory framework

# Technical Obsolescence

*–lack of spare parts and technical support,  
lack of suppliers or capabilities*

- Not regulated by the NRC
  - Power utilities manage via the **Nuclear Utility Obsolescence Group**
- However, potential solutions subject to regulatory requirements
  - Functions must be maintained in accordance with their licensing basis
  - QA requirements: controls for suitability of replacement materials, parts, & equipment



*Replacement of containment electrical penetration assemblies at the Fort Calhoun nuclear power plant*

# Code & Standards

- Participate in development committees
- Endorse in regulatory documents (e.g., 10 CFR 50.55a, Regulatory Guides, GALL Report)



*Boiler and Pressure Vessel Code, Section XI  
Rules for Inspection and Testing of Components of Light-Water-Cooled Plants*

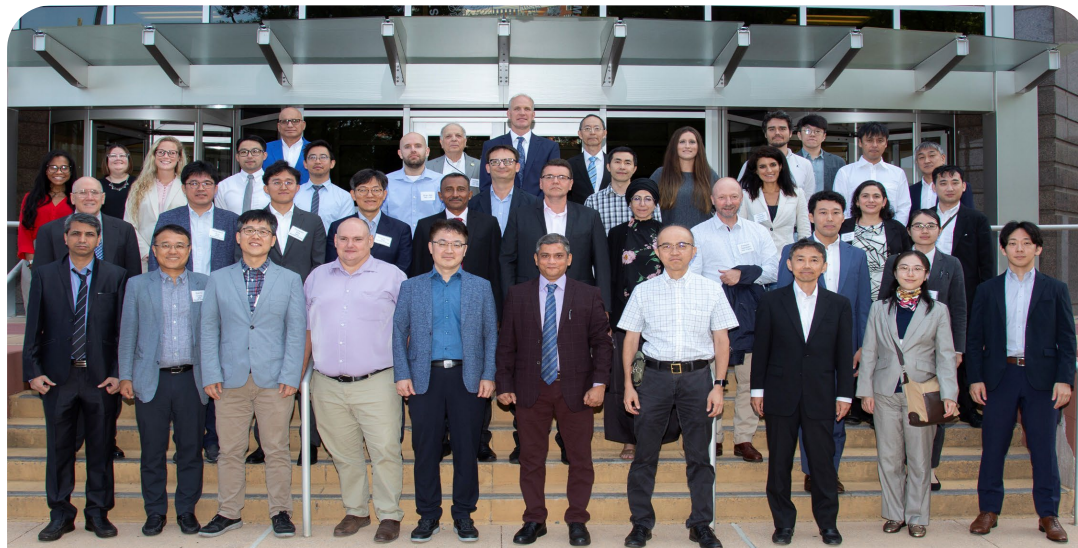
*349.3R, Evaluation of Existing Nuclear  
Safety-Related Concrete Structures*



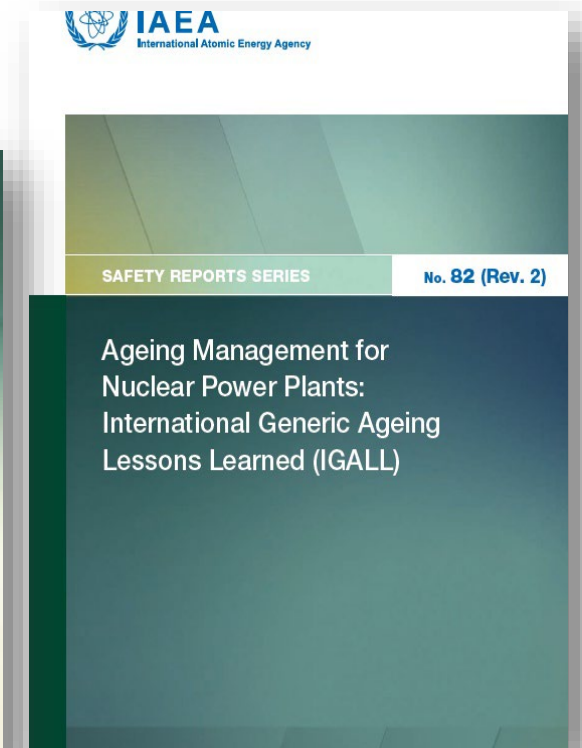
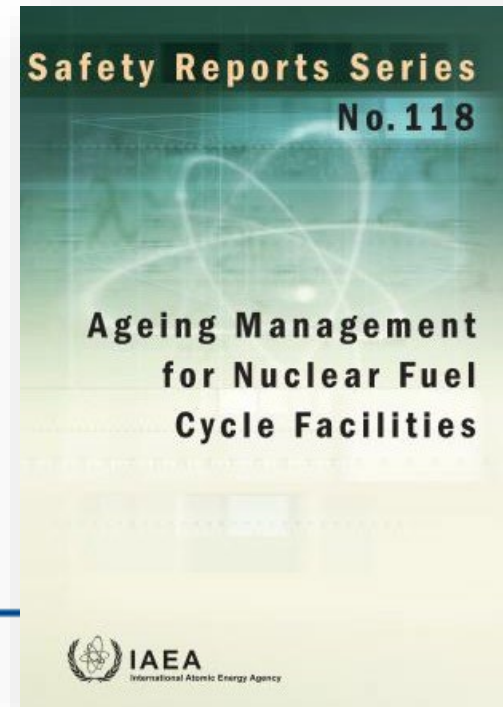
# International Engagement



NRC staff regularly participate in international workshops, conferences, and committees to **share operating experience** and **proven practices**



2023 US NRC Workshop on Long Term Operation Reviews with Korea, Japan, India, France and Spain



---

*Thank you*

