

VERIFICATION OF VYNPS LICENSE RENEWAL PROJECT REPORT

Title of Report: Aging Management Program Evaluation Results

Report Number: LRPD-02

Revision:

This report documents evaluations related to the VYNPS license renewal project. Signatures certify that the report was prepared, checked and reviewed by the License Renewal Project Team in accordance with the VYNPS license renewal project guidelines and that it was approved by the ENI License Renewal Project Manager and the VYNPS Manager, Engineering Projects.

License Renewal Project Team signatures also certify that a review for determining potential impact to other license renewal documents, based on previous revisions, was conducted for this revision.

Other document(s) impacted by this revision:  Yes, See Attachment  No

<u>License Renewal Project Team</u>	
Prepared by William L. Nichols	Date: 5/9/06
Reviewed by Lori Ann Potts	Date: 5/9/06
Approved by David J. Lach, ENI LR Project Manager	Date: -

<u>VYNPS Approval</u>	
Reviewed by	Date: -
Approved by VYNPS Manager, Engineering Projects	Date: -

DOCKETED  
USNRC  
August 12, 2008 (11:00am)  
OFFICE OF SECRETARY  
RULEMAKINGS AND  
ADJUDICATIONS STAFF

U.S. NUCLEAR REGULATORY COMMISSION  
 In the Matter of Entergy Nuclear Vermont Yankee LLC  
 Docket No. 50-271 Official Exhibit No. NEC-UW-06  
 OFFERED by: Applicant/Licensee (Intervenor) NEI  
 NRC Staff Other \_\_\_\_\_  
 IDENTIFIED on 7/23/08 Witness/Panel with  
 Action Taken: (ADMITTED) REJECTED WITHDRAWN  
 Reporter/Clerk MAC

Flow-Accelerated Corrosion Program

4.13 Flow-Accelerated Corrosion Program

A. Program Description

The Flow-Accelerated Corrosion (FAC) Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion.

This program applies to safety-related and nonsafety-related carbon steel components carrying two-phase or single-phase high-energy fluid  $\geq 2\%$  of plant operating time.

The program, based on EPRI Report NSAC-202L-R2 recommendations for an effective flow-accelerated corrosion program, predicts, detects, and monitors FAC in plant piping and other pressure retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions, or repair or replace components as necessary.

This program is credited in the following.

- AMRM-05, High Pressure Coolant Injection System
- AMRM-06, Reactor Core Isolation Cooling and Condensate Storage and Transfer Systems
- AMRM-26, Main Condenser and MSIV Leakage Pathway System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems
- AMRM-33, Reactor Coolant System Pressure Boundary

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"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 the predictions, or repairing or replacing components as necessary. NSAC-202L-

Flow-Accelerated Corrosion Program

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."

b. Comparison to VYNPS Scope

This program applies to safety-related and nonsafety-related carbon steel components carrying two-phase or single-phase high-energy fluid  $\geq$  2% of plant operating time.

(Ref. Appendix C, PP 7028)

The program, based on the recommendations of EPRI Report, NSAG-202L-R2, predicts, detects, and monitors FAC in plant piping and other pressure retaining components. The program includes an evaluation to determine critical locations, baseline inspections to determine the extent of thinning at these locations, and follow-up inspections.

(Ref. Section 1.3, PP 7028 and FAC Susceptible Piping Identification)

CHECWORKS, a predictive code that uses the implementation guidance of NSAC-202L-R2 to satisfy the criteria specified in 10 GFR Part 50, Appendix B, is used in this program.

(Ref. Section 4.3, PP 7028)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"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 FAG."

b. Comparison to VYNPS Preventive Actions

As stated in NUREG-1801, the FAG program is an analysis, inspection, and verification program; thus, there is no preventive action.

VYNPS preventive actions are consistent with NUREG-1801.

Flow-Accelerated Corrosion Program

3. Parameters Monitored/Inspected

a. NUREG-1801! Parameters Monitored/Inspected

"The aging management program (AMP) monitors the effects of FAC on the intended function of piping and components by measuring wall thickness."

b. Comparison to YVNPS Parameters Monitored/Inspected

The YVNPS program monitors wall thickness to ensure that FAC does not lead to loss of intended function of piping and components.  
(Ref. Section 1.1, PP 7028)

YVNPS parameters monitored and inspected are consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801! Detection of Aging Effects

"Degradation of piping and components occurs by wall thinning. The inspection program delineated in NSAC-202L 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."

b. Comparison to YVNPS Detection of Aging Effects

Non-destructive examinations (e.g. ultrasonic testing) are used to detect wall thinning at susceptible locations. The extent and schedule of inspections provide reasonable assurance of detection of wall thinning before loss of intended function.  
(Ref. Sections 1.2, 1.3 and 4.4.5, PP 7028)

This program is credited with managing the following aging effects.

- loss of material from internal surfaces of selected carbon steel components (AMRM-05, 06, 26, 30, 33)

YVNPS detection of aging effects is consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801! Monitoring and Trending

"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.

Flow-Accelerated Corrosion Program

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."

b. Comparison to VYNPS Monitoring and Trending

The EPRI software program, "CHECWORKS," is used to predict component degradation in FAC susceptible piping. The inspection schedule provides reasonable assurance that structural integrity will be maintained between inspections. If degradation is detected such that the predicted wall thickness at the next refueling outage is less than minimum allowable thickness, (or much less than the nominal thickness), additional evaluations or examinations are performed to assure the component's intended function will not be lost and identify corrective actions.

*(Ref. Sections 1.2, 4.3 and Appendix E, PP 7028 and Section 3, DP 0072)*

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Inspection results are used as input to 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."

b. Comparison to VYNPS Acceptance Criteria

Based on inspection results, CHECWORKS calculates the number of refueling or operating cycles remaining before the component reaches minimum allowable wall thickness. If calculations indicate that an area will reach minimum allowed thickness before the next scheduled outage, the component is repaired, replaced, or reevaluated.

*(Ref. Section 4.4, PP 7028 and Section 3, DP 0072)*

VYNPS acceptance criteria are consistent with NUREG-1801.

Flow-Accelerated Corrosion Program

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"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."

b. Comparison to VYNPS Corrective Actions

If acceptance criteria are not satisfied for particular components, they are repaired, replaced or reevaluated prior to returning to service. Use of improved materials for replaced components and appropriate design changes are part of the VYNPS long-term strategy to mitigate FAC.  
(*Ref. Sections 1.3 and 4.4, PP 7028 and Section 3, DP.0072*)

VYNPS corrective actions are consistent with those discussed in NUREG-1801.

8. Confirmation Process

This attribute is discussed in Section 2.0, Background.

9. Administrative Controls

This attribute is discussed in Section 2.0, Background.

10. Operating Experience

a. NUREG-1801, Operating Experience

"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."

b. Comparison to VYNPS Operating Experience

Operating experience shows that this program has been effective in managing aging effects. Therefore, continued implementation of the program provides reasonable assurance that effects of aging will be managed so that components crediting this program can perform their intended function

**Flow-Accelerated Corrosion Program**

consistent with the current licensing basis during the period of extended operation. For more information on applicable operating experience, see VYNPS Report LRPD-05, Operating Experience Review Results.

**C. References**

DP 0072, Rev. 00, LPC 01, Structural Evaluation of Thinned Wall Piping Components

FAC Susceptible Piping Identification, Rev. 0, May 15, 2000

PP 7028, Rev. 00, LPC 01, Piping Flow Accelerated Corrosion Inspection Program

**D. Summary**

The Flow-Accelerated Corrosion Program has been effective at managing aging effects. The program has been improved through implementation of lessons learned from operating experience. The Flow-Accelerated Corrosion Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The Flow-Accelerated Corrosion Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion.