

**AUDIT WORKSHEET**  
**GALL REPORT AMP**

PLANT: \_\_\_\_\_

LRA AMP: \_\_\_\_\_

REVIEWER: \_\_\_\_\_

GALL AMP: **XI.M17, Flow-Accelerated Corrosion**

DATE: \_\_\_\_\_

| Program Element     | Auditable GALL Criteria  | Documentation of Audit Finding  |
|---------------------|--|---|
| Program Description | A. The program relies on implementation of the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center (NSAC)-202L-R2 for an effective flow-accelerated corrosion (FAC) program. The program includes performing (a) an analysis to determine critical locations, (b) limited baseline inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm the predictions, or repairing or replacing components as necessary.  | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |
| 1. Scope of Program | A. The FAC program, described by the EPRI guidelines in NSAC-202L-R2, includes procedures or administrative controls to assure that the structural integrity of all carbon steel lines containing high-energy fluids (two phase as well as single phase) is maintained. Valve bodies retaining pressure in these high-energy systems are also covered by the program. The FAC program was originally outlined in NUREG-1344 and was further described through the Nuclear Regulatory Commission (NRC) Generic Letter (GL) 89-08. A program implemented in accordance with the EPRI guidelines predicts, detects, and monitors FAC in plant piping and other components, such as valve bodies, elbows and expanders. Such a program includes the following recommendations: (a) conducting an analysis to determine critical locations, (b) performing limited baseline inspections to determine the extent of thinning at these locations, and (c) performing follow-up inspections to confirm | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment  |

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|   | <p>the predictions, or repairing or replacing components as necessary. NSAC-202L-R2 (April 1999) provides general guidelines for the FAC program. To ensure that all the aging effects caused by FAC are properly managed, the program includes the use of a predictive code, such as CHECWORKS, that uses the implementation guidance of NSAC-202L-R2 to satisfy the criteria specified in 10 CFR Part 50, Appendix B, criteria for development of procedures and control of special processes.</p> |  |
| <p>2. Preventive Actions</p>              | <p>A. The FAC program is an analysis, inspection, and verification program; thus, there is no preventive action. However, it is noted that monitoring of water chemistry to control pH and dissolved oxygen content, and selection of appropriate piping material, geometry, and hydrodynamic conditions, are effective in reducing FAC.</p>   | <p>Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br/> Document(s) used to confirm Criteria:</p> <p>Comment:</p> |
| <p>3. Parameters Monitored/ Inspected</p> | <p>A. The aging management program (AMP) monitors the effects of FAC on the intended function of piping and components by measuring wall thickness.</p>  | <p>Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br/> Document(s) used to confirm Criteria:</p> <p>Comment:</p> |
| <p>4. Detection of Aging Effects</p>      | <p>A. Degradation of piping and components occurs by wall thinning. The inspection program delineated in NSAC-202L-R2 consists of identification of susceptible locations as indicated by operating conditions or special considerations. Ultrasonic and radiographic testing is used to detect wall thinning. The extent and schedule of the inspections assure detection of wall thinning before the loss of intended function.</p>  | <p>Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br/> Document(s) used to confirm Criteria:</p> <p>Comment:</p> |

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| 5. Monitoring and Trending | A. CHECWORKS or a similar predictive code is used to predict component degradation in the systems conducive to FAC, as indicated by specific plant data, including material, hydrodynamic, and operating conditions. CHECWORKS is acceptable because it provides a bounding analysis for FAC. CHECWORKS was developed and benchmarked by using data obtained from many plants. The inspection schedule developed by the licensee on the basis of the results of such a predictive code provides reasonable assurance that structural integrity will be maintained between inspections. Inspection results are evaluated to determine if additional inspections are needed to assure that the extent of wall thinning is adequately determined, assure that intended function will not be lost, and identify corrective actions. | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |
| 6. Acceptance Criteria     | A. Inspection results are input for a predictive computer code, such as CHECWORKS, to calculate the number of refueling or operating cycles remaining before the component reaches the minimum allowable wall thickness. If calculations indicate that an area will reach the minimum allowed wall thickness before the next scheduled outage, the component is to be repaired, replaced, or reevaluated.   | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |
| 7. Corrective Actions      | A. Prior to service, components for which the acceptance criteria are not satisfied are reevaluated, repaired, or replaced. Long-term corrective actions could include adjusting operating parameters or selecting materials resistant to FAC. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions.   | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |
| 8. Confirmation Process    | A. Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process and administrative controls.   | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |

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| 9. Administrative Controls | A. See Item 8, above.  | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |
| 10. Operating Experience   | A. Wall-thinning problems in single-phase systems have occurred in feedwater and condensate systems (NRC IE Bulletin No. 87-01; NRC Information Notices [INs] 81-28, 92-35, 95-11) and in two-phase piping in extraction steam lines (NRC INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (NRC INs 89-53, 91-18, 93-21, 97-84). Operating experience shows that the present program, when properly implemented, is effective in managing FAC in high-energy carbon steel piping and components. | Consistent with GALL AMP: <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Document(s) used to confirm Criteria:<br><br>Comment: |

EXCEPTIONS

| Item Number | Program Elements | LRA Exception Description | Basis for Accepting Exception | Documents Reviewed (Identifier, Para.# and/or Page #) |
|-------------|------------------|---------------------------|-------------------------------|---|
| 1.          |                  |                           |                               |   |
| 2.          |                  |                           |                               |   |
| ...         |                  |                           |                               |   |

ENHANCEMENTS

| Item Number | Program Elements | LRA Enhancement Description | Basis for Accepting Enhancement | Documents Reviewed (Identifier, Para.# and/or Page #) |
|-------------|------------------|-----------------------------|---------------------------------|---|
| 1.          |                  |                             |                                 |   |
| 2.          |                  |                             |                                 |   |
| ...         |                  |                             |                                 |   |

DOCUMENT REVIEWED DURING AUDIT

| Document Number | Identifier (number) | Title | Revision and/or Date |
|-----------------|---------------------|-------|----------------------|
| 1.              |                     |       |                      |
| 2.              |                     |       |                      |
| 3.              |                     |       |                      |
| 4.              |                     |       |                      |
| ....            |                     |       |                      |