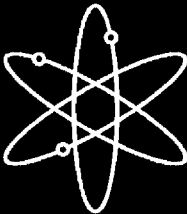
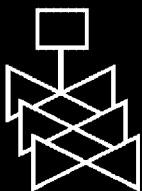


# Generic Aging Lessons Learned (GALL) Report



## Summary



**U.S. Nuclear Regulatory Commission  
Office of Nuclear Reactor Regulation  
Washington, DC 20555-0001**



Inside Front Cover  
(NRC to supply)

# Generic Aging Lessons Learned (GALL) Report

## Summary

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**Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001**



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## **Abstract**

The Generic Aging Lessons Learned (GALL) report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the extended period of operation. The evaluation results documented in the GALL report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components for license renewal without change. The GALL report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. An applicant may reference the GALL report in a license renewal application to demonstrate that the programs at the applicant's facility correspond to those reviewed and approved in the GALL report and that no further staff review is required. The focus of the staff review is on the augmented existing programs for license renewal. The incorporation of the GALL report information into NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," as directed by the Commission, should improve the efficiency of the license renewal process.

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## ABBREVIATIONS

|        |  |
|--------|--|
| ADS    | automatic depressurization system              |
| AFW    | auxiliary feedwater                            |
| AMP    | aging management program                       |
| ASME   | American Society of Mechanical Engineers       |
| B&W    | Babcock & Wilcox                               |
| BWR    | boiling water reactor                          |
| BWRVIP | boiling water reactor vessel internals project |
| CASS   | cast austenitic stainless steel                |
| CE     | Combustion Engineering                         |
| CEA    | control element assembly                       |
| CFR    | Code of Federal Regulations                    |
| CFS    | core flood system                              |
| CLB    | current licensing basis                        |
| CRD    | control rod drive                              |
| CRGT   | control rod guide tube                         |
| CS     | carbon steel                                   |
| CVCS   | chemical and volume control system             |
| DHR    | decay heat removal                             |
| DSCSS  | drywell and suppression chamber spray system   |
| ECCS   | emergency core cooling system                  |
| EDG    | emergency diesel generator                     |
| EQ     | environmental qualification                    |
| FW     | feedwater                                      |
| GALL   | generic aging lessons learned                  |
| HP     | high pressure                                  |
| HPCI   | high-pressure coolant injection                |
| HPCS   | high-pressure core spray                       |
| HPSI   | high-pressure safety injection                 |
| HVAC   | heating, ventilation, and air conditioning     |
| IASCC  | irradiation-assisted stress corrosion cracking |
| IGA    | intergranular attack                           |
| IGSCC  | intergranular stress corrosion cracking        |
| IR     | insulation resistance                          |
| IRM    | intermediate range monitor                     |
| ISI    | inservice inspection                           |
| LER    | licensee event report                          |
| LG     | lower grid                                     |
| LP     | low pressure                                   |
| LPCI   | low-pressure coolant injection                 |
| LPCS   | low-pressure core spray                        |

## ABBREVIATIONS (continued)

|        |  |
|--------|--|
| LPRM   | low-power range monitor                    |
| LPSI   | low-pressure safety injection              |
| MIC    | microbiologically influenced corrosion     |
| MSR    | moisture separator/reheater                |
| NEI    | Nuclear Energy Institute                   |
| NPAR   | Nuclear Plant Aging Research               |
| NPS    | nominal pipe size                          |
| NRC    | Nuclear Regulatory Commission              |
| NSSS   | nuclear steam supply system                |
| NUMARC | Nuclear Management and Resources Council   |
| ODSCC  | outside diameter stress corrosion cracking |
| PWR    | pressurized water reactor                  |
| PWSCC  | primary water stress corrosion cracking    |
| QA     | quality assurance                          |
| RCCA   | rod control cluster assembly               |
| RCIC   | reactor core isolation cooling             |
| RCP    | reactor coolant pump                       |
| RCPB   | reactor coolant pressure boundary          |
| RCS    | reactor coolant system                     |
| RG     | Regulatory Guide                           |
| RHR    | residual heat removal                      |
| RWC    | reactor water cleanup                      |
| RWT    | refueling water tank                       |
| SC     | suppression chamber                        |
| SCC    | stress corrosion cracking                  |
| SDC    | shutdown cooling                           |
| SFP    | spent fuel pool                            |
| SG     | steam generator                            |
| SLC    | standby liquid control                     |
| SRM    | source range monitor                       |
| SRM    | staff requirement memorandum               |
| SRP-LR | Standard Review Plan for License Renewal   |
| TLAA   | time-limited aging analysis                |
| UCS    | Union of Concerned Scientists              |
| UV     | ultraviolet                                |

## INTRODUCTION

By letter dated March 3, 1999, the Nuclear Energy Institute (NEI) documented the industry's views on how existing plant programs and activities should be credited for license renewal. The issue can be summarized as follows: To what extent should the staff review existing programs relied on for license renewal in determining whether an applicant has demonstrated reasonable assurance that such programs will be effective in managing the effects of aging on the functionality of structures and components in the period of extended operation? In a staff paper, SECY-99-148, "Credit for Existing Programs for License Renewal," dated June 3, 1999, the staff described options for crediting existing programs and recommended one option that the staff believed would improve the efficiency of the license renewal process.

By staff requirements memorandum (SRM), dated August 27, 1999, the Commission approved the staff's recommendation and directed the staff to focus the staff review guidance in the Standard Review Plan for License Renewal (SRP-LR) on areas where existing programs should be augmented for license renewal. The staff would develop a "Generic Aging Lessons Learned (GALL)" report to document the staff's evaluation of generic existing programs. The GALL report would document the staff's basis for determining which existing programs are adequate without modification and which existing programs should be augmented for license renewal. The GALL report would be referenced in the SRP-LR as a basis for determining the adequacy of existing programs.

## GALL REPORT EVALUATION PROCESS

This report builds on a previous report, NUREG/CR-6490, "Nuclear Power Plant Generic Aging Lessons Learned (GALL)," which is a systematic compilation of plant aging information. This report extends the information in NUREG/CR-6490 to provide an evaluation of the adequacy of aging management programs for license renewal. The NUREG/CR-6490 report was based on information in over 500 documents: Nuclear Plant Aging Research (NPAR) program reports sponsored by the Office of Nuclear Regulatory Research, Nuclear Management and Resources Council (NUMARC, now NEI) industry reports addressing license renewal, licensee event reports (LERs), information notices, generic letters, and bulletins. The staff has also considered information contained in the reports provided by the Union of Concerned Scientists (UCS) in a letter dated May 5, 2000.

Following the general format of NUREG-0800 for major plant sections except for refueling water, chilled water, residual heat removal, condenser circulating water, and condensate storage system in pressurized water reactor (PWR) and boiling water reactor (BWR) power plants, the staff has reviewed the aging effects on components and structures, identified the relevant existing programs, and evaluated program attributes to manage aging effects for license renewal. This report was prepared with the technical assistance of Argonne National Laboratory and Brookhaven National Laboratory. As directed in the SRM, this report has the benefit of the experience of the staff members who conducted the review of the initial license renewal applications. Also, as directed in the SRM, the staff has sought stakeholders' participation in the development of this report. The staff held many public meetings and workshops to solicit input from the public. The staff also issued the draft improved license renewal guidance documents, including the GALL report, for public comments in the Federal Register Notice, Vol. 65, No. 170, August 31, 2000. The staff's analysis of stakeholder comments is documented in NUREG-1739.

The results of the GALL effort are presented in a table format in the GALL report, Volume 2. The table column headings are: Item, Structure and/or Component, Material, Environment, Aging Effect/Mechanism, Aging Management Program (AMP), and Further Evaluation. The staff's evaluation of the adequacy of each generic aging management program in managing certain aging effects for particular structures and components is based on the review of the following 10 program attributes (or elements):

| Element                              | Description   |
|--------------------------------------|---|
| 1. Scope of the program              | The scope of the program should include the specific structures and components subject to an aging management review.   |
| 2. Preventive actions                | Preventive actions should mitigate or prevent the applicable aging effects.   |
| 3. Parameters monitored or inspected | Parameters monitored or inspected should be linked to the effects of aging on the intended functions of the particular structure and component.   |
| 4. Detection of aging effects        | Detection of aging effects should occur before there is a loss of any structure and component intended function. 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 for prediction of the extent of the effects of aging and timely corrective or mitigative actions.  |
| 6. Acceptance criteria               | Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the particular structure and component intended functions are maintained under all current licensing basis (CLB) design conditions during the period of extended operation.   |
| 7. Corrective actions                | Corrective actions, including root cause determination and prevention of recurrence, should be timely.  |
| 8. Confirmation process              | The confirmation process should ensure that preventive actions are adequate and 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 involving the aging management program, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support a determination that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation. |



If, on the basis of its evaluation, the staff determines that a program is adequate to manage certain aging effects for a particular structure or component without change, the "Further Evaluation" entry would indicate that no further staff evaluation is recommended for license renewal. Otherwise, the entry would recommend areas in which the staff should focus its review. The Commission's regulations in 10 CFR 54.21(c) require an evaluation of time-limited aging analyses (TLAAs). Examples of TLAAs are applicant analyses of metal fatigue and environmental qualification (EQ) of electric equipment. The GALL report in general refers the reader to the SRP-LR for guidance on how TLAAs should be evaluated. However, 10 CFR 54.21(c)(1)(iii) allows a TAA-associated aging effect to be managed by an aging management program. The GALL report, Volume 2, Chapter X, provides the staff's evaluation of several TLAAs under 10 CFR 54.21(c)(1)(iii) based on the initial license renewal reviews.

Chapter XI of the GALL report, Volume 2, contains the staff's evaluation of generic aging management programs that are relied on in the GALL report, such as the ASME Section XI inservice inspection, water chemistry, or structures monitoring program.

### **APPLICATION OF THE GALL REPORT**

The GALL report is a technical basis document to the SRP-LR, which provides the staff with guidance in reviewing a license renewal application. The GALL report should be treated in the same manner as an approved topical report that is generically applicable. An applicant may reference the GALL report in a license renewal application to demonstrate that the programs at the applicant's facility correspond to those reviewed and approved in the GALL report and that no further staff review is required, as described in the next paragraph. If the material presented in the GALL report is applicable to the applicant's facility, the staff should find the applicant's reference to the GALL report acceptable. In making this determination, the staff should consider whether the applicant has identified specific programs described and evaluated in the GALL report. The staff, however, should not conduct a re-review of the substance of the matters described in the GALL report. Rather, the staff should ensure that the applicant verifies that the approvals set forth in the GALL report for generic programs apply to the applicant's programs. The focus of the staff review should be on augmented programs for license renewal. The staff should also review information that is not addressed in the GALL report or is otherwise different from that in the GALL report.

If an applicant takes credit for a program in GALL, it is incumbent on the applicant to ensure that the plant program contains all the elements of the referenced GALL program. In addition, the conditions at the plant must be bounded by the conditions for which the GALL program was evaluated. The above verifications must be documented on-site in an auditable form. The applicant must include a certification in the license renewal application that the verifications have been completed and are documented on-site in an auditable form.

The GALL report contains one acceptable way to manage aging effects for license renewal. An applicant may propose alternatives for staff 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.

In addition, the GALL report does not address scoping of structures and components for license renewal. Scoping is plant specific, and the results depend on the plant design and current licensing basis. The inclusion of a certain structure or component in the GALL report does not mean that this particular structure or component is within the scope of license renewal for all plants. Conversely, the omission of a certain structure or component in the GALL report does

not mean that this particular structure or component is not within the scope of license renewal for any plants.

## **SUMMARY AND RECOMMENDATIONS**

The GALL report contains an evaluation of a large number of structures and components. The evaluation results documented in the GALL report indicate that many of the generic existing programs are adequate to manage aging effects for particular structures or components for license renewal without change. The GALL report also contains recommendations on specific areas for which generic existing programs should be augmented for license renewal and documents the technical basis for each such determination.

In the GALL report, Volume 1, Tables 1 through 6 are summaries of the aging management review. These tables are the same as Tables 3.1-1 to 3.6-1, respectively, in the SRP-LR, except for an additional sixth column in Tables 1 to 6 that identifies the specific item numbers assigned to each structure and/or component (i.e., each row in the section tables contained in Volume 2 of the GALL report). Descriptions of the specific item numbers used in the GALL report, Volume 2, Chapters II through VIII, are given in the Appendix of Volume 1. A locator for the plant systems evaluated in Volume 2 is also provided in the Appendix of Volume 1. The specific item number and associated aging effect serve as a pointer to the technical evaluation for the specific structure and component addressed in Volume 2 (Tabulation of Results).

The Appendix of Volume 2 of the GALL report addresses quality assurance (QA) for aging management programs. Those aspects of the aging management review process that affect the quality of safety-related structures, systems, and components are subject to the QA requirements of Appendix B to 10 CFR Part 50. For nonsafety-related structures and components subject to an aging management review, the existing 10 CFR Part 50, Appendix B, QA program may be used by an applicant to address the elements of the corrective actions, confirmation process, and administrative controls for an aging management program for license renewal.

The GALL report provides a technical basis for crediting existing plant programs and recommending areas for program augmentation and further evaluation. The incorporation of the GALL report information into the SRP-LR, as directed by the Commission, should improve the efficiency of the license renewal process and better focus staff resources.

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report**

| Type        | Component                                    | Aging Effect/<br>Mechanism | Aging Management Programs                          | Further Evaluation Recommended | Item Number in GALL  |
|-------------|--|----------------------------|--|--------------------------------|--|
| BWR/<br>PWR | Reactor coolant pressure boundary components | Cumulative fatigue damage  | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA                      | IV.A1.1-b,<br>IV.A1.2-a,<br>IV.A1.2-b,<br>IV.A1.3-a,<br>IV.A1.3-d,<br>IV.A1.4-b,<br>IV.A1.5-b,<br>IV.A1.6-a,<br>IV.A1.7-a,<br>IV.A2.1-b,<br>IV.A2.1-e,<br>IV.A2.2-c,<br>IV.A2.3-c,<br>IV.A2.4-a,<br>IV.A2.5-d,<br>IV.A2.8-a,<br>IV.B1.1-c,<br>IV.B1.2-b,<br>IV.B1.3-b,<br>IV.B1.4-b,<br>IV.B1.5-b,<br>IV.B1.6-b,<br>IV.B2.1-c,<br>IV.B2.1-h,<br>IV.B2.1-m,<br>IV.B2.2-c,<br>IV.B2.2-f,<br>IV.B2.3-d,<br>IV.B2.4-g,<br>IV.B2.5-d,<br>IV.B2.5-j,<br>IV.B2.5-p,<br>IV.B3.2-f,<br>IV.B3.4-d,<br>IV.B3.5-g,<br>IV.B4.1-d,<br>IV.B4.2-d,<br>IV.B4.3-f,<br>IV.B4.4-e,<br>IV.B4.5-f,<br>IV.B4.6-f,<br>IV.C1.1-b,<br>IV.C1.1-d,<br>IV.C1.1-e,<br>IV.C1.1-h,<br>IV.C1.2-a,<br>IV.C1.2-f,<br>IV.C1.3-d, |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| Type        | Component   | Aging Effect/<br>Mechanism  | Aging Management Programs  | Further Evaluation Recommended                             | Item Number in GALL  |
|-------------|---|---|--|--|--|
| BWR/<br>PWR | Reactor coolant pressure boundary components  | Cumulative fatigue damage   | TLAA, evaluated in accordance with 10 CFR 54.21(c)                     | Yes, TLAA  | IV.C1.3-g, IV.C2.1-a, IV.C2.1-b, IV.C2.2-a, IV.C2.2-b, IV.C2.2-c, IV.C2.3-a, IV.C2.3-d, IV.C2.4-a, IV.C2.4-d, IV.C2.5-a, IV.C2.5-d, IV.C2.5-e, IV.C2.5-f, IV.C2.5-q, IV.C2.5-t, IV.C2.5-w, IV.C2.6-a, IV.D1.1-a, IV.D1.1-b, IV.D1.1-h, IV.D1.2-d, IV.D2.1-c, IV.D2.1-g, IV.D2.2-e. |
| PWR         | Steam generator shell assembly  | Loss of material due to pitting and crevice corrosion                                 | Inservice inspection; water chemistry                                  | Yes, detection of aging effects is to be further evaluated | IV.D1.1-c, IV.D2.1-e.  |
| BWR         | Isolation condenser   | Loss of material due to general, pitting, and crevice corrosion                       | Inservice inspection; water chemistry                                  | Yes, plant specific  | IV.C1.4-b.   |
| BWR/<br>PWR | Pressure vessel ferritic materials that have a neutron fluence greater than $10^{17}$ n/cm <sup>2</sup> (E>1 MeV) | Loss of fracture toughness due to neutron irradiation embrittlement                   | TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99 | Yes, TLAA  | IV.A1.2-c, IV.A1.3-e, IV.A2.3-a, IV.A2.5-a.  |
| BWR/<br>PWR | Reactor vessel beltline shell and welds   | Loss of fracture toughness due to neutron irradiation embrittlement                   | Reactor vessel surveillance  | Yes, plant specific  | IV.A1.2-d, IV.A2.3-b, IV.A2.5-c.   |
| PWR         | Westinghouse and Babcock & Wilcox (B&W) baffle/ former bolts  | Loss of fracture toughness due to neutron irradiation embrittlement and void swelling | Plant specific   | Yes, plant specific  | IV.B2.4-f, IV.B4.5-i.  |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| Type        | Component   | Aging Effect/<br>Mechanism  | Aging Management Programs                                  | Further Evaluation Recommended  | Item Number in GALL  |
|-------------|---|---|--|---|--|
| BWR/<br>PWR | Small-bore reactor coolant system and connected systems piping      | Crack initiation and growth due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), and thermal and mechanical loading | Inservice inspection; water chemistry; one-time inspection | Yes, parameters monitored/ inspected and detection of aging effects are to be further evaluated | IV.C1.1-i, IV.C2.1-g, IV.C2.2-h.   |
| BWR         | Jet pump sensing line and reactor vessel flange leak detection line | Crack initiation and growth due to SCC, IGSCC, or cyclic loading  | Plant specific   | Yes, plant specific   | IV.A1.1-d, IV.B1.4-d.  |
| BWR         | Isolation condenser   | Crack initiation and growth due to SCC or cyclic loading  | Inservice inspection; water chemistry                      | Yes, plant specific   | IV.C1.4-a.   |
| PWR         | Vessel shell  | Crack growth due to cyclic loading  | TLAA   | Yes, TLAA   | IV.A2.5-b.   |
| PWR         | Reactor internals   | Changes in dimension due to void swelling   | Plant specific   | Yes, plant specific   | IV.B2.1-b, IV.B2.1-f, IV.B2.1-j, IV.B2.2-b, IV.B2.2-e, IV.B2.3-b, IV.B2.4-b, IV.B2.4-d, IV.B2.5-b, IV.B2.5-f, IV.B2.5-l, IV.B2.6-b, IV.B3.1-b, IV.B3.2-c, IV.B3.3-b, IV.B3.4-b, IV.B3.4-f, IV.B3.5-c, IV.B4.1-c, IV.B4.2-c, IV.B4.3-c, IV.B4.4-c, IV.B4.5-c, IV.B4.5-h, IV.B4.6-c, IV.B4.7-c, IV.B4.8-b. |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b> | <b>Further<br/>Evaluation<br/>Recommended</b>             | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|---|---|--|---|--|
| PWR         | PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains | Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)     | Plant specific                           | Yes, plant specific                                       | IV.A2.1-f, IV.A2.6-a, IV.A2.7-a, IV.C2.5-j, IV.D1.1-j, IV.D2.1-h, IV.D2.1-i. |
| PWR         | Cast austenitic stainless steel (CASS) reactor coolant system piping  | Crack initiation and growth due to SCC  | Plant specific                           | Yes, plant specific                                       | IV.C2.1-e, IV.C2.2-g, IV.C2.5-i.   |
| PWR         | Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys   | Crack initiation and growth due to PWSCC  | Inservice inspection; water chemistry    | Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated | IV.C2.5-k, IV.C2.5-s.  |
| PWR         | Westinghouse and B&W baffle former bolts  | Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC) | Plant specific                           | Yes, plant specific                                       | IV.B2.4-c, IV.B4.5-g.  |
| PWR         | Westinghouse and B&W baffle former bolts  | Loss of preload due to stress relaxation  | Plant specific                           | Yes, plant specific                                       | IV.B2.4-h, IV.B4.5-j.  |
| PWR         | Steam generator feedwater impingement plate and support   | Loss of section thickness due to erosion  | Plant specific                           | Yes, plant specific                                       | IV.D1.1-e.   |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| Type        | Component  | Aging Effect/<br>Mechanism  | Aging Management Programs   | Further Evaluation Recommended                          | Item Number in GALL   |
|-------------|--|---|---|---|---|
| PWR         | (Alloy 600) Steam generator tubes, repair sleeves, and plugs | Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA); or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections | Steam generator tubing integrity; water chemistry                     | Yes, effectiveness of a proposed AMP is to be evaluated | IV.D1.2-a, IV.D1.2-b, IV.D1.2-c, IV.D1.2-e, IV.D1.2-f, IV.D1.2-g, IV.D1.2-i, IV.D1.2-j, IV.D2.2-a, IV.D2.2-b, IV.D2.2-c, IV.D2.2-d, IV.D2.2-f, IV.D2.2-g. |
| PWR         | Tube support lattice bars made of carbon steel               | Loss of section thickness due to flow-accelerated corrosion (FAC)   | Plant specific  | Yes, plant specific                                     | IV.D1.2-h.  |
| PWR         | Carbon steel tube support plate                              | Ligament cracking due to corrosion  | Plant specific  | Yes, effectiveness of a proposed AMP is to be evaluated | IV.D1.2-k.  |
| PWR (CE)    | Steam generator feedwater inlet ring and supports            | Loss of material due to flow accelerated corrosion  | Combustion Engineering (CE) steam generator feedwater ring inspection | Yes, plant specific                                     | IV.D1.3-a.  |
| BWR/<br>PWR | Reactor vessel closure studs and stud assembly               | Crack initiation and growth due to SCC and/or IGSCC   | Reactor head closure studs  | No  | IV.A1.1-c, IV.A2.1-c.   |
| BWR/<br>PWR | CASS pump casing and valve body                              | Loss of fracture toughness due to thermal aging embrittlement   | Inservice inspection  | No  | IV.C1.2-c, IV.C1.3-b, IV.C2.3-c, IV.C2.4-c.   |
| BWR/<br>PWR | CASS piping  | Loss of fracture toughness due to thermal aging embrittlement   | Thermal aging embrittlement of CASS                                   | No  | IV.A2.2-d, IV.C1.1-g, IV.C2.1-f, IV.C2.2-e, IV.C2.5-l.  |
| BWR/<br>PWR | BWR piping and fittings; steam generator components          | Wall thinning due to flow accelerated corrosion   | Flow accelerated corrosion  | No  | IV.C1.1-a, IV.C1.1-c, IV.C1.3-a, IV.D1.1-d, IV.D2.1-f.  |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b>        | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|---|--|---|---|--|
| BWR/<br>PWR | Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high-pressure and high-temperature systems | Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity                               | No  | IV.A2.2-e,<br>IV.A2.2-f,<br>IV.A2.2-g,<br>IV.C1.2-d,<br>IV.C1.2-e,<br>IV.C1.3-e,<br>IV.C1.3-f,<br>IV.C2.3-e,<br>IV.C2.3-g,<br>IV.C2.4-e,<br>IV.C2.4-g,<br>IV.C2.5-n,<br>IV.C2.5-p,<br>IV.D1.1-f,<br>IV.D1.1-l,<br>IV.D2.1-k. |
| BWR         | Feedwater and control rod drive (CRD) return line nozzles   | Crack initiation and growth due to cyclic loading  | Feedwater nozzle; CRD return line nozzle        | No  | IV.A1.3-b,<br>IV.A1.3-c.   |
| BWR         | Vessel shell attachment welds   | Crack initiation and growth due to SCC and/or IGSCC  | BWR vessel ID attachment welds; water chemistry | No  | IV.A1.2-e.   |
| BWR         | Nozzle safe ends, recirculation pump casing, connected systems piping and fittings, body and bonnet of valves   | Crack initiation and growth due to SCC and/or IGSCC  | BWR stress corrosion cracking; water chemistry  | No  | IV.A1.4-a,<br>IV.C1.1-f,<br>IV.C1.2-b,<br>IV.C1.3-c.   |
| BWR         | Penetrations  | Crack initiation and growth due to SCC, IGSCC, and/or cyclic loading   | BWR bottom head penetrations; water chemistry   | No  | IV.A1.5-a.   |



**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>   | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>              | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>  |
|-------------|--|---|---|---|---|
| BWR         | Core shroud and core plate, support structure, top guide, core spray lines and spargers, jet pump assemblies, control rod drive housing, and nuclear instrumentation guide tubes | Crack initiation and growth due to SCC, IGSCC, and/or IASCC                           | BWR vessel internals; water chemistry                 | No  | IV.B1.1-a, IV.B1.1-b, IV.B1.1-f, IV.B1.1-g, IV.B1.2-a, IV.B1.3-a, IV.B1.4-a, IV.B1.5-c, IV.B1.6-a.                                  |
| BWR         | Core shroud and core plate access hole cover (welded and mechanical covers)  | Crack initiation and growth due to SCC, IGSCC, and/or IASCC                           | ASME Section XI inservice inspection; water chemistry | No  | IV.B1.1-d, IV.B1.1-e.   |
| BWR         | Jet pump assembly castings and orificed fuel support   | Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement | Thermal aging and neutron irradiation embrittlement   | No  | IV.B1.4-c, IV.B1.5-a.   |
| BWR         | Unclad top head and nozzles  | Loss of material due to general, pitting, and crevice corrosion                       | Inservice inspection; water chemistry                 | No  | IV.A1.1-a.  |
| PWR         | CRD nozzle   | Crack initiation and growth due to PWSCC  | Ni-alloy nozzles and penetrations; water chemistry    | No  | IV.A2.2-a, IV.A2.7-b.   |
| PWR         | Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting)  | Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC              | Inservice inspection; water chemistry                 | No  | IV.A2.2-b, IV.A2.4-b, IV.C2.1-c, IV.C2.2-f, IV.C2.3-b, IV.C2.4-b, IV.C2.5-c, IV.C2.5-g, IV.C2.5-h, IV.C2.5-m, IV.C2.5-r, IV.C2.6-c. |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>   | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>                         | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|--|---|--|---|--|
| PWR         | Reactor vessel internals CASS components   | Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling | Thermal aging and neutron irradiation embrittlement              | No  | IV.B2.1-g, IV.B2.5-m, IV.B3.2-e, IV.B3.5-f, IV.B4.3-d, IV.B4.4-g, IV.B4.6-e.   |
| PWR         | External surfaces of carbon steel components in reactor coolant system pressure boundary | Loss of material due to boric acid corrosion  | Boric acid corrosion   | No  | IV.A2.1-a, IV.A2.5-e, IV.A2.8-b, IV.C2.1-d, IV.C2.2-d, IV.C2.3-f, IV.C2.4-f, IV.C2.5-b, IV.C2.5-o, IV.C2.5-u, IV.C2.6-b, IV.D1.1-g, IV.D1.1-k, IV.D2.1-b, IV.D2.1-j. |
| PWR         | Steam generator secondary manways and handholds (carbon steel)                           | Loss of material due to erosion   | Inservice inspection   | No  | IV.D2.1-l.   |
| PWR         | Reactor internals, reactor vessel closure studs, and core support pads                   | Loss of material due to wear  | Inservice inspection   | No  | IV.A2.5-f, IV.B2.1-l, IV.B2.5-o, IV.B2.6-c, IV.B3.1-c, IV.B3.2-d, IV.B3.3-b, IV.B3.5-e, IV.B4.2-f, IV.B4.4-f, IV.B4.6-h.   |
| PWR         | Pressurizer integral support   | Crack initiation and growth due to cyclic loading   | Inservice inspection   | No  | IV.C2.5-v.   |
| PWR         | Upper and lower internals assembly (Westinghouse)  | Loss of preload due to stress relaxation  | Inservice inspection; loose part and/or neutron noise monitoring | No  | IV.B2.1-d, IV.B2.5-i.  |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| Type | Component  | Aging Effect/<br>Mechanism  | Aging Management Programs             | Further Evaluation Recommended | Item Number in GALL  |
|------|--|---|---------------------------------------|--------------------------------|--|
| PWR  | Reactor vessel internals in fuel zone region (except Westinghouse and B&W baffle former bolts) | Loss of fracture toughness due to neutron irradiation embrittlement and void swelling | PWR vessel internals; water chemistry | No                             | IV.B2.3-c, IV.B2.4-e, IV.B2.5-c, IV.B2.5-g, IV.B2.5-n, IV.B3.3-a, IV.B3.4-c, IV.B3.4-g, IV.B3.5-d, IV.B4.2-e, IV.B4.4-d, IV.B4.5-d, IV.B4.6-d, IV.B4.7-d, IV.B4.8-c. |
| PWR  | Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends           | Crack initiation and growth due to SCC, PWSCC, and/or IASCC                           | Inservice inspection; water chemistry | No                             | IV.D1.1-i, IV.D2.1-a.  |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| Type | Component  | Aging Effect/<br>Mechanism                       | Aging<br>Management<br>Programs             | Further<br>Evaluation<br>Recommended | Item<br>Number in<br>GALL  |
|------|--|--|---|--------------------------------------|--|
| PWR  | Vessel internals (except Westinghouse and B&W baffle former bolts) | Crack initiation and growth due to SCC and IASCC | PWR vessel internals; water chemistry       | No                                   | IV.B2.1-a,<br>IV.B2.1-e,<br>IV.B2.1-i,<br>IV.B2.2-a,<br>IV.B2.2-d,<br>IV.B2.3-a,<br>IV.B2.4-a,<br>IV.B2.5-a,<br>IV.B2.5-e,<br>IV.B2.5-k,<br>IV.B2.6-a,<br>IV.B3.1-a,<br>IV.B3.2-a,<br>IV.B3.2-b,<br>IV.B3.3-a,<br>IV.B3.4-a,<br>IV.B3.4-e,<br>IV.B3.5-a,<br>IV.B3.5-b,<br>IV.B4.1-a,<br>IV.B4.1-b,<br>IV.B4.2-a,<br>IV.B4.2-b,<br>IV.B4.3-a,<br>IV.B4.3-b,<br>IV.B4.4-a,<br>IV.B4.4-b,<br>IV.B4.5-a,<br>IV.B4.5-b,<br>IV.B4.6-a,<br>IV.B4.6-b,<br>IV.B4.7-a,<br>IV.B4.7-b,<br>IV.B4.8-a. |
| PWR  | Reactor internals (B&W screws and bolts)                           | Loss of preload due to stress relaxation         | Inservice inspection; loose part monitoring | No                                   | IV.B4.3-e,<br>IV.B4.4-h,<br>IV.B4.5-e,<br>IV.B4.6-g,<br>IV.B4.7-e.   |
| PWR  | Reactor vessel closure studs and stud assembly                     | Loss of material due to wear                     | Reactor head closure studs                  | No                                   | IV A2.1-d.   |

**Table 1. Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of the GALL Report (continued)**

| Type | Component   | Aging Effect/<br>Mechanism               | Aging Management Programs                   | Further Evaluation Recommended | Item Number in GALL                         |
|------|---|--|---|--------------------------------|---|
| PWR  | Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods) | Loss of preload due to stress relaxation | Inservice inspection; loose part monitoring | No                             | IV.B2.1-k, IV.B2.5-h, IV.B3.2-g, IV.B3.4-h. |

**Table 2. Summary of Aging Management Programs for the Engineered Safety Features Evaluated in Chapter V of the GALL Report**

| <b>Type</b> | <b>Component</b>   | <b>Aging Effect/<br/>Mechanism</b>                                   | <b>Aging<br/>Management<br/>Programs</b>           | <b>Further<br/>Evaluation<br/>Recommended</b>              | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|--|--|--|--|--|
| BWR/<br>PWR | Piping, fittings, and valves in emergency core cooling system  | Cumulative fatigue damage  | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA  | V.D1.1-c,<br>V.D1.4-a,<br>V.D2.1-b.  |
| BWR         | Piping, fittings, pumps, and valves in emergency core cooling system   | Loss of material due to general corrosion                            | Water chemistry and one-time inspection            | Yes, detection of aging effects is to be further evaluated | V.D2.1-a,<br>V.D2.2-a,<br>V.D2.3-b.  |
| BWR/<br>PWR | Components in containment spray (PWR only), standby gas treatment system (BWR only), containment isolation, and emergency core cooling systems | Loss of material due to general corrosion                            | Plant specific                                     | Yes, plant specific  | V.A.2-a,<br>V.A.5-a,<br>V.B.1-a,<br>V.B.2-a,<br>V.C.1-a,<br>V.D2.1-e,<br>V.D2.5-a. |
| BWR         | Piping, fittings, pumps, and valves in emergency core cooling system   | Loss of material due to pitting and crevice corrosion                | Water chemistry and one-time inspection            | Yes, detection of aging effects is to be further evaluated | V.D2.1-a,<br>V.D2.2-a,<br>V.D2.3-b.  |
| BWR/<br>PWR | Components in containment spray (PWR only), standby gas treatment system (BWR only), containment isolation, and emergency core cooling systems | Loss of material due to pitting and crevice corrosion                | Plant specific                                     | Yes, plant specific  | V.C.1-a,<br>V.C.1-b,<br>V.D1.8-c,<br>V.D2.1-e.                                     |
| BWR/<br>PWR | Containment isolation valves and associated piping   | Loss of material due to microbiologically influenced corrosion (MIC) | Plant specific                                     | Yes, plant specific  | V.C.1-a,<br>V.C.1-b.   |
| BWR         | Seals in standby gas treatment system  | Changes in properties due to elastomer degradation                   | Plant specific                                     | Yes, plant specific  | V.B.1-b,<br>V.B.2-b.   |

**Table 2. Summary of Aging Management Programs for the Engineered Safety Features Evaluated in Chapter V of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b> | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>  |
|-------------|---|--|--|---|---|
| PWR         | High-pressure safety injection (charging) pump miniflow orifice   | Loss of material due to erosion  | Plant specific                           | Yes, plant specific                           | V.D1.2-c.   |
| BWR         | Drywell and suppression chamber spray system nozzles and flow orifices  | Plugging of flow orifice and spray nozzles by general corrosion products   | Plant specific                           | Yes, plant specific                           | V.D2.5-b.   |
| BWR/<br>PWR | External surface of carbon steel components   | Loss of material due to general corrosion  | Plant specific                           | Yes, plant specific                           | V.E.1-b.  |
| BWR/<br>PWR | Piping and fittings of CASS in emergency core cooling systems   | Loss of fracture toughness due to thermal aging embrittlement  | Thermal aging embrittlement of CASS      | No  | V.D1.1-b,<br>V.D2.1-d.  |
| BWR/<br>PWR | Components serviced by open-cycle cooling system  | Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system          | No  | V.A.6-a,<br>V.A.6-b,<br>V.D1.6-b,<br>V.D1.6-c,<br>V.D2.4-a,<br>V.D2.4-b.                                      |
| BWR/<br>PWR | Components serviced by closed-cycle cooling system  | Loss of material due to general, pitting, and crevice corrosion  | Closed-cycle cooling water system        | No  | V.A.6-c,<br>V.D1.5-a,<br>V.D1.6-a,<br>V.D2.4-c.   |
| BWR         | Emergency core cooling system valves and lines to and from high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) pump turbines | Wall thinning due to flow-accelerated corrosion  | Flow-accelerated corrosion               | No  | V.D2.1-f,<br>V.D2.3-a.  |
| PWR         | Pumps, valves, piping and fittings, and tanks in containment spray and emergency core cooling system  | Crack initiation and growth due to SCC   | Water chemistry                          | No  | V.A.1-a,<br>V.A.1-c,<br>V.A.3-a,<br>V.A.4-a,<br>V.D1.1-a,<br>V.D1.2-a,<br>V.D1.4-b,<br>V.D1.7-b,<br>V.D1.8-a. |

**Table 2. Summary of Aging Management Programs for the Engineered Safety Features Evaluated in Chapter V of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>          | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|---|---|---|---|--|
| BWR         | Pumps, valves, piping and fittings in emergency core cooling system | Crack initiation and growth due to SCC and IGSCC  | Water chemistry and BWR stress corrosion cracking | No  | V.D2.1-c,<br>V.D2.3-c.   |
| PWR         | Carbon steel components   | Loss of material due to boric acid corrosion  | Boric acid corrosion                              | No  | V.A.1-b,<br>V.A.3-b,<br>V.A.4-b,<br>V.A.5-b,<br>V.A.6-d,<br>V.D1.1-d,<br>V.D1.2-b,<br>V.D1.3-a,<br>V.D1.4-c,<br>V.D1.5-b,<br>V.D1.6-d,<br>V.D1.7-a,<br>V.D1.8-b,<br>V.E.1-a. |
| BWR/<br>PWR | Closure bolting in high-pressure or high-temperature systems        | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity                                 | No  | V.E.2-a,<br>V.E.2-b.   |



**Table 3. Summary of Aging Management Programs for the Auxiliary Systems  
Evaluated in Chapter VII of the GALL Report**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>           | <b>Further<br/>Evaluation<br/>Recommended</b>              | <b>Item<br/>Number in<br/>GALL</b>  |
|-------------|---|---|--|--|---|
| BWR/<br>PWR | Components in spent fuel pool cooling and cleanup   | Loss of material due to general, pitting, and crevice corrosion                                     | Water chemistry and one-time inspection            | Yes, detection of aging effects is to be further evaluated | VII.A3.2-a,<br>VII.A3.3-a,<br>VII.A3.5-a,<br>VII.A4.1-a,<br>VII.A4.2-a,<br>VII.A4.3-a,<br>VII.A4.4-b,<br>VII.A4.5-a,<br>VII.A4.6-a.   |
| BWR/<br>PWR | Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems   | Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear | Plant specific                                     | Yes, plant specific  | VII.A3.2-d,<br>VII.A3.3-d,<br>VII.A3.5-c,<br>VII.A4.2-b,<br>VII.A4.3-b,<br>VII.A4.5-b,<br>VII.F1.1-b,<br>VII.F1.1-c,<br>VII.F1.4-b,<br>VII.F2.1-b,<br>VII.F2.1-c,<br>VII.F2.4-b,<br>VII.F3.1-b,<br>VII.F3.1-c,<br>VII.F3.4-b,<br>VII.F4.1-b,<br>VII.F4.1-c. |
| BWR/<br>PWR | Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) | Cumulative fatigue damage   | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA  | VII.B.1-a,<br>VII.E1.1-a,<br>VII.E1.3-a,<br>VII.E1.7-a,<br>VII.E1.8-a,<br>VII.E3.1-b,<br>VII.E3.2-b,<br>VII.E3.2-c,<br>VII.E4.1-b.  |
| BWR/<br>PWR | Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR)                    | Crack initiation and growth due to SCC or cracking  | Plant specific                                     | Yes, plant specific  | VII.E1.5-a,<br>VII.E3.3-d,<br>VII.E3.4-a.   |

**Table 3. Summary of Aging Management Programs for the Auxiliary Systems  
Evaluated in Chapter VII of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b>                  | <b>Further<br/>Evaluation<br/>Recommended</b>              | <b>Item<br/>Number in<br/>GALL</b>  |
|-------------|---|--|---|--|---|
| BWR/<br>PWR | Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components | Loss of material due to general, pitting, and crevice corrosion, and MIC                                   | Plant specific  | Yes, plant specific  | VII.F1.1-a,<br>VII.F1.2-a,<br>VII.F1.4-a,<br>VII.F2.1-a,<br>VII.F2.2-a,<br>VII.F2.4-a,<br>VII.F3.1-a,<br>VII.F3.2-a,<br>VII.F3.4-a,<br>VII.F4.1-a,<br>VII.F4.2-a,<br>VII.H1.1-a,<br>VII.H1.2-a,<br>VII.H1.3-a,<br>VII.H2.2-a,<br>VII.H2.3-a,<br>VII.H2.4-a,<br>VII. I1-b. |
| BWR/<br>PWR | Components in reactor coolant pump oil collect system of fire protection  | Loss of material due to galvanic, general, pitting, and crevice corrosion                                  | One-time inspection                                       | Yes, detection of aging effects is to be further evaluated | VII.G.7-a,<br>VII.G.7-b.  |
| BWR/<br>PWR | Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system   | Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling                       | Fuel oil chemistry and one-time inspection                | Yes, detection of aging effects is to be further evaluated | VII.H1.4-a,<br>VII.H2.5-a.  |
| BWR         | Piping, pump casing, and valve body and bonnets in shutdown cooling system (older BWR)  | Loss of material due to pitting and crevice corrosion  | Water chemistry and one-time inspection                   | Yes, detection of aging effects is to be further evaluated | VII.E4.1-a,<br>VII.E4.2-a.  |
| PWR         | Heat exchangers in chemical and volume control system   | Crack initiation and growth due to SCC and cyclic loading  | Water chemistry and a plant-specific verification program | Yes, plant specific  | VII.E1.7-c,<br>VII.E1.8-b.  |
| BWR/<br>PWR | Neutron absorbing sheets in spent fuel storage racks  | Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel) | Plant specific  | Yes, plant specific  | VII.A2.1-b.   |

**Table 3. Summary of Aging Management Programs for the Auxiliary Systems  
Evaluated in Chapter VII of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>   | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b> | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|--|--|--|---|--|
| BWR/<br>PWR | New fuel rack<br>assembly  | Loss of material<br>due to general,<br>pitting, and<br>crevice corrosion             | Structures<br>monitoring                 | No  | VII.A1.1-a.  |
| BWR/<br>PWR | Neutron<br>absorbing<br>sheets in spent<br>fuel storage<br>racks                                       | Reduction of<br>neutron absorbing<br>capacity due to<br>Boraflex<br>degradation      | Boraflex<br>monitoring                   | No  | VII.A2.1-a.  |
| BWR/<br>PWR | Spent fuel<br>storage racks<br>and valves in<br>spent fuel pool<br>cooling and<br>cleanup              | Crack initiation<br>and growth due to<br>stress corrosion<br>cracking                | Water chemistry                          | No  | VII.A2.1-c,<br>VII.A3.3-b.   |
| BWR/<br>PWR | Closure bolting<br>and external<br>surfaces of<br>carbon steel<br>and low-alloy<br>steel<br>components | Loss of material<br>due to boric acid<br>corrosion                                   | Boric acid<br>corrosion                  | No  | VII.A3.1-a,<br>VII.A3.2-b,<br>VII.A3.2-c,<br>VII.A3.3-c,<br>VII.A3.4-b,<br>VII.A3.5-b,<br>VII.A3.6-a,<br>VII.E1.1-b,<br>VII.E1.2-a,<br>VII.E1.3-b,<br>VII.E1.4-a,<br>VII.E1.5-b,<br>VII.E1.6-a,<br>VII.E1.7-b,<br>VII.E1.8-d,<br>VII.E1.9-a,<br>VII.E1.10-a,<br>VII.I.1-a. |
| BWR/<br>PWR | Components in<br>or serviced by<br>closed-cycle<br>cooling water<br>system                             | Loss of material<br>due to general,<br>pitting, and<br>crevice corrosion,<br>and MIC | Closed-cycle<br>cooling water<br>system  | No  | VII.A3.4-a,<br>VII.A4.4-a,<br>VII.C2.1-a,<br>VII.C2.2-a,<br>VII.C2.3-a,<br>VII.C2.4-a,<br>VII.C2.5-a,<br>VII.E1.8-c,<br>VII.E3.4-b,<br>VII.F1.3-a,<br>VII.F2.3-a,<br>VII.F3.3-a,<br>VII.F4.3-a,<br>VII.H2.1-a.   |

**Table 3. Summary of Aging Management Programs for the Auxiliary Systems  
Evaluated in Chapter VII of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b>   | <b>Further<br/>Evaluation<br/>Recommended</b>  | <b>Item<br/>Number in<br/>GALL</b>  |
|-------------|---|--|--|--|---|
| BWR/<br>PWR | Cranes including bridge and trolleys and rail system in load handling system                | Loss of material due to general corrosion and wear   | Overhead heavy load and light load handling systems                                      | No   | VII.B.1-b,<br>VII.B.2-a.  |
| BWR/<br>PWR | Components in or serviced by open-cycle cooling water systems                               | Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system  | No   | VII.C1.1-a,<br>VII.C1.2-a,<br>VII.C1.3-a,<br>VII.C1.3-b,<br>VII.C1.4-a,<br>VII.C1.5-a,<br>VII.C1.6-a,<br>VII.C3.1-a,<br>VII.C3.2-a,<br>VII.C3.3-a,<br>VII.H2.1-b. |
| BWR/<br>PWR | Buried piping and fittings  | Loss of material due to general, pitting, and crevice corrosion, and MIC   | Buried piping and tanks surveillance<br><br>or<br><br>Buried piping and tanks inspection | No<br><br><br>Yes, detection of aging effects and operating experience are to be further evaluated | VII.C1.1-b,<br>VII.H1.1-b.  |
| BWR/<br>PWR | Components in compressed air system   | Loss of material due to general and pitting corrosion  | Compressed air monitoring  | No   | VII.D.1-a,<br>VII.D.2-a,<br>VII.D.3-a,<br>VII.D.4-a,<br>VII.D.5-a,<br>VII.D.6-a.  |
| BWR/<br>PWR | Components (doors and barrier penetration seals) and concrete structures in fire protection | Loss of material due to wear; hardening and shrinkage due to weathering  | Fire protection  | No   | VII.G.1-a,<br>VII.G.1-d,<br>VII.G.2-a,<br>VII.G.2-d,<br>VII.G.3-a,<br>VII.G.3-d,<br>VII.G.4-a,<br>VII.G.4-d,<br>VII.G.5-c.  |

**Table 3. Summary of Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging Management Programs</b>                  | <b>Further Evaluation Recommended</b> | <b>Item Number in GALL</b>                               |
|-------------|---|--|---|---------------------------------------|--|
| BWR/<br>PWR | Components in water-based fire protection   | Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling       | Fire water system                                 | No                                    | VII.G.6-a,<br>VII.G.6-b.                                 |
| BWR/<br>PWR | Components in diesel fire system  | Loss of material due to galvanic, general, pitting, and crevice corrosion                            | Fire protection and fuel oil chemistry            | No                                    | VII.G.8-a.   |
| BWR/<br>PWR | Tanks in diesel fuel oil system   | Loss of material due to general, pitting, and crevice corrosion                                      | Aboveground carbon steel tanks                    | No                                    | VII.H1.4-b.  |
| BWR/<br>PWR | Closure bolting   | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC | Bolting integrity                                 | No                                    | VII.I.2-a,<br>VII.I.2-b.                                 |
| BWR         | Components in contact with sodium pentaborate solution in standby liquid control system (BWR) | Crack initiation and growth due to SCC   | Water chemistry                                   | No                                    | VII.E2.1-a,<br>VII.E2.2-a,<br>VII.E2.3-a,<br>VII.E2.4-a. |
| BWR         | Components in reactor water cleanup system  | Crack initiation and growth due to SCC and IGSCC   | Reactor water cleanup system inspection           | No                                    | VII.E3.1-a,<br>VII.E3.2-a.                               |
| BWR         | Components in shutdown cooling system (older BWR)   | Crack initiation and growth due to SCC   | BWR stress corrosion cracking and water chemistry | No                                    | VII.E4.1-c,<br>VII.E4.3-a.                               |
| BWR         | Components in shutdown cooling system (older BWR)   | Loss of material due to pitting and crevice corrosion, and MIC                                       | Closed-cycle cooling water system                 | No                                    | VII.E4.4-a.  |

**Table 3. Summary of Aging Management Programs for the Auxiliary Systems  
Evaluated in Chapter VII of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b>  | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|---|--|---|---|--|
| BWR/<br>PWR | Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink | Loss of material due to selective leaching   | Selective leaching of materials           | No  | VII.C1.1-a,<br>VII.C1.1-c,<br>VII.C1.2-a,<br>VII.C1.3-a,<br>VII.C1.5-a,<br>VII.C2.3-a,<br>VII.C3.1-a,<br>VII.C3.2-a.                     |
| BWR/<br>PWR | Fire barriers, walls, ceilings, and floors in fire protection   | Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel | Fire protection and structures monitoring | No  | VII.G.1-b,<br>VII.G.1-c,<br>VII.G.2-b,<br>VII.G.2-c,<br>VII.G.3-b,<br>VII.G.3-c,<br>VII.G.4-b,<br>VII.G.4-c,<br>VII.G.5-a,<br>VII.G.5-b. |

**Table 4. Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of the GALL Report**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging Effect/<br/>Mechanism</b>                 | <b>Further<br/>Evaluation<br/>Recommended</b>              | <b>Item<br/>Number in<br/>GALL</b>   |
|-------------|---|--|--|--|--|
| PWR/<br>BWR | Piping and fittings in main feedwater line, steam line and auxiliary feedwater (AFW) piping (PWR only)                                    | Cumulative fatigue damage  | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA  | VIII.B1.1-b,<br>VIII.B2.1-c,<br>VIII.D1.1-b,<br>VIII.D2.1-c,<br>VIII.G.1-b.  |
| PWR/<br>BWR | Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion          | Water chemistry and one-time inspection            | Yes, detection of aging effects is to be further evaluated | VIII.A.1-b,<br>VIII.A.2-b,<br>VIII.C.1-b,<br>VIII.C.2-b,<br>VIII.D1.1-c,<br>VIII.D1.2-b,<br>VIII.D1.3-a,<br>VIII.D2.1-b,<br>VIII.D2.2-b,<br>VIII.D2.3-b,<br>VIII.E.1-b,<br>VIII.E.2-b,<br>VIII.E.3-a,<br>VIII.E.4-a,<br>VIII.E.4-d,<br>VIII.E.5-a,<br>VIII.E.5-b,<br>VIII.E.6-a,<br>VIII.F.1-b,<br>VIII.F.2-b,<br>VIII.F.3-a,<br>VIII.F.4-a,<br>VIII.F.4-d,<br>VIII.G.1-c,<br>VIII.G.2-a,<br>VIII.G.3-a,<br>VIII.G.4-a,<br>VIII.G.4-b. |
| PWR         | AFW piping  | Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling         | Plant specific                                     | Yes, plant specific  | VIII.G.1-d.  |
| PWR         | Oil coolers in AFW system (lubricating oil side possibly contaminated with water)   | Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC | Plant specific                                     | Yes, plant specific  | VIII.G.5-d.  |

**Table 4. Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of the GALL Report (continued)**

| Type        | Component   | Aging Effect/<br>Mechanism   | Aging Effect/<br>Mechanism              | Further<br>Evaluation<br>Recommended | Item<br>Number in<br>GALL   |
|-------------|---|--|---|--------------------------------------|---|
| BWR/<br>PWR | External surface<br>of carbon steel<br>components   | Loss of material<br>due to general<br>corrosion  | Plant specific                          | Yes, plant specific                  | VIII.H.1-b.   |
| BWR/<br>PWR | Carbon steel<br>piping and valve<br>bodies  | Wall thinning due<br>to flow-<br>accelerated<br>corrosion  | Flow-<br>accelerated<br>corrosion       | No                                   | VIII.A.1-a,<br>VIII.A.2-a,<br>VIII.B1.1-c,<br>VIII.B1.2-b,<br>VIII.B2.1-b,<br>VIII.B2.2-a,<br>VIII.C.1-a,<br>VIII.C.2-a,<br>VIII.D1.1-a,<br>VIII.D1.2-a,<br>VIII.D1.3-b,<br>VIII.D2.1-a,<br>VIII.D2.2-a,<br>VIII.D2.3-a,<br>VIII.E.1-a,<br>VIII.E.2-a,<br>VIII.F.1-a,<br>VIII.F.2-a,<br>VIII.G.1-a. |
| BWR/<br>PWR | Carbon steel<br>piping and valve<br>bodies in main<br>steam system                            | Loss of material<br>due to pitting and<br>crevice corrosion  | Water chemistry                         | No                                   | VIII.B1.1-a,<br>VIII.B1.2-a,<br>VIII.B2.1-a,<br>VIII.B2.2-b.  |
| BWR/<br>PWR | Closure bolting in<br>high-pressure or<br>high-temperature<br>systems                         | Loss of material<br>due to general<br>corrosion; crack<br>initiation and<br>growth due to<br>cyclic loading<br>and/or SCC.   | Bolting integrity                       | No                                   | VIII.H.2-a,<br>VIII.H.2-b.  |
| BWR/<br>PWR | Heat exchangers<br>and coolers/<br>condensers<br>serviced by<br>open-cycle<br>cooling water   | Loss of material<br>due to general<br>(carbon steel<br>only), pitting, and<br>crevice corrosion,<br>MIC, and<br>biofouling; buildup<br>of deposit due to<br>biofouling | Open-cycle<br>cooling water<br>system   | No                                   | VIII.E.4-b,<br>VIII.E.4-c,<br>VIII.F.4-b,<br>VIII.F.4-c,<br>VIII.G.5-a,<br>VIII.G.5-b.  |
| BWR/<br>PWR | Heat exchangers<br>and coolers/<br>condensers<br>serviced by<br>closed-cycle<br>cooling water | Loss of material<br>due to general<br>(carbon steel<br>only), pitting, and<br>crevice corrosion  | Closed-cycle<br>cooling water<br>system | No                                   | VIII.E.4-e,<br>VIII.F.4-e,<br>VIII.G.5-c.   |



**Table 4. Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of the GALL Report (continued)**

| Type        | Component   | Aging Effect/<br>Mechanism  | Aging Effect/<br>Mechanism   | Further<br>Evaluation<br>Recommended  | Item<br>Number in<br>GALL                 |
|-------------|---|---|--|---|---|
| BWR/<br>PWR | External surface<br>of aboveground<br>condensate<br>storage tank              | Loss of material<br>due to general<br>(carbon steel<br>only), pitting, and<br>crevice corrosion | Aboveground<br>carbon steel<br>tanks   | No  | VIII.E.5-c,<br>VIII.G.4-c.                |
| BWR/<br>PWR | External surface<br>of buried<br>condensate<br>storage tank and<br>AFW piping | Loss of material<br>due to general,<br>pitting, and<br>crevice corrosion,<br>and MIC            | Buried piping<br>and tanks<br>surveillance<br><br>or<br><br>Buried piping<br>and tanks<br>inspection | No<br><br><br>Yes, detection of<br>aging effects and<br>operating<br>experience are to<br>be further<br>evaluated | VIII.E.5-d,<br>VIII.G.1-e,<br>VIII.G.4-d. |
| PWR         | External surface<br>of carbon steel<br>components                             | Loss of material<br>due to boric acid<br>corrosion  | Boric acid<br>corrosion  | No  | VIII.H.1-a.                               |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report**

| Type   | Component  | Aging Effect/<br>Mechanism  | Aging<br>Management<br>Programs                                       | Further<br>Evaluation<br>Recommended               | GALL<br>Item Number                                  |
|--|--|---|---|--|--|
| <b>Common Components of All Types of PWR and BWR Containment</b> |  |   |   |  |  |
| BWR/<br>PWR  | Penetration sleeves, penetration bellows, and dissimilar metal welds | Cumulative fatigue damage (CLB fatigue analysis exists)   | TCAA evaluated in accordance with 10 CFR 54.21(c)                     | Yes, TCAA  | II.A3.1-b,<br>II.B4.1-b.                             |
| BWR/<br>PWR  | Penetration sleeves, bellows, and dissimilar metal welds             | Cracking due to cyclic loading; crack initiation and growth due to SCC  | Containment inservice inspection (ISI) and containment leak rate test | Yes, detection of aging effects is to be evaluated | II.A3.1-c,<br>II.A3.1-d,<br>II.B4.1-c,<br>II.B4.1-d. |
| BWR/<br>PWR  | Penetration sleeves, penetration bellows, and dissimilar metal welds | Loss of material due to corrosion   | Containment ISI and Containment leak rate test                        | No   | II.A3.1-a,<br>II.B4.1-a.                             |
| BWR/<br>PWR  | Personnel airlock and equipment hatch                                | Loss of material due to corrosion   | Containment ISI and containment leak rate test                        | No   | II.A3.2-a,<br>II.B4.2-a.                             |
| BWR/<br>PWR  | Personnel airlock and equipment hatch                                | Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms           | Containment leak rate test and plant technical specifications         | No   | II.A3.2-b,<br>II.B4.2-b.                             |
| BWR/<br>PWR  | Seals, gaskets, and moisture barriers                                | Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers | Containment ISI and containment leak rate test                        | No   | II.A3.3-a,<br>II.B4.3-a.                             |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)**

| Type  | Component   | Aging Effect/<br>Mechanism  | Aging<br>Management<br>Programs                               | Further<br>Evaluation<br>Recommended  | GALL<br>Item Number  |
|---|---|---|---|---|--|
| <b>PWR Concrete (Reinforced and Prestressed) and Steel Containment<br/>BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment</b> |   |   |   |   |  |
| BWR/<br>PWR   | Concrete<br>elements:<br>foundation,<br>dome, and wall                | Aging of<br>accessible and<br>inaccessible<br>concrete areas<br>due to leaching<br>of calcium<br>hydroxide,<br>aggressive<br>chemical attack,<br>and corrosion of<br>embedded steel | Containment<br>ISI  | Yes, if aging<br>mechanism is<br>significant for<br>inaccessible<br>areas                             | II.A1.1-b,<br>II.A1.1-c,<br>II.A1.1-e,<br>II.A2.2-b,<br>II.A2.2-c,<br>II.A2.2-e,<br>II.B2.2.1-a,<br>II.B2.2.1-b,<br>II.B2.2.1-d,<br>II.B3.1.2-a,<br>II.B3.1.2-b,<br>II.B3.1.2-d,<br>II.B3.2.1-b,<br>II.B3.2.1-c,<br>II.B3.2.1-e. |
| BWR/<br>PWR   | Concrete<br>elements:<br>foundation                                   | Cracks,<br>distortion, and<br>increases in<br>component<br>stress level due<br>to settlement  | Structures<br>monitoring                                      | No, if within the<br>scope of the<br>applicant's<br>structures<br>monitoring<br>program               | II.A1.1-f,<br>II.A2.2-f,<br>II.B2.2.1-e,<br>II.B3.1.2-e,<br>II.B3.2.1-f.   |
| BWR/<br>PWR   | Concrete<br>elements:<br>foundation                                   | Reduction in<br>foundation<br>strength due to<br>erosion of porous<br>concrete<br>subfoundation   | Structures<br>monitoring                                      | No, if within the<br>scope of the<br>applicant's<br>structures<br>monitoring<br>program               | II.A1.1-g,<br>II.A2.2-g,<br>II.B2.2.1-f,<br>II.B3.1.2-f,<br>II.B3.2.1-g.   |
| BWR/<br>PWR   | Concrete<br>elements:<br>foundation,<br>dome, and wall                | Reduction of<br>strength and<br>modulus due to<br>elevated<br>temperature   | Plant specific  | Yes, for any<br>portions of<br>concrete<br>containment that<br>exceed specified<br>temperature limits | II.A1.1-h,<br>II.A2.2-h,<br>II.B2.2.1-g,<br>II.B3.1.2-g,<br>II.B3.2.1-h.   |
| BWR/<br>PWR   | Prestressed<br>containment:<br>tendons and<br>anchorage<br>components | Loss of prestress<br>due to relaxation,<br>shrinkage, creep,<br>and elevated<br>temperature   | TLAA<br>evaluated in<br>accordance<br>with 10 CFR<br>54.21(c) | Yes, TLAA   | II.A1.3-b,<br>II.B2.2.3-b.   |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>   | <b>Aging Effect/<br/>Mechanism</b>   | <b>Aging<br/>Management<br/>Programs</b>                      | <b>Further<br/>Evaluation<br/>Recommended</b>                    | <b>GALL<br/>Item Number</b>  |
|-------------|--|--|---|--|--|
| BWR/<br>PWR | Steel elements:<br>liner plate and<br>containment<br>shell                                     | Loss of material<br>due to corrosion<br>in accessible and<br>inaccessible<br>areas   | Containment<br>ISI and<br>containment<br>leak rate test       | Yes, if corrosion is<br>significant for<br>inaccessible<br>areas | II.A1.2-a,<br>II.A2.1-a,<br>II.B1.1.1-a,<br>II.B2.1.1-a,<br>II.B2.2.2-a,<br>II.B3.1.1-a,<br>II.B3.2.2-a.             |
| BWR         | Steel elements:<br>vent header,<br>drywell head,<br>torus,<br>downcomers,<br>and<br>pool shell | Cumulative<br>fatigue<br>damage(CLB<br>fatigue analysis<br>exists)   | TCAA<br>evaluated in<br>accordance<br>with 10 CFR<br>54.21(c) | Yes, TCAA  | II.B1.1.1-c,<br>II.B2.1.1-c,<br>II.B2.2.2-d.   |
| BWR/<br>PWR | Steel elements:<br>protected by<br>coating   | Loss of material<br>due to corrosion<br>in accessible<br>areas only  | Protective<br>coating<br>monitoring and<br>maintenance        | No   | II.A1.2-a,<br>II.A2.1-a,<br>II.B1.1.1-a,<br>II.B2.1.1-a,<br>II.B2.2.2-a,<br>II.B3.1.1-a,<br>II.B3.2.2-a.             |
| BWR/<br>PWR | Prestressed<br>containment:<br>tendons and<br>anchorage<br>components                          | Loss of material<br>due to corrosion<br>of prestressing<br>tendons and<br>anchorage<br>components                              | Containment<br>ISI  | No   | II.A1.3-a,<br>II.B2.2.3-a.   |
| BWR/<br>PWR | Concrete<br>elements:<br>foundation,<br>dome, and wall   | Scaling,<br>cracking, and<br>spalling due to<br>freeze-thaw;<br>expansion and<br>cracking due to<br>reaction with<br>aggregate | Containment<br>ISI  | No   | II.A1.1-a,<br>II.A1.1-d,<br>II.A2.2-a,<br>II.A2.2-d,<br>II.B2.2.1-c,<br>II.B3.1.2-c,<br>II.B3.2.1-a,<br>II.B3.2.1-d. |
| BWR         | Steel elements:<br>vent line<br>bellows, vent<br>headers, and<br>downcomers                    | Cracking due to<br>cyclic loads;<br>crack initiation<br>and growth due<br>to SCC   | Containment<br>ISI and<br>Containment<br>leak rate test       | Yes, detection of<br>aging effects is to<br>be evaluated         | II.B1.1.1-b,<br>II.B1.1.1-d,<br>II.B2.1.1-b,<br>II.B2.2.2-c.   |
| BWR         | Steel elements:<br>suppression<br>chamber liner  | Crack initiation<br>and growth due<br>to SCC   | Containment<br>ISI and<br>containment<br>leak rate test       | No   | II.B2.2.2-b,<br>II.B3.1.1-b,<br>II.B3.2.2-b.   |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)**

| Type                      | Component   | Aging Effect/<br>Mechanism          | Aging<br>Management<br>Programs | Further<br>Evaluation<br>Recommended  | GALL<br>Item Number  |
|---------------------------|---|-------------------------------------|---------------------------------|---|--|
| BWR                       | Steel elements:<br>drywell head<br>and<br>downcomer<br>pipes  | Fretting and lock<br>up due to wear | Containment<br>ISI              | No  | II.B1.1.1-e,<br>II.B2.1.1-d,<br>II.B2.2.2-e.   |
| <b>Class I Structures</b> |   |                                     |                                 |   |  |
| BWR/<br>PWR               | All Groups<br>except Group 6:<br>accessible<br>interior/exterior<br>concrete and<br>steel<br>components | All types of aging<br>effects       | Structures<br>monitoring        | No, if within the<br>scope of the<br>applicant's<br>structures<br>monitoring<br>program | III.A1.1-a,<br>III.A1.1-b,<br>III.A1.1-c,<br>III.A1.1-d,<br>III.A1.1-f,<br>III.A1.2-a,<br>III.A2.1-a,<br>III.A2.1-b,<br>III.A2.1-c,<br>III.A2.1-d,<br>III.A2.1-f,<br>III.A2.2-a,<br>III.A3.1-a,<br>III.A3.1-b,<br>III.A3.1-c,<br>III.A3.1-d,<br>III.A3.1-f,<br>III.A3.2-a,<br>III.A4.1-a,<br>III.A4.1-b,<br>III.A4.1-d,<br>III.A4.2-a,<br>III.A4.2-b,<br>III.A5.1-a,<br>III.A5.1-b,<br>III.A5.1-c,<br>III.A5.1-d,<br>III.A5.1-f,<br>III.A5.2-a,<br>III.A7.1-a,<br>III.A7.1-b,<br>III.A7.1-c,<br>III.A7.1-d,<br>III.A7.1-f,<br>III.A7.2-a,<br>III.A8.1-a, |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>  | <b>Further<br/>Evaluation<br/>Recommended</b>                            | <b>GALL<br/>Item Number</b>  |
|-------------|---|---|---|--|--|
| BWR/<br>PWR | All Groups except Group 6: accessible interior/exterior concrete and steel components                   | All types of aging effects  | Structures monitoring   | No, if within the scope of the applicant's structures monitoring program | III.A8.1-b,<br>III.A8.1-c,<br>III.A8.2-a,<br>III.A9.1-a,<br>III.A9.1-b,<br>III.A9.1-c,<br>III.A9.1-d,<br>III.A9.1-f.   |
| BWR/<br>PWR | Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation | Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel | Plant specific  | Yes, if an aggressive below-grade environment exists                     | III.A1.1-e,<br>III.A1.1-g,<br>III.A2.1-e,<br>III.A2.1-g,<br>III.A3.1-e,<br>III.A3.1-g,<br>III.A5.1-e,<br>III.A5.1-g,<br>III.A7.1-e,<br>III.A7.1-g,<br>III.A8.1-d,<br>III.A8.1-e,<br>III.A9.1-e,<br>III.A9.1-g. |
| BWR/<br>PWR | Group 6: all accessible/inaccessible concrete, steel, and earthen components                            | All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion       | Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance | No   | III.A6.1-a,<br>III.A6.1-b,<br>III.A6.1-c,<br>III.A6.1-d,<br>III.A6.1-e,<br>III.A6.1-f,<br>III.A6.1-h,<br>III.A6.2-a,<br>III.A6.4-a.  |
| BWR/<br>PWR | Group 5: liners   | Crack initiation and growth due to SCC; loss of material due to crevice corrosion                       | Water chemistry and monitoring of spent fuel pool water level   | No   | III.A5.2-b.  |
| BWR/<br>PWR | Groups 1-3, 5, 6: all masonry block walls   | Cracking due to restraint, shrinkage, creep, and aggressive environment                                 | Masonry wall  | No   | III.A1.3-a,<br>III.A2.3-a,<br>III.A3.3-a,<br>III.A5.3-a,<br>III.A6.3-a.  |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)**

| Type                      | Component  | Aging Effect/<br>Mechanism  | Aging Management Programs | Further Evaluation Recommended   | GALL Item Number   |
|---------------------------|--|---|---------------------------|--|--|
| BWR/<br>PWR               | Groups 1-3, 5, 7-9:<br>foundation  | Cracks, distortion, and increases in component stress level due to settlement     | Structures monitoring     | No, if within the scope of the applicant's structures monitoring program   | III.A1.1-h,<br>III.A2.1-h,<br>III.A3.1-h,<br>III.A5.1-h,<br>III.A7.1-h,<br>III.A8.1-f,<br>III.A9.1-h.  |
| BWR/<br>PWR               | Groups 1-3, 5-9:<br>foundation   | Reduction in foundation strength due to erosion of porous concrete subfoundation  | Structures monitoring     | No, if within the scope of the applicant's structures monitoring program   | III.A1.1-i,<br>III.A2.1-i,<br>III.A3.1-i,<br>III.A5.1-i,<br>III.A6.1-g,<br>III.A7.1-i,<br>III.A8.1-g,<br>III.A9.1-i.   |
| BWR/<br>PWR               | Groups 1-5:<br>concrete  | Reduction of strength and modulus due to elevated temperature                     | Plant specific            | Yes, for any portions of concrete that exceed specified temperature limits | III.A1.1-j,<br>III.A2.1-j,<br>III.A3.1-j,<br>III.A4.1-c,<br>III.A5.1-j.  |
| BWR/<br>PWR               | Groups 7, 8:<br>liners   | Crack Initiation and growth due to SCC; loss of material due to crevice corrosion | Plant specific            | Yes  | III.A7.2-b,<br>III.A8.2-b.   |
| <b>Component Supports</b> |  |   |                           |  |  |
| BWR/<br>PWR               | All Groups:<br>support members:<br>anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. | Aging of component supports   | Structures monitoring     | No, if within the scope of the applicant's structures monitoring program   | III.B1.1.4-a,<br>III.B1.2.3-a,<br>III.B1.3.3-a,<br>III.B2.1-a,<br>III.B2.2-a,<br>III.B3.1-a,<br>III.B3.2-a,<br>III.B4.1-a,<br>III.B4.2-a,<br>III.B4.3-a,<br>III.B5.1-a,<br>III.B5.2-a. |

**Table 5. Summary of Aging Management Programs for the Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>          | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>GALL<br/>Item Number</b>  |
|-------------|---|---|---|---|--|
| BWR/<br>PWR | Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds  | Cumulative fatigue damage (CLB fatigue analysis exists)   | TLAA evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA                                     | III.B1.1.1-c,<br>III.B1.2.1-c,<br>III.B1.3.1-b.  |
| PWR         | All Groups: support members: anchor bolts and welds   | Loss of material due to boric acid corrosion  | Boric acid corrosion                              | No  | III.B1.1.1-b,<br>III.B1.2.1-b,<br>III.B2.1-b,<br>III.B3.1-b,<br>III.B4.1-b,<br>III.B5.1-b.         |
| BWR/<br>PWR | Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators | Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc. | ISI   | No  | III.B1.1.1-a,<br>III.B1.1.3-a,<br>III.B1.2.1-a,<br>III.B1.2.2-a,<br>III.B1.3.1-a,<br>III.B1.3.2-a. |
| BWR/<br>PWR | Group B1.1: high strength low-alloy bolts   | Crack initiation and growth due to SCC  | Bolting integrity                                 | No  | III.B1.1.2-a.  |



**Table 6. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL Report**

| <b>Type</b> | <b>Component</b>  | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>  | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b> |
|-------------|---|---|---|---|------------------------------------|
| BWR/<br>PWR | Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements  | Degradation due to various aging mechanisms   | Environmental qualification of electric components  | Yes, TLAA                                     | VI.B.1-a.                          |
| BWR/<br>PWR | Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements   | Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/thermooxidative degradation of organics; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion | Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements                  | No  | VI.A.1-a.                          |
| BWR/<br>PWR | Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance | Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/thermooxidative degradation of organics; radiation-induced oxidation; moisture intrusion  | Aging management program for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements | No  | VI.A.1-b.                          |

**Table 6. Summary of Aging Management Programs for Electrical Components Evaluated in Chapter VI of the GALL Report (continued)**

| <b>Type</b> | <b>Component</b>   | <b>Aging Effect/<br/>Mechanism</b>  | <b>Aging<br/>Management<br/>Programs</b>  | <b>Further<br/>Evaluation<br/>Recommended</b> | <b>Item<br/>Number in<br/>GALL</b> |
|-------------|--|---|---|---|------------------------------------|
| BWR/<br>PWR | Inaccessible medium-voltage (2kV to 15kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements | Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees | Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements | No  | VI.A.1-c.                          |
| PWR         | Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage                                | Corrosion of connector contact surfaces caused by intrusion of borated water  | Boric acid corrosion  | No  | VI.A.2-a.                          |

## **APPENDIX**

### **PLANT SYSTEMS EVALUATED IN THE GALL REPORT (VOLUME 2)**

### **LISTS OF ITEM NUMBERS IN THE GALL REPORT (VOLUME 2)**

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**Plant Systems  
Evaluated in the GALL Report (Volume 2)**

| Type    | System  | Section in GALL<br>(Vol. 2)  |
|---------|---|--|
| BWR     | Automatic depressurization system   | V.D2   |
| BWR     | Containment structures:<br>Mark I steel containments<br>Mark II concrete and steel containments<br>Mark III concrete and steel containments<br>Common components  | II.B1<br>II.B2<br>II.B3<br>II.B4   |
| BWR     | High-pressure coolant injection   | V.D2   |
| BWR     | High-pressure core spray  | V.D2   |
| BWR     | Low-pressure coolant injection and residual heat removal  | V.D2   |
| BWR     | Low-pressure core spray   | V.D2   |
| BWR     | Reactor building  | III.A1   |
| BWR     | Reactor building with steel superstructure  | III.A2   |
| BWR     | Reactor coolant pressure boundary   | IV.C1  |
| BWR     | Reactor coolant system connected systems (up to and including the second isolation valve):<br>Automatic depressurization system<br>Feedwater<br>High-pressure core spray<br>High-pressure coolant injection<br>Isolation condenser<br>Low-pressure coolant injection<br>Low-pressure core spray<br>Main steam<br>Reactor core isolation cooling<br>Reactor water cleanup<br>Recirculation system<br>Residual heat removal<br>Shutdown cooling<br>Standby liquid control | IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1<br>IV.C1 |
| BWR     | Reactor core isolation cooling  | V.D2   |
| BWR     | Reactor vessel  | IV.A1  |
| BWR     | Reactor vessel internals  | IV.B1  |
| BWR     | Reactor water cleanup system  | VII.E3   |
| BWR     | Shutdown cooling system (older plants)  | VII.E4   |
| BWR     | Standby gas treatment system  | V.B  |
| BWR     | Standby liquid control system   | VII.E2   |
| BWR     | Suppression pool cleanup system   | VII.A5   |
| BWR     | Unit vent stack   | III.A9   |
| BWR/PWR | Auxiliary and radwaste area ventilation system  | VII.F2   |
| BWR/PWR | Auxiliary building, diesel generator building, radwaste building, turbine building, switchgear room, auxiliary feedwater pump house, and utility/piping tunnels   | III.A3   |
| BWR/PWR | Carbon steel components   | V.E, VII.I, VIII.H   |
| BWR/PWR | Closed-cycle cooling water system (reactor auxiliary cooling water)   | VII.C2   |

**Plant Systems  
Evaluated in the GALL Report (Volume 2) (continued)**

| Type    | System   | Section in GALL<br>(Vol. 2)     |
|---------|--|---------------------------------|
| BWR/PWR | Component supports   | III.B                           |
| BWR/PWR | Compressed air system  | VII.D                           |
| BWR/PWR | Concrete tanks   | III.A7                          |
| BWR/PWR | Condensate system  | VIII.E                          |
| BWR/PWR | Containment internal structures, excluding refueling canal   | III.A4                          |
| BWR/PWR | Containment isolation components (containment isolation valves for in-scope systems are addressed in chapters IV, VII, and VIII) | V.C                             |
| BWR/PWR | Control room/building  | III.A1                          |
| BWR/PWR | Control room area ventilation system   | VII.F1                          |
| BWR/PWR | Demineralized water makeup   | Not in scope of<br>10 CFR 50.54 |
| BWR/PWR | Diesel fuel oil system   | VII.H1                          |
| BWR/PWR | Diesel generator building ventilation system   | VII.F4                          |
| BWR/PWR | Electrical components  | VI.A, B                         |
| BWR/PWR | Emergency diesel generator system  | VII.H2                          |
| BWR/PWR | Extraction steam system  | VIII.C                          |
| BWR/PWR | Feedwater system   | VIII.D2, D1                     |
| BWR/PWR | Fire protection  | VII.G                           |
| BWR/PWR | Fuel storage facility and refueling canal  | III.A5                          |
| BWR/PWR | Heating and ventilation systems  | VII.F1, F2, F3, F4              |
| BWR/PWR | Main steam system  | VIII.B2, B1                     |
| BWR/PWR | New and spent fuel storage   | VII.A1, A2                      |
| BWR/PWR | Open-cycle cooling water system (service water system)   | VII.C1                          |
| BWR/PWR | Overhead heavy load and light load (related to refueling) handling systems   | VII.B                           |
| BWR/PWR | Potable and sanitary water   | Not in scope of<br>10 CFR 50.54 |
| BWR/PWR | Primary containment heating and ventilation system   | VII.F3                          |
| BWR/PWR | Refueling canal  | III.A5                          |
| BWR/PWR | Spent fuel pool cooling and cleanup  | VII.A3, A4                      |
| BWR/PWR | Steam turbine system   | VIII.A                          |
| BWR/PWR | Steel tanks  | III.A8                          |
| BWR/PWR | Ultimate heat sink   | VII.C3                          |
| BWR/PWR | Water-control structures (e.g., intake structure, cooling tower, and spray pond)   | III.A6                          |
| PWR     | Accumulators   | V.D1                            |
| PWR     | Auxiliary feedwater system   | VIII.G                          |
| PWR     | Chemical and volume control system   | VII.E1                          |
| PWR     | Combustible gas control (containment H <sub>2</sub> control)   | V.E1                            |
| PWR     | Containment spray system   | V.A                             |
| PWR     | Containments:<br>Concrete containments<br>Steel containments<br>Common components  | II.A1<br>II.A2<br>II.A3         |
| PWR     | Coolant storage/refueling water system   | V.D1                            |



**Plant Systems  
Evaluated in the GALL Report (Volume 2) (continued)**

| Type | System  | Section in GALL<br>(Vol. 2)  |
|------|---|--|
| PWR  | Core flood system (see accumulators or safety injection tanks)  | V.D1   |
| PWR  | High-pressure safety injection  | V.D1   |
| PWR  | Lines to chemical and volume control system   | V.D1   |
| PWR  | Low-pressure safety injection   | V.D1   |
| PWR  | Shield building   | III.A1   |
| PWR  | Reactor coolant system and connected lines (up to and including the second isolation valve):<br>Chemical and volume control system<br>Core flood system<br>Drains and instrumentation lines<br>High-pressure injection system<br>Low-pressure injection<br>Residual heat removal or shutdown cooling<br>Safety injection<br>Sampling system | IV.C2<br>IV.C2<br>IV.C2<br>IV.C2<br>IV.C2<br>IV.C2<br>IV.C2<br>IV.C2 |
| PWR  | Reactor coolant system, pressurizer, pressurizer relief tank, and other Class 1 components  | IV.C2  |
| PWR  | Reactor vessel  | IV.A2  |
| PWR  | Reactor vessel internals  | IV.B2, B3, B4  |
| PWR  | Residual heat removal or shutdown cooling   | V.D1   |
| PWR  | Safety injection tanks  | V.D1   |
| PWR  | Steam generator blowdown system   | VIII.F   |
| PWR  | Steam generators  | IV.D1, D2  |

**List of Item Numbers in the GALL Report  
II. Containment Structures**

| Item Number<br>in GALL | Description  |
|------------------------|--|
| <b>II.A</b>            | <b>Pressurized water reactor (PWR) containments</b>                            |
| <b>II.A1</b>           | <b>Concrete containments (reinforced and prestressed)</b>                      |
| II.A1.1                | Concrete elements  |
| II.A1.2                | Steel elements   |
| II.A1.3                | Prestressing system  |
| <b>II.A2</b>           | <b>Steel containments</b>  |
| II.A2.1                | Steel elements   |
| II.A2.2                | Concrete elements  |
| <b>II.A3</b>           | <b>Common components</b>   |
| II.A3.1                | Penetration sleeves, penetration bellows, and dissimilar metal welds           |
| II.A3.2                | Personnel airlock and equipment hatch  |
| II.A3.3                | Seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) |
| <b>II.B</b>            | <b>Boiling water reactor (BWR) containments</b>                                |
| <b>II.B1</b>           | <b>Mark I containments</b>   |
| II.B1.1                | Steel containments   |
| II.B1.1.1              | Steel elements   |
| <b>II.B2</b>           | <b>Mark II containments</b>  |
| II.B2.1                | Steel containments   |
| II.B2.1.1              | Steel elements   |
| II.B2.2                | Concrete containments  |
| II.B2.2.1              | Concrete elements  |
| II.B2.2.2              | Steel elements   |
| II.B2.2.3              | Prestressing system  |
| <b>II.B3</b>           | <b>Mark III containments</b>   |
| II.B3.1                | Steel containments   |
| II.B3.1.1              | Steel elements   |
| II.B3.1.2              | Concrete elements  |
| II.B3.2                | Concrete containments  |
| II.B3.2.1              | Concrete elements  |
| II.B3.2.2              | Steel elements   |
| <b>II.B4</b>           | <b>Common components</b>   |
| II.B4.1                | Penetration sleeves, penetration bellows, and dissimilar metal welds           |
| II.B4.2                | Personnel airlock, equipment hatch, and control rod drive (CRD) hatch          |
| II.B4.3                | Seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) |

**List of Item Numbers in the GALL Report**  
**III. Class 1 Structures and Component Supports**

| Item Number<br>in GALL | Description  |
|------------------------|--|
| <b>III.A</b>           | <b>Class 1 structures</b>  |
| <b>III.A1</b>          | <b>Group 1 structures (BWR reactor building, PWR shield building, and control room/building)</b>   |
| III.A1.1               | Concrete elements  |
| III.A1.2               | Steel elements   |
| III.A1.3               | Masonry walls  |
| <b>III.A2</b>          | <b>Group 2 structures (BWR reactor building with steel superstructure)</b>   |
| III.A2.1               | Concrete elements  |
| III.A2.2               | Steel elements   |
| III.A2.3               | Masonry walls  |
| <b>III.A3</b>          | <b>Group 3 structures (auxiliary building, diesel generator building, radwaste building, turbine building, switchgear room, auxiliary feedwater (AFW) pumphouse, and utility/piping tunnels)</b> |
| III.A3.1               | Concrete elements  |
| III.A3.2               | Steel elements   |
| III.A3.3               | Masonry walls  |
| <b>III.A4</b>          | <b>Group 4 structures (containment internal structures, excluding refueling canal)</b>   |
| III.A4.1               | Concrete elements  |
| III.A4.2               | Steel elements   |
| <b>III.A5</b>          | <b>Group 5 structures (fuel storage facility, refueling canal)</b>   |
| III.A5.1               | Concrete elements  |
| III.A5.2               | Steel elements   |
| III.A5.3               | Masonry walls  |
| <b>III.A6</b>          | <b>Group 6 structures (water control structures )</b>  |
| III.A6.1               | Concrete elements  |
| III.A6.2               | Steel elements   |
| III.A6.3               | Masonry walls  |
| III.A6.4               | Earthen water control structures   |
| <b>III.A7</b>          | <b>Group 7 structures (concrete tanks)</b>   |
| III.A7.1               | Concrete elements  |
| III.A7.2               | Steel elements   |
| <b>III.A8</b>          | <b>Group 8 structures (steel tanks)</b>  |
| III.A8.1               | Concrete elements  |
| III.A8.2               | Steel elements   |
| <b>III.A9</b>          | <b>Group 9 structures (BWR unit vent stack)</b>  |
| III.A9.1               | Concrete elements  |
| <b>III.B</b>           | <b>Component supports</b>  |
| <b>III.B1</b>          | <b>Supports for ASME piping and components</b>   |
| III.B1.1               | Supports for ASME Class 1 piping and components  |
| III.B1.1.1             | Support members; welds, bolted connections; support anchorage to building structure  |
| III.B1.1.2             | High-strength bolts for NSSS component supports  |
| III.B1.1.3             | Constant/variable load spring hangers; guides; stops; sliding surfaces; design clearances; vibration isolators   |
| III.B1.1.4             | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates  |
| III.B1.2               | Supports for ASME Class 2 and 3 piping and components  |
| III.B1.2.1             | Support members; welds, bolted connections; support anchorage to building structure  |

**List of Item Numbers in the GALL Report  
III. Class I Structures and Component Supports (continued)**

| Item Number<br>in GALL | Description   |
|------------------------|---|
| III.B1.2.2             | Constant/variable load spring hangers; guides; stops; sliding surfaces; design clearances; vibration isolators                        |
| III.B1.2.3             | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates                                   |
| III.B1.3               | Supports for ASME Class MC components (BWR containment supports)  |
| III.B1.3.1             | Support members; welds, bolted connections; support anchorage to building structure   |
| III.B1.3.2             | Guides; stops; sliding surfaces; design clearances  |
| III.B1.3.3             | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates                                   |
| <b>III.B2</b>          | <b>Supports for cable trays, conduits, HVAC ducts, tube track, instrument tubing, and non-ASME piping and components</b>              |
| III.B2.1               | Support members; welds; bolted connections; support anchorage to building structure   |
| III.B2.2               | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates                                   |
| <b>III.B3</b>          | <b>Anchorage of racks, panels, cabinets, and enclosures for electric equipment and instrumentation</b>                                |
| III.B3.1               | Support members; welds; bolted connections; support anchorage to building structure   |
| III.B3.2               | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates                                   |
| <b>III.B4</b>          | <b>Supports for emergency diesel generator (EDG), HVAC system components, and other miscellaneous mechanical equipment</b>            |
| III.B4.1               | Support members; welds; bolted connections; support anchorage to building structure   |
| III.B4.2               | Vibration isolation elements  |
| III.B4.3               | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates                                   |
| <b>III.B5</b>          | <b>Supports for platforms, pipe whip restraints, jet impingement shields, masonry walls, and other miscellaneous steel structures</b> |
| III.B5.1               | Support members; welds; bolted connections; support anchorage to building structure   |
| III.B5.2               | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates                                   |

**List of Item Numbers in the GALL Report  
IV.A1. Reactor Vessel (BWR)**

| Item Number<br>in GALL | Description   |
|------------------------|---|
| <b>IV.A1.1</b>         | <b>Top head enclosure</b>   |
| IV.A1.1.1              | Top head  |
| IV.A1.1.2              | Nozzles [vent, top head spray or reactor core isolation cooling (RCIC), and spare]  |
| IV.A1.1.3              | Head flange   |
| IV.A1.1.4              | Closure studs and nuts  |
| IV.A1.1.5              | Vessel flange leak detection line   |
| <b>IV.A1.2</b>         | <b>Vessel shell</b>   |
| IV.A1.2.1              | Vessel flange   |
| IV.A1.2.2              | Upper shell   |
| IV.A1.2.3              | Intermediate nozzle shell   |
| IV.A1.2.4              | Intermediate beltline shell   |
| IV.A1.2.5              | Lower shell   |
| IV.A1.2.6              | Beltline welds  |
| IV.A1.2.7              | Attachment welds  |
| <b>IV.A1.3</b>         | <b>Nozzles</b>  |
| IV.A1.3.1              | Main steam  |
| IV.A1.3.2              | Feedwater   |
| IV.A1.3.3              | CRD return line   |
| IV.A1.3.4              | Low-pressure coolant injection (LPCI) or residual heat removal (RHR) injection mode |
| <b>IV.A1.4</b>         | <b>Nozzles safe ends</b>  |
| IV.A1.4.1              | High-pressure core spray (HPCS)   |
| IV.A1.4.2              | Low-pressure core spray (LPCS)  |
| IV.A1.4.3              | CRD return line   |
| IV.A1.4.4              | Recirculating water (inlet and outlet)  |
| IV.A1.4.5              | LPCI or RHR injection mode  |
| <b>IV.A1.5</b>         | <b>Penetrations</b>   |
| IV.A1.5.1              | CRD stub tubes  |
| IV.A1.5.2              | Instrumentation   |
| IV.A1.5.3              | Jet pump instrument   |
| IV.A1.5.4              | Standby liquid control  |
| IV.A1.5.5              | Flux monitor  |
| IV.A1.5.6              | Drain line  |
| <b>IV.A1.6</b>         | <b>Bottom head</b>  |
| <b>IV.A1.7</b>         | <b>Support skirt and attachment welds</b>   |

**List of Item Numbers in the GALL Report  
IV.A2. Reactor Vessel (PWR)**

| Item Number<br>in GALL | Description                                     |
|------------------------|---|
| <b>IV.A2.1</b>         | <b>Closure head</b>                             |
| IV.A2.1.1              | Dome  |
| IV.A2.1.2              | Head flange                                     |
| IV.A2.1.3              | Stud assembly                                   |
| IV.A2.1.4              | Vessel flange leak detection line               |
| <b>IV.A2.2</b>         | <b>Control rod drive (CRD) head penetration</b> |
| IV.A2.2.1              | Nozzle  |
| IV.A2.2.2              | Pressure housing                                |
| IV.A2.2.3              | Flange bolting                                  |
| <b>IV.A2.3</b>         | <b>Nozzles</b>                                  |
| IV.A2.3.1              | Inlet   |
| IV.A2.3.2              | Outlet  |
| IV.A2.3.3              | Safety injection (on some)                      |
| <b>IV.A2.4</b>         | <b>Nozzle safe ends</b>                         |
| IV.A2.4.1              | Inlet   |
| IV.A2.4.2              | Outlet  |
| IV.A2.4.3              | Safety injection (on some)                      |
| <b>IV.A2.5</b>         | <b>Shell</b>                                    |
| IV.A2.5.1              | Upper (nozzle) shell                            |
| IV.A2.5.2              | Intermediate and lower shell                    |
| IV.A2.5.3              | Vessel flange                                   |
| IV.A2.5.4              | Bottom head                                     |
| <b>IV.A2.6</b>         | <b>Core support pads/core guide lugs</b>        |
| <b>IV.A2.7</b>         | <b>Penetrations</b>                             |
| IV.A2.7.1              | Instrumentation tubes (bottom head)             |
| IV.A2.7.2              | Head vent pipe (top head)                       |
| IV.A2.7.3              | Instrument tubes (top head)                     |
| <b>IV.A2.8</b>         | <b>Pressure vessel support</b>                  |
| IV.A2.8.1              | Skirt support                                   |
| IV.A2.8.2              | Cantilever/column support                       |
| IV.A2.8.3              | Neutron shield tank                             |

**List of Item Numbers in the GALL Report  
IV.B1. Reactor Vessel Internals (BWR)**

| Item Number in<br>GALL | Description                                     |
|------------------------|---|
| <b>IV.B1.1</b>         | <b>Core shroud, shroud head, and core plate</b> |
| IV.B1.1.1              | Core shroud (upper, central, and lower)         |
| IV.B1.1.2              | Core plate                                      |
| IV.B1.1.3              | Core plate bolts                                |
| IV.B1.1.4              | Access hole cover                               |
| IV.B1.1.5              | Shroud support structure                        |
| IV.B1.1.6              | LPCI coupling                                   |
| <b>IV.B1.2</b>         | <b>Top guide</b>                                |
| <b>IV.B1.3</b>         | <b>Core spray lines and spargers</b>            |
| IV.B1.3.1              | Core spray lines (headers)                      |
| IV.B1.3.2              | Spray ring                                      |
| IV.B1.3.3              | Spray nozzles                                   |
| IV.B1.3.4              | Thermal sleeve                                  |
| <b>IV.B1.4</b>         | <b>Jet pump assemblies</b>                      |
| IV.B1.4.1              | Thermal sleeve                                  |
| IV.B1.4.2              | Inlet header                                    |
| IV.B1.4.3              | Riser brace arm                                 |
| IV.B1.4.4              | Holddown beams                                  |
| IV.B1.4.5              | Inlet elbow                                     |
| IV.B1.4.6              | Mixing assembly                                 |
| IV.B1.4.7              | Diffuser  |
| IV.B1.4.8              | Castings  |
| IV.B1.4.9              | Jet pump sensing line                           |
| <b>IV.B1.5</b>         | <b>Fuel support and CRD assemblies</b>          |
| IV.B1.5.1              | Orificed fuel support                           |
| IV.B1.5.2              | CRD housing                                     |
| <b>IV.B1.6</b>         | <b>Instrumentation</b>                          |
| IV.B1.6.1              | Intermediate range monitor (IRM) dry tubes      |
| IV.B1.6.2              | Low-power range monitor (LPRM) dry tubes        |
| IV.B1.6.3              | Source range monitor (SRM) dry tubes            |
| <b>IV.B1.6.4</b>       | <b>Incore neutron flux monitor guide tubes</b>  |

**List of Item Numbers in the GALL Report  
IV.B2. Reactor Vessel Internals (PWR) – Westinghouse**

| Item Number in<br>GALL | Description                              |
|------------------------|--|
| <b>IV.B2.1</b>         | <b>Upper internals assembly</b>          |
| IV.B2.1.1              | Upper support plate                      |
| IV.B2.1.2              | Upper support column                     |
| IV.B2.1.3              | Upper support column bolts               |
| IV.B2.1.4              | Upper core plate                         |
| IV.B2.1.5              | Upper core plate alignment pins          |
| IV.B2.1.6              | Fuel alignment pins                      |
| IV.B2.1.7              | Hold-down spring                         |
| <b>IV.B2.2</b>         | <b>RCCA guide tube assemblies</b>        |
| IV.B2.2.1              | RCCA guide tubes                         |
| IV.B2.2.2              | RCCA guide tube bolts                    |
| IV.B2.2.3              | RCCA guide tube support pins             |
| <b>IV.B2.3</b>         | <b>Core barrel</b>                       |
| IV.B2.3.1              | Core barrel                              |
| IV.B2.3.2              | Core barrel flange                       |
| IV.B2.3.3              | Core barrel outlet nozzles               |
| IV.B2.3.4              | Thermal shield                           |
| <b>IV.B2.4</b>         | <b>Baffle/former assembly</b>            |
| IV.B2.4.1              | Baffle/former plates                     |
| IV.B2.4.2              | Baffle/former bolts                      |
| <b>IV.B2.5</b>         | <b>Lower internal assembly</b>           |
| IV.B2.5.1              | Lower core plate                         |
| IV.B2.5.2              | Fuel alignment pins                      |
| IV.B2.5.3              | Lower support forging or casting         |
| IV.B2.5.4              | Lower support plate columns              |
| IV.B2.5.5              | Lower support plate column bolts         |
| IV.B2.5.6              | Radial support keys and clevis inserts   |
| IV.B2.5.7              | Clevis insert bolts                      |
| <b>IV.B2.6</b>         | <b>Instrumentation support structure</b> |
| IV.B2.6.1              | Flux thimble guide tubes                 |
| IV.B2.6.2              | Flux thimbles                            |



**List of Item Numbers in the GALL Report**  
**IV.B3. Reactor Vessel Internals (PWR) – Combustion Engineering**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>IV.B3.1</b>         | <b>Upper internals assembly</b>                              |
| IV.B3.1.1              | Upper guide structure support plate                          |
| IV.B3.1.2              | Fuel alignment plate   |
| IV.B3.1.3              | Fuel alignment plate guide lugs and guide lug inserts        |
| IV.B3.1.4              | Hold-down ring   |
| <b>IV.B3.2</b>         | <b>Control-core element assembly (CEA) shroud assemblies</b> |
| IV.B3.2.1              | CEA shrouds  |
| IV.B3.2.2              | CEA shrouds bolts  |
| IV.B3.2.3              | CEA shrouds extension shaft guides                           |
| <b>IV.B3.3</b>         | <b>Core support barrel</b>                                   |
| IV.B3.3.1              | Core support barrel  |
| IV.B3.3.2              | Core support barrel upper flange                             |
| IV.B3.3.3              | Core support barrel alignment keys                           |
| <b>IV.B3.4</b>         | <b>Core shroud assembly</b>                                  |
| IV.B3.4.1              | Core shroud assembly   |
| IV.B3.4.2              | Core shroud assembly bolts                                   |
| IV.B3.4.3              | Core shroud tie rods   |
| <b>IV.B3.5</b>         | <b>Lower internal assembly</b>                               |
| IV.B3.5.1              | Core support plate   |
| IV.B3.5.2              | Fuel alignment pins  |
| IV.B3.5.3              | Lower support structure beam assemblies                      |
| IV.B3.5.4              | Core support column  |
| IV.B3.5.5              | Core support column bolts                                    |
| IV.B3.5.6              | Core support barrel snubber assemblies                       |

**List of Item Numbers in the GALL Report**  
**IV.B4. Reactor Vessel Internals (PWR) – Babcock & Wilcox (B&W)**

| Item Number<br>in GALL | Description  |
|------------------------|--|
| <b>IV.B4.1</b>         | <b>Plenum cover and plenum cylinder</b>              |
| IV.B4.1.1              | Plenum cover assembly                                |
| IV.B4.1.2              | Plenum cylinder                                      |
| IV.B4.1.3              | Reinforcing plates                                   |
| IV.B4.1.4              | Top flange-to-cover bolts                            |
| IV.B4.1.5              | Bottom flange-to-upper grid screws                   |
| <b>IV.B4.2</b>         | <b>Upper grid assembly</b>                           |
| IV.B4.2.1              | Upper grid rib section                               |
| IV.B4.2.2              | Upper grid ring forging                              |
| IV.B4.2.3              | Fuel assembly support pads                           |
| IV.B4.2.4              | Plenum rib pads                                      |
| IV.B4.2.5              | Rib-to-ring screws                                   |
| <b>IV.B4.3</b>         | <b>Control rod guide tube (CRGT) assembly</b>        |
| IV.B4.3.1              | CRGT pipe and flange                                 |
| IV.B4.3.2              | CRGT spacer casting                                  |
| IV.B4.3.3              | CRGT spacer screws                                   |
| IV.B4.3.4              | Flange-to-upper grid screws                          |
| IV.B4.3.5              | CRGT rod guide tubes                                 |
| IV.B4.3.6              | CRGT rod guide sectors                               |
| <b>IV.B4.4</b>         | <b>Core support shield assembly</b>                  |
| IV.B4.4.1              | Core support shield cylinder (top and bottom flange) |
| IV.B4.4.2              | Core support shield-to-core barrel bolts             |
| IV.B4.4.3              | Outlet and vent valve nozzles                        |
| IV.B4.4.4              | Vent valve body and retaining ring                   |
| IV.B4.4.5              | Vent valve assembly locking device                   |
| <b>IV.B4.5</b>         | <b>Core barrel assembly</b>                          |
| IV.B4.5.1              | Core barrel cylinder (top and bottom flange)         |
| IV.B4.5.2              | Lower internals assembly-to-core barrel bolts        |
| IV.B4.5.3              | Core barrel-to-thermal shield bolts                  |
| IV.B4.5.4              | Baffle plates and formers                            |
| IV.B4.5.5              | Baffle/former bolts and screws                       |
| <b>IV.B4.6</b>         | <b>Lower grid (LG) assembly</b>                      |
| IV.B4.6.1              | Lower grid rib section                               |
| IV.B4.6.2              | Fuel assembly support pads                           |
| IV.B4.6.3              | Lower grid rib-to-shell forging screws               |
| IV.B4.6.4              | Lower grid flow distributor plate                    |
| IV.B4.6.5              | Orifice plugs  |
| IV.B4.6.6              | Lower grid and shell forgings                        |
| IV.B4.6.7              | Lower internals assembly-to-thermal shield bolts     |
| IV.B4.6.8              | Guide blocks and bolts                               |
| IV.B4.6.9              | Shock pads and bolts                                 |
| IV.B4.6.10             | Support post pipes                                   |
| IV.B4.6.11             | Incore guide tube spider castings                    |

**List of Item Numbers in the GALL Report**  
**IV.B4. Reactor Vessel Internals (PWR) – Babcock & Wilcox (B&W) (continued)**

| <b>Item Number<br/>in GALL</b> | <b>Description</b>                      |
|--------------------------------|---|
| <b>IV.B4.7</b>                 | <b>Flow distributor</b>                 |
| IV.B4.7.1                      | Flow distributor head and flange        |
| IV.B4.7.2                      | Shell forging-to-flow distributor bolts |
| IV.B4.7.3                      | Incore guide support plate              |
| IV.B4.7.4                      | Clamping ring                           |
| <b>IV.B4.8</b>                 | <b>Thermal shield</b>                   |

**List of Item Numbers in the GALL Report  
IV.C1. Reactor Coolant Pressure Boundary (BWR)**

| Item Number<br>in GALL | Description   |
|------------------------|---|
| <b>IV.C1.1</b>         | <b>Piping and fittings</b>  |
| IV.C1.1.1              | Main steam  |
| IV.C1.1.2              | Feedwater   |
| IV.C1.1.3              | High-pressure coolant injection (HPCI) system                                 |
| IV.C1.1.4              | Reactor core isolation cooling (RCIC) system                                  |
| IV.C1.1.5              | Recirculation   |
| IV.C1.1.6              | Residual heat removal (RHR) system  |
| IV.C1.1.7              | Low pressure coolant injection (LPCI) system                                  |
| IV.C1.1.8              | Low pressure core spray (LPCS) system   |
| IV.C1.1.9              | High pressure core spray (HPCS) system  |
| IV.C1.1.10             | Lines to isolation condenser  |
| IV.C1.1.11             | Lines to reactor water cleanup (RWC) and standby liquid control (SLC) systems |
| IV.C1.1.12             | Steam line to HPCI and RCIC pump turbine                                      |
| IV.C1.1.13             | Small bore piping less than NPS 4   |
| <b>IV.C1.2</b>         | <b>Recirculation pump</b>   |
| IV.C1.2.1              | Casing  |
| IV.C1.2.2              | Cover   |
| IV.C1.2.3              | Seal flange   |
| IV.C1.2.4              | Closure bolting   |
| <b>IV.C1.3</b>         | <b>Valves</b>   |
| IV.C1.3.1              | Body  |
| IV.C1.3.2              | Bonnet  |
| IV.C1.3.3              | Seal flange   |
| IV.C1.3.4              | Closure bolting   |
| <b>IV.C1.4</b>         | <b>Isolation condenser</b>  |
| IV.C1.4.1              | Tubing  |
| IV.C1.4.2              | Tubesheet   |
| IV.C1.4.3              | Channel head  |
| IV.C1.4.4              | Shell   |

**List of Item Numbers in the GALL Report**  
**IV.C2. Reactor Coolant System and Connected Lines (PWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>IV.C2.1</b>         | <b>Reactor coolant system piping and fittings</b>  |
| IV.C2.1.1              | Cold-leg   |
| IV.C2.1.2              | Hot-leg  |
| IV.C2.1.3              | Surge line   |
| IV.C2.1.4              | Spray line   |
| IV.C2.1.5              | Small-bore reactor coolant system (RCS) piping, fittings, and branch connections less than NPS 4 |
| <b>IV.C2.2</b>         | <b>Connected systems piping and fittings</b>   |
| IV.C2.2.1              | RHR or low-pressure injection system (decay heat removal [DHR]/shutdown system)                  |
| IV.C2.2.2              | Core flood system (CFS)  |
| IV.C2.2.3              | High-pressure injection system (makeup and letdown functions)                                    |
| IV.C2.2.4              | Chemical and volume control system   |
| IV.C2.2.5              | Sampling system  |
| IV.C2.2.6              | Drains and instrument lines  |
| IV.C2.2.7              | Nozzles and safe ends  |
| IV.C2.2.8              | Small-bore piping, fittings, and branch connections less than NPS 4 in connected systems         |
| <b>IV.C2.3</b>         | <b>Reactor coolant pump</b>  |
| IV.C2.3.1              | Casing   |
| IV.C2.3.2              | Cover  |
| IV.C2.3.3              | Closure bolting  |
| <b>IV.C2.4</b>         | <b>Safety and relief valves</b>  |
| IV.C2.4.1              | Body   |
| IV.C2.4.2              | Bonnet   |
| IV.C2.4.3              | Closure bolting  |
| <b>IV.C2.5</b>         | <b>Pressurizer</b>   |
| IV.C2.5.1              | Shell/heads  |
| IV.C2.5.2              | Spray line nozzle  |
| IV.C2.5.3              | Surge line nozzle  |
| IV.C2.5.4              | Spray head   |
| IV.C2.5.5              | Thermal sleeves  |
| IV.C2.5.6              | Instrument penetrations  |
| IV.C2.5.7              | Safe ends  |
| IV.C2.5.8              | Manway and flanges   |
| IV.C2.5.9              | Manway and flange bolting  |
| IV.C2.5.10             | Heater sheaths and sleeves   |
| IV.C2.5.11             | Support keys, skirt, and shear lugs  |
| IV.C2.5.12             | Integral support   |
| <b>IV.C2.6</b>         | <b>Pressurizer relief tank</b>   |
| IV.C2.6.1              | Tank shell and heads   |
| IV.C2.6.2              | Flanges and nozzles  |

**List of Item Numbers in the GALL Report  
IV.D1. Steam Generator (Recirculating)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>IV.D1.1</b>         | <b>Pressure boundary and structural</b>                 |
| IV.D1.1.1              | Top head  |
| IV.D1.1.2              | Steam nozzle and safe end                               |
| IV.D1.1.3              | Upper and lower shell                                   |
| IV.D1.1.4              | Transition cone   |
| IV.D1.1.5              | Feedwater nozzle and safe end                           |
| IV.D1.1.6              | Feedwater impingement plate and support                 |
| IV.D1.1.7              | Secondary manway and handhole bolting                   |
| IV.D1.1.8              | Lower head  |
| IV.D1.1.9              | Primary nozzles and safe ends                           |
| IV.D1.1.10             | Instrument nozzles                                      |
| IV.D1.1.11             | Primary manway (cover and bolting)                      |
| <b>IV.D1.2</b>         | <b>Tube bundle</b>                                      |
| IV.D1.2.1              | Tubes and sleeves                                       |
| IV.D1.2.2              | Tube support lattice bars (combustion engineering [CE]) |
| IV.D1.2.3              | Tube plugs  |
| IV.D1.2.4              | Tube support plates                                     |
| <b>IV.D1.3</b>         | <b>Upper assembly and separators</b>                    |
| IV.D1.3.1              | Feedwater inlet ring and support                        |

**List of Item Numbers in the GALL Report  
IV.D2. Steam Generator (Once-Through)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>IV.D2.1</b>         | <b>Pressure boundary and structural</b>                   |
| IV.D2.1.1              | Upper and lower heads                                     |
| IV.D2.1.2              | Tube sheets   |
| IV.D2.1.3              | Primary nozzles and safe ends                             |
| IV.D2.1.4              | Shell assembly  |
| IV.D2.1.5              | Feedwater and auxiliary feedwater nozzles and safe ends   |
| IV.D2.1.6              | Steam nozzles and safe ends                               |
| IV.D2.1.7              | Primary side drain nozzles                                |
| IV.D2.1.8              | Secondary side nozzles (vent, drain, and instrumentation) |
| IV.D2.1.9              | Primary manways (cover and bolting)                       |
| IV.D2.1.10             | Secondary manways and handholes (cover and bolting)       |
| <b>IV.D2.2</b>         | <b>Tube bundle</b>  |
| IV.D2.2.1              | Tubes and sleeves   |
| IV.D2.2.2              | Tube plugs  |

**List of Item Numbers in the GALL Report  
V.A. Containment Spray System (PWR)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>V.A.1</b>           | <b>Piping, fittings and miscellaneous items</b>   |
| V.A.1.1                | Piping and fittings up to isolation valve   |
| V.A.1.2                | Flow orifice/elements   |
| V.A.1.3                | Temperature elements/indicators   |
| V.A.1.4                | Bolting   |
| V.A.1.5                | Eductors  |
| <b>V.A.2</b>           | <b>Headers and spray nozzles</b>  |
| V.A.2.1                | Piping and fittings   |
| V.A.2.2                | Flow orifice  |
| V.A.2.3                | Headers   |
| V.A.2.4                | Spray nozzles   |
| <b>V.A.3</b>           | <b>Pumps</b>  |
| V.A.3.1                | Bowl/casing   |
| V.A.3.2                | Bolting   |
| <b>V.A.4</b>           | <b>Valves (hand, control, check, motor-operated, and containment isolation) in containment spray system</b> |
| V.A.4.1                | Body and bonnet   |
| V.A.4.2                | Bolting   |
| <b>V.A.5</b>           | <b>Valves (hand, control, and containment isolation) in headers and spray nozzles</b>                       |
| V.A.5.1                | Body and bonnet   |
| V.A.5.2                | Bolting   |
| <b>V.A.6</b>           | <b>Containment spray heat exchanger</b>   |
| V.A.6.1                | Bonnet/cover  |
| V.A.6.2                | Tubing  |
| V.A.6.3                | Shell   |
| V.A.6.4                | Case/cover  |
| V.A.6.5                | Bolting   |



**List of Item Numbers in the GALL Report  
V.B. Standby Gas Treatment System (BWR)**

| Item Number<br>in GALL | Description                                    |
|------------------------|--|
| <b>V.B1</b>            | <b>Ductwork</b>                                |
| V.B.1.1                | Duct fittings, access doors, and closure bolts |
| V.B.1.2                | Equipment frames and housing                   |
| V.B.1.3                | Seals between ducts and fan                    |
| V.B.1.4                | Seals in dampers and doors                     |
| <b>V.B.2</b>           | <b>Filters</b>                                 |
| V.B.2.1                | Housing and supports                           |
| V.B.2.2                | Elastomer seals                                |

**List of Item Numbers in the GALL Report  
V.C. Containment Isolation Components**

| Item Number in<br>GALL | Description               |
|------------------------|---------------------------|
| <b>V.C.1</b>           | <b>Isolation barriers</b> |
| V.C.1.1                | Valve body and bonnet     |
| V.C.1.2                | Pipe penetrations         |

**List of Item Numbers in the GALL Report  
V.D1. Emergency Core Cooling System (PWR)**

| Item Number<br>in GALL | Description   |
|------------------------|---|
| <b>V.D1.1</b>          | <b>Piping and fittings</b>  |
| V.D1.1.1               | Core flood system (CFS)   |
| V.D1.1.2               | Residual heat removal (RHR) or shutdown cooling (SDC)   |
| V.D1.1.3               | High-pressure safety injection (HPSI)   |
| V.D1.1.4               | Low-pressure safety injection (LPSI)  |
| V.D1.1.5               | Connecting lines to chemical and volume control system (CVCS) and spent fuel pool (SFP) cooling |
| V.D1.1.6               | Lines to emergency sump   |
| V.D1.1.7               | Bolting for flange connections  |
| <b>V.D1.2</b>          | <b>HPSI and LPSI pumps</b>  |
| V.D1.2.1               | Bowl/casing   |
| V.D1.2.2               | Bolting   |
| V.D1.2.3               | Orifice   |
| <b>V.D1.3</b>          | <b>Refueling water tank (RWT) circulation pump</b>  |
| V.D1.3.1               | Bolting   |
| <b>V.D1.4</b>          | <b>Valves</b>   |
| V.D1.4.1               | Body and bonnet   |
| V.D1.4.2               | Bolting   |
| <b>V.D1.5</b>          | <b>Heat exchangers (RCP, HPSI and LPSI pump seals, and RHR or SDC)</b>                          |
| V.D1.5.1               | Bonnet/cover  |
| V.D1.5.2               | Tubing  |
| V.D1.5.3               | Shell   |
| V.D1.5.4               | Case/cover  |
| V.D1.5.5               | Bolting   |
| <b>V.D1.6</b>          | <b>Heat exchangers (RWT heating)</b>  |
| V.D1.6.1               | Bonnet/cover  |
| V.D1.6.2               | Tubing  |
| V.D1.6.3               | Shell   |
| V.D1.6.4               | Bolting   |
| <b>V.D1.7</b>          | <b>Safety injection tank (accumulator)</b>  |
| V.D1.7.1               | Shell   |
| V.D1.7.2               | Manway  |
| V.D1.7.3               | Penetrations/nozzles  |
| <b>V.D1.8</b>          | <b>Refueling water tank (RWT)</b>   |
| V.D1.8.1               | Shell   |
| V.D1.8.2               | Manhole   |
| V.D1.8.3               | Penetrations/nozzles  |
| V.D1.8.4               | Bolting   |
| V.D1.8.5               | Buried portion of tank  |

**List of Item Numbers in the GALL Report  
V.D2. Emergency Core Cooling System (BWR)**

| Item Number in GALL | Description   |
|---------------------|---|
| <b>V.D2.1</b>       | <b>Piping and Fittings</b>  |
| V.D2.1.1            | High pressure coolant injection (HPCI)                                    |
| V.D2.1.2            | Reactor core isolation cooling (RCIC)                                     |
| V.D2.1.3            | High-pressure core spray (HPCS)   |
| V.D2.1.4            | Low-pressure core spray (LPCS)  |
| V.D2.1.5            | Low-pressure coolant injection (LPCI) and residual heat removal (RHR)     |
| V.D2.1.6            | Lines to suppression chamber (SC)   |
| V.D2.1.7            | Lines to drywell and suppression chamber spray system (DSCSS)             |
| V.D2.1.8            | Automatic depressurization system (ADS)                                   |
| V.D2.1.9            | Lines to HPCI and RCIC pump turbine                                       |
| V.D2.1.10           | Lines from HPCI and RCIC pump turbines to condenser                       |
| <b>V.D2.2</b>       | <b>Pumps (HPCS or HPCI main and booster, LPCS, LPCI or RHR, and RCIC)</b> |
| V.D2.2.1            | Bowl/casing   |
| V.D2.2.2            | Suction head  |
| V.D2.2.3            | Discharge head  |
| <b>V.D2.3</b>       | <b>Valves (check, control, hand, motor operated, and relief valves)</b>   |
| V.D2.3.1            | Body and bonnet   |
| <b>V.D2.4</b>       | <b>Heat exchangers (RHR and LPCI)</b>                                     |
| V.D2.4.1            | Tubes   |
| V.D2.4.2            | Tubesheet   |
| V.D2.4.3            | Channel head  |
| <b>V.D2.4.4</b>     | <b>Shell</b>  |
| <b>V.D2.5</b>       | <b>Drywell and suppression chamber spray system (DSCSS)</b>               |
| V.D2.5.1            | Piping and fittings   |
| V.D2.5.2            | Flow orifice  |
| V.D2.5.3            | Headers   |
| V.D2.5.4            | Spray nozzles   |

**List of Item Numbers in the GALL Report  
V.E. Carbon Steel Components**

| Item Number in GALL | Description                                  |
|---------------------|--|
| <b>V.E.1</b>        | <b>Carbon steel components</b>               |
| V.E.1.1             | External surfaces                            |
| <b>V.E.2</b>        | <b>Closure bolting</b>                       |
| V.E.2.1             | In high-pressure or high-temperature systems |

**List of Item Numbers in the GALL Report  
VI.A. Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental  
Qualification Requirements**

| Item Number<br>in GALL | Description   |
|------------------------|---|
| <b>VI.A.1</b>          | <b>Conductor insulation</b>   |
| VI.A.1.1               | Electrical cables and connections exposed to an adverse localized environment caused by heat, radiation, or moisture  |
| VI.A.1.2               | Electrical cables used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR) exposed to an adverse localized environment caused by heat, radiation, or moisture |
| VI.A.1.3               | Inaccessible medium-voltage (2 kV to 15 kV) cables (e.g., installed in conduit or direct buried) exposed to an adverse localized environment caused by exposure to moisture and voltage                       |
| <b>VI.A.2</b>          | <b>Connector contacts</b>   |
| VI.A.2.1               | Electrical connectors exposed to borated water leakage  |

**List of Item Numbers in the GALL Report  
VI.B. Equipment Subject to 10 CFR 50.49  
Environmental Qualification Requirements**

| Item Number<br>in GALL | Description  |
|------------------------|--|
| <b>VI.B.1</b>          | <b>Equipment subject to 10 CFR 50.49 environmental qualification requirements</b>          |
| VI.B.1.1               | Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements |

**List of Item Numbers in the GALL Report  
VII.A1. New Fuel Storage**

| Item Number in<br>GALL | Description            |
|------------------------|------------------------|
| <b>VII.A1.1</b>        | <b>New fuel rack</b>   |
| VII.A1.1.1             | New fuel rack assembly |

**List of Item Numbers in the GALL Report  
VII.A2. Spent Fuel Storage**

| Item Number in<br>GALL | Description                    |
|------------------------|--------------------------------|
| <b>VII.A2.1</b>        | <b>Spent fuel storage rack</b> |
| VII.A2.1.1             | Neutron-absorbing sheets       |
| VII.A2.1.2             | Storage rack                   |

**List of Item Numbers in the GALL Report  
VII.A3. Spent Fuel Pool Cooling and Cleanup (PWR)**

| Item Number in<br>GALL | Description                           |
|------------------------|---------------------------------------|
| <b>VII.A3.1</b>        | <b>Piping</b>                         |
| VII.A3.1.1             | Closure bolting                       |
| <b>VII.A3.2</b>        | <b>Filter</b>                         |
| VII.A3.2.1             | Housing                               |
| VII.A3.2.2             | Closure bolting                       |
| VII.A3.2.3             | Elastomer lining                      |
| <b>VII.A3.3</b>        | <b>Valves (check and hand valves)</b> |
| VII.A3.3.1             | Body and bonnet                       |
| VII.A3.3.2             | Closure bolting                       |
| VII.A3.3.3             | Elastomer lining (hand valves only)   |
| <b>VII.A3.4</b>        | <b>Heat exchanger</b>                 |
| VII.A3.4.1             | Shell and access cover                |
| VII.A3.4.2             | Channel head and access cover         |
| VII.A3.4.3             | Closure bolting                       |
| <b>VII.A3.5</b>        | <b>Ion exchanger</b>                  |
| VII.A3.5.1             | Shell                                 |
| VII.A3.5.2             | Nozzles                               |
| VII.A3.5.3             | Closure bolting                       |
| VII.A3.5.4             | Elastomer lining                      |
| <b>VII.A3.6</b>        | <b>Pump</b>                           |
| VII.A3.6.1             | Closure bolting                       |

**List of Item Numbers in the GALL Report  
VII.A4. Spent Fuel Pool Cooling and Cleanup (BWR)**

| Item Number in<br>GALL | Description                           |
|------------------------|---------------------------------------|
| <b>VII.A4.1</b>        | <b>Piping</b>                         |
| VII.A4.1.1             | Piping, fittings, and flanges         |
| <b>VII.A4.2</b>        | <b>Filter</b>                         |
| VII.A4.2.1             | Housing                               |
| VII.A4.2.2             | Elastomer lining                      |
| <b>VII.A4.3</b>        | <b>Valves (check and hand valves)</b> |
| VII.A4.3.1             | Body and bonnet                       |
| VII.A4.3.2             | Elastomer lining (hand valves only)   |
| <b>VII.A4.4</b>        | <b>Heat exchanger</b>                 |
| VII.A4.4.1             | Shell and access cover                |
| VII.A4.4.2             | Channel head and access cover         |
| VII.A4.4.3             | Tubes                                 |
| VII.A4.4.4             | Tubesheet                             |
| <b>VII.A4.5</b>        | <b>Ion exchanger</b>                  |
| VII.A4.5.1             | Shell                                 |
| VII.A4.5.2             | Nozzles                               |
| VII.A4.5.3             | Elastomer lining                      |
| <b>VII.A4.6</b>        | <b>Pump</b>                           |
| VII.A4.6.1             | Casing                                |

**List of Item Numbers in the GALL Report  
VII.A5. Suppression Pool Cleanup System (BWR)**

*See Evaluation Summary, page VII A5-1, in Volume 2 of the GALL report (NUREG-1801, March 2001).*

**List of Item Numbers in the GALL Report  
VII.B. Overhead Heavy Load and  
Light Load (Related to Refueling) Handling Systems**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.B.1</b>         | <b>Cranes including bridge and trolley (for cranes that fall within the scope of 10 CFR 54)</b> |
| VII.B.1.1              | Structural girders  |
| <b>VII.B.2</b>         | <b>Rail system</b>  |
| VII.B.2.1              | Rail  |

**List of Item Numbers in the GALL Report  
VII.C1. Open-Cycle Cooling Water System (Service Water System)**

| Item Number in<br>GALL | Description                     |
|------------------------|---------------------------------|
| <b>VII.C1.1</b>        | <b>Piping</b>                   |
| VII.C1.1.1             | Piping and fittings             |
| VII.C1.1.2             | Underground piping and fittings |
| <b>VII.C1.2</b>        | <b>Valves</b>                   |
| VII.C1.2.1             | Body and bonnet                 |
| <b>VII.C1.3</b>        | <b>Heat exchanger</b>           |
| VII.C1.3.1             | Shell                           |
| VII.C1.3.2             | Channel                         |
| VII.C1.3.3             | Channel head and access cover   |
| VII.C1.3.4             | Tubesheet                       |
| VII.C1.3.5             | Tubes                           |
| <b>VII.C1.4</b>        | <b>Flow orifice</b>             |
| VII.C1.4.1             | Body                            |
| <b>VII.C1.5</b>        | <b>Pump</b>                     |
| VII.C1.5.1             | Casing                          |
| <b>VII.C1.6</b>        | <b>Basket strainer</b>          |
| VII.C1.6.1             | Body                            |

**List of Item Numbers in the GALL Report  
VII.C2. Closed-Cycle Cooling Water System**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VII.C2.1</b>        | <b>Piping</b>  |
| VII.C2.1.1             | Pipe, fittings, and flanges  |
| <b>VII.C2.2</b>        | <b>Valves (check, hand, control, relief, solenoid, and containment isolation valves)</b> |
| VII.C2.2.1             | Body and bonnet  |
| <b>VII.C2.3</b>        | <b>Pump</b>  |
| VII.C2.3.1             | Casing   |
| <b>VII.C2.4</b>        | <b>Tank</b>  |
| VII.C2.4.1             | Shell  |
| <b>VII.C2.5</b>        | <b>Flow orifice</b>  |
| VII.C2.5.1             | Body   |

**List of Item Numbers in the GALL Report  
VII.C3. Ultimate Heat Sink**

| Item Number in<br>GALL | Description                                     |
|------------------------|---|
| <b>VII.C3.1</b>        | <b>Piping</b>                                   |
| VII.C3.1.1             | Piping and fittings                             |
| <b>VII.C3.2</b>        | <b>Valves (check, hand, and control valves)</b> |
| VII.C3.2.1             | Body and bonnet                                 |
| <b>VII.C3.3</b>        | <b>Pump</b>                                     |
| VII.C3.3.1             | Casing  |

**List of Item Numbers in the GALL Report  
VII.D. Compressed Air System**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.D.1</b>         | <b>Piping</b>   |
| VII.D.1.1              | Piping and fittings   |
| VII.D.1.2              | Closure bolting   |
| <b>VII.D.2</b>         | <b>Valves (including check valves and containment isolation valves)</b> |
| VII.D.2.1              | Body and bonnet   |
| VII.D.2.2              | Closure bolting   |
| <b>VII.D.3</b>         | <b>Air receiver</b>   |
| VII.D.3.1              | Shell and access cover  |
| VII.D.3.2              | Closure bolting   |
| <b>VII.D.4</b>         | <b>Pressure regulators</b>  |
| VII.D.4.1              | Body and bonnet   |
| <b>VII.D.5</b>         | <b>Filter</b>   |
| VII.D.5.1              | Shell and access cover  |
| VII.D.5.2              | Closure bolting   |
| <b>VII.D.6</b>         | <b>Dryer</b>  |
| VII.D.6.1              | Shell and access cover  |
| VII.D.6.2              | Closure bolting   |



**List of Item Numbers in the GALL Report  
VII.E1. Chemical and Volume Control System (PWR)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.E1.1</b>        | <b>High-pressure piping (1,500 psig rating)</b>   |
| VII.E1.1.1             | Pipe, fittings, and flanges   |
| VII.E1.1.2             | Closure bolting   |
| <b>VII.E1.2</b>        | <b>Low-pressure piping (150 psig rating)</b>  |
| VII.E1.2.1             | Closure bolting   |
| <b>VII.E1.3</b>        | <b>High-pressure valves (check, control, hand, motor-operated, pressure control, and relief valves)</b> |
| VII.E1.3.1             | Body and bonnet   |
| VII.E1.3.2             | Closure bolting   |
| <b>VII.E1.4</b>        | <b>Low-pressure valves (check, control, hand, motor-operated, pressure control, and relief valves)</b>  |
| VII.E1.4.1             | Closure bolting   |
| <b>VII.E1.5</b>        | <b>High-pressure pump</b>   |
| VII.E1.5.1             | Casing  |
| VII.E1.5.2             | Closure bolting   |
| <b>VII.E1.6</b>        | <b>Low-pressure pump</b>  |
| VII.E1.6.1             | Closure bolting   |
| <b>VII.E1.7</b>        | <b>Regenerative heat exchanger</b>  |
| VII.E1.7.1             | Channel head and access cover   |
| VII.E1.7.2             | Tubesheet   |
| VII.E1.7.3             | Tubes   |
| VII.E1.7.4             | Shell and access cover  |
| VII.E1.7.5             | Closure bolting   |
| <b>VII.E1.8</b>        | <b>Letdown heat exchanger</b>   |
| VII.E1.8.1             | Channel head and access cover   |
| VII.E1.8.2             | Tubesheet   |
| VII.E1.8.3             | Tubes   |
| VII.E1.8.4             | Shell and access cover  |
| VII.E1.8.5             | Closure bolting   |
| <b>VII.E1.9</b>        | <b>Basket strainers</b>   |
| VII.E1.9.1             | Closure bolting   |
| <b>VII.E1.10</b>       | <b>Volume control tank</b>  |
| VII.E1.10.1            | Closure bolting   |

**List of Item Numbers in the GALL Report  
VII.E2. Standby Liquid Control System (BWR)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.E2.1</b>        | <b>Piping</b>   |
| VII.E2.1.1             | Piping and fittings   |
| <b>VII.E2.2</b>        | <b>Solution storage</b>   |
| VII.E2.2.1             | Tank  |
| VII.E2.2.2             | Tank heaters  |
| <b>VII.E2.3</b>        | <b>Valves (pump suction, relief, injection, containment isolation, and explosive actuated discharge valves)</b> |
| VII.E2.3.1             | Body and bonnet   |
| <b>VII.E2.4</b>        | <b>Injection pumps</b>  |
| VII.E2.4.1             | Casing  |

**List of Item Numbers in the GALL Report  
VII.E3. Reactor Water Cleanup System (BWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VII.E3.1</b>        | <b>Piping</b>  |
| VII.E3.1.1             | Piping and fittings (beyond second isolation valves) |
| <b>VII.E3.2</b>        | <b>Reactor water cleanup (RWCU) pump</b>             |
| VII.E3.2.1             | Casing   |
| <b>VII.E3.3</b>        | <b>Regenerative heat exchanger</b>                   |
| VII.E3.3.1             | Channel head and access cover                        |
| VII.E3.3.2             | Tubesheet  |
| VII.E3.3.3             | Tubes  |
| VII.E3.3.4             | Shell and access cover                               |
| <b>VII.E3.4</b>        | <b>Nonregenerative heat exchanger</b>                |
| VII.E3.4.1             | Channel head and access cover                        |
| VII.E3.4.2             | Tubesheet  |
| VII.E3.4.3             | Tubes  |
| VII.E3.4.4             | Shell and access cover                               |

**List of Item Numbers in the GALL Report  
VII.E4. Shutdown Cooling System (Older BWR)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.E4.1</b>        | <b>Piping</b>   |
| VII.E4.1.1             | Piping and fittings   |
| <b>VII.E4.2</b>        | <b>Pump</b>   |
| VII.E4.2.1             | Casing  |
| <b>VII.E4.3</b>        | <b>Valves (check, control, hand, motor-operated, and relief valves)</b> |
| VII.E4.3.1             | Body and bonnet   |
| <b>VII.E4.4</b>        | <b>Heat Exchanger</b>   |
| VII.E4.4.1             | Channel head and access cover   |
| VII.E4.4.2             | Tubesheet   |
| VII.E4.4.3             | Tubes   |
| VII.E4.4.4             | Shell and access cover  |

**List of Item Numbers in the GALL Report  
VII.F1. Control Room Area Ventilation System**

| Item Number in<br>GALL | Description                                    |
|------------------------|--|
| <b>VII.F1.1</b>        | <b>Duct</b>                                    |
| VII.F1.1.1             | Duct fittings, access doors, and closure bolts |
| VII.F1.1.2             | Equipment frames and housing                   |
| VII.F1.1.3             | Flexible collars between ducts and fans        |
| VII.F1.1.4             | Seals in dampers and doors                     |
| <b>VII.F1.2</b>        | <b>Air handler heating/cooling</b>             |
| VII.F1.2.1             | Heating/cooling coils                          |
| <b>VII.F1.3</b>        | <b>Piping</b>                                  |
| VII.F1.3.1             | Piping and fittings                            |
| <b>VII.F1.4</b>        | <b>Filters</b>                                 |
| VII.F1.4.1             | Housing and supports                           |
| VII.F1.4.2             | Elastomer seals                                |

**List of Item Numbers in the GALL Report  
VII.F2. Auxiliary and Radwaste Area Ventilation System**

| Item Number in<br>GALL | Description                                    |
|------------------------|--|
| <b>VII.F2.1</b>        | <b>Duct</b>                                    |
| VII.F2.1.1             | Duct fittings, access doors, and closure bolts |
| VII.F2.1.2             | Equipment frames and housing                   |
| VII.F2.1.3             | Flexible collars between ducts and fans        |
| VII.F2.1.4             | Seals in dampers and doors                     |
| <b>VII.F2.2</b>        | <b>Air handler heating/cooling</b>             |
| VII.F2.2.1             | Heating/cooling coils                          |
| <b>VII.F2.3</b>        | <b>Piping</b>                                  |
| VII.F2.3.1             | Piping and fittings                            |
| <b>VII.F2.4</b>        | <b>Filters</b>                                 |
| VII.F2.4.1             | Housing and supports                           |
| VII.F2.4.2             | Elastomer seals                                |

**List of Item Numbers in the GALL Report  
VII. F3. Primary Containment Area Ventilation System**

| Item Number in<br>GALL | Description                                    |
|------------------------|--|
| <b>VII.F3.1</b>        | <b>Duct</b>                                    |
| VII.F3.1.1             | Duct fittings, access doors, and closure bolts |
| VII.F3.1.2             | Equipment frames and housing                   |
| VII.F3.1.3             | Flexible collars between ducts and fans        |
| VII.F3.1.4             | Seals in dampers and doors                     |
| <b>VII.F3.2</b>        | <b>Air handler heating/cooling</b>             |
| VII.F3.2.1             | Heating/cooling coils                          |
| <b>VII.F3.3</b>        | <b>Piping</b>                                  |
| VII.F3.3.1             | Piping and fittings                            |
| <b>VII.F3.4</b>        | <b>Filters</b>                                 |
| VII.F3.4.1             | Housing and supports                           |
| VII.F3.4.2             | Elastomer seals                                |

**List of Item Numbers in the GALL Report  
VII.F4. Diesel Generator Building Ventilation System**

| Item Number in<br>GALL | Description                                    |
|------------------------|--|
| <b>VII.F4.1</b>        | <b>Duct</b>                                    |
| VII.F4.1.1             | Duct fittings, access doors, and closure bolts |
| VII.F4.1.2             | Equipment frames and housing                   |
| VII.F4.1.3             | Flexible collars between ducts and fans        |
| VII.F4.1.4             | Seals in dampers and doors                     |
| <b>VII.F4.2</b>        | <b>Air handler heating/cooling</b>             |
| VII.F4.2.1             | Heating/cooling coils                          |
| <b>VII.F4.3</b>        | <b>Piping</b>                                  |
| VII.F4.3.1             | Piping and fittings                            |

**List of Item Numbers in the GALL Report  
VII.G. Fire Protection**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.G.1</b>         | <b>Intake structure</b>   |
| VII.G.1.1              | Fire barrier penetration seals  |
| VII.G.1.2              | Fire barrier walls, ceilings, and floors  |
| VII.G.1.3              | Fire rated doors  |
| <b>VII.G.2</b>         | <b>Turbine building</b>   |
| VII.G.2.1              | Fire barrier penetration seals  |
| VII.G.2.2              | Fire barrier walls, ceilings, and floors  |
| VII.G.2.3              | Fire rated doors  |
| <b>VII.G.3</b>         | <b>Auxiliary building</b>   |
| VII.G.3.1              | Fire barrier penetration seals  |
| VII.G.3.2              | Fire barrier walls, ceilings, and floors  |
| VII.G.3.3              | Fire rated doors  |
| <b>VII.G.4</b>         | <b>Diesel generator building</b>  |
| VII.G.4.1              | Fire barrier penetration seals  |
| VII.G.4.2              | Fire barrier walls, ceilings, and floors  |
| VII.G.4.3              | Fire rated doors  |
| <b>VII.G.5</b>         | <b>Primary containment</b>  |
| VII.G.5.1              | Fire barrier walls, ceilings, and floors  |
| VII.G.5.2              | Fire rated doors  |
| <b>VII.G.6</b>         | <b>Water-based fire protection system</b>   |
| VII.G.6.1              | Piping and fittings   |
| VII.G.6.2              | Filter, fire hydrants, multisifier, pump casing, sprinkler, strainer, and valve bodies (including containment isolation valves) |
| <b>VII.G.7</b>         | <b>Reactor coolant pump oil collection system</b>   |
| VII.G.7.1              | Tank  |
| VII.G.7.2              | Piping, tubing, and valve bodies  |
| <b>VII.G.8</b>         | <b>Diesel fire system</b>   |
| VII.G.8.1              | Diesel-driven fire pump and fuel supply line  |

**List of Item Numbers in the GALL Report  
VII.H1. Diesel Fuel Oil System**

| Item Number in<br>GALL | Description                   |
|------------------------|-------------------------------|
| <b>VII.H1.1</b>        | <b>Piping</b>                 |
| VII.H1.1.1             | Aboveground pipe and fittings |
| VII.H1.1.2             | Underground pipe and fittings |
| <b>VII.H1.2</b>        | <b>Valves</b>                 |
| VII.H1.2.1             | Body and bonnet               |
| VII.H1.2.2             | Closure bolting               |
| <b>VII.H1.3</b>        | <b>Pump</b>                   |
| VII.H1.3.1             | Casing                        |
| VII.H1.3.2             | Closure bolting               |
| <b>VII.H1.4</b>        | <b>Tank</b>                   |
| VII.H1.4.1             | Internal surfaces             |
| VII.H1.4.2             | External surfaces             |

**List of Item Numbers in the GALL Report  
VII.H2. Emergency Diesel Generator System**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VII.H2.1</b>        | <b>Diesel engine cooling water subsystem</b>          |
| VII.H2.1.1             | Pipe and fittings                                     |
| <b>VII.H2.2</b>        | <b>Diesel engine starting air subsystem</b>           |
| VII.H2.2.1             | Pipe and fittings                                     |
| VII.H2.2.2             | Valves (hand and check)                               |
| VII.H2.2.3             | Drain trap  |
| VII.H2.2.4             | Air accumulator vessel                                |
| <b>VII.H2.3</b>        | <b>Diesel engine combustion air intake subsystem</b>  |
| VII.H2.3.1             | Piping and fittings                                   |
| VII.H2.3.2             | Filter  |
| VII.H2.3.3             | Muffler   |
| <b>VII.H2.4</b>        | <b>Diesel engine combustion air exhaust subsystem</b> |
| VII.H2.4.1             | Piping and fittings                                   |
| VII.H2.4.2             | Muffler   |
| <b>VII.H2.5</b>        | <b>Diesel engine fuel oil subsystem</b>               |
| VII.H2.5.1             | Tanks (day and drip)                                  |

**List of Item Numbers in the GALL Report  
VII.I. Carbon Steel Components**

| Item Number in<br>GALL | Description                                  |
|------------------------|--|
| <b>VII.I.1</b>         | <b>Carbon steel components</b>               |
| VII.I.1.1              | External surfaces                            |
| <b>VII.I.2</b>         | <b>Closure bolting</b>                       |
| VII.I.2.1              | In high-pressure or high-temperature systems |

**List of Item Numbers in the GALL Report  
VIII.A. Steam Turbine System**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VIII.A.1</b>        | <b>Piping and fittings</b>   |
| VIII.A.1.1             | High-pressure (HP) turbine to moisture separator/reheater (MSR)  |
| VIII.A.1.2             | MSR to low-pressure (LP) turbine   |
| <b>VIII.A.2</b>        | <b>Valves (stop, control or governor, intermediate stop and control or combined intermediate, bypass or steam dumps, atmospheric dumps, main steam safety, or safety/relief)</b> |
| VIII.A.2.1             | Body and bonnet  |

**List of Item Numbers in the GALL Report  
VIII.B1. Main Steam System (PWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VIII.B1.1</b>       | <b>Piping and fittings</b>   |
| VIII.B1.1.1            | Steam lines from steam generator to isolation valves (Group B or C)                            |
| VIII.B1.1.2            | Steam lines from isolation valves to main turbine (Group D)                                    |
| VIII.B1.1.3            | Lines to feedwater (FW) and auxiliary feedwater (AFW) pump turbines                            |
| VIII.B1.1.4            | Lines to moisture separator/reheater (MSR)   |
| VIII.B1.1.5            | Turbine bypass   |
| VIII.B1.1.6            | Steam drains   |
| <b>VIII.B1.2</b>       | <b>Valves (check, control, hand, motor operated, safety, and containment isolation valves)</b> |
| VIII.B1.2.1            | Body and bonnet  |

**List of Item Numbers in the GALL Report  
VIII.B2. Main Steam System (BWR)**

| Item Number in<br>GALL | Description   |
|------------------------|---|
| <b>VIII.B2.1</b>       | <b>Piping and fittings</b>  |
| VIII.B2.1.1            | Steam lines to main turbine (Group B)                                   |
| VIII.B2.1.2            | Steam lines to main turbine (Group D)                                   |
| VIII.B2.1.3            | Lines to FW pump turbines   |
| VIII.B2.1.4            | Turbine bypass  |
| VIII.B2.1.5            | Steam drains  |
| VIII.B2.1.6            | Steam line to HPCI turbine  |
| VIII.B2.1.7            | Steam line to RCIC turbine  |
| <b>VIII.B2.2</b>       | <b>Valves (check, control, hand, motor-operated, and safety valves)</b> |
| VIII.B2.2.1            | Body and bonnet   |

**List of Item Numbers in the GALL Report  
VIII.C. Extraction Steam System**

| Item Number in<br>GALL | Description                |
|------------------------|----------------------------|
| <b>VIII.C.1</b>        | <b>Piping and fittings</b> |
| VIII.C.1.1             | Lines to feedwater heaters |
| VIII.C.1.2             | Steam drains               |
| <b>VIII.C.2</b>        | <b>Valves</b>              |
| VIII.C.2.1             | Body and bonnet            |

**List of Item Numbers in the GALL Report  
VIII.D1. Feedwater Systems (PWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VIII.D1.1</b>       | <b>Main feedwater line</b>   |
| VIII.D1.1.1            | Pipe and fittings (Group B, C, or D)   |
| <b>VIII.D1.2</b>       | <b>Valves (control, check, hand, safety, and containment isolation valves)</b> |
| VIII.D1.2.1            | Body and bonnet  |
| <b>VIII.D1.3</b>       | <b>Feedwater pump (steam turbine and motor driven)</b>                         |
| VIII.D1.3.1            | Casing   |
| VIII.D1.3.2            | Suction and discharge lines  |



**List of Item Numbers in the GALL Report  
VIII.D2. Feedwater Systems (BWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VIII.D2.1</b>       | <b>Main feedwater line</b>                             |
| VIII.D2.1.1            | Pipe and fittings (Group B or D)                       |
| <b>VIII.D2.2</b>       | <b>Valves (control, check, and hand valves)</b>        |
| VIII.D2.2.1            | Body and bonnet  |
| <b>VIII.D2.3</b>       | <b>Feedwater pump (steam turbine and motor driven)</b> |
| VIII.D2.3.1            | Casing   |
| VIII.D2.3.2            | Suction and discharge lines                            |

**List of Item Numbers in the GALL Report  
VIII.E. Condensate System**

| Item Number in<br>GALL | Description                                      |
|------------------------|--|
| <b>VIII.E.1</b>        | <b>Condensate lines</b>                          |
| VIII.E.1.1             | Piping and fittings                              |
| <b>VIII.E.2</b>        | <b>Valves</b>                                    |
| VIII.E.2.1             | Body and bonnet                                  |
| <b>VIII.E.3</b>        | <b>Condensate pumps (main and booster pumps)</b> |
| VIII.E.3.1             | Casing   |
| <b>VIII.E.4</b>        | <b>Condensate coolers/condensers</b>             |
| VIII.E.4.1             | Tubes  |
| VIII.E.4.2             | Tubesheet  |
| VIII.E.4.3             | Channel head                                     |
| VIII.E.4.4             | Shell  |
| <b>VIII.E.5</b>        | <b>Condensate storage</b>                        |
| VIII.E.5.1             | Tank   |
| <b>VIII.E.6</b>        | <b>Condensate cleanup system</b>                 |
| VIII.E.6.1             | Piping and fittings                              |
| VIII.E.6.2             | Demineralizer                                    |
| VIII.E.6.3             | Strainer   |

**List of Item Numbers in the GALL Report  
VIII.F. Steam Generator Blowdown System (PWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VIII.F.1</b>        | <b>Blowdown lines</b>                                  |
| VIII.F.1.1             | Pipe and fittings (Group B)                            |
| VIII.F.1.2             | Pipe and fittings (Group D)                            |
| <b>VIII.F.2</b>        | <b>Valves (including containment isolation valves)</b> |
| VIII.F.2.1             | Body and bonnet  |
| <b>VIII.F.3</b>        | <b>Blowdown pump</b>                                   |
| VIII.F.3.1             | Casing   |
| <b>VIII.F.4</b>        | <b>Blowdown heat exchanger</b>                         |
| VIII.F.4.1             | Tubes  |
| VIII.F.4.2             | Tubesheet  |
| VIII.F.4.3             | Channel head and access cover                          |
| VIII.F.4.4             | Shell and access cover                                 |

**List of Item Numbers in the GALL Report  
VIII.G. Auxiliary Feedwater (AFW) System (PWR)**

| Item Number in<br>GALL | Description  |
|------------------------|--|
| <b>VIII.G.1</b>        | <b>Auxiliary feedwater piping</b>                                      |
| VIII.G.1.1             | Pipe and fittings (above ground)                                       |
| VIII.G.1.2             | Pipe and fittings (buried)   |
| <b>VIII.G.2</b>        | <b>AFW pumps (steam turbine and motor driven)</b>                      |
| VIII.G.2.1             | Casing   |
| VIII.G.2.2             | Suction and discharge lines  |
| <b>VIII.G.3</b>        | <b>Valves (control, check, hand, and containment isolation valves)</b> |
| VIII.G.3.1             | Body and bonnet  |
| <b>VIII.G.4</b>        | <b>Condensate storage (emergency)</b>                                  |
| VIII.G.4.1             | Tank   |
| <b>VIII.G.5</b>        | <b>Bearing oil coolers (for steam turbine pump)</b>                    |
| VIII.G.5.1             | Shell  |
| VIII.G.5.2             | Tubes  |
| VIII.G.5.3             | Tubesheet  |

**List of Item Numbers in the GALL Report  
VIII.H. Carbon Steel Components**

| Item Number in<br>GALL | Description                                  |
|------------------------|--|
| <b>VIII.H.1</b>        | <b>Carbon steel components</b>               |
| VIII.H.1.1             | External surfaces                            |
| <b>VIII.H.2</b>        | <b>Closure bolting</b>                       |
| VIII.H.2.1             | In high-pressure or high-temperature systems |