Aging Management Briefing Report

Condition Monitoring of Passive Systems, Structures, and Components

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Prepared for

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Background

This briefing report on the condition monitoring of passive systems and components was prepared by the Chockie Group International as part of the project for the Petroleum Safety Authority (PSA) Norway entitled, *Design Life Extension Regulations* (PSA Project Reference Number: NO 99B16).

The objective of the report is to provide an overview of the life extension regulations within the United States nuclear power industry – in particular the regulations affecting the aging management of passive systems, structures and components.

This report is a companion to a previous briefing report that the Chockie Group International prepared for the PSA entitled, *Performance Monitoring of Systems and Active Components* (CGI Report 06.21).

Passive versus Active Systems, Structures, and Components

In order to ensure that the US nuclear power plants continue to maintain adequate levels of safety during extended operation beyond their original license period the US Nuclear Regulatory Commission (USNRC) has developed two important sets of requirements. These are the:

- License Renewal Rule
- Maintenance Rule

The focus of the License Renewal Rule is on the management of aging degradation of "passive" and long-lived systems, structures, and components (SSCs) at the nuclear power plants.

The requirements for the aging management of "active" systems and components are addressed by the Maintenance Rule (as discussed in CGI Report 06.21).

An important point of the US nuclear plant life extension requirements is the distinction between passive and active systems, structures, and components. As a general definition[*], passive SSCs are those that do not move to function (such as, structures, heat exchangers, cables, valve and pump bodies, and piping). Their age related degradation can only be monitored and trended by performing periodic condition assessments (such as inspections, testing, and measurements). An aging evaluation is

[*] An extensive discussion concerning the identification of passive and active SSCs within the scope of the USNRC License Renewal Rule is provided in several regulatory and industry guidance documents, including NEI-95-10.

typically required to identify the degradation mechanisms and to select the effective inspections and tests. Long-lived items are those that are not subject to replacement based on a qualified life or specified time period.

The USNRC and the nuclear industry have developed a strategy to ensure the extended safe operation of the plants. This strategy focuses the license renewal process on the condition monitoring of safety critical passive SSCs. The aging management of active SSCs should be part of the plant maintenance program. Good maintenance practices should identify and correct any aging degradation issues of the active SSCs and that no special license renewal aging management requirements are necessary for extended operational approval.

Report Format

The following section provides an overview of the twenty-five years of extensive research and analysis that has gone into the development of the current License Renewal Rule regulations. The findings from the hundreds of studies laid the foundation for the License Renewal Rule requirements.

The second section examines the License Renewal Rule and the lessons learned that lead the USNRC to revise the initial version of the Rule.

The third section provides a review of the renewal application process. Included in this section is the discussion of the extensive guidance and support provided to the plant licensees. In particular two key documents are reviewed – the industry guidance reports NEI-95-10 and the USNRC Generic Aging Lessons Learned (GALL). The GALL report provides a template of aging management programs that have been determined to be acceptable to manage the aging effects of SSCs that are within the scope of the License Renewal Rule.

The final section provides a summary of the possible applicability of the twenty-five years of research, demonstrations, assessment, and lessons learned to the Norwegian petroleum industry situation – how the PSA and the industry can take advantage of the extensive work and lessons to develop “focused” life extension requirements to ensure that adequate levels of safety are maintained during extended operation.

The 40-Year Operating License

When the original licensing requirements for United States commercial nuclear power plants were developed it was agreed to limit the licenses for a 40-year operating period. The 40-year limit was selected based on economic considerations rather than technical limitations.

The 40-year limit was specified by the US Congress in the Atomic Energy Act of 1954. The law was modeled on the Communications Act of 1934. This Act set up the conditions for radio stations to be licensed and operate for several years. Then the stations would be allowed to renew their licenses as long as they continued to meet their

charters. Similarly, the Atomic Energy Act allows for the renewal of operating licenses for the nuclear power plants.

Congress selected 40 years for nuclear power plant licenses based on the view that this was the time required to pay off the plant investments through the anticipated income from the electrical rate base. The 40-year license term was not based on safety, technical, or environmental factors.

As specified in the Atomic Energy Act, the plants can reapply for a new operating license after 20-years of operation. If granted, the new license covers the remaining term of the 40-year operation plus up to a 20-year extension. The regulations do not set any limit on the number of renewals that a plant can apply for.

Renewal is voluntary. The decision is primarily economical and whether the licensee believes they can continue to meet NRC requirements. By June 2006, 21 nuclear plants have received regulatory approval for 20-years of extended operation. Another nine plant applications are being reviewed.

Aging Research Programs

In the late 1970s the USNRC began to address the life extension issue. The first initiatives were directed at determining whether or not extended operation could be safely justified. If extended operations could be justified, then the USNRC would establish a license renewal process to ensure continued safe operation of the plants.

The NPAR Program

In 1982, in anticipation of possible interest in license renewal, the USNRC held a well attended regulatory/industry workshop on aging management and life extension. Based in part on the workshop results, the USNRC created the 10-year, multi-million dollar Nuclear Aging Research (NPAR) Program. The program provided the basis for determining that extended operations were technically justifiable. It also provided the foundation for the license renewal requirements and renewal process.

The NPAR Program identified aging as the cumulative, time-dependent degradation of a systems, structures, and components (SSCs) that, if unmitigated, could compromise continuing safe operation of the plant. Mitigating measures are therefore needed to ensure that aging does not reduce either the operational readiness of a plant's safety systems or the defense-in-depth through common-mode failures of redundant, safety-related equipment.

The main goals of the NPAR Program were to understand aging and to identify ways to manage aging of safety-related SSCs. The specific technical objectives were to:

- identify and characterize aging effects which, if unmitigated, could cause degradation of SSCs and impact plant safety
- develop supporting data to facilitate management of age-related degradation

- identify methods of inspection, surveillance, and monitoring, or of evaluating residual-life of SSCs, which will ensure timely detection of significant aging effects before loss of safety function
- evaluate the effectiveness of storage, maintenance, repair, and replacement practices in mitigating the effects of aging and diminishing the rate and extent of degradation caused by aging
- provide technical bases and support for the License Renewal Rule and the license renewal process

During the mid-1980s the USNRC initiated two other aging assessment programs as companions to the NPAR Program. One focused on the aging of nuclear plant vessels, piping, steam generators, and nondestructive examination techniques. The other involved the assessment of age-related degradation on plant civil structures. These three programs provided a wealth of information and insights on aging and aging management that formed the basis for the License Renewal Rule.

The NPAR Program alone produced over 150 technical reports and numerous papers and proceedings concerning aging characteristics and aging management of safety-related SSCs. The major subjects examined by the NPAR and related aging research programs are shown in Table 1.

Table 1: *Subjects Examined by the NPAR and Related Aging Research Programs*

Air operated valves	Chillers
Auxiliary feedwater pumps	Heat exchangers
Batteries	Large electric motors
Bistables/switches	Main steam isolation valves
Cables	Motor operated valves
Chargers/inverters	Piping
Check valves	Power operated relief valves
Civil structures	Small electric motors
Circuit breakers/relays	Snubbers
Compressors	Solenoid valves
Connectors, terminal blocks	Steam generators
Diesel generators	Transformers
Electrical penetrations	Vessels

Although the aging studies examined SSCs with respect to their operation in the nuclear plants, much of the aging degradation and aging management information is applicable to the petroleum and other industrial sectors.

A list of selected aging reports from the NPAR program is provided in Attachment A.

Concerning the issue of whether or not there was justification to allow continued operation of the nuclear plants beyond their 40-year operating license, a technical review group examined the aging research findings and concluded that many aging phenomena are readily manageable and do not pose technical issues that would preclude life extension for nuclear power plants. They also stated that as long as there are effective inspection and maintenance practices, the plant life is simply limited by the

economic cost of repair or replacement of any components that don't meet specified acceptance criteria. Based on these conclusions and recommendations, the USNRC moved forward with the development of license renewal requirements.

The License Renewal Rule

In 1991, the safety requirements for license renewal (entitled, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants)* were adopted by the USNRC. These requirements, known as the License Renewal Rule, established the procedures, criteria, and standards governing the renewal of nuclear power plant operating licenses. These were made mandatory requirements as part of the United States Code of Federal Regulations (commonly referred to as 10 CFR Part 54).

Revisions to the Rule – Lessons Learned

For the next few years the USNRC, in cooperation with the nuclear industry, conducted a demonstration program to apply the Rule to pilot plants. The objective was to assess the effectiveness of the requirements and the application/review process. The USNRC also undertook a number of activities related to the implementation of the Rule. These included:

- developing a draft regulatory guide
- developing a draft standard review plan for license renewal
- reviewing generic industry technical information

Based on discussions with industry and results from the demonstration program the USNRC determined that revisions to the Rule were needed. In contrast to the underlying assumption in the initial Rule, the USNRC found that many aging effects are dealt with adequately during the initial license period. In addition, the USNRC found that the review did not allow sufficient credit for existing programs, particularly those under the USNRC Maintenance Rule, which help manage plant aging phenomena on an on-going basis.

The initial License Renewal Rule did not provide a predictable nor stable process. Industry point out, and the USNRC agreed, that it is essential to have a predictable and stable regulatory process that clearly and unequivocally defines the regulatory expectations for license renewal.

In 1995 the USNRC published a revised version of the License Renewal Rule. A copy of the Rule is provided in Attachment B. The key changes that were made to the initial version of the Rule included:

- the license renewal review was focused on the adverse effects of aging rather than identification of all aging mechanisms – identification of individual aging mechanisms is not required as part of the license renewal review
- a new definition of the SSCs within the scope of the Rule was added that identifies the important functions that must be maintained
- the integrated plant assessment (IPA) process was simplified and made consistent with the revised focus on the detrimental effects of aging

- an evaluation of time-limited aging analyses (TLAA) was added
- a statement that only passive, long-lived structures and components are subject to an aging management review for license renewal
- records and recordkeeping requirements were made less prescriptive

In summary, the amended Rule established a regulatory process that is simpler, more stable, and more predictable than the initial License Renewal Rule. It put the focus of the license renewal assessment on the licensees aging management activities concerning passive and long-lived SSCs. It also clarified the focus on managing the adverse effects of aging rather than identification of all aging mechanisms. The changes to the integrated plant assessment (IPA) process were to make it simpler and more consistent with the revised focus on passive, long-lived systems, structures and components.[†]

The License Renewal Process

The license renewal process proceeds along two tracks – one for the review of safety issues and another for environmental issues. The safety requirements, as noted above, are addressed in 10 CFR Part 54. The environmental requirements are found in 10 CFR Part 51.

The USNRC developed a generic environmental impact statement (GEIS) which covered impacts that were common to most all nuclear power plants. The GEIS, published in 1996, allows the licensee and the USNRC to focus on the important environmental issues specific to each plant. The plant specific environmental information for each plant applicant is provided in a supplemental report to the GEIS document.

A simplified diagram of the two tracks of the license renewal process is provided in Figure 1. As can be noted in the figure, there are extensive opportunities for public participation, comment, and input throughout the renewal review process.

The license renewal review process is intended to identify any additional actions that will be needed to maintain the functionality of the SSCs for the extended operation. The USNRC determined that the following can be excluded from the license renewal aging management review:

- those structures and components that perform active functions
- structures and components that are replaced based on qualified life or specified time period.

However, as discussed in the following section, all SSCs that require a re-evaluation of their time-limited aging analyses would be subject to the license renewal requirements.

[†] An extensive discussion of the revisions and the USNRC's license renewal philosophy can be found in the Statement of Considerations that accompanied the License Renewal Rule as published in the US Federal Register, Vol. 60, No. 88, page 22461, May 8, 1995.

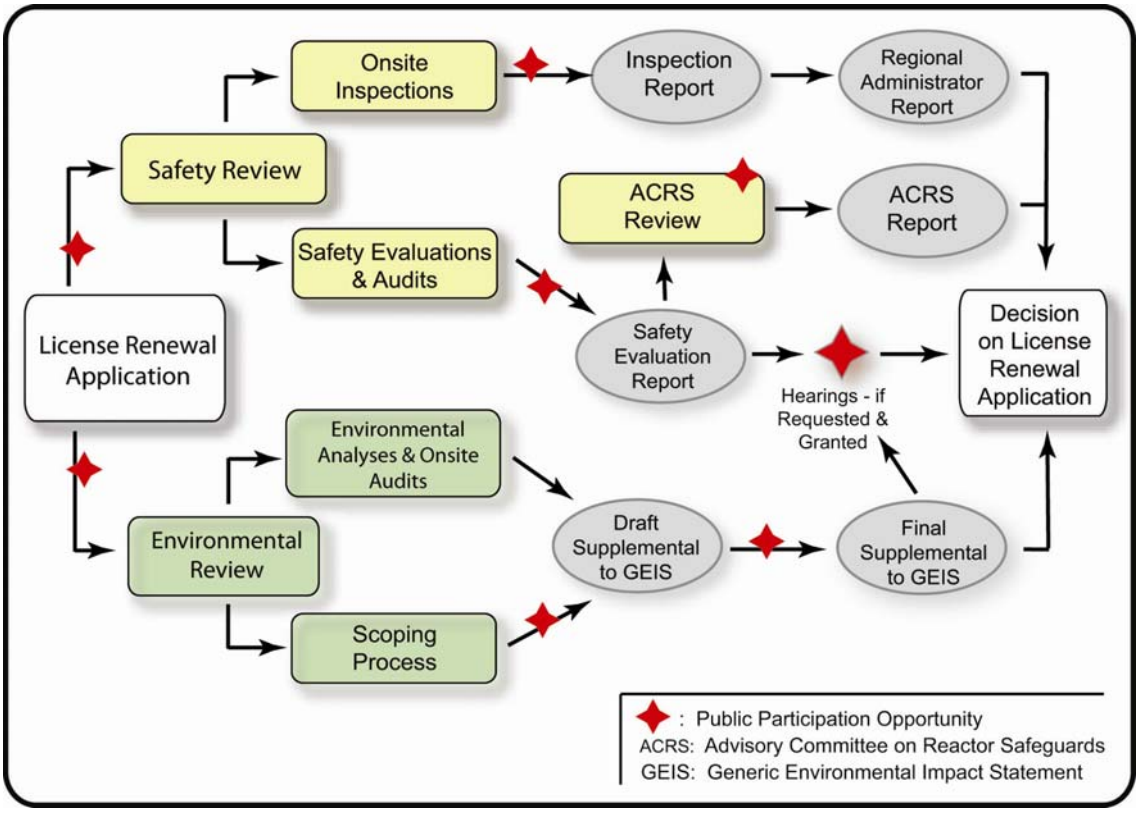

Figure 1: *Simplified Flow Chart of the License Renewal Process (source: USNRC)*

The focus of this briefing report is on the safety review portion of the license renewal process – the requirements concerning passive and long-lived SSCs as found in the License Renewal Rule (10 CFR Part 54).

License Renewal Principals

The license renewal is to ensure that the detrimental effects of aging resulting from operation beyond the initial license term are adequately managed. The license renewal requirements for nuclear power plants are based on two key principles:

- the existing USNRC regulatory process (such as the Maintenance Rule) is adequate to ensure that currently operating plants will continue to maintain adequate levels of safety during extended operation – however, license renewal requirements are needed to address age-related degradation unique to life extension for certain passive and long-lived SSCs as well as a few other issues that may arise during the period of extended operation
- each plant's licensing basis is required to be maintained during the renewal term in the same manner and to the same extent as during the original licensing term

The USNRC Safety Review

As shown in the Figure 1, the USNRC safety review portion of the license renewal process consists of two parallel activities, the safety evaluations and audits and the onsite inspections.

The objectives of the safety review are to determine whether there is reasonable assurance that activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis and if the licensee has adequately demonstrated that the effects of aging will not adversely affect any SSCs within the scope of the Rule. The manual for these inspections is provided in Attachment D.

When the plant was designed, certain assumptions were made about the length of time the plant would be operated. During the renewal process, the licensee must confirm whether these design assumptions will continue to be valid throughout the period of extended operation or whether aging effects will be adequately managed. The licensee must demonstrate that the effects of aging will be managed in such a way that the intended functions of passive or long-lived structures and components will be maintained during extended operation.

If additional aging management activities are needed, the licensee may be required to establish new monitoring programs or increase inspections. For instance, applicants should specify activities that need to be performed (such as water chemistry and inspections) to prevent and mitigate age-related degradation. These activities increase the likelihood that the program is effective in minimizing degradation and that a component is replaced if specified thresholds are exceeded.

An important part of the review and approval process is onsite inspections by USNRC personnel. The purpose of the inspections is to verify both the information in the application and the findings from the USNRC safety evaluations. The inspections involve a sampling of the licensee's:

- process to identify the SSCs within the scope of the license renewal Rule
- aging management programs
- design analysis changes

As noted in Figure 1, the results of the inspections are documented in a publicly available report. A copy of the License Renewal Inspection Procedure Manual (IP 71002) is provided in Attachment D.

The safety review process involves numerous USNRC headquarters staff as well as regional office personnel and on-site USNRC plant inspectors. Also involved is the independent Advisory Committee on Reactor Safeguards (ACRS). Their role is to review the USNRC staff findings and provide over-site and advice to the USNRC Commissioners.

The entire review process, including the environmental review activities, requires 22 months (or 30 months if a final public hearing is required). This is a reduction of more

than one year from the amount of review time that was required by the initial License Renewal Rule in 1995.

The License Renewal Application

Two principal components of the license renewal application are:

- an evaluation that addresses the technical aspects of plant aging and describes the ways those effects will be managed
- an evaluation of the potential plant specific environmental impacts due to extended operation for another 20 years

As mentioned previously, this briefing report examines the requirements and content of the first part of the application, the technical aspects of plant aging and the aging management programs.

Concerning the technical aspects of the license renewal, the licensee is required to include in the application the following information:

- an integrated plant assessment
- an evaluation of time-limited aging analyses
- changes to the current licensing basis (CLB) that may be made during the USNRC review of the application

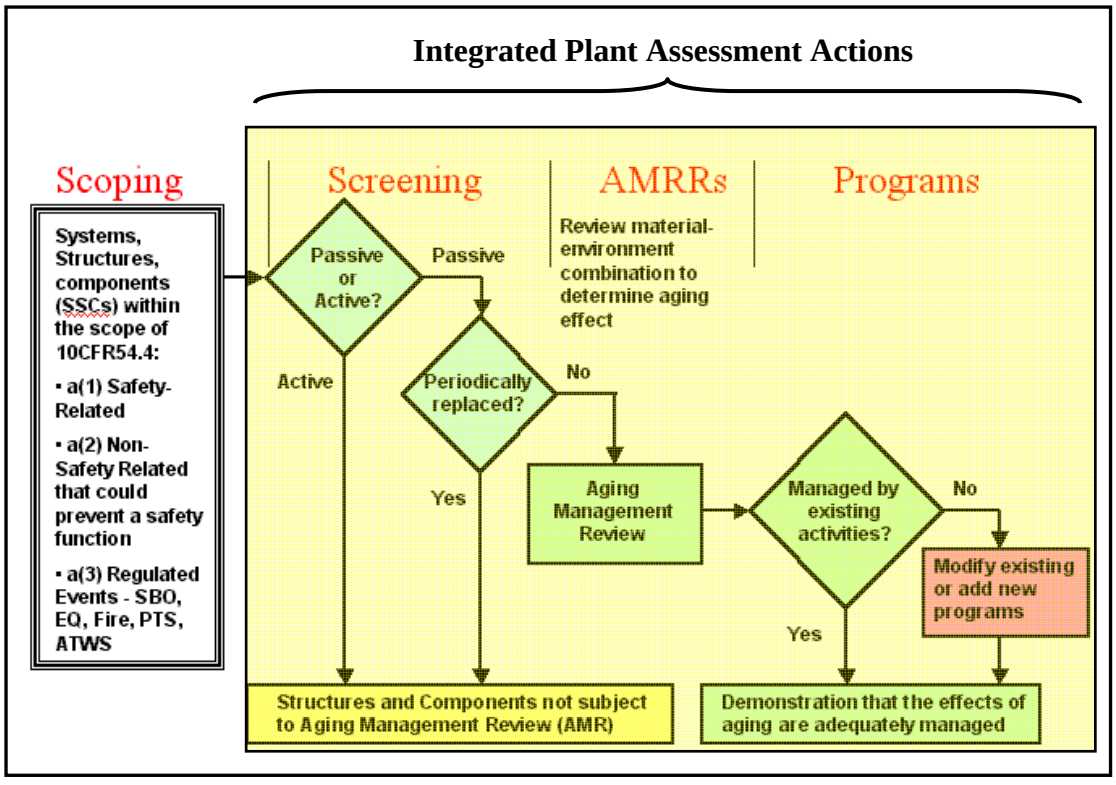

Figure 2: *License Renewal Application Activities*

The application development process involves the following actions:

- identification of the SSCs within the scope of License Renewal Rule
- identification of the intended functions of SSCs
- identification of the structures and components subject to aging management review and intended functions
- assurance that effects of aging are managed
- development and applications of new aging management programs and inspections
- identification and resolution of time-limited aging analyses
- identification and evaluation of exemptions containing time-limited aging analyses

Scoping

The scoping phase requires the licensee to identify all plant systems, structures and components that are:

- safety-related or whose failure could affect safety-related functions
- that are relied on to demonstrate compliance with the USNRC's regulations for:
  - fire protection
  - environmental qualification
  - pressurized thermal shock
  - anticipated transients without scram
  - station blackout

The licensee must determine exactly which structures and components at the plant fall within the scope of the Rule and are subject to an aging management review. The actual selection method will depend to some degree on the licensee's information management system. Applicants have used, and the USNRC has approved, selection techniques such as the grouping of like structures, possibly including both active and passive, to disposition the entire group with a single aging management review. Components and structures could be grouped by similar design, construction materials, aging management practices, or operating environments.

However, this scoping or categorization process can be rather complicated and requires careful review of the nature and function of the various SSCs being considered. For example in the case of valves and pumps, the valve bodies and pump casings may perform an intended function by maintaining the pressure-retaining boundary and therefore would be subject to aging management review.

Over the years the NEI has developed some specific recommendations to assist in making the process as efficient as possible. For example, concerning structures which require aging management review (NEI-95-10):

> *Structures within the scope of license renewal are long-lived and passive and require aging management review. It may be useful,*

however, to categorize structures by type (e.g., poured concrete, block concrete, structural steel, shield walls, metal siding, foundation on piles, etc.) in preparation for the aging management review. Subdividing complex structures into discrete elements (e.g., walls, floors, slabs, doors, penetrations, foundations, etc.) may be useful because some elements may not have intended functions as defined in the Rule and, therefore, are not subject to aging management review. It may also be useful to individually identify spill containment, flood control and fire barrier structural components where applicable and appropriate. A building, for example, with several rooms may be in the scope of renewal because one of its rooms performs an intended function. Only that one room needs to be identified as requiring aging management review.

Other items to be considered are the structural support components that either support or restrain mechanical and electrical equipment. They can be considered part of or separate from the equipment, it is up to the licensee to make and justify the determination.

It is recommended that boundaries be set for complex assemblies, such as heating, ventilation, air conditioning refrigeration units, and diesel generator assemblies. These are excluded from the list of passive SSCs. Also, consumables such as packing gaskets, O-rings, oil and grease, and fire hoses need to be carefully considered since they are short-lived items and should have replacement periods specified in the condition monitoring program.

Integrated Plant Assessment (IPA)

The integrated plant assessment (IPA) is the core of the license renewal application. As shown in Figure 2, once the licensee has determined which SSCs fall within the scope of the Rule, they then need to perform the integrated plant assessment. The purpose of the IPA is to demonstrate that the structures and components requiring aging management (within the scope of the Rule) have been identified and the effects of aging on their functionality will be managed to maintain an acceptable level of safety during extended operations.

The first part of the IPA process is to determine which of the structures and components within the scope of the Rule are passive and long-lived. The Rule states that passive structures and components are those that perform their function without a change in configuration or properties. Long-lived items are those that are not subject to replacement based on a qualified life or specified time period. An example list of such structures and components is provided in Table 2.

The objective of this screening exercise is to determine which components and structures are performing functions required under the License Rule and require aging management review.

The next activity of the IPA process is the aging management review. This involves the identification and evaluation of aging effects that may require some form of aging management.

Table 2: *Examples of Structures and Components included in, or excluded from, the License Renewal Rule Scope* (Source: 10 CFR 54)

Passive Structures & Components Included in Rule Scope (Example List)	Active Structures & Components Excluded from Rule Scope (Example List)
cable trays	air compressors
component supports	batteries
containment	battery chargers
containment liner	breakers
core shroud	circuit boards
electrical and mechanical penetrations	cooling fans
electrical cabinets	diesel generators
electrical cables and connections	motors
equipment hatches	power inverters
heat exchangers	power supplies
piping	pressure indicators
pressure retaining boundaries	pressure transmitters
pressurizer	pumps (except casing)
pump casings	relays
reactor coolant system pressure boundary	snubbers
reactor vessel	switches
seismic Category I structures	switchgears
steam generators	the control rod drive
valve bodies	transistors
ventilation ducts	valves (except body)
	ventilation dampers
	water level indicators

There are a number of different techniques that can be used to identify and assess aging effects. In certain cases the design margins and material properties may be known and can be used to demonstrate that the effects of aging are being managed. In most cases such data may not be available or adequate.

Other approaches that may be appropriate are the:

- Material-Environment-Stressors Approach
  - extensive industry reference resources are available to assist in identifying and evaluating the aging effects of known materials in known environments
  - this approach should include a review of the design or material properties to determine if certain aging effects can be shown by analysis not to affect the capability of the structure or component to perform its intended function during the period of extended operation. Of particular interest are parameters such as corrosion allowance, fatigue cycles, loading conditions, fracture toughness, tensile strength, dielectric strength, radiation exposure and environmental exposure.
- Spaces Approach
  - this involves segregating the plant areas where common, bounding environments can be assigned

  - an example could be a specific area in a room, an entire room, a floor of a building or even all inside areas of an entire building
  - an example bounding environmental parameter could be the highest average temperature present around the subject components in the area
- Plant Specific Aging Analysis Based on Loss of Intended Function
  - analysis of aging effect on the loss of the function of the structure or component
  - if the CLB can be maintained for the period of extended operation the effects of aging need not be managed
  - if the CLB can not be maintained, a commitment to an inspection may be needed to verify specific design values, demonstrate that an aging effect is occurring as anticipated, or that an aging effect is not significant
- Use of Similar Aging Management Reviews Approved by the USNRC
  - demonstrate that conditions for selected component or structure are the same as, or bounded by, a previously USNRC approved aging management review
  - characteristics to be considered may include configuration, functions, materials, service conditions and original design parameters (e.g., corrosion allowance, loading cycles) and protective measures (e.g., coatings, cathodic protection) affecting the expected service life of the structure or component.
  - significance of outlier conditions should be identified and relevance to the results or conclusions of the previous review – otherwise a structure or component-specific aging management review of the outlier condition should be performed

The licensee must demonstrate that the effects of aging will be managed in such a way that the intended functions will be maintained for the extended operation period. Where the licensee can demonstrate that the existing programs provide adequate aging management throughout the period of extended operation, no additional action may be required. However, if additional aging management activities are warranted, it will be up to the licensee to define these actions. This can include such activities as developing new monitoring programs or increasing current inspections. Licensees should consider all programs and activities associated with the component or structure to determine to what degree they already manage the aging degradation. The four general types of aging management programs are:

- Prevention – to preclude certain levels of aging degradation from occurring (e.g., coating programs to prevent external corrosion of a tank)
- Mitigation – to reduce or slow aging effects (e.g., chemistry programs to mitigate internal corrosion of piping)
- Condition monitoring – to inspect for the presence of and extent of aging effects (e.g., visual inspection of concrete structures for cracking and ultrasonic measurement of pipe wall for erosion-corrosion induced wall thinning

- Performance monitoring – to test the ability to perform its function (e.g., heat balances on heat exchangers for the heat transfer intended function of the tubes)

Once the licensee has determined an appropriate aging management approach (based on a single program or a combination of programs), the approach should be reviewed with respect to a set of ten criteria. These criteria, presented in Table 3, ensure that the licensee's application concerning the effectiveness of the aging management programs will meet all the regulatory review requirements.

The licensee can demonstrate the applicability of the aging management program in three ways. They can show that their program corresponds to a program reviewed and approved by the USNRC as presented in NUREG-1801. The second way is to perform a plant-specific evaluation. The third method is to reference the results of a previous program that has been found acceptable by the USNRC.

Table 3: *Aging Management Activity Program Elements* (Source, NUREG-1801)

Element	Description
1. Scope of the activity	Scope of the program/activity should include the specific structures and components subject to an aging management review for license renewal.
2. Preventive actions	Preventive actions should mitigate or prevent aging degradation.
3. Parameters monitored or inspected	Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended function(s).
4. Detection of aging effects	Detection of aging effects should occur before there is a loss of structure or component intended function(s). This includes aspects such as method or technique (i.e. visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects.
5. Monitoring and trending	Monitoring and trending should provide predictability of the extent of degradation and provide timely corrective or mitigating actions.
6. Acceptance criteria	Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all current licensing basis design conditions during the period of extended operation.
7. Corrective actions	Corrective actions, including root cause determination and prevention recurrence, should be timely.
8. Confirmation processes	Confirmation processes should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.
9. Administrative controls	Administrative controls should provide a formal review and approval process.
10. Operating experience	Operating experience of the aging management activity, including past corrective actions resulting in program enhancements or additional programs or activities, should provide objective evidence to ensure that the effects of aging will be adequately managed so that the intended functions of the structure or component will be maintained during the period of extended operation.

Time Limited Aging Analysis

One of the major provisions of the Rule is the identification and analysis of Time Limited Aging Analyses (TLAA). As part of the license renewal application, the licensee must identify and update time-limited aging analyses. During the design phase

for a plant, certain assumptions about the length of time the plant will be operated are incorporated into design calculations for various SSCs. In order to obtain approval for a renewed license, these calculations must be shown to be valid for the period of extended operation, or the affected SSCs must be included in an appropriate aging management program.

In essence, the USNRC requires the licensee to go back to the original plant design documents and determine if the design criteria included specific time limited assumptions or criteria. Once identified, the original calculations or qualification tests must be updated for the new extended operating life. This process may be a simple ratio method to establish a new value for fatigue cycles, or it may involve a complex fatigue analysis, considering the used-up cycles and extended operating life.

In order for a calculation or analysis to be a TLAA it must satisfy all six of the following criteria:

- be within the scope of license renewal
- have defined aging effects
- have a defined operating term (i.e. 40 years)
- be a part of the original licensing (design) basis
- be related to the maintenance of the safety functions
- be part of the current licensing basis

A comprehensive review was performed by the industry to identify potential TLAAs that may be part of the original design basis, the underlying design codes and standards, and the qualifications tests (i.e. environmental exposure of cables, corrosion tests) that were performed in support of the original design life calculations. The principal issues identified by this industry review are (NUREG-1800 & NEI-95-10):

- reactor vessel neutron embrittlement
- prestressed concrete containment tendon prestress
- metal fatigue
- environmental qualification of electrical equipment
- metal corrosion allowance
- inservice flaw growth analyses

Once the licensee has identified their specific TLAAs, analysis must be performed to extend the design basis for the extended operating period or compensatory measures must be implemented. The licensee must demonstrate one of the following:

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

These options clearly include full or partial replacement of the component, requalification by testing, more sophisticated analyses (i.e. finite element analysis and

fracture mechanics) or use of mitigative measures to impede or avoid degradation. Some plants have chosen to implement stricter preventive and predictive maintenance, one-time inspections to assess used-up margins, monitoring of the environments to recalculate cable life, new inspections to quantify degradation and installation of coupons to monitor corrosion and cracking.

Two examples of current concerns reveal the importance and value of TLAAs in ensuring plants continue to maintain adequate levels of safety during extended operation beyond their original 40-year license period. The most important current concern to the industry is the life uncertainty associated with cable insulation. Specifically cables that are located in harsh environments, such as underwater, underground, in ducts and in cable trays/bundles exposed to elevated temperatures (>125F, 52C). There are very limited in-situ condition monitoring technologies available to assess the cable life and its remaining capacity, short of destructive testing. Replacement is a very costly and time consuming task, considering there are about 1000 kilometers of cable in a typical plant and most of them relatively inaccessible. The current industry position is to extend the original cable qualification data for 40 years to the new 60-year life by applying the Arrhenius theory and using the consolidated exposure time-temperature history of the specific cables. Selected replacements are then contemplated for cables that do not meet the acceptance criteria.

The second important TLAA issue is fatigue associated with the primary coolant circuits of the reactors. Stress corrosion cracking of stainless steel (base metal, weld metal and cladding), Alloy-600 (Inconel) cracking, thermal striping/pumping and stratification and similar events have been experienced during the past and require now consolidation for license renewal. The USNRC has found that the fatigue design criteria established in the ASME Code is non-conservative with respect to consideration of environmental assisted fatigue (the S-N curves). For license renewal, a new criterion is to be applied, amounting to a factor of between two and ten on the Cumulative Usage Factor (CUF), depending on specific material and environments. This requirement may lead to more analyses and potential partial replacements of highly stressed or fatigue prone components.

Support and Guidance

Since the beginning of the license renewal process the USNRC and the nuclear industry had continued to produce guidance and support documentation. The purpose is to assist the licensees in their preparation of effective live extension or aging management programs and the documentation of such programs in the license renewal application. Guidance has also been developed to assist the USNRC staff in their review of the applications. With such guidance and support both the USNRC and the industry consider the license renewal process a predictable and stable regulatory process that clearly defines the regulatory expectations for license renewal.

Some to the key documents that are used by both the licensees and the USNRC during the license renewal process are listed in Table 4.

Table 4: *License Renewal Support and Guidance Documents*

Document Title	Document Identifier
Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants	NUREG-1800 (USNRC)
Generic Aging Lessons Learned (GALL) Report	NUREG-1801 (USNRC)
Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses	Regulatory Guide 1.188 (USNRC)
License Renewal Inspections	Inspection Manual 71002 (USNRC)
Policy and Guidance for License Renewal Inspection Programs	MC-2516 (USNRC)
Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule	NEI 95-10 (Nuclear Energy Institute)

These are all “living documents”. Revised versions of the reports are routinely produced that incorporate changes based on experience gained from numerous license renewal application reviews by USNRC staff and from insights identified by the industry. For example, the, NEI 95-10 is currently in its sixth revision.

Generic Aging Lessons Learned (GALL) Report

In particular, the Generic Aging Lessons Learned report, commonly referred to as the GALL Report and NEI 95-10 are essential documents for the development of appropriate aging management programs and license renewal application development.

The GALL report provides a template of aging management programs that have been determined to be acceptable to manage the aging effects of SSCs that are within the scope of the License Renewal Rule. The GALL Report documents the USNRC’s basis for determining which existing programs are adequate without modification and which existing programs should be augmented for license renewal. Also, the GALL Report is referenced in the NUREG-1800 as a basis for determining the adequacy of existing programs.

The GALL Report consists of two volumes, Volume 1 summarizes the aging management reviews that are discussed in Volume 2, and Volume 2 lists generic aging management reviews of SSC that may be in the scope of license renewal applications. The aging management programs listed in Volume 2 have been determined by the USNRC to be acceptable to manage the aging effects. As noted previously, the licensees are strongly encouraged to use the GALL report as appropriate to identify possible aging management programs for their components and structures.

The GALL Report contains one acceptable way to manage aging effects for license renewal. The licensee may propose alternatives for USNRC review in its plant-specific license renewal application. Use of the GALL Report is not required, but its use should facilitate both preparation of a license renewal application by an applicant and timely, uniform review by the NRC staff.

An example of the type of aging management information provided in Volume 2 of the GALL Report is provided in Attachment C. This example is a section that identifies the aging management issues and programs for concrete structures.

The GALL Report provides an enormous wealth of information in a summarized format. The approximately 1000 pages identify only the tip of the volumes of reference and supporting material that backs up the various USNRC approved aging management programs. The report builds on a major effort for the systematic compilation of plant aging information. The GALL Report extends the information to provide an evaluation of the adequacy of aging management programs for license renewal.

Much of the information in the GALL Report is applicable to aging management of systems, structures, and components in non nuclear industrial applications.

NEI 95-10 – Industry Guidelines

A second key document for the license renewal process is NEI 95-10, Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule. NEI 95-10 provides an approach that the USNRC has found to be acceptable and has endorsed for implementing the requirements of the License Renewal Rule. The guidelines in the NEI 95-10 report are based on industry experience in implementing License Renewal Rule. The objective is to make the renewal process as stable and efficient as possible for the licensees (as well as the USNRC license renewal reviewers).

It is noted that the methods provided in the guideline are only recommended. The licensee is free to elect to use other suitable methods or approaches for satisfying the Rule's requirements and completing a license renewal application.

Application to the Petroleum Industry

For almost twenty-five years the USNRC and the nuclear industry have been continuously involved in the development of requirements to ensure that nuclear plants can be safely operated beyond their original licensing period. There are many aspects of this effort that can be of value to the petroleum industry and regulator.

The wealth of aging research sponsored by the USNRC NPAR and other programs is a valuable resource for both nuclear and non-nuclear sectors. Many of the reports that are presented in Attachment A could be of value or interest to the petroleum industry situation. The information and insights in these reports provided a strong technical justification for moving forward with the development of the License Renewal requirements. The approach used by the USNRC and the nuclear industry in their review of these studies to develop such a justification could be another item of interest to the petroleum industry.

A critical aspect of the entire process of allowing extended operation beyond the original operating license period is the focus of life extension requirements on the aging management of passive and long-lived systems, structures, and components. This

focusing effort allows the license renewal process to be one that is of manageable proportions – it does not require one to consider everything to justify extended operations.

Also many aging phenomena are readily manageable and do not pose technical issues that would preclude life extension. As long as there are effective inspection and maintenance practices, the plant life is simply limited by the economic cost of repair or replacement of any components that don't meet specified acceptance criteria. However, there needs to be clear, stable, and predicable set of requirements for approval of extended operations.

Over the years both the USNRC and the industry have been working to make the license renewal process more efficient and effective. The industry believes that the USNRC is handling applications for license renewal in an effective and timely manner. There are many "lessons learned" in the course of reaching this point.

One of the key lessons has been the need to provide clear guidance and support to all involved parties. The GALL Report is a major resource for determining appropriate aging management programs for an enormous number of different structures and components. The NEI 95-10 report is an effective way to provide licensees with a standardized approach to license renewal applications – making it a relatively efficient process to develop a standardized application.

Other important guidance documents have been prepared to support the USNRC license renewal inspections and the review of the applications.

In combination, the guidance and support documents prepared by the USNRC and the nuclear industry ensure that the license renewal process is as efficient, predictable, and stable as possible.

Attachment A

Selected NPAR Program Reports

Nuclear Plant Aging Research (NPAR) Reports is a collection of literature on mechanical, structural, and thermal-hydraulic components and systems providing a systematic review of plant aging information in order to assess materials and component aging issues related to continued operation and license renewal of operating reactors.

NPAR Report Title	Document Identifier
A Characterization of Check Valve Degradation and Failure Experience in the Nuclear Power Industry	NUREG/CR-5944 (ORNL-6734)V2
Aging and Life Extension Assessment Program (ALEAP) Systems Level Plan	BNL Tech Reports: A-3270-12-86
Aging and Service Wear of Auxiliary Feedwater Pumps for PWR Nuclear Power Plants, Vol. 1: Operating Experience and Failure Identification	NUREG/CR-4597 V1 (ORNL-6282)
Aging and Service Wear of Auxiliary Feedwater Pumps for PWR Nuclear Power Plants, Vol. 2: Aging Assessment and Monitoring Method Evaluations	NUREG/CR-4597 V2 (ORNL-6282)
Aging and Service Wear of Check Valves Used in Engineered Safety-Feature Systems of Nuclear Power Plants	NUREG/CR-4302 V1 (ORNL-6193)
Aging and Service Wear of Check Valves Used in Engineered Safety-Feature Systems of Nuclear Power Plants	NUREG/CR-4302 V2(ORNL-6193)
Aging and Service Wear of Control Rod Drive Mechanisms for BWR Nuclear Plants - V1	NUREG/CR-5699 V1 (ORNL-6666/V1)
Aging and Service Wear of Hydraulic and Mechanical Snubbers Used on Safety-Related Piping and Components of Nuclear Power Plants	NUREG/CR-4279 V1 (PNL-5479)
Aging and Service Wear of Solenoid-Operated Valves Used in Safety Systems of Nuclear Power Plants	NUREG/CR-4819 V1 (ORNL/SUB/83-28915/4)
Aging and Service Wear of Solenoid-Operated Valves Used in Safety Systems of Nuclear Power Plants: Evaluation of Monitoring Methods	NUREG/CR-4819 V2 (ORNL/TM-12038)
Aging Assessment of BWR Standby Liquid Control Systems	NUREG/CR-6001 (PNL-8020)
Aging Assessment of Component Cooling Water Systems in Pressurized Water Reactors-Phase II	NUREG/CR-5693 (BNL-NUREG-52283)
Aging Assessment of Instrument Air Systems in Nuclear Power Plants	NUREG/CR-5419 (BNL-NUREG-5221)
Aging Assessment of Nuclear Air Treatment System HEPA Filters and Absorbers - Phase 1	NUREG/CR-6029
Aging Assessment of the Combustion Engineering and Babcock & Wilcox Control Rod Drives	NUREG/CR-5783 (BNL-NUREG-52299)
Aging Assessment of the Westinghouse PWR Control Rod Drive System	NUREG/CR-5555
Aging Data Analysis and Risk Assessment - Development and Demonstration Study	NUREG/CR-5378 (EGG-2567)
Aging Mitigation and Improved Programs for Nuclear Service Diesel Generators	NUREG/CR-5057 (PNL-6397)
Aging of Control and Service Air Compressors and Dryers Used in Nuclear Power Plants	NUREG/CR-5519 V1 (ORNL-6607/V1)
Aging of Non-Power-Cycle Heat Exchangers Used in Nuclear Power Plants	NUREG/CR-5779 V1 (ORNL-6687)
An Aging Failure Survey of Light Water Reactor Safety Systems and Components, V1	NUREG/CR-4747 V1 EGG-2473)
An Aging Failure Survey of Light Water Reactor Safety Systems and Components, V2	NUREG/CR-4747 V2 EGG-2473)
An Evaluation of the Effects of Valve Body Erosion on Motor-Operated Valve	BNL Tech Reports:EGG-SSRE-

NPAR Report Title	Document Identifier
Operability	10039
An Operational Assessment of the Babcock & Wilcox and Combustion Engineering Control Rod Drives	BNL Tech Reports: TR-3270-9-90
Approaches for Age-Dependent Probabilistic Safety Assessments With Emphasis on Prioritization and Sensitivity Studies	NUREG/CR-5587 (SAIC-92/1137)
ASME Subsection ISTD Recommendations Based upon NPAR Snubber Aging Research Results	PNL-SA-20219
Auxiliary Feedwater System Aging Study, Phase I Follow-On Study	NUREG/CR-5404 V2 (ORNL-6566, V2)
Auxiliary Feedwater System Aging Study, V1	NUREG/CR-5404 V1 (ORNL-6566, V1)
Basis for Snubber Aging Research: Nuclear Plant Aging Research Program	NUREG/CR-5386 (PNL-6911)
Boiling-Water Reactor Internals Aging Degradation Study-Phase I	NUREG/CR-5754 (ORNL/TM-11876)
BWR Reactor Water Cleanup System Flexible Wedge Gate Isolation Valve Qualification and High Energy Flow Interruption Test, V2: Analysis and Conclusions	NUREG/CR-5406 V1 (EGG-2569, V1)
BWR Reactor Water Cleanup System Flexible Wedge Gate Isolation Valve Qualification and High Energy Flow Interruption Test, V2: Data Report	NUREG/CR-5406 V2 (EGG-2569, V2)
BWR Reactor Water Cleanup System Flexible Wedge Gate Isolation Valve Qualification and High Energy Flow Interruption Test, V3: Review of Issues Associated with the BWR Containment Isolation Valve Closure	NUREG/CR-5406 V3 (EGG-2569, V3)
Concrete Component Aging and Its Significance Relative to Extension of Nuclear Power Plants	NUREG/CR-4652 (ORNL/TM-10059)
Current Applications of Vibration Monitoring and Neutron Noise Analysis: Detection and Analysis of Structural Degradation of Reactor Vessel Internals from Operational Aging	NUREG/CR-5479(ORNL/TM/11398)
Degradation Modeling: Extensions and Applications	BNL Tech Reports: A-3270-6-21-91
Emergency Diesel Generator Technical Specifications Study Results	PNL-7516
Estimating Hazard Functions for Repairable Components	BNL Tech Reports:EGG-SSRE-8972
Evaluation of EPRI Draft Report NP-7065-Review of NRC/INEL Gate Valve Test Program	BNL Tech Reports:EGG-SSRE-9926
Evaluation of the Motor-Operated Valve Analysis and Test System (MOVATS) to Detect Degradation, Incorrect Adjustments, and Other Abnormalities in Motor Operated Valves	NUREG/CR-4380 (ORNL-6226)
Evaluations of Core Melt Frequency Effects due to Component Aging Maintenance	NUREG/CR-5510
Generic Issue 87: Flexible Wedge Gate Valve Test Program: Phase II Results and Analysis	NUREG/CR-5558 (EGG-2600)
Importance Ranking Based on Aging Consideration of Components Included in Probabilistic Risk Assessments	NUREG/CR-4144 (PNL-5389)
Improvements in Motor Operated Gate Valve Design and Prediction Models for Nuclear Power Plant Systems	NUREG/CR-5807
Interim Report - Aging Effects of Important Balance of Plant Systems in Nuclear Power Plants	BNL Tech Reports: A-3270R-2-90
Isolation Valve Assessment (IVA) Software Version 3.10, User's Manual	BNL Tech Reports: EGG-SSRE-9777
Life Assessment Procedures for Major LWR Components	NUREG/CR-5314 V3 EGG-2562)
Light Water Reactor Pressure Isolation Valve Performance Testing	NUREG/CR-5515 (ETEC 88-01)
Maintenance Practices to Manage Aging: A Review of Several Technologies	PNL-7823
Maintenance Team Inspection Results: Insights Related to Plant Aging	BNL Tech Reports: TR-3270-6-90
Motor-Operated Valve Research Update	NUREG/CR-5720 (EGG-2643)
NRC Bulletin 88-04: Potential Safety-Related Pump Loss- An Assessment of Industry Data	NUREG/CR-5706 (ORNL-6671)

NPAR Report Title	Document Identifier
Nuclear Plant Aging Research (NPAR) Program Plan, Status and Accomplishments, Rev. 2	NUREG-1144, V3
Nuclear Plant Aging Research on High Pressure Injection Systems	NUREG/CR-4967(EGG-2514)
Nuclear Plant Service Water System Aging Degradation Assessment: Phase I, Vol. 1	NUREG/CR-5379 V1 (PNL-6560)
Nuclear Plant Service Water System Aging Degradation Assessment: Phase II, Vol. 2	NUREG/CR-5379 V2 (PNL-6560)
Operating Experience and Aging Assessment of ECCS Pump Room Coolers	PNL-5722
Operating Experience Review of Failures of Power Operated Relief Valves and Block Valves in Nuclear Power Plants	NUREG/CR-4692 (ORNL/NOAC-233)
Phase I Aging Assessment of Essential HVAC Chillers Used in Nuclear Power Plants	NUREG/CR-6043 V1 (PNL-8614)
Piping System Response During High Level Simulated Seismic Tests at the Heissdampfreaktor Facility (SHAM Test Facility)	NUREG/CR-5646 (EGG-2655)
Prediction of Check Valve Performance and Degradation in Nuclear Power Plant Systems	NUREG/CR-5159 (KEI-1559)
Prediction of Check Valve Performance and Degradation in Nuclear Power Plant Systems-Wear and Impact Tests	NUREG/CR-5583 (KEI No. 1656)
Pressurized-Water Reactor Internals Aging Degradation Study --A Phase I Report	NUREG/CR-6048 (ORNL-TM-12371)
Prioritization of TIRALEX-Recommended Components for Further Aging Research	NUREG/CR-5248 (PNL-6701)
Proceedings of the International Nuclear Power Plant Aging Symposium	NUREG/CP-0100
Proceedings of the Seventeenth Water Reactor Safety Information Meeting (aging session only)	NUREG/CP-0105 Vol. 3
Recordkeeping Needs to Mitigate the Impact of Aging Degradation	NUREG/CR-5848
Regulatory Instrument Review: Management of Aging of LWR Major Safety Components	NUREG/CR-5490 V1 (PNL-7190)
Residual Life Assessment of Major Light Water Reactor Components - Overview, Vol. 2	NUREG/CR-4731 V2 (EGG-2469)
Residual Life Assessment of Major Light Water Reactor Components, Vol. 1	NUREG/CR-4731 V1 (EGG-2469)
Results from the Nuclear Plant Aging Research Program: Their Use in Inspection Activities	NUREG/CR-5507 (BNL-NUREG-52222)
Results of LWR Snubber Aging Research	NUREG/CR-5870 (PNL-8051)
Scoping Test on Containment Purge and Vent Seal Material	BNL Tech Reports: A-3270-11-26-84
SHAG Test Series: Seismic Research on an Aged United States Gate Valve and on a Piping System in the Decommissioned Heissdampfreaktor (HDR): Summary, V1	NUREG/CR-4977 V1 (EGG-2505 V1)
SHAG Test Series: Seismic Research on an Aged United States Gate Valve and on a Piping System in the Decommissioned Heissdampfreaktor (HDR): Appendices, V2	NUREG/CR-4977 V2 (EGG-2505 V2)
Study Group Review of Nuclear Service Diesel Generator Testing and Aging Mitigation	PNL-6287
The In-Plant Reliability Data Base for Nuclear Power Plant Components: Data Collection and Methodology Report	NUREG/CR-2641(ORNL/TM-8271)
The In-Plant Reliability Data Base for Nuclear Power Plant Components: Interim Report - The Valve Component	NUREG/CR-3154(ORNL/TM 8647)
Throttled Valve Cavitation and Erosion	ORNL/NRC/LTR-91/25
User's Guide to PHAZE, a Computer Program for Parametric Hazard Function Estimation	BNL Tech Reports: EGG-SSRE-9017

Attachment B

The License Renewal Rule Text

Title 10 of the US Code of Federal Regulations, Part 54 (10 CFR Part 54) Requirements for Renewal of Operating Licenses for Nuclear Power Plants

General Provisions

§ 54.1 Purpose.

This part governs the issuance of renewed operating licenses for nuclear power plants licensed pursuant to Sections 103 or 104b of the Atomic Energy Act of 1954, as amended (68 Stat. 919), and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242).

§ 54.3 Definitions.

(a) As used in this part,

Current licensing basis (CLB) is the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect. The CLB includes the NRC regulations contained in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 54, 55, 70, 72, 73, 100 and appendices thereto; orders; license conditions; exemptions; and technical specifications. It also includes the plant-specific design-basis information defined in 10 CFR 50.2 as documented in the most recent final safety analysis report (FSAR) as required by 10 CFR 50.71 and the licensee's commitments remaining in effect that were made in docketed licensing correspondence such as licensee responses to NRC bulletins, generic letters, and enforcement actions, as well as licensee commitments documented in NRC safety evaluations or licensee event reports.

Integrated plant assessment (IPA) is a licensee assessment that demonstrates that a nuclear power plant facility's structures and components requiring aging management review in accordance with § 54.21(a) for license renewal have been identified and that the effects of aging on the functionality of such structures and components will be managed to maintain the CLB such that there is an acceptable level of safety during the period of extended operation.

Nuclear power plant means a nuclear power facility of a type described in 10 CFR 50.21(b) or 50.22.

Time-limited aging analyses, for the purposes of this part, are those licensee calculations and analyses that:

(1) Involve systems, structures, and components within the scope of license renewal, as delineated in § 54.4(a);
(2) Consider the effects of aging;
(3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;
(4) Were determined to be relevant by the licensee in making a safety determination;
(5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in § 54.4(b); and
(6) Are contained or incorporated by reference in the CLB.

(b) All other terms in this part have the same meanings as set out in 10 CFR 50.2 or Section 11 of the Atomic Energy Act, as applicable.

§ 54.4 Scope.

(a) Plant systems, structures, and components within the scope of this part are--

(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions--

(i) The integrity of the reactor coolant pressure boundary;

(ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

(iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.

(2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section.

(3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates 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), and station blackout (10 CFR 50.63).

(b) The intended functions that these systems, structures, and components must be shown to fulfill in § 54.21 are those functions that are the bases for including them within the scope of license renewal as specified in paragraphs (a)(1) - (3) of this section.

[60 FR 22491, May 8, 1995, as amended at 61 FR 65175, Dec. 11, 1996; 64 FR 72002, Dec. 23, 1999]

§ 54.5 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

§ 54.7 Written communications.

All applications, correspondence, reports, and other written communications shall be filed in accordance with applicable portions of 10 CFR 50.4.

§ 54.9 Information collection requirements: OMB approval.

(a) The Nuclear Regulatory Commission has submitted the information collection requirements contained in this part to the Office of Management and Budget (OMB) for approval as required by the Paperwork Reduction Act (44 U.S.C. 3501 et seq.). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB has approved the information collection requirements contained in this part under control number 3150-0155.

(b) The approved information requirements contained in this part appear in §§ 54.13, 54.15, 54.17, 54.19, 54.21, 54.22, 54.23, 54.33, and 54.37.

[60 FR 22491, May 8, 1995, as amended at 62 FR 52188, Oct. 6, 1997; 67 FR 67100, Nov. 4, 2002]

§ 54.11 Public inspection of applications.

Applications and documents submitted to the Commission in connection with renewal applications may be made available for public inspection in accordance with the provisions of the regulations contained in 10 CFR Part 2.

§ 54.13 Completeness and accuracy of information.

(a) Information provided to the Commission by an applicant for a renewed license or information required by statute or by the Commission's regulations, orders, or license conditions to be maintained by the applicant must be complete and accurate in all material respects.

(b) Each applicant shall notify the Commission of information identified by the applicant as having, for the regulated activity, a significant implication for public health and safety or common defense and security. An applicant violates this paragraph only if the applicant fails to notify the Commission of information that the applicant has identified as having a significant implication for public health and safety or common defense and security. Notification must be provided to the Administrator of the appropriate regional office within 2 working days of identifying the information. This requirement is not applicable to information that is already required to be provided to the Commission by other reporting or updating requirements.

§ 54.15 Specific exemptions.

Exemptions from the requirements of this part may be granted by the Commission in accordance with 10 CFR 50.12.

§ 54.17 Filing of application.

(a) The filing of an application for a renewed license must be in accordance with Subpart A of 10 CFR Part 2 and 10 CFR 50.4 and 50.30.
(b) Any person who is a citizen, national, or agent of a foreign country, or any corporation, or other entity which the Commission knows or has reason to know is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government, is ineligible to apply for and obtain a renewed license.
(c) An application for a renewed license may not be submitted to the Commission earlier than 20 years before the expiration of the operating license currently in effect.
(d) An applicant may combine an application for a renewed license with applications for other kinds of licenses.
(e) An application may incorporate by reference information contained in previous applications for licenses or license amendments, statements, correspondence, or reports filed with the Commission, provided that the references are clear and specific.
(f) If the application contains Restricted Data or other defense information, it must be prepared in such a manner that all Restricted Data and other defense information are separated from unclassified information in accordance with 10 CFR 50.33(j).
(g) As part of its application, and in any event before the receipt of Restricted Data or classified National Security Information or the issuance of a renewed license, the applicant shall agree in writing that it will not permit any individual to have access to or any facility to possess Restricted Data or classified National Security Information until the individual and/or facility has been approved for such access under the provisions of 10 CFR Parts 25 and/or 95. The agreement of the applicant in this regard shall be deemed part of the renewed license, whether so stated therein or not.
[60 FR 22491, May 8, 1995, as amended at 62 FR 17690, Apr. 11, 1997]

§ 54.19 Contents of application--general information.

(a) Each application must provide the information specified in 10 CFR 50.33(a) through (e), (h), and (i). Alternatively, the application may incorporate by reference other documents that provide the information required by this section.
(b) Each application must include conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license.

§ 54.21 Contents of application--technical information.

Each application must contain the following information:
(a) An integrated plant assessment (IPA). The IPA must--
- (1) For those systems, structures, and components within the scope of this part, as delineated in § 54.4, identify and list those structures and components subject to an aging management review. Structures and components subject to an aging management review shall encompass those structures and components--
  - (i) That perform an intended function, as described in § 54.4, without moving parts or without a change in configuration or properties. These structures and components include, but are not limited to, the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and mechanical penetrations, equipment hatches, seismic Category I structures, electrical cables and connections, cable trays, and electrical cabinets, excluding, but not limited to, pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies; and
  - (ii) That are not subject to replacement based on a qualified life or specified time period.
- (2) Describe and justify the methods used in paragraph (a)(1) of this section.
- (3) For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

(b) CLB changes during NRC review of the application. Each year following submittal of the license renewal application and at least 3 months before scheduled completion of the NRC review, an amendment to the renewal application must be submitted that identifies any change to the CLB of the facility that materially affects the contents of the license renewal application, including the FSAR supplement.
(c) An evaluation of time-limited aging analyses.
- (1) A list of time-limited aging analyses, as defined in § 54.3, must be provided. The applicant shall demonstrate that--
  - (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.

(2) A list must be provided of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on time-limited aging analyses as defined in § 54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.

(d) An FSAR supplement. The FSAR supplement for the facility must contain a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses for the period of extended operation determined by paragraphs (a) and (c) of this section, respectively.

§ 54.22 Contents of application--technical specifications.

Each application must include any technical specification changes or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. The justification for changes or additions to the technical specifications must be contained in the license renewal application.

§ 54.23 Contents of application--environmental information.

Each application must include a supplement to the environmental report that complies with the requirements of Subpart A of 10 CFR Part 51.

§ 54.25 Report of the Advisory Committee on Reactor Safeguards.

Each renewal application will be referred to the Advisory Committee on Reactor Safeguards for a review and report. Any report will be made part of the record of the application and made available to the public, except to the extent that security classification prevents disclosure.

§ 54.27 Hearings.

A notice of an opportunity for a hearing will be published in the Federal Register in accordance with 10 CFR 2.105. In the absence of a request for a hearing filed within 30 days by a person whose interest may be affected, the Commission may issue a renewed operating license without a hearing upon 30-day notice and publication once in the *Federal Register* of its intent to do so.

§ 54.29 Standards for issuance of a renewed license.

A renewed license may be issued by the Commission up to the full term authorized by § 54.31 if the Commission finds that:

(a) Actions have been identified and have been or will be taken with respect to the matters identified in Paragraphs (a)(1) and (a)(2) of this section, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the plant's CLB in order to comply with this paragraph are in accord with the Act and the Commission's regulations. These matters are:

(1) managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under § 54.21(a)(1); and

(2) time-limited aging analyses that have been identified to require review under § 54.21(c).

(b) Any applicable requirements of Subpart A of 10 CFR Part 51 have been satisfied.

(c) Any matters raised under § 2.335 have been addressed.

[69 FR 2279, Jan. 14, 2004]

§ 54.30 Matters not subject to a renewal review.

(a) If the reviews required by § 54.21 (a) or (c) show that there is not reasonable assurance during the current license term that licensed activities will be conducted in accordance with the CLB, then the licensee shall take measures under its current license, as appropriate, to ensure that the intended function of those systems, structures or components will be maintained in accordance with the CLB throughout the term of its current license.

(b) The licensee's compliance with the obligation under Paragraph (a) of this section to take measures under its current license is not within the scope of the license renewal review.

§ 54.31 Issuance of a renewed license.

(a) A renewed license will be of the class for which the operating license currently in effect was issued.

(b) A renewed license will be issued for a fixed period of time, which is the sum of the additional amount of time beyond the expiration of the operating license (not to exceed 20 years) that is requested in a renewal application plus the remaining number of years on the operating license currently in effect. The term of any renewed license may not exceed 40 years.

(c) A renewed license will become effective immediately upon its issuance, thereby superseding the operating license previously in effect. If a renewed license is subsequently set aside upon further administrative or judicial appeal, the operating license previously in effect will be reinstated unless its term has expired and the renewal application was not filed in a timely manner.

(d) A renewed license may be subsequently renewed in accordance with all applicable requirements.

§ 54.33 Continuation of CLB and conditions of renewed license.

(a) Whether stated therein or not, each renewed license will contain and otherwise be subject to the conditions set forth in 10 CFR 50.54.
(b) Each renewed license will be issued in such form and contain such conditions and limitations, including technical specifications, as the Commission deems appropriate and necessary to help ensure that systems, structures, and components subject to review in accordance with § 54.21 will continue to perform their intended functions for the period of extended operation. In addition, the renewed license will be issued in such form and contain such conditions and limitations as the Commission deems appropriate and necessary to help ensure that systems, structures, and components associated with any time-limited aging analyses will continue to perform their intended functions for the period of extended operation.
(c) Each renewed license will include those conditions to protect the environment that were imposed pursuant to 10 CFR 50.36b and that are part of the CLB for the facility at the time of issuance of the renewed license. These conditions may be supplemented or amended as necessary to protect the environment during the term of the renewed license and will be derived from information contained in the supplement to the environmental report submitted pursuant to 10 CFR Part 51, as analyzed and evaluated in the NRC record of decision. The conditions will identify the obligations of the licensee in the environmental area, including, as appropriate, requirements for reporting and recordkeeping of environmental data and any conditions and monitoring requirements for the protection of the nonaquatic environment.
(d) The licensing basis for the renewed license includes the CLB, as defined in § 54.3(a); the inclusion in the licensing basis of matters such as licensee commitments does not change the legal status of those matters unless specifically so ordered pursuant to paragraphs (b) or (c) of this section.

§ 54.35 Requirements during term of renewed license.

During the term of a renewed license, licensees shall be subject to and shall continue to comply with all Commission regulations contained in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 54, 55, 70, 72, 73, and 100, and the appendices to these parts that are applicable to holders of operating licenses.

§ 54.37 Additional records and recordkeeping requirements.

(a) The licensee shall retain in an auditable and retrievable form for the term of the renewed operating license all information and documentation required by, or otherwise necessary to document compliance with, the provisions of this part.
(b) After the renewed license is issued, the FSAR update required by 10 CFR 50.71(e) must include any systems, structures, and components newly identified that would have been subject to an aging management review or evaluation of time-limited aging analyses in accordance with § 54.21. This FSAR update must describe how the effects of aging will be managed such that the intended function(s) in § 54.4(b) will be effectively maintained during the period of extended operation.

§ 54.41 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of the following acts--

(1) The Atomic Energy Act of 1954, as amended.
(2) Title II of the Energy Reorganization Act of 1974, as amended or
(3) A regulation or order issued pursuant to those acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under Section 234 of the Atomic Energy Act--

(1) For violations of the following--
(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;
(ii) Section 206 of the Energy Reorganization Act;
(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section;
(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under Section 186 of the Atomic Energy Act of 1954, as amended.

§ 54.43 Criminal penalties.

(a) Section 223 of the Atomic Energy Act of 1954, as amended, provides for criminal sanctions for willful violations of, attempted violation of, or conspiracy to violate, any regulation issued under sections 161b, 161i, or 161o of the Act. For purposes of section 223, all the regulations in Part 54 are issued under one or more of sections 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.
(b) The regulations in Part 54 that are not issued under Sections 161b, 161i, or 161o for the purposes of Section 223 are as follows: §§ 54.1, 54.3, 54.4, 54.5, 54.7, 54.9, 54.11, 54.15, 54.17, 54.19, 54.21, 54.22, 54.23, 54.25, 54.27, 54.29, 54.31, 54.41, and 54.43.

Attachment C

Example Aging Management Programs for Concrete Structures

Generic Aging Lessons Learned Report, Volume 2 (NUREG-1801)

A1. GROUP 1 STRUCTURES (BWR Reactor Building, PWR Shield Building, Control Room/Building)

Systems, Structures, and Components

This section addresses the elements of boiling water reactor (BWR) reactor building, pressurized water reactor (PWR) shield building, and control room/building. For this group, the applicable structural elements are concrete, steel, and masonry walls. The aging management review is presented for each applicable combination of structural element and aging effect.

System Interfaces

Physical interfaces exist with any system or component that either penetrates the structure wall or is supported by the structure wall, floor, and roof. The direct interface is through the system or component supports that are anchored to the structure. Structures also protect housed systems or components from internal and external design basis events. In the case of tanks, there is a functional interface with the associated system. Water-control structures are integral parts of the systems that provide plant cooling water and residual heat removal.

Table Column Headings

Column Heading	Description
ID	A unique row identifier. This identifier is useful in matching the row with the row in the corresponding 3.X-1 Table in the SRP-LR (where the "X" represents the chapter number within the SRP-LR). Thus, the Table 1 row labeled ID 1 in GALL Vol. 1 represents the same information contained in the row labeled ID 1 in Table 3.1-1 of the SRP-LR.
Type	Identifies the plant design that the item applies to (i.e., BWR or PWR or both).
Component	Identifies the structure or components to which the row applies
Aging Effect/ Mechanism	Identifies the applicable aging effect and mechanism(s). See Chapter IX of Volume 2 for more information.
Aging Management Programs	Identifies the time limited aging analysis or aging management program found acceptable for properly managing the affects of aging. See Chapter X and XI of Volume 2.
Further Evaluation	Identifies whether further evaluation is required, and references the section of the SRP-LR that provides further information on this evaluation.
Recommended Related Generic Item	Identifies the item number in Volume 2, Chapters II through VIII presenting the detailed information summarized by this row. This chapter-specific generic identifier is used in the AMR subsystem rows and can appear multiple times within a chapter.
Unique Item	The unique item is an AMR line-item identifier which is coded to indicate the chapter, AMR subsystem and unique row number within GALL Volume 2 (i.e., VIII.B1-1 is the first row in the steam and power conversion system, main steam system table, row 1).

III STRUCTURES AND COMPONENT SUPPORTS
A1
Group 1 Structures (BWR Reactor Bldg., PWR Shield Bldg., Control Rm./Bldg.)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.A1-1 (T-10)	III.A1.1-j	Concrete: All	Reinforced concrete	Air – indoor uncontrolled	Reduction of strength and modulus/ elevated temperature (>150°F general; >200°F local)	Plant-specific aging management program For any concrete elements that exceed specified temperature limits, further evaluations are warranted. Appendix A of ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 150°F except for local areas which are allowed to have increased temperatures not to exceed 200°F.	Yes, if temperature limits are exceeded
III.A1-2 (T-03)	III.A1.1-c	Concrete: All	Reinforced concrete	Any	Cracking due to expansion/ reaction with aggregates	Chapter XI.S6, “Structures Monitoring Program” Accessible Areas: Inspections/evaluations performed in accordance with the Structures Monitoring Program will indicate the presence of expansion and cracking due to reaction with aggregates. Inaccessible Areas: As described in NUREG-1557, investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50 can demonstrate that those aggregates do not react within reinforced concrete. For potentially reactive aggregates, aggregate- reinforced concrete reaction is not significant if the concrete was constructed in accordance with ACI 201.2R. Therefore, if these conditions are satisfied, aging management is not necessary	Yes, if not within the scope of the applicant’s structures monitoring program or concrete was not constructed as stated for inaccessible areas.
III.A1-3 (T-08)	III.A1.1-h	Concrete: All	Reinforced concrete	Soil	Cracks and distortion due to increased stress levels from settlement	Chapter XI.S6, “Structures Monitoring Program” If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the dewatering system through the period of extended operation.	Yes, if not within the scope of the applicant’s structures monitoring program or a de-watering system is relied upon

III STRUCTURES AND COMPONENT SUPPORTS
A1
Group 1 Structures (BWR Reactor Bldg., PWR Shield Bldg., Control Rm./Bldg.)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.A1-4 (T-05)	III.A1.1-e	Concrete: Below-grade exterior; foundation	Reinforced concrete	Ground water/soil	Cracking, loss of bond, and loss of material (spalling), scaling)/ corrosion of embedded steel	Chapter XI.S6, "Structures Monitoring Program" Accessible Areas: Inspections performed in accordance with the Structures Monitoring Program will indicate the cracking, loss of bond, or loss of material (spalling, scaling) due to corrosion of embedded steel. Inaccessible Areas: For plants with non-aggressive ground water/soil; i.e., pH > 5.5, chlorides < 500 ppm, or sulfates <1500 ppm, as a minimum, consider (1) Examination of the exposed portions of the below-grade concrete, when excavated for any reason, and (2) Periodic monitoring of below-grade water chemistry, including consideration of potential seasonal variations. For plants with aggressive groundwater/soil, and/or where the concrete structural elements have experienced degradation, a plant specific AMP accounting for the extent of the degradation experienced should be implemented to manage the concrete aging during the period of extended	Yes, if plant specific environment is aggressive
III.A1-5 (T-07)	III.A1.1-g	Concrete: Below-grade exterior; foundation	Reinforced concrete	Ground water/soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack	Inaccessible Areas: For plants with non-aggressive ground water/soil; i.e., pH > 5.5, chlorides < 500 ppm, or sulfates <1500 ppm, as a minimum, consider (1) Examination of the exposed portions of the below-grade concrete, when excavated for any reason, and (2) Periodic monitoring of below-grade water chemistry, including consideration of potential seasonal variations. For plants with aggressive groundwater/soil, and/or where the concrete structural elements have experienced degradation, a plant specific AMP accounting for the extent of the degradation experienced should be implemented to manage the concrete aging during the period of extended operation.	Yes, plant specific if environment is aggressive

III STRUCTURES AND COMPONENT SUPPORTS
A1
Group 1 Structures (BWR Reactor Bldg., PWR Shield Bldg., Control Rm./Bldg.)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.A1-6 (T-01)	III.A1.1-a	Concrete: Exterior above- and below-grade; foundation	Reinforced concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking/ freeze-thaw	Chapter XI.S6, “Structures Monitoring Program” Accessible Areas: Inspections performed in accordance with the Structures Monitoring Program will indicate the presence of loss of material (spalling, scaling) and cracking due to freeze-thaw. Inaccessible Areas: Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557). Documented evidence to confirm that existing concrete has air content of 3% to 6% and water-to-cement ratio of 0.35- 0.45, and subsequent inspections did not exhibit degradation related to freeze-thaw, should be considered a part of the evaluation. The weathering index for the continental US is shown in ASTM C33-90, Fig.1.	Yes, if not within the scope of the applicant’s structures monitoring program or for inaccessible areas of plants located in moderate to severe weathering
III.A1-7 (T-02)	III.A1.1-b	Concrete: Exterior above- and below-grade; foundation	Reinforced concrete	Water – flowing	Increase in porosity and permeability, loss of strength/ leaching of calcium hydroxide	Chapter XI.S6, "Structures Monitoring Program" Accessible areas: Inspections performed in accordance with the Structures Monitoring Program will indicate the presence of increase in porosity, and permeability due to leaching of calcium hydroxide. Inaccessible Areas: An aging management program is not necessary, even if reinforced concrete is exposed to flowing water, if there is documented evidence that confirms the in-place concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas.
III.A1-8 (T-09)	III.A1.1-i	Concrete: Foundation; subfoundation	Reinforced concrete;	Porous concrete Water – flowing under foundation	Reduction in foundation strength, cracking, differential settlement/ erosion of porous concrete subfoundation	Chapter XI.S6, “Structures Monitoring Program” Erosion of cement from porous concrete subfoundations beneath containment basemats is described in NRC IN 97-11. NRC IN 98-26 proposes Maintenance Rule Structures Monitoring for managing this aging effect, if applicable. If a dewatering system is relied upon for control of erosion of cement from porous concrete subfoundations, the licensee is to ensure proper functioning of the dewatering system through the period of extended operation.	Yes, if not within the scope of the applicant’s structures monitoring program or a de-watering system is relied upon

III STRUCTURES AND COMPONENT SUPPORTS
A1
Group 1 Structures (BWR Reactor Bldg., PWR Shield Bldg., Control Rm./Bldg.)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.A1-9 (T-04)	III.A1.1-d	Concrete: Interior and above-grade exterior	Reinforced concrete	Air – indoor uncontrolled or air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel	Chapter XI.S6, “Structures Monitoring Program” Accessible areas: Inspections performed in accordance with the Structures Monitoring Program will indicate the presence of cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel.	Yes, if not within the scope of the applicant’s structures monitoring
III.A1-10 (T-06)	III.A1.1-f	Concrete: Interior and above-grade exterior	Reinforced concrete	Air – indoor uncontrolled or air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack	Chapter XI.S6, "Structures Monitoring Program" Accessible Areas: Inspections performed in accordance with Structures Monitoring Program will indicate the presence of increase in porosity and permeability, cracking, or loss of material (spalling, scaling) due to aggressive chemical attack.	Yes, if not within the scope of the applicant’s structures monitoring
III.A1-11 (T-12)	III.A1.3-a	Masonry walls: All	Concrete block	Air – indoor uncontrolled or air – outdoor	Cracking due to restraint shrinkage, creep, and aggressive environment	Chapter XI.S5, “Masonry Wall Program”	No
III.A1-12 (T-11)	III.A1.2-a	Steel components: All structural steel	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ corrosion	Chapter XI.S6, “Structures Monitoring Program” If protective coatings are relied upon to manage the effects of aging, the structures monitoring program is to include provisions to address protective coating monitoring and maintenance.	Yes, if not within the scope of the applicant’s structures monitoring program

Attachment D

License Renewal Inspection Procedure Manual

USNRC Inspection Procedure 71002

PROGRAM APPLICABILITY: IMC 2516

71002-01 INSPECTION OBJECTIVES

01.01 To verify the applicant's license renewal program, including supporting activities, are implemented consistent with the requirements of Title 10 of the *Code of Federal Regulation (10 CFR)*, Part 54, "Requirements for the Renewal of Operating Licenses for Nuclear Power Plants", hereinafter referred to as the "rule", and the applicant's license renewal application (LRA).

01.02 To verify the material condition of the systems, structures and components (SSCs) that require an aging management review, will be adequately maintained consistent with the rule, the staff's safety evaluations, and the applicant's license renewal program.

01.03 To verify the information and documentation required by, or necessary to document compliance with, the provisions of the rule are retrievable, auditable and consistent with the rule and applicant approved programs and procedures.

71002-02 DEFINITIONS

Passive Structures and Components (SCs). Structures and Components which perform an intended function without moving parts or without a change in configuration change in properties, or change of state. These may include SCs which are classified as inherently reliable under the maintenance rule, or SCs for which aging degradation is not readily monitored.

Long-lived Structures and Components. Structures and components which are not subject to replacement based on a qualified life or specified time period.

Current Licensing Basis (CLB). As defined in 10 CFR 54.3, CLB is the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect.

71002-03 INSPECTION REQUIREMENTS

03.01 General Inspection Requirements

The License Renewal Inspections (LRIs) verify, on a sampling basis:

a. The applicant's implementation of the scoping and screening methodology includes nonsafety-related systems, structures, and components (SSCs) whose failure could prevent safety-related SSCs from accomplishing a safety function.

b. Passive, long lived SSCs within the scope of license renewal are subject to an aging management review (AMR), and have existing or planned aging management programs (AMPs) that conform with descriptions contained in the LRA. The AMPs can reasonably manage the effects of aging.

c. The documentation used to support the application is auditable and retrievable and contains information that supports the application.

03.02 Specific Inspection Requirements

a. Scoping and Screening Inspection. The LRI verifies on a sampling basis, through onsite review and walk-down of selected areas of the plant, that the SSCs required by the rule have been adequately documented. In addition, the inspection should verify that nonsafety-related SSCs whose failure could prevent safety-related SSCs from accomplishing a safety function are correctly included within scope of license renewal. Depending on insights gained from the staff's review, the inspection may also include safety-related SSCs and SSCs relied on to mitigate regulated events as specified in 10

CFR 54.4(a). The LRI verifies that there is reasonable assurance that the applicant has adequately documented all the identified passive and long-lived SSCs requiring an AMR. The LRI verifies, through review of supporting documents and a walk-down of select systems, that the effects of aging can be adequately managed in the period of extended operation. Using a set of samples selected based on insights from the staff's review of the LRA, uniqueness, safety impact, and risk insights, the inspection should emphasize evaluation of whether the scoping process adequately includes nonsafety-related SSCs whose failure could prevent safety-related SSCs from accomplishing a safety function. These nonsafety-related SSCs should be included in order to provide protection against safety function failure in cases where the safety-related structure or component is not itself impaired by age-related degradation, but is vulnerable to failure from the failure of another structure or component that may be so impaired. Consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing bases and that have not been previously experienced is not required. The scoping criterion required under 10 CFR 54.4(a)(2) does not apply to functions identified in 10 CFR 54.4(a)(3) "Regulated Events".

One of the samples selected should include at least one system, structure, or commodity group not identified as being within the scope of license renewal.

b. Aging Management Programs Inspection. This inspection is intended to assess the adequate implementation of the aging management programs (AMPs) resulting from the applicant's license renewal program, and may be performed in conjunction with the scoping and screening inspection. For selected SSCs within the scope of the rule the following inspection activities should be undertaken:

1. For the selected SSCs, determine from the LRA which AMPs are credited with preventing applicable aging effects. Verify the AMPs will ensure the Issue Date: 02/18/05 - 3 - 71002 aging effects will be managed so that there is reasonable assurance that the intended function will be maintained consistent with the CLB throughout the period of extended operation.

2. Review the description of these AMPs from the LRA, UFSAR, plant procedures, and related engineering support documentation. Interview the on-site engineering staff responsible for implementation of these AMPs to assess their knowledge and involvement in the license renewal effort. Discuss AMP program methods, past results, past weaknesses and corrections, and future plans.

3. Verify the applicant evaluated site-specific information such as surveillance test results, preventive maintenance records, corrective maintenance records, equipment history files, inservice test and inspection results in determining aging effects. Verify the applicant evaluated industry operational experience such as generic communications, vendor notifications, INPO notifications, etc., in determining aging effects.

4. Perform walk-downs of selected in-scope SSCs to verify that any observable aging effects were identified by the applicant for these SSCs. If possible, the inspector should have a representative from the on-site responsible engineering staff accompany the inspector during the walk-down to discuss observations at the equipment location. The purpose of these walk-downs is to assess how plant equipment is currently being maintained and to visually observe examples of nonsafety-related equipment determined to be in scope due to their proximity to safety-related equipment and their potential for failure due to aging effects. If possible, a part of this inspection should be performed during a unit outage, to allow visual observation of equipment inaccessible during power operation, i.e., inside containment, normal high radiation areas, etc. Containment inspection shall be performed if (a) there is evidence that some aging effects are not adequately addressed in the application, or (b) there is an open item, generated either by the inspection or the application review, that is related to an area inaccessible during the regularly scheduled inspection, and (c) the areas of interest in the facility will become available prior to the final inspection exit meeting observed by the public. Observed aging effects not addressed by the LRA and resulting AMPs should be discussed and addressed to the applicant and resolved with the support of NRR.

5. For previously existing AMPs, review the results of past tests and inspections. Verify the proposed and existing programs adequately demonstrate ample opportunity to detect, monitor, trend, and correct age related degradations through performance and/or condition monitoring, technical specification surveillances, and other aging management activities.

c. Annual Update/Open Item Inspection. The applicant may make changes to the plant or the current licensing basis while the NRC performs its review of the LRA. Annually, after the initial application,

the applicant is required to submit an amendment to the original application describing any change that materially affects the contents of the original application. The applicant may also make changes or commitments to satisfy an issue raised during the NRC review process or raised during a previous LRI. This inspection will be conducted at the option of the Regional Administrator. During this LRI the following inspection tasks should be accomplished:

1. Select a sample of plant modifications and CLB changes the applicant made since the date of the original LRA submittal. Determine that these changes 71002 - 4 - Issue Date: 02/18/05 were included in an annual LRA update. For newly installed plant equipment required to be in the scope of license renewal, verify that the equipment is included in appropriate aging management programs.

2. Compile the issues raised by previous LRIs and determine the current status from the applicant. Determine if the issue has been resolved. If the issue has not been resolved, determine what the applicant's plans are to resolve the issue and coordinate with NRR to determine the acceptability of those plans.

3. Determine that the applicant has compiled a list of future tasks to be accomplished as a result of commitments made during the license renewal process and loaded this list into an official plant work tracking system. This review is to ensure that committed tasks are being tracked to be accomplished prior to and during the period of extended operation.

71002-04 INSPECTION GUIDANCE

04.01 General Inspection Guidance.

This license renewal inspection procedure will be implemented, prior to the approval of an application for renewed license, to verify that an applicant, requesting a renewed license under 10 CFR Part 54, meets the requirements of the rule and has implemented license renewal programs and activities consistent with their LRA and the safety evaluations developed by the NRC staff. LRIs will be performed by NRC regional offices and will include visits to the applicant's site. The inspections will cover the items discussed in 03.01. The inspection may include the annual LRA update process, and unresolved open items resulting from previous inspections or staff review of the LRA.

Inspectors should familiarize themselves with the requirements and guidance relating to license renewal. Inspectors should familiarize themselves with the LRA and associated safety evaluations performed by the staff for the specific plant to be inspected. License renewal requirements and guidance documents that should be reviewed prior to an inspection include:

a. 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants";

b. The statements of consideration (SOC) published with the revision to the rule in the Federal Register, Vol. 60, No. 88, Monday, May 8, 1995, pages 22461 to 22495;

c. Regulatory Guide 1.188; "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," July 2001;

d. NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," July 2001;

e. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," July 2001;

f. Nuclear Energy Institute 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Rev. 3, March 2001; and

g. NRC approved Interim Staff Guidance positions relating to license renewal.

Throughout the license renewal inspection, the inspectors should review the supporting documentation associated with an applicant's license renewal program to verify that documentation required by the rule, or otherwise necessary to verify compliance with the rule, is being maintained in an auditable and retrievable form consistent with the requirements of 10 CFR 54.13 and 54.37, the applicant's LRA, and applicant's approved programs and procedures.

04.02 Specific Inspection Guidance

a. Scoping and Screening Requirements. The license renewal program must include nonsafety-related SSCs whose failure could prevent safety-related SSCs from accomplishing a safety function. These nonsafety-related SSCs are included in order to provide protection against safety function failure in cases where the safety related structure or component is not itself impaired by age-related degradation but is vulnerable to failure from the failure of another structure or component that may be so impaired. Consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing bases and that have not been previously experienced is not required.

b. Aging Management Programs Inspection. As required under 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the aging effects will be adequately managed so the intended function will be maintained consistent with the CLB for the period of extended operation. To fulfill this requirement an applicant must first identify the applicable aging effects, and the aging management program(s) and activities that will manage each aging effect.

As part of the inspection process of AMP documentation, the site inspector needs to ensure that the implementation of the program is producing results consistent with the claims made by the applicant as to how the program will manage the aging effect in question. Each program should clearly state how the aging management program will manage the aging effect, and the supporting documentation, along with the material condition of the SSCs, must be consistent with these claims.

Some AMPs may have an objective to monitor and trend ongoing degradation, and implement corrective actions prior to anticipated failure of a structure or component to perform its intended function consistent with the applicant's CLB. During the site inspection, any trends identified as being less conservative with respect to the objectives of the AMPs in the LRA and/or applicant approved procedures need to be identified to NRR and included in the inspection report.

71002-05 RESOURCE ESTIMATES

License renewal inspection activities will require approximately two weeks of inspection time on site involving a team of four inspectors and a team leader. An additional week will be allocated each to inspection preparation, in-office review between two onsite weeks, and for documentation of the inspection results. In addition, from past experience, the team leader will need approximately 15 additional working days to finalize the inspection report. Based on past experience, the final follow up inspection can be accomplished by one inspector with one preparation week, one week of inspection on site, plus two additional weeks for documentation. Based on these estimates, each application will require approximately 32 inspector weeks of inspection activities prior to the approval of a renewed license.

71002-06 REFERENCES

10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants"

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," July 2001

Nuclear Energy Institute, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," NEI 95-10, Rev. 3, March 2001

NUREG 1568, "License Renewal Demonstration Program: NRC Observation and Lessons Learned," December 1996

NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," July 2001

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," July 2001

U.S. Nuclear Regulator Commission, "Nuclear Power Plants License Renewal; Revisions," Federal Register, Vol. 60, No. 88, Monday, May 8, 1995, pages 22461 to 22495

U.S. Nuclear Regulator Commission, "Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants," April 21, 2000.