



License Renewal in the United States

Allen Hiser, Jr.
Senior Technical Advisor

Division of License Renewal
Office of Nuclear Reactor Regulation

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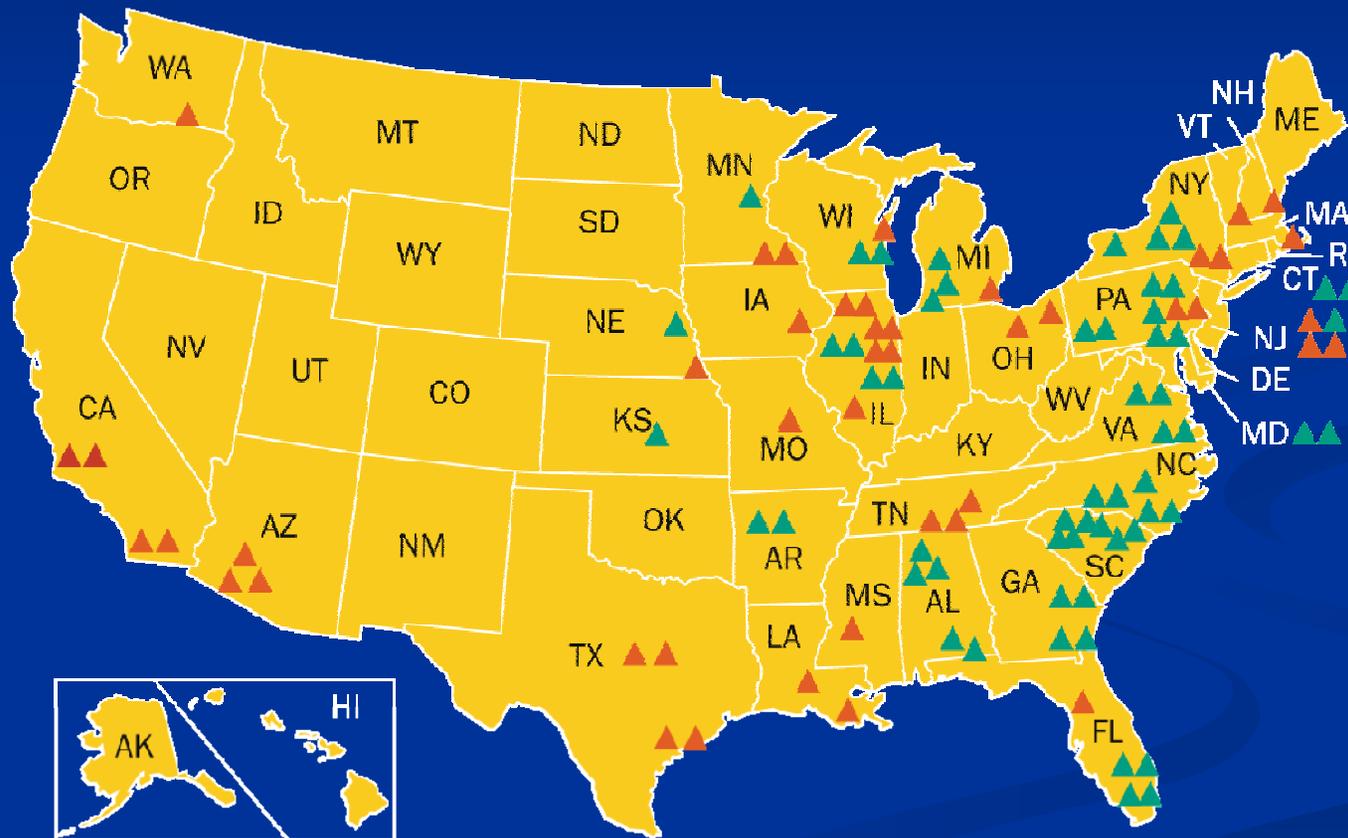
Outline

- Status of License Renewals
- License Renewal Review Process and Guidance
- Current Aging Management Technical Issues
- Prognosis for “Life Beyond 60”
- Conclusions

License Renewal Program Status

- 104 operating reactors in the U.S.
 - 69 PWRs
 - 35 BWRs
- Renewed Licenses issued for 59 units at 34 sites
- Reviewing applications for 20 units at 13 sites
- 4 plants entered their 41st year of operation in 2009; 3 will enter in 2010
- For more information:
 - Reactor License Renewal Web Page
 - Includes applications, safety evaluation reports
 - <http://www.nrc.gov/reactors/operating/licensing/renewal.html>

Renewed Power Reactors



Licensed to Operate (104)
▲ License Renewal Granted

As of March 2010

Scope of License Renewal Rule

- 10 CFR Part 54
 - Safety-related systems, structures, and components (SSCs)
 - Non-safety related SSCs: failure could affect safety-related SSC functions
 - SSCs relied upon for compliance with the Commission's regulations for:
 - Fire Protection (10 CFR 50.48)
 - Environmental qualification (10 CFR 50.49)
 - Pressurized thermal shock (10 CFR 50.61)
 - Anticipated transients without scram (10 CFR 50.62)
 - Station blackout (10 CFR 50.63)

LICENSE RENEWAL REGULATION (10 CFR PART 54)

- Focus is on managing the effects of aging of long-lived, passive structures and components important to plant safety
- Items cannot be scoped out of license renewal consideration based on risk
- Per Standard Review Plan, “a program based solely on detecting structure and component failures is not considered an effective aging management program” (A.1.2.3.4.4)

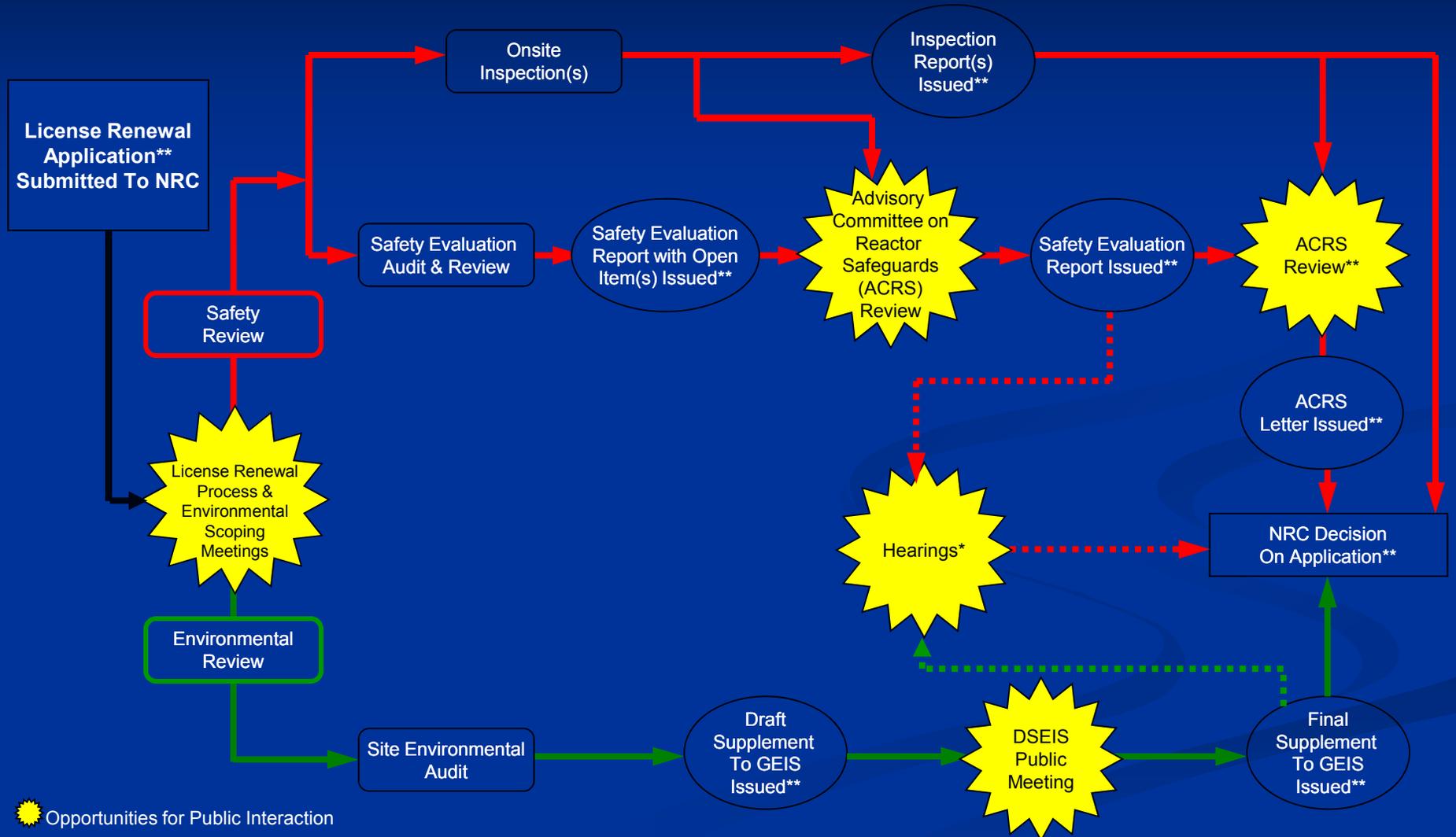
License Renewal Safety Principles

- The ongoing regulatory process is adequate to ensure the safety of currently operating plants
- The same plant operating rules apply during the renewal term
 - Requires additional actions for aging management of plant structures and components for license renewal

License Renewal Process

- Atomic Energy Act
 - 40-year license to operate
 - Allows for license renewal up to 20 years (e.g., 40 to 60 years)
- Safety Review (10 CFR 54)
 - Regional Inspection
 - Advisory Committee on Reactor Safeguards
- Environmental Review (10 CFR 51)
- Hearing Opportunity
- Agency Decision
- Regional Inspection before end of 40 years

License Renewal Process



☀ Opportunities for Public Interaction

* If a Request for Hearing is Granted

** Available at www.nrc.gov

License Renewal Reviews – Schedule & Resources

- Review schedule
 - 22 months for review with no hearing
 - 30 months for review with hearing

- Resources
 - Licensee development of application – ~2 years and ~\$20 million
 - NRC review – ~15 man-years or ~\$4 million

- Reviewers come from a variety of sources
 - Division of License Renewal staff (technical reviews and project management)
 - Technical staff from divisions dealing with plant operational issues
 - May be supplemented by contractor reviews

Public Notifications & Meetings

- Application receipt
- Application acceptance/rejection & opportunity for hearing (60 days)
- Public meeting(s) – license renewal overview and environmental scoping
- ASLB hearing (if necessary)
- ACRS meetings
- Inspection exit meetings
- Draft supplemental environmental impact statement available and public meeting
- Final supplemental environmental impact statement
- Decision on issuance of license

License Renewal Application

- General Information about the plant owner or operator
- Technical Information
 - Identify SSCs subject to aging management review
 - Demonstration that aging effects will be adequately managed during renewed period
 - An evaluation of time limited aging analyses (TLAAs)
 - Supplement to final safety analysis report with summary of AMPs and TLAAs
- Changes to plant Technical Specifications
- Environmental Information
 - Consistent with Subpart A to Part 51

Screening Methodology

- Process for determining which components and structural elements require an aging management review (AMR)
 - Identify and list structures and components within scope that are subject to an AMR
 - Describe and justify screening methods used
 - Demonstrate that aging effects will be adequately managed

Issues Not in Scope

- Ongoing Regulatory Oversight Issues:
 - Emergency planning (10 CFR 50.47)
 - Security (10 CFR Part 73)
 - Current safety performance

<http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/index.html>

License Renewal Review

➤ Safety Review

- Focus is on the effects of aging on long-lived, passive structures and components important to plant safety
- NRC staff review is to determine that aging effects will be adequately managed for license renewal
- Evaluation of time-limited aging analyses (TLAAs) in the current license basis

Safety Review and Inspection

- Review application and supporting documentation
 - On-site Audits & Inspection
 - Inspection on scoping & screening and AMP
 - Scoping and screening methodology audit
 - Aging Management Programs (AMPs) that are consistent with GALL
 - Document in Audit Reports and Inspection Reports
- Document review results in Safety Evaluation Report
- Post-approval Site Inspection

License Renewal Inspection Program

- License renewal inspection guidance (Manual Chapter 2516)
- License renewal inspection (Inspection Procedure (IP) 71002)
 - Scoping and Screening inspection
 - Aging Management Program inspection
 - Annual Update/Open Item inspection (optional)
 - Public exit meeting
 - Regional Administrator recommendation

Renewal Inspection Program (cont'd.)

- Post-approval site inspection for license renewal (IP-71003)
 - 100% of conditions/commitments associated with AMP or TLAA that did not exist at time of IP-71002
 - Risk informed sample of those modifications and enhancements per license conditions
 - Updated FSAR Supplement
 - Timing – depends on when commitments are due:
 - Licensee has until end of year 40 to implement
 - Outage before extended period
 - Various outages after extended period
 - Team review shortly after AMP in effect

Time-Limited Aging Analyses

What is a TLAA?

- Involve SSCs within the scope of license renewal
- Consider the effects of aging
- Involve time-limited assumptions defined by the current operating term
- Relevant in making a safety determination
- Impact conclusions on ability of SSC to perform its intended function
- A part of current licensing basis

Time-Limited Aging Analyses

Examples of TLAAs

- Reactor vessel neutron embrittlement
- Metal fatigue
- Environmental qualification of electrical equipment
- Concrete containment tendon prestress
- Flow-induced vibration endurance limit for reactor vessel internals
- Leak before break
- Flaw growth analyses from inservice inspections

Resolution of TLAAs

Application demonstrates one of the following:

- i. The analyses remain valid for the period of extended operation;
- ii. The analyses have been projected to the end of the period of extended operation; or
- iii. The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Environmental Review (10 CFR Part 51)

- An Environmental Impact Statement (EIS) is required for Federal actions significantly affecting the quality of the human environment.
- Scope
 - Generic Environmental Impact Statement (GEIS) identifies issues common to all plants and draws conclusions on these issues.
 - Site-specific Supplemental Environmental Impact Statement (SEIS) focuses on assessment of site-specific issues as well as information that challenges generic conclusions reached in the GEIS.

Components of the Environmental Review

- Staff Evaluates Impacts to Resources from Proposed Renewal and Alternatives
 - Wildlife and Fish
 - Water and Air Resources
 - Historical and Cultural Resources
 - Taxes, Community Development, Environmental Justice
 - Human Health
 - Land Use
- Public Input Drives Consideration of Environmental Issues in each SEIS

Independent Review Bodies

- Advisory Committee on Reactor Safeguards
 - Mandated by the Atomic Energy Act
 - Independent review of license renewal applications
 - Public meetings to review safety evaluation report with open items and after resolution of open items
 - Reports directly to the Commission
- Atomic Safety and Licensing Board
 - Mandated by the Atomic Energy Act
 - Independent adjudicatory body
 - Conduct public hearings on contested issues
 - Comprised of three administrative judges

License Renewal Guidance Documents

- Generic Aging Lessons Learned (GALL) report (NUREG-1801)
- Standard Review Plan (SRP) for License Renewal (NUREG-1800)
- Regulatory Guide 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses”, endorses Nuclear Energy Institute (NEI) guidance NEI 95-10

**NRC is revising the GALL Report and the SRP;
target completion is end of 2010**

GALL Report (NUREG-1801, Rev. 1)

- Catalog of generic aging management evaluations
 - Builds on previous aging studies
 - Reviews aging effects
 - Identifies relevant aging programs
 - Evaluates program attributes to manage aging effects
- Evaluation conclusion
 - Program is adequate and no further evaluation is needed, or
 - Program should be augmented or new program considered
- NRC is updating GALL Report

Example Page of GALL Report

September 2005	V A ENGINEERED SAFETY FEATURES Containment Spray System (PWR)							
	Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
	V.A-8 (E-20)	V.A.6-a	Heat exchanger components	Stainless steel	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.A-9 (E-17)	V.A.6-c	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No	
V.A.3	V.A-10 (E-18)	V.A.6-a	Heat exchanger components	Steel	Raw water	Loss of material/ general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
	V.A-11 (EP-39)	V.A.	Heat exchanger tubes	Copper alloy	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
NUREG-	V.A-12 (EP-47)	V.A.	Heat exchanger tubes	Copper alloy	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See	Yes, detection of aging effects is to be evaluated

Benefits of GALL Report

- GALL report is a key technical document for license renewal
 - Documents NRC expectations to ensure a stable regulatory process
- GALL report improves effectiveness and efficiency of NRC staff review
 - Applicants typically claim 80% consistency with GALL report
 - Helps focus NRC resources by not re-reviewing aging evaluations that have been found adequate generically

Aging Management Program (AMP)

Attributes

1. Scope of program
2. Preventive actions
3. Parameters monitored or inspected
4. Detection of aging effects
5. Monitoring and trending
6. Acceptance criteria
7. Corrective actions
8. Confirmation process
9. Administrative controls
10. Operating experience

AMP Attributes

Scope of program

Identifies the specific structures and components and aging effects to be managed by the AMP

Preventive actions

Identifies specific activities for prevention and mitigation

Parameters monitored or inspected

Identifies aging effects and how monitoring will ensure adequate aging management

- Condition monitoring – detect presence of aging effects
- Performance monitoring – link between parameter monitored and degradation/intended function
- Prevention/mitigation – parameters being controlled to achieve prevention/mitigation

AMP Attributes

Detection of aging effects

Identifies “when,” “where,” and “how” data are collected

- Monitoring method, frequency & timing

Monitoring and trending

Describes how collected data are evaluated and trended

Acceptance criteria

Specifies and justifies the quantitative (e.g., numerical values) or qualitative criteria for acceptability – deviations require corrective actions

- Need not justify criteria in FSAR, technical specifications, NRC-approved Codes & standards & other methods

AMP Attributes

Corrective actions

Describes actions taken when acceptance criteria are not met

- Analysis should ensure functionality is maintained
- Appendix B Quality Assurance program can be used for safety-related components

Confirmation process

Describes process to ensure corrective actions have been completed and are effective

AMP Attributes

Administrative controls

Describes the formal review and approval process

- Process to consider future plant-specific and industry operating experience

Operating Experience

Describes relevant plant and industry operating experience

- Existing AMPs – Experience from program implementation
- New AMPs – Impact of operating experience on development of program elements

Emergent Safety Review Issues

- Issues identified are resolved on a plant-by-plant basis
 - Followed-up with either generic correspondence, interim staff guidance, or a revision to the GALL Report
- Example: Metal Fatigue Analyses
 - Identified use of simplified inputs which had the potential to yield non-conservative estimates of stresses associated with cyclic loads for certain plant components
 - RIS 2008-30, “Fatigue Analysis of Nuclear Power Plant Components,” dated December 19, 2008

Emergent Safety Review Issues

- Buried Piping
 - Experience with tritium leakage
- Containment Liner/Drywell Corrosion
 - Exterior of liner/drywell
- Inaccessible Medium Voltage Cables
 - Submerged cables and need for monitoring test techniques
- Refueling Cavity and Spent Fuel Pool Leakage
 - Degradation of concrete and structural steel
- Neutron Absorber Degradation
 - Interim Staff Guidance (ISG) issued
 - Identified need for aging management of Boral and others

Safety Review Issues

- Buried Piping
 - Nuclear power plants have replaced buried piping leaks are often caused by misapplication of internal coatings
 - Several recent leaks have been caused by corrosion from the soil side of the piping
 - Use of inappropriate backfill (containing rocks and debris)
 - Poor external coating
 - Contact of aluminum pipe with concrete
 - EPRI, NEI are developing improved inspection procedures and methods for monitoring buried piping
 - NRC Staff is updating GALL buried piping program



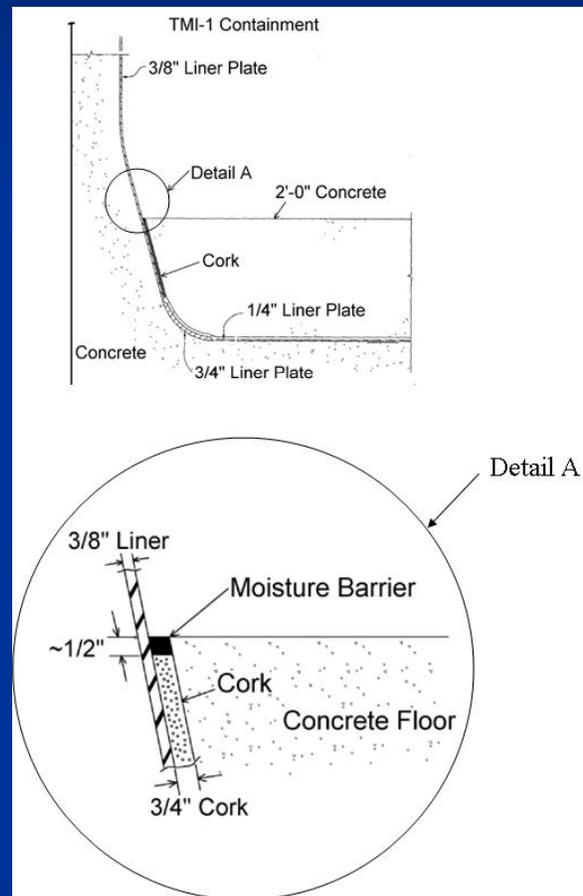
Safety Review Issues

- Oyster Creek “Buried” Piping, through turbine building concrete



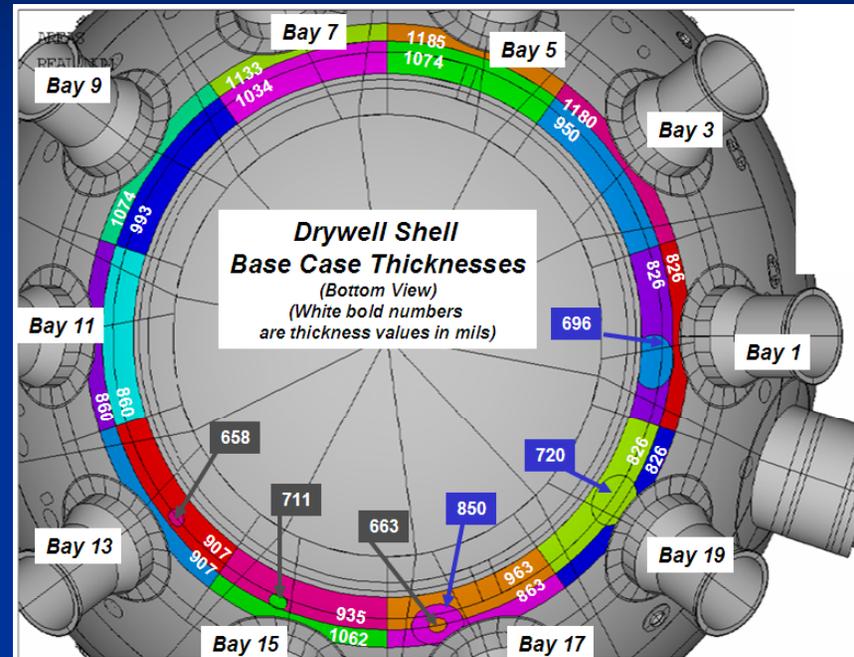
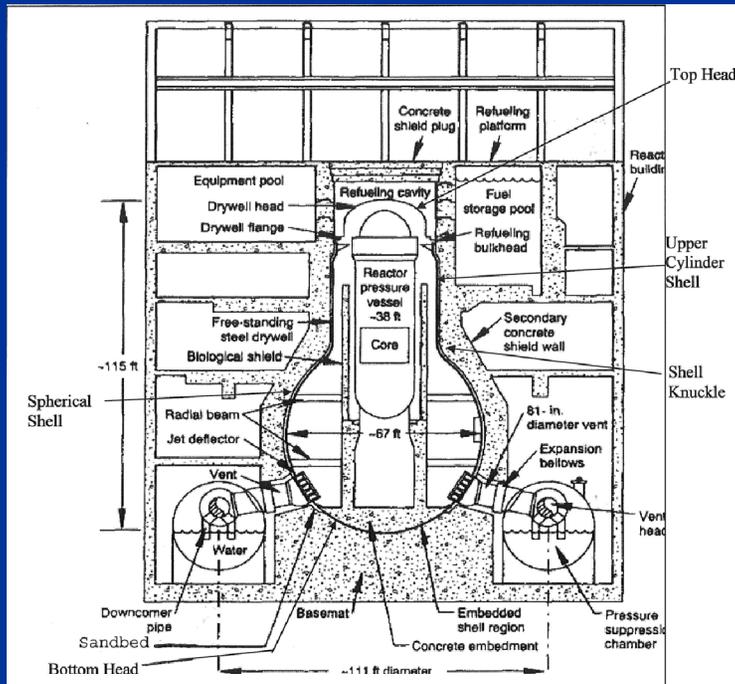
Safety Review Issues

- Containment Liner Degradation (PWR)
 - The NRC staff has evaluated containment liner degradation at plants due to corrosion caused by water accumulation or the degradation of barrier seals.
 - Plants have repaired the conditions and/or committed to improved monitoring and inspection



Safety Review Issues

■ Containment Liner Degradation (BWR)



LOCATION	THICKNESS (mils)
Cylindrical Region	604
Knuckle Region	2530
Upper Spherical Region	676
Middle Spherical Region	678
Lower Spherical Region	1160

Safety Review Issues

Oyster Creek Drywell Shell

Before



After



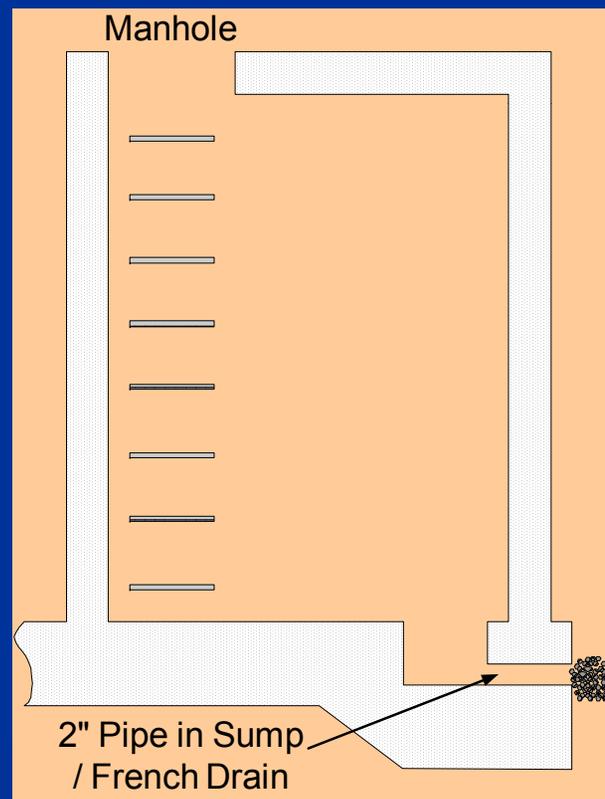
Safety Review Issues

Beaver Valley Power Station Containment Liner Hole



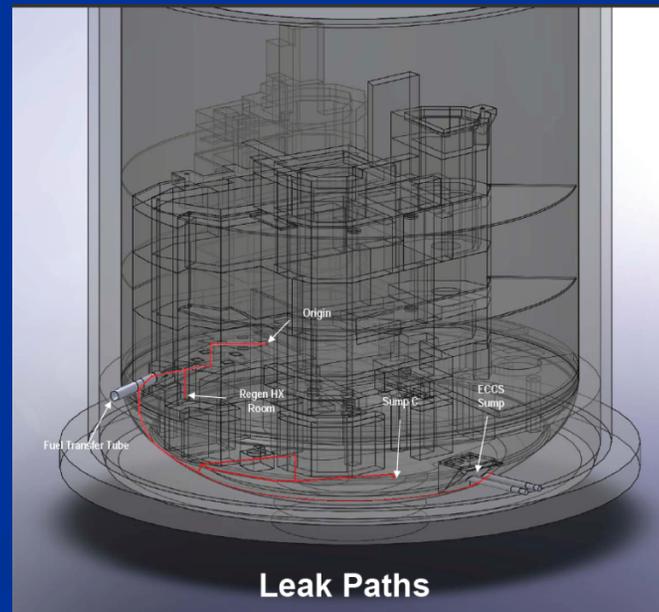
Safety Review Issues

- Inaccessible medium voltage cables
 - Identified water in the manholes at several nuclear power plants, necessitating commitments from the applicants to access and manage the ingress of water into the manholes, and to periodically test the cables.



Safety Review Issues

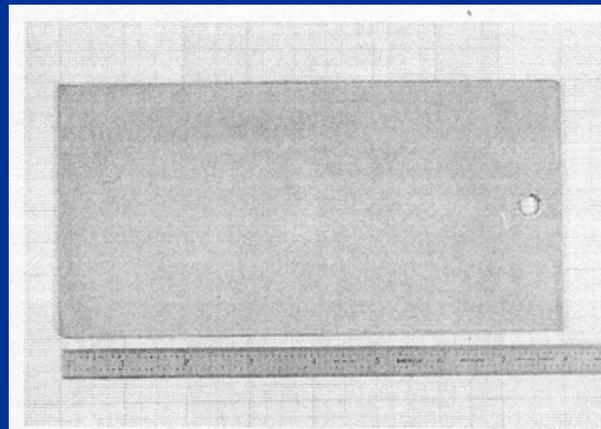
- Refueling Cavity Leakage
 - Staff has ensured that licensees that have had, or are experiencing leakage of borated water from the refueling cavity, are properly evaluating and assessing the aging impacts of the leakage on both metal and concrete in containment.



Safety Review Issues

- Neutron Absorber Degradation
 - Identified the need for plants to monitor the performance of neutron absorber materials (such as Boral) for criticality control in the spent fuel pools. Degradation identified, including blistering and loss of material, challenges assumptions made in spent fuel criticality analyses. Staff ensuring plants have a program that verifies neutron absorption performance coupon surveillance testing or in-situ measurements.

PWR Coupon
(Clad Composite – Al & Al/B₄C)



NRC Tasks on “Life Beyond 60”

- Hold NRC/Industry workshops on operating experience and industry research activities
- Develop an expanded materials degradation assessment
- Assess results from implementation of Aging Management Programs
- Share expertise; domestic and international

First phase of activities to develop a comprehensive basis for license renewal beyond 60 years

Conclusions

- NRC has a standard process for approval of “first” license renewal period (40 to 60 years)
- Industry is responsible for demonstrating that aging can be adequately managed for licensed operating period
- NRC ensures that plants will be operated with reasonable assurance of adequate protection of the public health and safety
- NRC will collaborate with industry and others in an integrated, holistic program to ensure long-term safety