VERIFICATION OF VYNPS LICENSE RENEWAL PROJECT REPORT

Title of Report: **Aging Management Program Evaluation Results**

Report Number: **LRPD-02**

Revision: 2

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 X No

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REVISION DESCRIPTION SHEET

Revision Number	Description	Pages and/or Sections Revised and Description
2	Changes to address NRC aging management program audit items.	1. Section 3.2.A – elaborated on discussion of type of test to be performed. (Audit item 118) 2. Section 3.2.A – indicated that medium-voltage cables have voltage levels from 2 kV to 35 kV. (Audit item 120) 3. Section 3.4.B.1.b – clarified scope of program. (Audit item 124) 4. Section 3.3.B.3.b – clarified parameters monitored for this program. (Audit item 143) 5. Section 3.3.B.6.b – clarified acceptance criteria for this program. (Audit item 144) 6. Sections 4.21.1.B.1.b, 3.b, 4.b, 5.b, 6.b, and 4.21.1.C – added reference to the maintenance rule crane inspection program, OP 5240. (Audit item 81)
1	Update reference revisions and resolve QA surveillance issues (CR-VTY-06-00756).	a) various sections revised to show new reference revision numbers and delete procedure DP 4027, which has been cancelled. b) Sections 3.7.B.7.b, 4.2.B.7.b, 4.3.B.7.b, and 4.18.B.7.b revised to delete reference to IWB-4000 and IWB-7000. These sections of ASME XI were deleted in the 1994 Addenda. c) Deleted "to confirm that coating and wrapping are intact" from end of first sentence in Section 4.1.B.4.b since guidance on parameters monitored in contained in Section 4.1.B.3.b. d) Added exception and related references to Section 4.8.B.6.b because new revision of PP 7006 states that main steam pathway leakage contributions

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		(leakage through all four main steam lines and the main steam drain line) are excluded from the overall integrated leakage rate Type A test measurement and from the sum of the leakage rates from Type B and Type C tests. e) Deleted reference to OP 4221 from Section 4.12.1 because it relates only to Cardox and Halon systems, which are not managed by this program for license renewal. f) Section 4.14.2.A, added that Subarticle IWA-4540 of the 2003 Addenda of the 2001 Edition of ASME Section XI has also been adopted, as stated in Section 1.3 of the new revision of PP 7024. g) Revised 4.18.B.6.b because PP 7015 does not quote the exact articles of the code that are used for acceptance criteria. h) Deleted references M107, M108, ME022, ME023, NE 8064, and OP 4124 from Section 4.20 and Section 6 because they were not used. i) Deleted references PP 7030 and NRC IEB 80-11 from Section 4.21.2.C since they are not referenced. j) Added an enhancement to Section 4.22.B.1.b because EN-DC-178 does not define "assigned systems." k) Attachment 3, AMRC-02 credited activities – Deleted "Note 1" which required enhancement for procedure OP 5230, refueling platform equipment assembly carbon steel components to ensure no significant wear or corrosion. The new revision of OP 5230 (Precautions/Limitations step 8) ensures no significant wear or

		corrosion.

TABLE OF CONTENTS

1.0 Introduction 5

2.0 Background 9

3.0 New Programs or Activities Credited in the AMRRs 12

- 3.1 Heat Exchanger Monitoring Program 12
- 3.2 Non-EQ Inaccessible Medium-Voltage Cable Program 15
- 3.3 Non-EQ Instrumentation Circuits Test Review Program 20
- 3.4 Non-EQ Insulated Cables and Connections Program 26
- 3.5 One-Time Inspection Program 31
- 3.6 Selective Leaching Program 39
- 3.7 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program 44

4.0 Existing Programs or Activities Credited in the AMRRs 51

- 4.1 Buried Piping Inspection Program 51
- 4.2 BWR CRD Return Line Nozzle Program 57
- 4.3 BWR Feedwater Nozzle Program 64
- 4.4 BWR Penetrations Program 70
- 4.5 BWR Stress Corrosion Cracking Program 78
- 4.6 BWR Vessel ID Attachment Welds Program 86
- 4.7 BWR Vessel Internals Program 93
- 4.8 Containment Leak Rate Program 107
- 4.9 Diesel Fuel Monitoring Program 113
- 4.10 Environmental Qualification (EQ) of Electric Components Program 120
- 4.11 Fatigue Monitoring Program 126
- 4.12 Fire Protection Programs 133
  - 4.12.1 Fire Protection Program 133
  - 4.12.2 Fire Water System Program 143
- 4.13 Flow-Accelerated Corrosion Program 152
- 4.14 Inservice Inspection Programs 158
  - 4.14.1 Inservice Inspection (ISI) Program 159
  - 4.14.2 Containment Inservice Inspection (CII) Program 163
- 4.15 Instrument Air Quality Program 166
- 4.16 Oil Analysis Program 169
- 4.17 Periodic Surveillance and Preventive Maintenance Program 175
- 4.18 Reactor Head Closure Studs Program 180
- 4.19 Reactor Vessel Surveillance Program 186

4.20 Service Water Integrity Program 191
4.21 Structures Monitoring Programs 198
4.21.1 Structures Monitoring Program 198
4.21.2 Masonry Wall Program 206
4.21.3 Vernon Dam FERC Inspection 211
4.22 System Walkdown Program 212
4.23 Water Chemistry Control Programs 220
4.23.1 Water Chemistry Control – Auxiliary Systems Program 220
4.23.2 Water Chemistry Control – BWR Program 224
4.23.3 Water Chemistry Control – Closed Cooling Water Program 231
5.0 Summary and Conclusions 238
6.0 References 240
Attachment 1 – Proposed Changes to Implementing Procedures 247
Attachment 2 – One-Time Inspection Activities 256
Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities 259
Attachment 4 – Structures Monitoring Program General Criteria 268
Attachment 5 - VYNPS Response to BWRVIP Applicant Action Items 269

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1.0 Introduction

This report is part of the integrated plant assessment performed to extend the operating license of Vermont Yankee Nuclear Power Station (VYNPS). The purpose of this report is to identify and review programs credited in the VYNPS license renewal evaluations. For additional information on the license renewal project overall scope and documentation hierarchy, refer to LRPG-01, License Renewal Project Plan.

This report identifies programs credited in VYNPS license renewal aging management review reports (AMRRs) and demonstrates that the programs are adequate to support license renewal of VYNPS. The report documents that the programs address applicable key elements (the "ten attributes") identified in the NRC standard review plan for license renewal applications (NUREG-1800). Program adequacy is described in the format of the ten attributes and, when applicable, by comparing the VYNPS program to the program description in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report.*

In this report, individual programs are described in general terms, a road map is provided to program procedures and controlling documentation, and program elements required to support the VYNPS license renewal are described. Actual operating experience is provided as objective evidence of the effectiveness of existing programs to support license renewal. This is consistent with guidelines of the NRC standard review plan for license renewal applications.

Some VYNPS programs were found adequate to support aging management for license renewal. Other programs require modifications to support license renewal. In some cases, new programs will be developed to manage certain aging effects identified during aging management reviews.

Section 2.0 of this report provides a description of the aging management program evaluation process, including background information. Section 3.0 and 4.0 document program reviews. Section 3.0 addresses new programs or activities that will need to be developed to manage aging effects during the license renewal term. Section 4.0 addresses existing programs or activities that are credited for managing aging effects during the license renewal term. Section 4.0 also describes appropriate modifications to existing programs that are necessary to support license renewal. Each program description includes a statement that the program is consistent with NUREG-1801, takes exception to parts of the program description in NUREG-1801, or is a plant-specific program not addressed in NUREG-1801.

Included in Section 4.0 are two TLAA support activities. The Environmental Qualification of Electric Components Program is credited for managing the effects of aging on electrical and I&C components within the scope of 10 CFR 50.49. The Fatigue Monitoring Program is credited for confirming that reactor coolant system design cycle assumptions remain valid.

Section 5.0 gives the summary and conclusions of the report.

Attachment 1 lists proposed changes to implementing procedures.

As a part of the license renewal project, the VYNPS Updated Final Safety Analysis Report (UFSAR) will be supplemented by a description of aging management programs and activities credited for license renewal. The UFSAR descriptions, in conjunction with the commitment tracking database, will ensure these programs are implemented such that structure and component intended functions can be maintained in accordance with the current licensing basis (CLB) during the period of extended operation.

2.0 Background

The Code of Federal Regulations 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," governs the issuance of renewed operating licenses for nuclear power plants. Included in 10 CFR Part 54 is the requirement for an integrated plant assessment (10CFR54.21). The integrated plant assessment must

- identify structures and components subject to an aging management review for those systems, structures, and components within scope (the only concern is with long-lived passive structures and components);
- describe and justify the methods used in identification; and
- for each structure and component identified, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) for the period of extended operation.

This report evaluates the VYNPS aging management programs to ensure that they are able to adequately manage various aging effects.

The VYNPS aging management programs are compared to aging management programs described in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report.* For each program in Sections 3 and 4 that has a corresponding NUREG-1801 program, program attributes are compared to their corresponding NUREG-1801 program attributes. Inconsistencies are identified and evaluated. Programs that do not have a corresponding NUREG-1801 program are described in terms of the ten attributes defined in NUREG-1800.

Aging management programs are described in terms of ten elements or attributes. These ten attributes are discussed in NUREG-1800, Appendix A, Table A.1-1. Additional information may be found in NEI 95-10, Sections 4.2.1.2 and 4.3.

The ten attributes are

- Scope
- Preventive Actions
- Parameters Monitored or Inspected
- Detection of Aging Effects
- Monitoring and Trending
- Acceptance Criteria
- Corrective Actions
- Confirmation Process
- Administrative Controls
- Operating Experience

VYNPS Corrective Actions, Confirmation Process, and Administrative Controls

Three attributes common to all aging management programs described in this report are corrective actions, confirmation process and administrative controls. Discussion of these

attributes is presented below. Corrective actions have program-specific details which are included in the descriptions of the individual programs in this report, but further discussion of the confirmation process and administrative controls is not necessary and is not included in descriptions of the individual programs.

Evaluation of Corrective Actions

a. NUREG-1801, Corrective Actions (Volume 2 Appendix, 1st bullet)

"Criterion XVI of 10 CFR Part 50, Appendix B, requires that measures be established to ensure that conditions adverse to quality, such as failures, malfunctions, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, measures must be implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude repetition. In addition, the root cause of the significant condition adverse to quality and the corrective action implemented must be documented and reported to appropriate levels of management."

b. Comparison to VYNPS Corrective Actions

Conditions adverse to quality; such as failures, malfunctions, deviations, defective material and equipment, and nonconformances; are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude recurrence. In addition, the root cause of the significant condition adverse to quality and the corrective action implemented is documented and reported to appropriate levels of management.

Evaluation of Confirmation Process

a. NUREG-1801, Confirmation Process (Volume 2 Appendix A, 2nd bullet)

"Because Criterion XVI of 10 CFR Part 50, Appendix B, requires that measures be taken to preclude repetition of significant conditions adverse to quality, follow-up actions must be taken to verify effective implementation of the proposed corrective action. This verification comprises the confirmation process element for aging management programs for license renewal. For example, in managing internal corrosion of piping, a mitigation program (water chemistry) may be used to minimize susceptibility to corrosion. However, it may also be necessary to have a condition monitoring program (ultrasonic inspection) to verify that corrosion is indeed insignificant. When corrective actions are necessary for significant conditions, follow-up activities are to confirm that the corrective actions implemented are effective in preventing recurrence."

b. Comparison to VYNPS Confirmation Process

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. The VYNPS Quality Assurance Program applies to

safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety-related structures and components are accomplished per the existing VYNPS corrective action program and the VYNPS document control program.

The confirmation process is part of the corrective action program and includes

- reviews to assure that proposed actions are adequate,
- tracking and reporting of open corrective actions, and
- review of corrective action effectiveness.

Any follow-up inspection required by the confirmation process is documented in accordance with the corrective action program. The corrective action program constitutes the confirmation process for the VYNPS aging management programs and activities. The VYNPS confirmation process is consistent with NUREG-1801.

Evaluation of Administrative Controls

a. NUREG-1801, Administrative Controls (Appendix A, 3rd bullet)

"Administrative controls are the provisions associated with organization and management, policies, orders, instructions, procedures, record keeping, and designations of authority and responsibility that are necessary to ensure operation of the facility in a safe manner. 10 CFR 50.34(b)(6)(ii) and 10 CFR 50.36(c)(5) require that nuclear power plant license applicants include in the final safety analysis report information on the managerial and administrative controls to be used to ensure safe operation. 10 CFR 50.34(b)(6)(ii) and 10 CFR 50.36(c)(5) also stipulate that Appendix B to 10 CFR Part 50 sets forth the requirements for these managerial and administrative controls. Accordingly, programs consistent with the requirements of 10 CFR Part 50, Appendix B, also satisfy the administrative controls element necessary for aging management programs (AMPs) for license renewal."

b. Comparison to VYNPS Administrative Controls

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. The VYNPS Quality Assurance Program applies to safety-related structures and components. Administrative (document) control for both safety-related and nonsafety-related structures and components is accomplished per the existing VYNPS document control program. The VYNPS administrative controls are consistent with NUREG-1801.

Heat Exchanger Monitoring Program

3.0 New Programs or Activities Credited in the AMRRs

3.1 Heat Exchanger Monitoring Program

A. Program Description

There is no corresponding NUREG-1801 program.

The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation. If degradation is found, then an evaluation will be performed to evaluate its effects on the heat exchanger's design functions including its ability to withstand a seismic event.

Representative tubes within the sample population of heat exchangers will be eddy current tested at a frequency determined by internal and external operating experience to ensure that effects of aging are identified prior to loss of intended function. Along with each eddy current test, visual inspections will be performed on accessible heat exchanger heads, covers and tube sheets to monitor surface condition for indications of loss of material. The sample population of heat exchangers includes the HPCI gland seal condenser, HPCI lube oil cooler, RCIC lube oil cooler, CST steam reheat coil, drywell atmospheric cooling units (RRU-1, 2, 3 & 4), reactor recirculation pump seal water coolers, reactor recirculation pump motor upper and lower bearing oil coolers, and reactor recirculation pump motor air coolers.

This program will be initiated prior to the period of extended operation.

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-12, Reactor Building Closed Cooling Water System

B. Evaluation

1. Scope of Program

The Heat Exchanger Monitoring Program will manage aging effects on selected heat exchangers in various systems as identified in aging management reviews.

2. Preventive Actions

This is an inspection program and no actions are taken as part of this program to prevent degradation.

Heat Exchanger Monitoring Program

3. Parameters Monitored/Inspected

Where practical, eddy current inspections of shell-and-tube heat exchanger tubes may be performed to determine tube wall thickness. Visual inspections will be performed on heat exchanger heads, covers and tube sheets where accessible to monitor surface condition for indications of loss of material.

4. Detection of Aging Effects

Loss of material is the aging effect managed by this program. Representative tubes within the sample population of heat exchangers will be eddy current tested at a frequency determined by internal and external operating experience to ensure that effects of aging are identified prior to loss of intended function. Visual inspections of accessible heat exchangers will be performed on the same frequency as eddy current inspections.

An appropriate sample population of heat exchangers will be determined based on operating experience prior to inspections. Inspection can reveal loss of material that could result in degradation of the heat exchangers. Fouling is not addressed by this program.

This program is credited with managing the following aging effects.

- loss of material for HPCI gland seal condenser (E-18-1A) and HPCI lube oil cooler (E-19-1A) (AMRM-05)
- loss of material and cracking for RCIC lube oil cooler (E-21-1A) and CST aluminum steam reheat coil (E-HB-1) (AMRM-06)
- loss of material for drywell atmospheric cooling units (RRU-1, 2, 3 & 4) (AMRM-12)
- loss of material for drywell equipment drain cooler (E-ESC-1A) (AMRM-12)
- loss of material for reactor recirculation pump seal water coolers (P-18-1A HX-3 and P-18-1B HX-3) (AMRM-12)
- loss of material for reactor recirculation pump motor upper and lower bearing oil coolers (P-18-1A HX-2 and P-18-1B HX-2) (AMRM-12)
- loss of material for reactor recirculation pump motor air coolers (P-18-1A HX-1 and P-18-1B HX-1) (AMRM-12)

5. Monitoring and Trending

Results will be evaluated against established acceptance criteria and an assessment will be made regarding the applicable degradation mechanism, degradation rate and allowable degradation level. This information will be used to develop future inspection scope and to modify inspection frequency, if appropriate. Wall thickness will be trended and projected to the next inspection. Corrective actions will be taken if projections indicate that the acceptance criteria may not be met at the next inspection.

6. **Acceptance Criteria**

   The minimum acceptable tube wall thickness for each heat exchanger to be eddy current inspected will be established based upon a component-specific engineering evaluation. Wall thickness will be acceptable if greater than the minimum wall thickness for the component.

   The acceptance criterion for visual inspections of heat exchanger heads, covers and tubesheets will be no evidence of degradation that could lead to loss of function. If degradation that could lead to loss of intended function is detected, a condition report will be written and the issue resolved in accordance with the site corrective action program.

7. **Corrective Actions**

   This program will be administered under the site QA program which meets requirements of 10 CFR Part 50, Appendix B.

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**

    The Heat Exchanger Monitoring Program at VYNPS is a new program for which there is no operating experience.

C. References

None

D. Summary

The Heat Exchanger Monitoring Program will be effective for managing aging effects since it will incorporate proven monitoring techniques and conservative acceptance criteria. The Heat Exchanger Monitoring Program will provide 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.

3.2 Non-EQ Inaccessible Medium-Voltage Cable Program

A. Program Description

The Non-EQ Inaccessible Medium-Voltage Cable Program at VYNPS will be comparable to the program described in NUREG-1801, Section XI.E3, Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

In this aging management program, periodic actions will be taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In scope medium-voltage cables (2 kV to 35 kV) exposed to significant moisture and voltage will be tested to provide an indication of the condition of the conductor insulation. The specific test performed will be determined prior to the initial test and will be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, parital discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed.

The program will be initiated prior to the period of extended operation.

This program is credited in the following.

- AMRE-01, Electrical Screening and Aging Management Reviews

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"This program applies to inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with significant voltage. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The moisture and voltage exposures described as significant in these definitions, which are based on operating experience and engineering judgment, are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization is not significant for submarine cables)."

b. Comparison to VYNPS Scope

This program will include inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with applied voltage.

VYNPS scope will be consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Periodic actions are taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes, and draining water, as needed."

b. Comparison to VYNPS Preventive Actions

This program at VYNPS will take periodic actions to prevent cables from being exposed to significant moisture by inspecting for water collection in cable manholes and conduit, and draining water, as needed.

VYNPS preventive actions will be consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed."

b. Comparison to VYNPS Parameters Monitored/Inspected

In scope medium-voltage cables that are exposed to significant moisture and significant voltage will be tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Medium-voltage cables exposed to significant moisture and significant voltage that are within the scope of this program are tested at least once every 10 years. This is an adequate period to preclude failures of the conductor insulation since experience has shown that aging degradation is a slow process. A 10 year testing interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. The first tests for license renewal are to be completed before the period of extended operation.

The inspection for water collection should be performed based on actual plant experience with water accumulation in the manhole. However, the inspection frequency should be at least once every two years. The first inspection for license renewal is to be completed before the period of extended operation."

b. Comparison to VYNPS Detection of Aging Effects

Testing will be performed at least once every 10 years, with the first tests for license renewal occurring before the period of extended operation.

Inspections for water collection in manholes and conduit will occur at least once every two years, with the first inspection for license renewal occurring before the period of extended operation.

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Trending actions are not included as part of this program because the ability to trend test results is dependent on the specific type of test chosen. However, results that are trendable provide additional information on the rate of degradation."

b. Comparison to VYNPS Monitoring and Trending

Trending is not planned as part of this program since the ability to trend test results will depend on the specific type of test chosen.

VYNPS monitoring and trending will be consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"The acceptance criteria for each test is defined by the specific type of test performed and the specific cable tested."

b. Comparison to VYNPS Acceptance Criteria

The acceptance criteria for each test will be defined by the type of test performed and the specific cable tested.

VYNPS acceptance criteria will be consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"An engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cables can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and the likelihood of recurrence. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other inaccessible, in-scope, medium-voltage cables. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions."

b. Comparison to VYNPS Corrective Actions

An engineering evaluation will be performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cables can be maintained consistent with the current licensing basis. When an unacceptable condition or situation is identified, the requirements of 10 CFR Part 50, Appendix B, will be used to address corrective actions.

VYNPS corrective actions will be consistent with 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

"Operating experience has shown that cross linked polyethylene (XLPE) or high molecular weight polyethylene (HMWPE) insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Water treeing is much less prevalent in 4 kV cables than those operated at 13 or 33 kV. Also, minimizing exposure to moisture minimizes the potential for the development of water treeing. As additional operating experience is obtained, lessons learned can be used to adjust the program, as needed."

b. Comparison to VYNPS Operating Experience

The Non-EQ Inaccessible Medium-Voltage Cable Program at VYNPS is a new program for which there is no operating experience.

C. References

None

D. Summary

The Non-EQ Inaccessible Medium-Voltage Cable Program will be effective for managing aging effects since it will incorporate appropriate monitoring techniques. The Non-EQ Inaccessible Medium-Voltage Cable Program will provide reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The program attributes of the Non-EQ Inaccessible Medium-Voltage Cable Program at VYNPS will be consistent with the program attributes described in NUREG-1801, Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements.

3.3 Non-EQ Instrumentation Circuits Test Review Program

A. Program Description

The Non-EQ Instrumentation Circuits Test Review Program at VYNPS will be comparable to the program described in NUREG-1801, Section XI.E2, Electrical Cables and Connections Not Subject to 10CFR50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

The Non-EQ Instrumentation Circuits Test Review Program will provide reasonable assurance that the intended functions of instrument cables exposed to adverse localized equipment environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service environment for the cable. This program will consider the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

The program will be initiated prior to the period of extended operation.

This program is credited in the following.

- AMRE-01, Electrical Screening and Aging Management Reviews

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"This program applies to electrical cables and connections (cable system) used in circuits with sensitive, high voltage, low-level signals such as radiation monitoring and nuclear instrumentation that are subject to aging management review."

b. Comparison to VYNPS Scope

This program will include Non-EQ electrical cables used in circuits with sensitive, high voltage, low-level signals; i.e., neutron flux monitoring instrumentation.

VYNPS scope will be consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"No actions are taken as part of this program to prevent or mitigate aging degradation."

b. Comparison to VYNPS Preventive Actions

The program will be an inspection program without preventive actions.

VYNPS preventive actions will be consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The parameters monitored are determined from the specific calibration, surveillances or testing performed and are based on the specific instrumentation circuit under surveillance or being calibrated, as documented in plant procedures."

b. Comparison to VYNPS Parameters Monitored/Inspected

Results from the calibrations or surveillances of components within the scope of license renewal will be reviewed. The parameters monitored will be determined from the specific calibration, surveillance, or testing performed and will be based on the specific instrumentation circuit under surveillance or being calibrated, as documented in plant procedures.

Cable testing is performed, using plant procedures, on cables in the scope of the program that are disconnected during instrument calibration. The parameter for cable testing will be determined from plant procedures.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Review of calibration results or findings of surveillance programs can provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance. By reviewing the results obtained during normal calibration or surveillances, an applicant may detect severe aging degradation prior to the loss of the cable and connection intended function. The first reviews will be completed before the period of extended operation and at least every ten years thereafter. All calibration or

surveillance results that fail to meet acceptance criteria will be reviewed for aging effects when the results are available."

In cases where a calibration or surveillance program does not include the cabling system in the testing circuit, or as an alternative to the review of calibration results described above, the applicant will perform cable system testing. A proven cable system test for detecting deterioration of the insulation system (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable insulation condition as justified in the application) will be performed. The test frequency of these cables shall be determined by the applicant based on engineering evaluation, but the test frequency shall be at least once every ten years. The first test shall be completed before the period of extended operation.

b. Comparison to VYNPS Detection of Aging Effects

This program will detect aging effects for high voltage, low-level signals sensitive to IR losses caused by exposure to heat and radiation by reviewing calibration or surveillance results for the components within the program. The first reviews for license renewal will be completed before the period of extended operation and subsequent reviews will occur every 10 years thereafter. Calibrations or surveillances that fail to meet acceptance criteria will be reviewed at the time of the calibration or surveillance.

Cable system testing will be performed on the neutron monitoring system cables that are disconnected during instrument calibrations. The first test, using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests, or time domain reflectometry tests), shall be completed before the period of extended operation and subsequent tests will occur at least every 10 years.

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Trending actions are not included as part of this program because the ability to trend test results is dependent on the specific type of test chosen. However, test results that are trendable provide additional information on the rate of degradation."

b. Comparison to VYNPS Monitoring and Trending

Trending actions are not included as part of the VYNPS program.

VYNPS monitoring and trending will be consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Calibration results or findings of surveillance and cable system testing results are to be within the acceptance criteria, as set out in procedures."

b. Comparison to VYNPS Acceptance Criteria

Calibration results or findings of surveillances and cable system testing will be within the acceptance criteria in plant procedures.

VYNPS acceptance criteria will be consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Corrective actions such as recalibration and circuit trouble-shooting are implemented when calibration or surveillance results or findings of surveillances do not meet the acceptance criteria. An engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cable system can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and likelihood of recurrence. 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

Corrective actions such as recalibration and circuit trouble-shooting are implemented when calibration or surveillance results or findings of surveillances do not meet the acceptance criteria. An engineering evaluation will be performed when the test acceptance criteria are not met in order to ensure that he intended functions of the electrical cables can be maintained consistent with the current licensing basis. When an unacceptable condition or situation is identified, the requirements of 10 CFR Part 50 Appendix B, will be used to address corrective actions.

VYNPS corrective actions will be consistent with 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

"Operating experience has identified a case where a change in temperature across a high range radiation monitor cable in containment resulted in substantial change in the reading of the monitor. Changes in instrument calibration can be caused by degradation of the circuit cable and are a possible indication of electrical cable degradation.

The vast majority of site specific and industry wide operating experience regarding neutron flux instrumentation circuits is related to cable/connector issues inside of containment near the reactor vessel."

b. Comparison to VYNPS Operating Experience

The Non-EQ Instrumentation Circuits Test Review Program at VYNPS is a new program for which there is no operating experience. Industry and plant-specific operating experience will be considered in the development of this program, and future operating experience will be appropriately incorporated into the program.

C. References

EPRI TR-109619, Guideline for the Management of Adverse Localized Equipment Environments, Electric Power Research Institute, Palo Alto, CA, June 1999

IEEE Std. P1205-2000, IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations

NUREG/CR-5643, Insights Gained From Aging Research, U. S. Nuclear Regulatory Commission, March 1992

SAND96-0344, Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations, prepared by Sandia National Laboratories for the U.S. Department of Energy, September 1996

D. Summary

The Non-EQ Instrumentation Circuits Test Review Program will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. Implementation of the Non-EQ Instrumentation Circuits Test Review Program will provide reasonable assurance that the effects of aging will be managed so that the components within the scope of this program will perform their intended

Non-EQ Instrumentation Circuits Test Review Program

functions consistent with the current licensing basis for the period of extended operation.

The Non-EQ Instrumentation Circuits Test Review Program at VYNPS will be initiated prior to the period of extended operation. The program will be consistent with NUREG-1801, Section XI.E2, Electrical Cables and Connections Not Subject to 10CFR50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

3.4 Non-EQ Insulated Cables and Connections Program

A. Program Description

The Non-EQ Insulated Cables and Connections Program at VYNPS will be comparable to the program described in NUREG-1801, Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

The Non-EQ Insulated Cables and Connections Program will provide reasonable assurance that intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service condition for the insulated cable or connection.

A representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The technical basis for sampling will be determined using EPRI document TR-109619, Guideline for the Management of Adverse Localized Equipment Environments.

The program will be initiated prior to the period of extended operation.

This program is credited in the following.

- AMRE-01, Electrical Screening and Aging Management Reviews

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"This inspection program applies to accessible electrical cables and connections within the scope of license renewal that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen."

b. Comparison to VYNPS Scope

This program will include accessible (e.g. able to be approached and viewed easily) insulated cables and connections within the scope of license renewal that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen.

VYNPS scope will be consistent with NUREG-1801.

Non-EQ Insulated Cables and Connections Program

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"This is an inspection program and no actions are taken as part of this program to prevent or mitigate aging degradation."

b. Comparison to VYNPS Preventive Actions

The program will be an inspection program without preventive actions.

VYNPS preventive actions will be consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"A representative sample of accessible electrical cables and connections installed in adverse localized environments are visually inspected for cable and connection jacket surface anomalies. Technical basis for the sample selected is to be provided."

b. Comparison to VYNPS Parameters Monitored/Inspected

A representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The technical basis for sampling will be determined using EPRI document TR-109619, Guideline for the Management of Adverse Localized Equipment Environments.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Conductor insulation aging degradation from heat, radiation, or moisture in the presence of oxygen causes cable and connection jacket surface anomalies. A representative sample of accessible electrical cables and connections installed in adverse localized environments are visually inspected for cable and connection jacket surface anomalies, such as embrittlement, discoloration, cracking, or surface contamination. Accessible electrical cables and connections installed in adverse localized environments are visually inspected at least once every 10 years. This is an adequate period to preclude failures of the conductor insulation since experience has shown that aging degradation is a slow process. A 10-year inspection frequency will provide two data points during a 20-year period, which can be

used to characterize the degradation rate. The first inspection for license renewal is to be completed before the period of extended operation."

b. Comparison to VYNPS Detection of Aging Effects

This program will detect aging effects for accessible insulated cables and connections caused by heat, radiation and moisture prior to loss of intended function. A representative sample of accessible insulated electrical cables and connections in adverse localized environments will be visually inspected for cable and connection jacket surface anomalies, such as embrittlement, discoloration, cracking, or surface contamination at least once every 10 years. The first inspection will be performed before the period of extended operation. EPRI TR-109619, Guideline for the Management of Adverse Localized Equipment Environments, will be used as guidance in performing the inspections.

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Trending actions are not included as part of this program because the ability to trend inspection results is limited. However, trending would provide additional information on the rate of degradation."

b. Comparison to VYNPS Monitoring and Trending

Trending actions will not be a part of this program.

VYNPS monitoring and trending will be consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"The accessible cables and connections are to be free from unacceptable, visual indications of surface anomalies, which suggest that conductor insulation or connection degradation exists. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function."

b. Comparison to VYNPS Acceptance Criteria

No visual indications of unacceptable cable and connection jacket surface anomalies, which suggest that conductor insulation degradation exists.

VYNPS acceptance criteria will be consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"All unacceptable visual indications of cable and connection jacket surface anomalies are subject to an engineering evaluation. Such an evaluation is to consider the age and operating environment of the component, as well as the severity of the anomaly and whether such an anomaly has previously been correlated to degradation of conductor insulation or connections. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, or relocation or replacement of the affected cable or connection. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions."

b. Comparison to VYNPS Corrective Actions

Further investigation will be performed through the corrective action program on insulated electrical cables and connections when acceptance criteria are not met in order to ensure that the intended functions will be maintained consistent with the current licensing basis. When an adverse localized equipment environment is identified for a cable or connection, a determination will be made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, relocation or replacement of the affected cable or connection.

VYNPS corrective actions will be consistent with 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

"Operating experience has shown that adverse localized environments caused by heat or radiation for electrical cables and connections may exist next to or above (within three feet of) steam generators, pressurizers or hot process pipes, such as feedwater lines. These adverse localized environments have been found to cause degradation of the insulating

materials on electrical cables and connections that is visually observable, such as color changes or surface cracking. These visual indications can be used as indicators of degradation."

b. Comparison to VYNPS Operating Experience

The Non-EQ Insulated Cables and Connections Program at VYNPS is a new program for which there is no operating experience.

C. References

None

D. Summary

The Non-EQ Insulated Cables and Connections Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Insulated Cables and Connections Program will provide 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 Non-EQ Insulated Cables and Connections Program at VYNPS will be consistent with the program described in NUREG-1801, Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

3.5 One-Time Inspection Program

A. Program Description

The One-Time Inspection Program at VYNPS is a new program that will be implemented prior to the period of extended operation. The program will be comparable to the program described in NUREG-1801, Section XI.M32, One-Time Inspection. The one-time inspection activity for small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary, will also be comparable to the program described in NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class I Small-Bore Piping. The VYNPS program will be consistent with the program elements described in NUREG-1801.

The program will include measures to verify effectiveness of an aging management program (AMP) and confirm the absence of an aging effect. For example, for structures and components that rely on an AMP, this program will verify effectiveness of the AMP by confirming that unacceptable degradation is not occurring and the intended function of a component will be maintained during the extended period of operation. One-time inspections may be needed to address concerns for potentially long incubation periods for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly. For these cases, there will be confirmation that either the aging effect is indeed not occurring, or the aging effect is occurring very slowly as not to affect the component or structure intended function. A one-time inspection of the subject component or structure is appropriate for this verification. One-time inspections provide additional assurance that either aging is not occurring or aging is so insignificant that an aging management program is not warranted.

The elements of the program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any aging degradation.

When evidence of an aging effect is revealed by a one-time inspection, routine evaluation of the inspection results will identify appropriate corrective actions.

The inspection will be performed within the 10 years prior to the period of extended operation.

This program is credited in the following.

- AMRM-07, Standby Gas Treatment System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

- AMRM- 33, Reactor Coolant System

B. Evaluation

1. Scope of Program

a. NUREG-1801, XI.M32 Scope

"The program includes measures to verify that unacceptable degradation is not occurring, thereby validating the effectiveness of existing AMPs or confirming that there is no need to manage aging-related degradation for the period of extended operation. The structures and components for which one-time inspection is specified to verify the effectiveness of the AMPs (e.g., water chemistry control, etc.) have been identified in the Generic Aging Lessons Learned (GALL) report. Examples include the feedwater system components in boiling water reactors (BWRs) and pressurized water reactors (PWRs)."

b. NUREG-1801, XI.M35 Scope

"This program is a one-time inspection of a sample of ASME Code Class 1 piping less than or equal to NPS 4. The program includes measures to verify that degradation is not occurring; thereby either confirming that there is no need to manage aging-related degradation or validate the effectiveness of any existing AMP for the period of extended operation. The one-time inspection program for ASME Code Class 1 smallbore piping includes locations that are susceptible to cracking. Guidelines for identifying piping susceptible to potential effects of thermal stratification or turbulent penetration are provided in EPRI Report 1000701, "Interim Thermal Fatigue Management Guideline (MRP-24)," January 2001."

c. Comparison to VYNPS Scope

The program will include measures to verify that unacceptable degradation is not occurring, thereby validating effectiveness of existing aging management programs or confirming that there is no need to manage aging-related degradation for the period of extended operation.

See Attachment 2, One-Time Inspection Activities, for the scope of each one-time inspection activity.

VYNPS scope will be consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, XI.M32 Preventive Actions

"One-time inspection is an inspection activity independent of methods to mitigate or prevent degradation."

b. NUREG-1801, XI.M35 Preventive Actions

"This program is an inspection activity independent of methods to mitigate or prevent degradation."

c. Comparison to VYNPS Preventive Actions

One-time inspection is an inspection activity and no actions will be taken as part of this program to prevent or mitigate aging degradation.

VYNPS preventive actions will be consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, XI.M32 Parameters Monitored/Inspected

"The program monitors parameters directly related to the degradation of a component. Inspection is performed by qualified personnel following procedures consistent with the requirements of the American Society of Mechanical Engineers (ASME) Code and 10 CFR 50, Appendix B, by using a variety of nondestructive examination (NDE) methods, including visual, volumetric, and surface techniques."

b. NUREG-1801, XI.M35 Parameters Monitored/Inspected

"This inspection detects cracking in ASME Code Class 1 small-bore piping."

c. Comparison to VYNPS Parameters Monitored/Inspected

Nondestructive examinations (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures consistent with ASME Section XI and 10CFR50, Appendix B.

See Attachment 2, One-Time Inspection Activities for the parameters monitored and inspected in each one-time inspection activity.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, XI.M32 Detection of Aging Effects

"The inspection includes a representative sample of the system population, and, where practical, focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.

One-Time Inspection Program

The program will rely on established NDE techniques, including visual, ultrasonic, and surface techniques that are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR Part 50, Appendix B.

The inspection and test techniques will have a demonstrated history of effectiveness in detecting the aging effect of concern. Typically, the one time inspections should be performed as indicated in the following table."

Examples of Parameters Monitored or Inspected And Aging Effect for Specific Structure or Component[9]			
Aging Effect	**Aging Mechanism**	**Parameter Monitored**	**Inspection Method[10]**
Loss of Material	Crevice Corrosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	Galvanic Corrosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	General Corrosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	MIC	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	Pitting Corrosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Material	Erosion	Wall Thickness	Visual (VT-3 or equivalent) and/or Volumetric (RT or UT)
Loss of Heat Transfer	Fouling	Tube Fouling	Visual (VT-3 or equivalent) or Enhanced VT-1 for CASS
Cracking	SCC or Cyclic Loading	Cracks	Enhanced Visual (VT-1 or equivalent) and/or Volumetric (RT or UT)
Loss of Preload	Thermal Effects, Gasket Creep and Self-loosening	Loosening of Components	Visual (VT-3 or equivalent)

With respect to inspection timing, the population of components inspected before the end of the current operating term needs to be sufficient to provide reasonable assurance that the aging effect will not compromise any intended function at any time during the period of extended operation. Specifically, inspections need to be completed early enough to ensure that the aging effects that may affect intended functions early in the period of extended operation are appropriately managed. Conversely, inspections need to be timed to allow the inspected components to attain sufficient age to ensure that the aging effects with long incubation periods (i.e., those that may affect intended functions near the end of the period of extended operation) are identified. Within these constraints, the applicant should schedule the inspection no earlier than 10 years prior to the period of extended

operation, and in such a way as to minimize the impact on plant operations. As a plant will have accumulated at least 30 years of use before inspections under this program begin, sufficient times will have elapsed for aging effects, if any, to be manifest.

[9] The examples provided in the table may not be appropriate for all relevant situations. If the applicant chooses to use an alternative to the recommendations in this table, a technical justification should be provided as an exception to this AMP. This exception should list the AMR line item component, examination technique, acceptance criteria, evaluation standard and a description of the justification.

[10] Visual inspection may be used only when the inspection methodology examines the surface potentially experiencing the aging effect.

b. NUREG-1801, XI.M35 Detection of Aging Effects

"The inspection is designed to provide assurance, in plants that have not experienced cracking of ASME Code Class 1 small-bore piping due to stress corrosion or thermal and mechanical loading, that aging of this piping is not occurring or that the effects of aging are not significant. For ASME Code Class 1small-bore piping, one-time inspections using volumetric examination are performed on selected weld locations to detect cracking."

c. Comparison to VYNPS Detection of Aging Effects

Nondestructive examinations (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with ASME Section XI and 10CFR50, Appendix B. The inspection will be performed within the 10 years prior to the period of extended operation.

See Attachment 2, One-Time Inspection Activities, for detection of aging effects for each one-time inspection activity.

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801, XI.M32 Monitoring and Trending

"The program provides for increasing of the inspection sample size and locations in the event that aging effects are detected. Determination of the sample size is based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience. Unacceptable inspection findings are evaluated in accordance with the site corrective action process to determine the need for subsequent (including periodic) inspections and for monitoring and trending the results."

b. NUREG-1801, XI.M35 Monitoring and Trending

"This is a one-time inspection to determine whether cracking in ASME Code Class 1 small-bore piping resulting from stress corrosion or thermal and mechanical loading is an issue. A one-time volumetric inspection is an acceptable method for confirming that cracking of ASME Code Class 1 small-bore piping, as a result of stress corrosion or thermal and mechanical loading, is not occurring in plants that have not experienced cracking due to these aging effects. However, evaluation of the inspection results may indicate the need for additional examinations, i.e., a plant-specific AMP, consistent with ASME Section XI, Subsection IWB. This inspection should be performed at a sufficient number of locations to assure an adequate sample. This number, or sample size, will be based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 smallbore piping locations."

c. Comparison to VYNPS Monitoring and Trending

The program will provide for increasing of the inspection sample size and locations in the event that aging effects are detected. Determination of the sample size will be based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience. Unacceptable inspection findings will be evaluated in accordance with the site corrective action process to determine the need for subsequent (including periodic) inspections and for monitoring and trending the results.

VYNPS monitoring and trending will be consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, XI.M32 Acceptance Criteria

"Any indication or relevant conditions of degradation detected are evaluated. The ultrasonic thickness measurements are to be compared to predetermined limits, such as design minimum wall thickness for piping."

b. NUREG-1801, XI.M35 Acceptance Criteria

"If flaws or indications exceed the acceptance criteria of ASME Code, Section XI, Paragraph IWB-3400, they will be evaluated in accordance with ASME Code, Section XI, Paragraph IWB-3131, and additional examinations are performed in accordance with ASME Code, Section XI, Paragraph IWB-2430."

c. Comparison to VYNPS Acceptance Criteria

Ultrasonic thickness measurements will be compared to predetermined limits and indication of degradation will be evaluated.

If flaws or indications in the one-time inspection activity for AMRM-33 small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary, exceed the acceptance criteria of ASME Code, Section XI, Paragraph IWB-3400, they will be evaluated in accordance with ASME Code, Section XI, Paragraph IWB-3131, and additional examinations are performed in accordance with ASME Code, Section XI, Paragraph IWB-2430.

See Attachment 2, One-Time Inspection Activities, for acceptance criteria for each one-time inspection activity.

VYNPS acceptance criteria will be consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, XI.M32 Corrective Actions

"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 corrective actions, confirmation process, and administrative controls."

b. NUREG-1801, XI.M35 Corrective Actions

"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 corrective actions, confirmation process, and administrative controls."

c. Comparison to VYNPS Corrective Actions

Corrective actions for unacceptable inspection results will be carried out in accordance with the Corrective Action Program.

VYNPS corrective actions will be consistent with 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, XI.M32 Operating Experience

"This program applies to potential aging effects for which there are currently no operating experience indicating the need for an aging management program. Nevertheless, the elements that comprise these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with years of industry practice and staff expectations."

b. NUREG-1801, XI.M35 Operating Experience

"This inspection uses volumetric inspection techniques with demonstrated capability and a proven industry record to detect cracking in piping weld and base material. However, the application of the specific technique to ASME Code Class 1 small-bore piping needs to be qualified before the examination."

c. Comparison to VYNPS Operating Experience

The One-Time Inspection Program is a new program for which there is no VYNPS-specific operating experience. Industry and plant-specific operating experience will be considered in development of this program, as appropriate.

C. References

None

D. Summary

Verification of the effectiveness of the Water Chemistry Control programs and confirmation of the absence of aging effects on specific standby gas treatment, potable water, instrument air, radwaste, retired in place and reactor coolant system components will be undertaken to ensure component intended functions can be maintained in accordance with the current licensing basis (CLB) during the period of extended operation.

The One-Time Inspection Program will be consistent with the program described in NUREG-1801, Section XI.M32, One-Time Inspection. The one-time inspection activity for AMRM-33, small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary, will also be comparable to the program described in NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class I Small-Bore Piping. The inspection will be performed within the 10 years prior to the period of extended operation.

3.6 Selective Leaching Program

A. Program Description

The Selective Leaching Program at VYNPS will be comparable to the program described in NUREG-1801, Section XI.M33 Selective Leaching of Materials.

The Selective Leaching Program will ensure the integrity of components made of cast iron, bronze, brass, and other alloys exposed to raw water, brackish water, treated water, or groundwater that may lead to selective leaching. The program includes a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function for the period of extended operation.

The program will be initiated prior to the period of extended operation.

This program is credited in the following.

- AMRM-02, Residual Heat Removal System
- AMRM-05, High Pressure Coolant Injection System
- AMRM-06, Reactor Core Isolation Cooling and Condensate Storage and Transfer Systems
- AMRM-11, Service Water Systems
- AMRM-12, Reactor Building Closed Cooling Water System
- AMRM-13, Emergency Diesel Generator System
- AMRM-17, Fire Protection – Water System
- AMRM-19, Heating, Ventilation and Air Conditioning System
- AMRM-21, John Deere Diesel
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"This AMP determines the acceptability of the components that may be susceptible to selective leaching and assess their ability to perform the intended function during the period of extended operation. These components include piping, valve bodies and bonnets, pump casings, and heat exchanger components. The materials of construction for these components may include cast iron, brass, bronze, or aluminum-bronze. These components may be exposed to a raw water, treated water, or groundwater environment. The AMP includes a one-time visual inspection and hardness measurement of a selected set of sample components to

determine whether loss of material due to selective leaching is not occurring for the period of extended operation.

The selective leaching process involves the preferential removal of one of the alloying elements from the material, which leads to the enrichment of the remaining alloying elements. Dezincification (loss of zinc from brass) and graphitization (removal of iron from cast iron) are examples of such a process. Susceptible materials, high temperatures, stagnant-flow conditions, and corrosive environment such as acidic solutions, for example, for brasses with high zinc content, and dissolved oxygen, are conducive to selective leaching."

b. Comparison to VYNPS Scope

Susceptible components may include piping, valve bodies and bonnets, pump casings, and heat exchanger components. The materials of construction for these components may include cast iron, brass, bronze, or aluminum-bronze.. These components may be exposed to a raw water, treated water, or groundwater environment. The program will include a one-time hardness measurement of a selected set of components to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function for the period of extended operation.

VYNPS scope will be consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The one-time visual inspection and hardness measurement is an inspection/verification program; thus, there is no preventive action. However, it is noted that monitoring of water chemistry to control pH and concentration of corrosive contaminants, and treatment with hydrazine to minimize dissolved oxygen in water are effective in reducing selective leaching."

b. Comparison to VYNPS Preventive Actions

The VYNPS program will be an inspection and verification program with no preventive actions to prevent or mitigate aging effects.

VYNPS preventive actions will be consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The visual inspection and hardness measurement is to be a one-time inspection. Because selective leaching is a slow acting corrosion process,

this measurement is performed just before the beginning of the license renewal period. Follow-up of unacceptable inspection findings includes expansion of the inspection sample size and location."

b. Comparison to VYNPS Parameters Monitored/Inspected

The visual inspection and hardness measurement will be a one-time inspection performed just prior to the period of extended operation. Follow-up of unacceptable inspection findings includes expansion of the inspection sample size and location.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The one-time visual inspection and hardness measurement includes close examination of a select set of components to determine whether selective leaching has occurred and whether the resulting loss of strength and/or material will affect the intended functions of these components during the period of extended operation. Selective leaching generally does not cause changes in dimensions and is difficult to detect. However, in certain brasses it causes plug-type dezincification, which can be detected by visual inspection. One acceptable procedure is to visually inspect the susceptible components closely and conduct Brinell Hardness testing on the inside surfaces of the selected set of components to determine if selective leaching has occurred. If it is occurring, an engineering evaluation is initiated to determine acceptability of the affected components for further service."

b. Comparison to VYNPS Detection of Aging Effects

The one-time visual inspection and hardness measurement will include close examination of a select set of components to determine whether selective leaching has occurred and whether the resulting loss of strength or material will affect the intended functions of these components during the period of extended operation. A selected set of components that may be susceptible to selective leaching will be visually inspected and hardness testing will be performed to determine if selective leaching has occurred. If it has occurred, an engineering evaluation will be initiated to determine acceptability of the affected components for further service.

This program is credited with managing selective leaching in the following material and environment combinations.

- gray cast iron and copper alloy >15% Zn surfaces in treated water, untreated water, raw water, steam, fire protection foam, or soil (AMRM-02, 05, 06, 11, 12, 13, 17, 19, 21, 30)

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"There is no monitoring and trending for the one-time visual inspection and hardness measurement."

b. Comparison to VYNPS Monitoring and Trending

There is no monitoring and trending for the one-time visual inspection and hardness measurement.

VYNPS monitoring and trending will be consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Identification of selective leaching will define the need for further engineering evaluation before the affected components can be qualified for further service. If necessary, the evaluation will include a root cause analysis."

b. Comparison to VYNPS Acceptance Criteria

Identification of selective leaching will define the need for further engineering evaluation before the affected components can be qualified for further service. If necessary, the evaluation will include a root cause analysis.

VYNPS acceptance criteria will be consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Evaluations are performed for test or inspection results that do not satisfy established acceptance criteria. The corrective actions program ensures that conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude repetition. 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

Evaluations will be performed for test or inspection results that do not satisfy established acceptance criteria. The corrective actions program will ensure that conditions adverse to quality are promptly corrected. If a deficiency is

assessed to be significantly adverse to quality, the cause of the condition will be determined and an action plan is developed to preclude repetition.

VYNPS corrective actions will be consistent with 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

"One-time inspection is a new program to be applied by the applicant. The elements that comprise these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice and staff expectations."

b. Comparison to VYNPS Operating Experience

The Selective Leaching Program is a new program for which there is no VYNPS - specific operating experience.

C. References

None

D. Summary

The Selective Leaching Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Selective Leaching Program will provide 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 Selective Leaching Program at VYNPS will be consistent with the program described in NUREG-1801, Section XI.M33 Selective Leaching of Materials. The program will be initiated prior to the period of extended operation.

Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

3.7 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

A. Program Description

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program at VYNPS will be comparable to the program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS).

The purpose of the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is to assure that reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of the intended function. This program will evaluate CASS components in the reactor vessel internals and require non-destructive examinations as appropriate.

EPRI, the BWR Owners Group and other industry groups are focused on reactor vessel internals to ensure a better understanding of aging effects. Future Boiling Water Reactor Vessel Internals Project (BWRVIP) reports, EPRI reports, and other industry operating experience will provide additional bases for evaluations and inspections under this program. This program will supplement reactor vessel internals inspections required by the BWR Vessel Internals Program, described in Section 4.7, to assure that aging effects do not result in loss of the intended functions of reactor vessel internals during the period of extended operation.

The program will be initiated prior to the period of extended operation.

This program is credited in the following.

- AMRM-32, Reactor Vessel Internals

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program provides screening criteria to determine the susceptibility of CASS components to thermal aging on the basis of casting method, molybdenum content, and percent ferrite. The screening criteria are applicable to all primary pressure boundary and reactor vessel internal components constructed from SA-351 Grades CF3, CF3A, CF8, CF8A, CF3M, CF3MA, CF8M, with service conditions above 250°C (482°F). The screening criteria for susceptibility to thermal aging embrittlement are not applicable to niobium-containing steels; such steels require evaluation on a case-by-case basis. For "potentially susceptible" components, the program provides for the consideration of the synergistic loss of fracture toughness due to neutron embrittlement and thermal aging embrittlement. For each

such component, an applicant can implement either (a) a supplemental examination of the affected component as part of a 10-year ISI program during the license renewal term, or (b) a component-specific evaluation to determine the component's susceptibility to loss of fracture toughness.

Based on the criteria set forth in the May 19, 2000 letter from Christopher Grimes, Nuclear Regulatory Commission (NRC), to Mr. Douglas Walters, Nuclear Energy Institute (NEI), the susceptibility to thermal aging embrittlement of CASS components is determined in terms of casting method, molybdenum content, and ferrite content. For low-molybdenum content (0.5 wt.% max.) steels, only static-cast steels with >20% ferrite are potentially susceptible to thermal embrittlement. Static-cast low-molybdenum steels with ≤20% ferrite and all centrifugal-cast low-molybdenum steels are not susceptible. For high-molybdenum content (2.0 to 3.0 wt.%) steels, static-cast steels with >14% ferrite and centrifugal-cast steels with >20% ferrite are potentially susceptible to thermal embrittlement. Static-cast high-molybdenum steels with ≤14% ferrite and centrifugal-cast high-molybdenum steels with ≤20% ferrite are not susceptible. In the susceptibility screening method, ferrite content is calculated by using the Hull's equivalent factors (described in NUREG/CR-4513, Rev. 1) or a method producing an equivalent level of accuracy (± 6% deviation between measured and calculated values). A fracture toughness value of 255 kJ/m^2 (1,450 in.-lb/in.^{2}) at a crack depth of 2.5 mm (0.1 in.) is used to differentiate between CASS materials that are nonsusceptible and those that are potentially susceptible to thermal aging embrittlement. Extensive research data indicate that for nonsusceptible CASS materials, the saturated lower-bound fracture toughness is greater than 255 kJ/m^2 (NUREG/CR-4513, Rev. 1)."

b. Comparison to VYNPS Scope

The VYNPS program will consider all CASS reactor vessel internals subcomponents potentially susceptible to thermal aging embrittlement, regardless of casting method, molybdenum content, and percent ferrite.

The jet pump castings, CRD guide tube bases, and the fuel support pieces are fabricated from CASS.
(Ref. AMRM-32)

For each CASS component, VYNPS will (a) examine the affected component as part of a 10-year ISI program during the license renewal term, or (b) evaluate the specific component to determine the component's susceptibility to loss of fracture toughness.

The fuel support pieces and control rod guide tubes will be evaluated to determine their susceptibility to loss of fracture toughness, based on material of construction, fluence received, and operating temperature. If susceptible components are identified, augmented inspections of a representative sample

of those components will occur during the period of extended operation. Inspection criteria will be developed based on the results of the evaluations.

VYNPS scope will be consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The program consists of evaluation and inspection and provides no guidance on methods to mitigate thermal aging and neutron irradiation embrittlement."

b. Comparison to VYNPS Preventive Actions

The VYNPS program will be an evaluation and inspection program with no preventive actions to prevent or mitigate aging effects.

VYNPS preventive actions will be consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program specifics depend on the neutron fluence and thermal embrittlement susceptibility of the component. The AMP monitors the effects of loss of fracture toughness on the intended function of the component by identifying the CASS materials that either have a neutron fluence of greater than 10^{17} n/cm^2 (E>1 MeV) or are determined to be susceptible to thermal aging embrittlement. For such materials, the program consists of either supplemental examination of the affected component based on the neutron fluence to which the component has been exposed, or component-specific evaluation to determine the component's susceptibility to loss of fracture toughness."

b. Comparison to VYNPS Parameters Monitored/Inspected

The fuel support pieces and control rod guide tubes will be independently evaluated based on material of construction, fluence received, and operating temperature. If susceptible components are identified, augmented inspections of a representative sample of those components to monitor crack propagation will occur during the period of extended operation.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"For reactor vessel internal CASS components that have a neutron fluence of greater than 10^{17} n/cm^2 (E>1 MeV) or are determined to be susceptible to thermal embrittlement, the 10-year ISI program during the renewal period includes a supplemental inspection covering portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility (i.e., ferrite and molybdenum contents, casting process, and operating temperature), neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions). The inspection technique is capable of detecting the critical flaw size with adequate margin. The critical flaw size is determined based on the service loading condition and service-degraded material properties. One example of a supplemental examination is enhancement of the visual VT-1 examination of Section XI IWA-2210. A description of such an enhanced visual VT-1 examination could include the ability to achieve a 0.0005-in. resolution, with the conditions (e.g., lighting and surface cleanliness) of the inservice examination bounded by those used to demonstrate the resolution of the inspection technique. Alternatively, the applicant may perform a component-specific evaluation, including a mechanical loading assessment to determine the maximum tensile loading on the component during ASME Code Level A, B, C, and D conditions. If the loading is compressive or low enough (<5 ksi) to preclude fracture, then supplemental inspection of the component is not required. Failure to meet this criterion requires continued use of the supplemental inspection program. For each CASS component that has been subjected to a neutron fluence of less than 10^{17} n/cm^2 (E>1 MeV) and is potentially susceptible to thermal aging, the supplement inspection program applies; otherwise, the existing ASME Section XI inspection requirements are adequate if the components are not susceptible to thermal aging embrittlement."

b. Comparison to VYNPS Detection of Aging Effects

The VYNPS program will either evaluate or inspect all CASS subcomponents in the reactor vessel internals. If evaluation does not justify operation without inspection, then supplemental inservice inspections of portions of the components determined to be limiting from the standpoint of thermal aging susceptibility will be performed. Industry experience and BWRVIP vessel internals inspection recommendations will be considered when determining what inspections are required.

This program is credited with managing the following aging effect.

- Reduction of fracture toughness of cast austenitic stainless steel components in the vessel internals (AMRM-32)

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. **Monitoring and Trending**

   a. NUREG-1801, Monitoring and Trending

   "Inspections scheduled in accordance with IWB-2400 and reliable examination methods provide timely detection of cracks."

   b. Comparison to VYNPS Monitoring and Trending

   The VYNPS ISI program provides inspection in accordance with IWB-2400. The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will augment those inspections as determined by the subcomponent specific evaluations.

   VYNPS monitoring and trending will be consistent with NUREG-1801.

6. **Acceptance Criteria**

   a. NUREG-1801, Acceptance Criteria

   "Flaws detected in CASS components are evaluated in accordance with the applicable procedures of IWB-3500. Flaw tolerance evaluation for components with ferrite content up to 25% is performed according to the principles associated with IWB-3640 procedures for submerged arc welds (SAW), disregarding the Code restriction of 20% ferrite in IWB-3641(b)(1). Extensive research data indicate that the lower-bound fracture toughness of thermally aged CASS materials with up to 25% ferrite is similar to that for SAWs with up to 20% ferrite (Lee et al., 1997). Flaw evaluation for CASS components with >25% ferrite is performed on a case-by-case basis by using fracture toughness data provided by the applicant."

   b. Comparison to VYNPS Acceptance Criteria

   The subcomponent specific evaluations will determine if augmented inspections are required. Flaws detected during inspections will be evaluated in accordance with ASME Section XI, Subsection IWB-3500.

   VYNPS acceptance criteria will be consistent with NUREG-1801.

7. **Corrective Actions**

   a. NUREG-1801, Corrective Actions

   "Repair is performed in conformance with IWA-4000 and IWB-4000, and replacement is in accordance with IWA-7000 and IWB-7000. As discussed in

the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions."

b. Comparison to VYNPS Corrective Actions

Repair and replacement will be in conformance with ASME Section XI repair and replacement criteria. The VYNPS Corrective Action Program is also applicable.

VYNPS corrective actions will be consistent with 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

"The AMP was developed by using research data obtained on both laboratory-aged and service-aged materials. Based on this information, the effects of thermal aging embrittlement on the intended function of CASS components are effectively managed."

b. Comparison to VYNPS Operating Experience

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a new program for which there is no operating experience.

C. References

BWRVIP-41, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines

D. Summary

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will use existing techniques with demonstrated capability and a proven industry record to provide 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 Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will be consistent with the program described in NUREG-1801, Section XI.M13, Thermal

Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.

4.0 Existing Programs or Activities Credited in the AMRRs

4.1 Buried Piping Inspection Program

A. Program Description

The Buried Piping Inspection Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection.

This program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and gray cast iron components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance.

Prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection occurred within the past ten years. A focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows an assessment of pipe condition without excavation) occurs within this ten-year period.

This program is credited in the following.

- AMRM-07, Standby Gas Treatment System
- AMRM-11, Service Water System
- AMRM-15, Fuel Oil System
- AMRM-17, Fire Protection – Water System

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program relies on preventive measures such as coating, wrapping and periodic inspection for loss of material caused by corrosion of the external surface of buried steel piping and tanks. Loss of material in these components, which may be exposed to aggressive soil environment, is caused by general, pitting, and crevice corrosion, and microbiologically-influenced corrosion (MIC). Periodic inspections are performed when the components are excavated for maintenance or for any other reason. The scope of the program covers buried components that are within the scope of license renewal for the plant."

Buried Piping Inspection Program

b. Comparison to VYNPS Scope

The program relies on preventive measures such as coating and wrapping and inspection for loss of material caused by corrosion of the external surface of buried carbon steel, stainless steel, and gray cast iron components. Inspections are performed when the components are excavated for maintenance or for any other reason. The VYNPS program manages loss of material on buried components subject to aging management review as indicated in the AMRRs listed above.
(Ref. PP 7030)

VYNPS scope is not consistent with NUREG-1801. NUREG-1801 refers to buried steel piping and tanks. The VYNPS program inspects piping, but there are no buried tanks subject to aging management review for VYNPS.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"In accordance with industry practice, underground piping and tanks are coated during installation with a protective coating system, such as coal tar enamel with a fiberglass wrap and a kraft paper outer wrap, a polyolifin tape coating, or a fusion bonded epoxy coating to protect the piping from contacting the aggressive soil environment."

b. Comparison to VYNPS Preventive Actions

Protective coatings are used on underground components to protect the components from the soil environment.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program monitors parameters such as coating and wrapping integrity that are directly related to corrosion damage of the external surface of buried steel piping and tanks. Coatings and wrappings are inspected by visual techniques. Any evidence of damaged wrapping or coating defects, such as coating perforation, holidays, or other damage, is an indicator of possible corrosion damage to the external surface of piping and tanks."

b. Comparison to VYNPS Parameters Monitored/Inspected

Buried piping is visually examined for evidence of corrosion damage or coating defects.
(Section 4.3, PP 7030)

Enhancement: Guidance for performing examinations of buried piping will be enhanced to specify that coating degradation and corrosion are attributes to be evaluated.
(Ref. Section 4.3, PP 7030)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Inspections performed to confirm that coating and wrapping are intact are an effective method to ensure that corrosion of external surfaces has not occurred and the intended function is maintained. Buried piping and tanks are opportunistically inspected whenever they are excavated during maintenance. When opportunistic, the inspections are performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems within the areas made accessible to support the maintenance activity.

The applicant's program is to be evaluated for the extended period of operation. It is anticipated that one or more opportunistic inspections may occur within a ten-year period. Prior to entering the period of extended operation, the applicant is to verify that there is at least one opportunistic or focused inspection is performed within the past ten years. Upon entering the period of extended operation, the applicant is to perform a focused inspection within ten years, unless an opportunistic inspection occurred within this ten-year period. Any credited inspection should be performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems."

b. Comparison to VYNPS Detection of Aging Effects

Buried components are inspected when excavated during maintenance activities. If trending within the corrective action program identifies susceptible locations, areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement. Prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection occurred within the past ten years. A focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows an assessment of pipe condition without excavation) occurs within this ten-year period.
(Ref. PP 7030)

This program is credited with managing the following aging effects.

- loss of material from the external surfaces of buried carbon steel, stainless steel and gray cast iron components (AMRM-07, 11, 15, 17)

VYNPS detection of aging effects is not consistent with NUREG-1801 because inspections via methods that allow assessment of pipe condition without excavation may be substituted for opportunistic inspections of excavated piping. Methods such as phased array UT technology provide indication of wall thickness for buried piping without excavation. Use of such methods to identify the effects of aging is preferable to excavation for visual inspection, which could result in damage to coatings or wrappings.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Results of previous inspections are used to identify susceptible locations."

b. Comparison to VYNPS Monitoring and Trending

Trending within the corrective action program will identify the need for additional inspections. If additional inspections are necessary, results of previous inspections will be used to identify susceptible locations.

VYNPS monitoring and trending is consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Any coating and wrapping degradations are reported and evaluated according to site corrective actions procedures."

b. Comparison to VYNPS Acceptance Criteria

Coating and wrapping degradation, or loss of material due to corrosion, is evaluated in accordance with the site corrective action program.
(Section 4.8, PP 7030)

VYNPS acceptance criteria is consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"The site corrective actions program, quality assurance (QA) procedures, site review and approval process, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The staff

finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions, confirmation process, and administrative controls."

b. Comparison to VYNPS Corrective Actions

VYNPS corrective actions are in accordance with 10 CFR 50 Appendix B. The corrective actions may include scheduled inspections, change of coating system, or replacement of corrosion susceptible components.

VYNPS corrective actions are consistent with 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

"Operating experience shows that the program described here is effective in managing corrosion of external surfaces of buried steel piping and tanks. However, because the inspection frequency is plant-specific and also depends on the plant operating experience, the applicant's plant-specific operating experience is further evaluated for the extended period of operation."

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 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

PP 7030, Rev. 00, LPC 01, Structures Monitoring Program Procedure

D. Summary

The Buried Piping Inspection Program has been effective at managing aging effects. It provides reasonable assurance that effects of aging will be managed such that

Buried Piping Inspection Program

applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The Buried Piping Inspection Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection, with the following exceptions and enhancement.

Attributes Affected	Exceptions
1. Scope of Program	NUREG-1801 refers to buried steel piping and tanks. The VYNPS program does not inspect tanks. (Note 1)
4. Detection of Aging Effects	Inspections via methods that allow assessment of pipe condition without excavation may be substituted for opportunistic inspections of excavated piping. (Note 2)

Exception Notes

1. There are no buried steel tanks subject to aging management review.
2. Methods such as phased array UT technology provide indication of wall thickness for buried piping without excavation. Use of such methods to identify the effects of aging is preferable to excavation for visual inspection, which could result in damage to coatings or wrappings.

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement
3. Parameters Monitored/Inspected	Guidance for performing examinations of buried piping will be enhanced to specify that coating degradation and corrosion are attributes to be evaluated.

BWR CRD Return Line Nozzle Program

4.2 BWR CRD Return Line Nozzle Program

A. Program Description

The BWR Control Rod Drive (CRD) Return Line Nozzle Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M6, BWR Control Rod Drive Return Line Nozzle.

Under this program, VYNPS has rerouted the CRD return flow to the reactor water cleanup (RWCU) system, with the rerouted line flow valved open, and capped the CRD return line vessel nozzle to mitigate cracking. Continuing Inservice Inspection (ISI) examinations monitor the effects of crack initiation and growth on the intended function of the control rod drive return line nozzle and cap.

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program includes systems modifications, enhanced ISI, and maintenance programs to monitor the effects of cracking on the intended function of CRDRL nozzles."

b. Comparison to VYNPS Scope

VYNPS has performed system modifications to mitigate cracking and continues Inservice Inspection (ISI) examinations to monitor the effects of crack initiation and growth on the intended function of the control rod drive return line nozzle, N9.
(Ref. Section 4.9.3, VYNPS UFSAR; Section 3.4.1, CRD; and App. C, Table 5, Vermont Yankee ISI Database)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Mitigation occurs by system modifications, such as rerouting the CRDRL to a system that connects to the reactor vessel. For some classes of BWRs, or those that can prove satisfactory system operation, mitigation also is accomplished by confirmation of proper return flow capability, two-pump operation and cutting and capping the CRDRL nozzle without rerouting."

BWR CRD Return Line Nozzle Program

b. Comparison to VYNPS Preventive Actions

VYNPS has rerouted the CRD return flow to the reactor water cleanup (RWCU) system, with the rerouted line flow valved open, and capped the CRD return line vessel nozzle, N9.
(Ref. Section 7, EDCR 79-14)

VYNPS preventive actions are consistent with the first option provided in NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The aging management program (AMP) monitors the effects of cracking on the intended function of the CRDRL nozzles by detecting and sizing cracks by ISI in accordance with Table IWB 2500-1 and NUREG-0619."

b. Comparison to VYNPS Parameters Monitored/Inspected

The VYNPS program monitors the effects of cracking on the intended function of the CRD return line nozzle by performing ultrasonic inspection of the nozzle inner radius, nozzle to vessel weld, and nozzle to cap weld in accordance with ASME Section XI, Subsection IWB.
(Ref. App. C, Table 5, Vermont Yankee ISI Database)

VYNPS parameters monitored and inspected are not consistent with NUREG-1801. NUREG-1801 states that the effects of cracking will also be monitored in accordance with NUREG-0619. For licensees who have cut and capped the CRD return line nozzle with rerouting of the CRD return line (rerouted line flow valved open), NUREG-0619 requires that during each refueling outage the licensee inspect the welded connection joining the rerouted CRD return line to the system which then returns flow to the reactor vessel. As stated in Section 4.B.3.2.b, VYNPS has rerouted the CRD return flow to the RWCU system, with the rerouted line flow valved open, and capped the CRD return line vessel nozzle, N9. However, VYNPS does not inspect the welded connection between the CRD return line and the RWCU system piping during each refueling outage. In its safety evaluation of BWR feedwater and CRD return line modifications at VYNPS, NRC accepted VYNPS' commitment to inspect the CRD return line to RWCU joint, by UT methods, for three consecutive refuel outages, then reassess the inspection frequency based upon the inspection results. Inspection of the three CRD return line to RWCU welds confirmed there were no indications and reassessment concluded that further inspections are not required. It is reasonable to maintain this exception for the period of extended operation since the CRD return line now ties into the RWCU system in a section of piping that is Safety Class 0 and not subject to aging management review as it has no license renewal function.
(Ref. Section 8.2, NUREG-0619; NVY 84-144; FVY 82-3)

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The extent and schedule of inspection, as delineated in NUREG 0619, assures detection of cracks before the loss of intended function of the CRDRL nozzles. Inspection recommendations include liquid penetrant testing (PT) of CRDRL nozzle blend radius and bore regions and the reactor vessel wall area beneath the nozzle, return-flow-capacity demonstration, CRD-system-performance testing and ultrasonic inspection of welded connections in the rerouted line. The inspection is to include base metal to a distance of one-pipe-wall thickness or 0.5 in., whichever is greater, on both sides of the weld."

b. Comparison to VYNPS Detection of Aging Effects

VYNPS implemented NUREG-0619 requirements by rerouting the CRD return flow to the RWCU system, with the rerouted line valved open, and capping the CRD return line vessel nozzle, N9. The CRD return line nozzle bend radius and bore regions and the reactor vessel wall area beneath the nozzle were dye-penetrant tested and all cracks were removed. System performance testing and subsequent system operation demonstrated CRD return flow capacity. Continued examinations discussed in Section 4.B.3.3.b, detect aging effects for the vessel nozzle, nozzle to vessel weld, and nozzle to cap weld.
(Ref. FVY 82-3; App. C, Table 5, Vermont Yankee ISI Database)

This program is credited with managing the following aging effects.

- cracking of the CRD return line nozzle (AMRM-31)

VYNPS detection of aging effects is not consistent with NUREG-1801. VYNPS does not inspect the welded connection between the CRD return line and the RWCU system piping during each refueling outage. In its safety evaluation of BWR feedwater and CRD return line modifications at VYNPS, NRC accepted VYNPS' commitment to inspect the CRD return line to RWCU joint, by UT methods, for three consecutive refuel outages, then reassess the inspection frequency based upon the inspection results. Inspection of the three CRD return line to RWCU welds confirmed there were no indications and reassessment concluded that further inspections are not required. It is reasonable to maintain this exception for the period of extended operation since the CRD return line now ties into the RWCU system in a section of piping that is Safety Class 0 and not subject to aging management review as it has no license renewal function.
(Ref. NVY 84-144; FVY 82-3)

5. **Monitoring and Trending**

   a. NUREG-1801, Monitoring and Trending

   "The inspection schedule of NUREG-0619 provides timely detection of cracks."

   b. Comparison to VYNPS Monitoring and Trending

   The VYNPS program monitors the effects of cracking on the intended function of the CRD return line nozzle by performing ultrasonic inspection of the nozzle inner radius, nozzle to vessel weld, and nozzle to cap weld in accordance with ASME Section XI, Subsection IWB.
   (Ref. App. C, Table 5, Vermont Yankee ISI Database)

   VYNPS monitoring and trending are not consistent with NUREG-1801. VYNPS does not inspect the welded connection between the CRD return line and the RWCU system piping during each refueling outage. In its safety evaluation of BWR feedwater and CRD return line modifications at VYNPS, NRC accepted VYNPS' commitment to inspect the CRD return line to RWCU joint, by UT methods, for three consecutive refuel outages, then reassess the inspection frequency based upon the inspection results. Inspection of the three CRD return line to RWCU welds confirmed there were no indications and reassessment concluded that further inspections are not required. It is reasonable to maintain this exception for the period of extended operation since the CRD return line now ties into the RWCU system in a section of piping that is Safety Class 0 and not subject to aging management review as it has no license renewal function.
   (Ref. NVY 84-144; FVY 82-3)

6. **Acceptance Criteria**

   a. NUREG-1801, Acceptance Criteria

   "Any cracking is evaluated in accordance with IWB-3100 by comparing inspection results with the acceptance standards of IWB-3400 and IWB-3500. All cracks found in the CRDRL nozzles are to be removed by grinding."

b. Comparison to VYNPS Acceptance Criteria

Cracking found during inservice inspection is evaluated and dispositioned in accordance with ASME Section XI, Subsection IWB. Cracks found in the CRD return line nozzles will be removed by mechanical means such as grinding.
(Ref. Section 4.5, PP 7015 and OP 4026)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair is performed in conformance with IWB-4000 and replacement in accordance with IWB-7000. 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

VYNPS repair and replacement procedure is in conformance with ASME Section XI repair and replacement criteria. The VYNPS Corrective Action Program is also applicable.
(Ref. AP 0070)

VYNPS corrective actions are consistent with 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

"Cracking has occurred in several BWR plants (NUREG-0619 and Information Notice 2004-08). The present AMP has been implemented for nearly 25 years and has been found to be effective in managing the effect of cracking on the intended function of CRDRL nozzles."

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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

CRD, Control Rod Drive Design Basis Document, Rev. 1, 10/4/05

EDCR 79-14, CRD Reroute, 9/28/79

FVY 82-3, Vermont Yankee Position on NUREG-0619 Items Regarding Feedwater System Changes, dated 1/15/82

NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," U.S. Nuclear Regulatory Commission, November 1980

NVY 84-144, NRC letter, Implementation of NUREG-0619, BWR Feedwater and CRD Nozzle Cracking

OP 4026, Rev. 07, LPC 00, Pressure Boundary Repair Procedure

PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program

Vermont Yankee ISI Database

VYNPS UFSAR, Rev. 19-1, Updated Final Safety Analysis Report

D. Summary

The BWR CRD Return Line Nozzle Program has been effective at managing aging effects. The BWR CRD Return Line Nozzle 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 BWR CRD Return Line Nozzle Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M6, BWR Control Rod Drive Return Line Nozzle, with the following exception.

Attributes Affected	Exceptions
3. Parameters Monitored/Inspected 4. Detection of Aging Effects 5. Monitoring and Trending	VYNPS does not inspect the welded connection between the CRD return line and the RWCU system piping during each refueling outage. (Note 1)

BWR CRD Return Line Nozzle Program

Exception Notes

1. In its safety evaluation of BWR feedwater and CRD return line modifications at VYNPS, NRC accepted VYNPS' commitment to inspect the CRD return line to RWCU joint, by UT methods, for three consecutive refuel outages, then reassess the inspection frequency based upon the inspection results. Inspection of the three CRD return line to RWCU welds confirmed there were no indications and reassessment concluded that further inspections are not required. It is reasonable to maintain this exception for the period of extended operation since the CRD return line now ties into the RWCU system in a section of piping that is Safety Class 0 and not subject to aging management review as it has no license renewal function.
   (Ref. NVY 84-144; FVY 82-3)

4.3 BWR Feedwater Nozzle Program

A. Program Description

The BWR Feedwater Nozzle Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M5, BWR Feedwater Nozzle.

Under this program, VYNPS has replaced the original low flow control valve with a drag type valve having improved flow characteristics, replaced the feedwater spargers with interference-fit thermal sleeve spargers, and installed a thermal sleeve bypass leak detection system to mitigate cracking. This program continues enhanced inservice inspection (ISI) of the feedwater nozzles in accordance with the requirements of ASME Section XI, Subsection IWB and the recommendation of General Electric (GE) NE-523-A71-0594 to monitor the effects of cracking on the intended function of the feedwater nozzles.

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program includes enhanced ISI to monitor the effects of cracking on the intended function of the component, and systems modifications to mitigate cracking."

b. Comparison to VYNPS Scope

VYNPS performs the enhanced ISI recommended by GE NE-523-A71-0594 to monitor the effects of cracking on the intended function of the feedwater nozzles and has performed system modifications to mitigate cracking. ***(Ref. NVY 84-144; EDCR 75-30; EDCR 81-27; and Section 4.1.2.2, PP 7015)***

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Mitigation occurs by systems modifications, such as removal of stainless steel cladding and installation of improved spargers. Mitigation is also accomplished by changes to plant-operating procedures, such as improved feedwater control and rerouting of the reactor water cleanup system, to decrease the magnitude and frequency of temperature fluctuations."

b. Comparison to VYNPS Preventive Actions

VYNPS replaced the original low flow control valve with a drag type valve having improved flow characteristics and a single element water level control system with both manual and automatic control characteristics.
(Ref. NVY 84-144)

VYNPS replaced the feedwater spargers with interference-fit thermal sleeve spargers, without clad removal, and installed a thermal sleeve bypass leak detection system.
(Ref. EDCR 75-30 and EDCR 81-27)

VYNPS preventive actions are not consistent with NUREG-1801 because stainless steel cladding was not removed, a low-flow controller was not installed and the reactor water cleanup system was not rerouted. In its safety evaluation of BWR feedwater and CRD return line modifications at VYNPS, NRC noted that the intent of the requirements of NUREG-0619 and NEDE-21821-A had been satisfied with the VYNPS modifications. Since liquid penetrant inspection of the nozzles revealed no cracks and a thermal sleeve bypass leak detection system has been installed, an adequate margin of safety against feedwater nozzle crack growth exists. Therefore, NRC concluded that, with continued inspections to monitor for crack initiation and growth, VYNPS can operate without rerouting the RWCU, without removing the clad, and without installing a low-flow controller for the feedwater system. Since inspections to monitor for crack initiation and growth will continue, this conclusion remains valid for the period of extended operation.
(Ref. NVY 84-144)

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The aging management program (AMP) monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by ISI in accordance with ASME Section XI, Subsection IWB and the recommendation of GE NE-523-A71-0594."

b. Comparison to VYNPS Parameters Monitored/Inspected

The program monitors the effects of cracking by detection and sizing of cracks in accordance with ASME Section XI, Subsection IWB and GE NE-523-A71-0594.
(Ref. Section 4.1.2.2, PP 7015)

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

BWR Feedwater Nozzle Program

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The extent and schedule of the inspection prescribed by the program are designed to ensure that aging effects will be discovered and repaired before the loss of intended function of the component. Inspection can reveal cracking. GE NE-523-A71-0594 specifies ultrasonic testing (UT) of specific regions of the blend radius and bore. The UT examination techniques and personnel qualifications are in accordance with the guidelines of GE NE-523-A71-0594. Based on the inspection method and techniques and plant-specific fracture mechanics assessments, the inspection schedule is in accordance with Table 6-1 of GE NE-523-A71-0594. Leakage monitoring may be used to modify the inspection interval."

b. Comparison to VYNPS Detection of Aging Effects

Inspections, examination techniques, personnel qualifications, and schedule are in accordance with GE NE-523-A71-0594.
(Ref. Section 4.1.2.2, PP 7015)

VYNPS calculates the allowed interval between UT examinations for the main feedwater nozzles based on time and events (cycles). Cycles are monitored to ensure the allowable number of transients is not exceeded prior to the next inspection. Leakage is also monitored to ensure the allowable number of nozzle leak pattern changes is not exceeded prior to the next inspection.
(Ref. Section 4.2.6, VYNPS UFSAR; VYC-1005; and Form VYAPF 0145.01, Part B, AP 0145)

This program is credited with managing the following aging effects.

- cracking of the feedwater nozzles (AMRM-31)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Inspections scheduled in accordance with GE NE-523-A71-0594 provide timely detection of cracks."

b. Comparison to VYNPS Monitoring and Trending

VYNPS schedules inspections in accordance with GE NE-523-A71-0594.
(Ref. Section 4.1.2.2, PP 7015)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Any cracking is evaluated in accordance with IWB-3100 by comparing inspection results with the acceptance standards of IWB-3400 and IWB-3500."

b. Comparison to VYNPS Acceptance Criteria

Indications found during inservice inspection are evaluated and dispositioned in accordance with ASME Section XI, Subsection IWB.
(Ref. Section 4.5, PP 7015)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair is performed in conformance with IWB-4000 and replacement in accordance with IWB-7000. 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

VYNPS repair and replacement procedure is in conformance with ASME Section XI repair and replacement criteria. The VYNPS Corrective Action Program is also applicable.
(Ref. AP 0070)

VYNPS corrective actions are consistent with 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

"Cracking has occurred in several BWR plants (NUREG-0619, NRC Generic Letter 81-11). This AMP has been implemented for nearly 25 years and has

been found to be effective in managing the effect of cracking on the intended function of feedwater nozzles."

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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

AP 0145, Rev. 08, LPC 03, Equipment Cycle Record Keeping

EDCR 75-30, FW Sparger Replacement

EDCR 81-27, Bypass Leak Detection System Installation

FVY 82-3, Vermont Yankee Position on NUREG-0619 Items Regarding Feedwater System Changes, dated 1/15/82

NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," U.S. Nuclear Regulatory Commission, November 1980

NVY 84-144, NRC letter, Implementation of NUREG-0619, BWR Feedwater and CRD Nozzle Cracking

PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program

VYNPS UFSAR, Rev. 19-1, Updated Final Safety Analysis Report

VYC-1005, Rev. 02, Crack Growth Calculation for the Vermont Yankee FW Nozzles

D. Summary

The BWR Feedwater Nozzle Program has been effective at managing aging effects. The BWR Feedwater Nozzle 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 BWR Feedwater Nozzle Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M5, BWR Feedwater Nozzle, with the following exception.

BWR Feedwater Nozzle Program

Attributes Affected	Exception
2. Preventive Actions	Stainless steel cladding was not removed, a low-flow controller was not installed and the reactor water cleanup system was not rerouted. (Note 1)

Exception Notes

1. In its safety evaluation of BWR feedwater and CRD return line modifications at VYNPS, NRC noted that the intent of the requirements of NUREG-0619 and NEDE-21821-A had been satisfied with the VYNPS modifications. Since liquid penetrant inspection of the nozzles revealed no cracks and a thermal sleeve bypass leak detection system has been installed, an adequate margin of safety against feedwater nozzle crack growth exists. Therefore, NRC concluded that, with continued inspections to monitor for crack initiation and growth, VYNPS can operate without rerouting the RWCU, without removing the clad, and without installing a low-flow controller for the feedwater system. Since inspections to monitor for crack initiation and growth will continue, this conclusion remains valid for the period of extended operation.
   (Ref. NVY 84-144)

4.4 BWR Penetrations Program

A. Program Description

The BWR Penetrations Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M8, BWR Penetrations.

The program includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) documents BWRVIP-27 and BWRVIP-49 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel penetrations and nozzles.

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program is focused on managing the effects of cracking due to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC). The program contains preventive measures to mitigate SCC or IGSCC, inservice inspection (ISI) to monitor the effects of cracking on the intended function of the components, and repair and/or replacement as needed to maintain the ability to perform the intended function.

The inspection and evaluation guidelines of BWRVIP-49 and BWRVIP-27 contain generic guidelines intended to present appropriate inspection recommendations to assure safety function integrity. The guidelines of BWRVIP-49 provide information on the type of instrument penetration, evaluate their susceptibility and consequences of failure, and define the inspection strategy to assure safe operation. The guidelines of BWRVIP-27 are applicable to plants in which the SLC system injects sodium pentaborate into the bottom head region of the vessel (in most plants, as a pipe within a pipe of the core plate ΔP monitoring system). The BWRVIP-27 guidelines address the region where the ΔP and SLC nozzle or housing penetrates the vessel bottom head and include the safe ends welded to the nozzle or housing. Guidelines for repair design criteria are provided in BWRVIP-57 for instrumentation penetrations and BWRVIP-53 for SLC line."

b. Comparison to VYNPS Scope

Preventive measures to mitigate cracking are in accordance with the Water Chemistry Control – BWR program, Section 4.23.2.

Inspections to monitor the effects of cracking on the intended function of the region where the ΔP and standby liquid control (SLC) nozzle (N10) penetrates the vessel bottom head, including the safe ends welded to the nozzle, are in accordance with ASME, Section XI and BWRVIP-27. Inspections to monitor the effects of cracking on the intended function of the instrument penetration nozzles (N11A/B and N12A/B) are in accordance with ASME, Section XI and BWRVIP-49.
(Ref. App. C, Table 5, Vermont Yankee ISI Database and App. B, PP 7027)

Repair or replacement occurs as needed to maintain the ability to perform the intended function.
(Ref. AP 0070)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Maintaining high water purity reduces susceptibility to SCC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515). The program description and the evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in Chapter XI.M2, "Water Chemistry"."

b. Comparison to VYNPS Preventive Actions

The VYNPS Water Chemistry Control – BWR Program, Section 4.23.2, is consistent with EPRI Report 1008192 (BWRVIP-130) which supercedes BWRVIP-29.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program monitors the effects of SCC/IGSCC on the intended function of the component by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-49 or BWRVIP-27 and the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB 2500-1 (2001 edition[6] including the 2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry, provided that such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff."

[6] An applicant may rely on a different version of the ASME Code, but should justify such use. An applicant may wish to refer to the SOC for an update of 10 C.F.R. § 50.55a to justify use of a more recent edition of the Code.

b. Comparison to VYNPS Parameters Monitored/Inspected

Inservice inspections to monitor the effects of cracking on the intended function of the components in accordance with ASME Section XI, Subsection IWB include UT inspections of the SLC/ΔP nozzle (N10) inner radius and nozzle to vessel weld. They also include visual and surface inspections of the N10 nozzle to safe end weld. Visual inspections of instrument nozzle (N11A/B and N12A/B) partial penetration and nozzle-to-extension welds are performed during system pressure testing. Surface inspections of the instrument penetration nozzle-to-extension welds and extensions are also performed.
(Ref. App. A, PP 7015 and App. C, Table 5, Vermont Yankee ISI Database)

For the VYNPS SLC nozzle configuration, BWRVIP-27 recommends that, in addition to the requirements of ASME Section XI, Subsection IWB, a volumetric examination of the nozzle to safe end weld be performed every 10 years, as soon as a method for conducting that examination is developed. In accordance with BWRVIP-27 recommendation, VYNPS performs either an enhanced leakage inspection (with direct view of component during pressure test) every outage or a surface examination every other refueling outage until such time as a volumetric inspection technique is developed. Once an acceptable volumetric examination is developed, it will be performed each 10 year ISI interval in conjunction with continued visual inspections each outage.
(Ref. App. C, Table 5, Vermont Yankee ISI Database and App. C, PP 7027)

For the VYNPS instrument penetration configuration, BWRVIP-49 recommended no additional inspections beyond those required by ASME Section XI, Subsection IWB-2500.
(Ref. App. C, PP 7027)

To date, VYNPS has not sought inspection relief for the SLC or instrument penetration nozzles based on the use of hydrogen water chemistry. If inspection relief is sought in the future, the guidelines of BWRVIP-62 will be followed and a relief request will be submitted under the provisions of 10 CFR 50.55a and approved by the staff.
(Ref. App. C, PP 7027)

VYNPS parameters monitored and inspected are <u>not</u> consistent with NUREG-1801 because Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used to specify nozzle inspections, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda. Since

ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.
(Ref. App. A, PP 7015 and App. C, Table 5, Vermont Yankee ISI Database)

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The evaluation guidelines of BWRVIP-49 and BWRVIP-27 recommend that the inspection requirements currently in ASME Section XI continue to be followed. The extent and schedule of the inspection and test techniques prescribed by the ASME Section XI program are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of the component. Inspection can reveal cracking and leakage of coolant. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

Instrument penetrations and SLC system nozzles or housings are inspected in accordance with the requirements of ASME Section XI, Subsection IWB. Components are examined and tested as specified in Table IWB-2500-1, examination categories B-E for pressure-retaining partial penetration welds in vessel penetrations, B-D for full penetration nozzle-to-vessel welds, B-F for pressure-retaining dissimilar metal nozzle-to-safe end welds, or B-J for similar metal nozzle-to-safe end welds. In addition, these components are part of examination category B-P for pressure-retaining boundary. Further details for examination are described in Chapter XI.M1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD," of this report."

b. Comparison to VYNPS Detection of Aging Effects

Inservice inspections to monitor the effects of cracking on the intended function of the components in accordance with ASME Section XI, Subsection IWB include UT inspections of the SLC/ΔP nozzle (N10) inner radius and nozzle to vessel weld. They also include visual and surface inspections of the N10 nozzle to safe end weld. Visual inspections of instrument nozzle (N11A/B and N12A/B) partial penetration and nozzle-to-extension welds are performed during system pressure testing. Surface inspections of the instrument penetration nozzle-to-extension welds and extensions are also performed.
(Ref. App. A, PP 7015 and App. C, Table 5, Vermont Yankee ISI Database)

For the VYNPS SLC nozzle configuration, BWRVIP-27 recommends that, in addition to the requirements of ASME Section XI, Subsection IWB, a volumetric examination of the nozzle to safe end weld be performed every 10 years, as soon as a method for conducting that examination is developed. In accordance with BWRVIP-27 recommendation, VYNPS performs an enhanced leakage inspection (with direct view of component during pressure test) every outage until such time as a volumetric inspection technique is developed. Once an acceptable volumetric examination is developed, it will be performed each 10 year ISI interval in conjunction with continued visual inspections each outage.
(Ref. App. C, Table 5, Vermont Yankee ISI Database and App. C, PP 7027)

For the VYNPS instrument penetration configuration, BWRVIP-49 recommended no additional inspections beyond those required by ASME Section XI, Subsection IWB-2500.

This program is credited with managing the following aging effects.

- cracking of the SLC/ΔP (N10) and instrumentation (N11A/B, N12A/B) nozzles (AMRM-31)

VYNPS detection of aging effects is <u>not</u> consistent with NUREG-1801 because Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used to specify nozzle inspections as discussed in Section 4.3.B.3.b, Comparison to VYNPS Parameters Monitored/Inspected. Also, VYNPS examines ½ inch of the volume next to the widest part of the N10 nozzle to vessel weld, rather than half of the vessel wall thickness.
(Ref. App. A, PP 7015 and App. C, Table 5, Vermont Yankee ISI Database)

5. Monitoring and Trending

a. <u>NUREG-1801, Monitoring and Trending</u>

"Inspections scheduled in accordance with IWB-2400 and approved BWRVIP-48 *(sic)* or BWRVIP-27 provide timely detection of cracks. The scope of examination and reinspection must be expanded beyond the baseline inspection are required if flaws are detected."

b. <u>Comparison to VYNPS Monitoring and Trending</u>

The VYNPS program requires expanded inspection scope and re-inspection if flaws are detected.
(Ref. Section 4.5.1 and 4.6.1, PP 7015)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Any indication detected is evaluated in accordance with ASME Section XI or other acceptable flaw evaluation criteria, such as the staff-approved BWRVIP-49 or BWRVIP-27 guidelines. Applicable and approved BWRVIP-14, BWRVIP-59, and BWRVIP-60 documents provide guidelines for evaluation of crack growth in stainless steels (SSs), nickel alloys, and low-alloy steels, respectively."

b. Comparison to VYNPS Acceptance Criteria

Indications found during inservice inspection are evaluated and dispositioned in accordance with BWRVIP inspection and flaw evaluation guidelines. ***(Ref. Section 4.5, PP 7015)***

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair and replacement procedures in the staff-approved BWRVIP-57 and BWRVIP-53 are equivalent to those requirements in the ASME Section XI. Guidelines for repair design criteria are provided in BWRVIP-57 for instrumentation penetrations and BWRVIP-53 for standby liquid control line. As discussed in the appendix to this report, the staff finds that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions."

b. Comparison to VYNPS Corrective Actions

VYNPS repair and replacement procedure is in conformance with ASME Section XI repair and replacement criteria or the applicable code for the indication. The VYNPS Corrective Action Program is also applicable. ***(Ref. AP 0070)***

VYNPS corrective actions are consistent with 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

"Cracking due to SCC or IGSCC has occurred in BWR components made of austenitic stainless steels and nickel alloys. The program guidelines are based on an evaluation of available information, including BWR inspection data and information about the elements that cause IGSCC, to determine which locations may be susceptible to cracking. Implementation of the program provides reasonable assurance that cracking will be adequately managed so the intended functions of the instrument penetrations and SLC system nozzles or housings will be maintained consistent with the current licensing basis (CLB) for the period of extended operation."

b. Comparison to VYNPS Operating Experience

As a participant in the BWRVIP, VYNPS is committed to incorporate lessons learned from operating experience of the BWR fleet, not just that of VYNPS. 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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

BWRVIP-27-A, BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines, EPRI Report TR-1007279, August 2003

BWRVIP-49-A, BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines, EPRI Technical Report 1006602, March 2002

BWRVIP-130, BWR Water Chemistry Guidelines - 2004 Revision, EPRI Report 1008192

PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program

PP 7027, Rev. 03, LPC 00, Reactor Vessel Internals Management Program

Vermont Yankee ISI Database

BWR Penetrations Program

D. Summary

The BWR Penetrations Program has been effective at managing aging effects. The BWR Penetrations 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 BWR Penetrations Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M8, BWR Penetrations, with the following exceptions.

Attributes Affected	Exceptions
3. Parameters Monitored/Inspected 4. Detection of Aging Effects	Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used to specify SLC nozzle inspections, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda. (Note 1)
4. Detection of Aging Effects	VYNPS examines ½ inch of the volume next to the widest part of the N10 nozzle to vessel weld, rather than half of the vessel wall thickness. (Note 2)

Exception Notes

1. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.
2. Extending the examination volume into the base metal as required by ASME Section XI, 1998 Edition, 2000 Addenda, Figure IWB-2500-7(b) prolongs the examination time significantly and results in no net increase in safety. The extra volume is base metal region which is not prone to in-service cracking and has been extensively examined before the vessel was put into service and during the first, second and third interval examinations.

4.5 BWR Stress Corrosion Cracking Program

A. Program Description

The BWR Stress Corrosion Cracking Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking.

The program includes (a) preventive measures to mitigate intergranular stress corrosion cracking (IGSCC), and (b) inspection and flaw evaluation to monitor IGSCC and its effects on reactor coolant pressure boundary components made of stainless steel, CASS, or nickel alloy.

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel
- AMRM-33, Reactor Coolant System Pressure Boundary

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program focuses on (a) managing and implementing countermeasures to mitigate IGSCC and (b) performing inservice inspection (ISI) to monitor IGSCC and its effects on the intended function of BWR components. The program is applicable to all BWR piping and piping welds made of austenitic SS and nickel alloy that is 4 in. or larger in nominal diameter and contains reactor coolant at a temperature above 93°C (200°F) during power operation, regardless of code classification. The program also applies to pump casings, valve bodies and reactor vessel attachments and appurtenances, such as head spray and vent components. NUREG-0313 and NRC GL-88-01, respectively, describe the technical basis and staff guidance regarding mitigation of IGSCC in BWRs. Attachment A of NRC GL 88-01 delineates the staff-approved positions regarding materials, processes, water chemistry, weld overlay reinforcement, partial replacement, stress improvement of cracked welds, clamping devices, crack characterization and repair criteria, inspection methods and personnel, inspection schedules, sample expansion, leakage detection, and reporting requirements."

b. Comparison to VYNPS Scope

Measures to mitigate cracking are in accordance with the Water Chemistry Control – BWR Program, Section 4.23.2.

The VYNPS program applies to austenitic stainless steel and nickel alloy piping and safe ends that are 4 inches or larger in nominal diameter and contains reactor coolant at a temperature above 93°C (200°F) during power

operation. The program also applies to pump casings, valve bodies and reactor vessel attachments and appurtenances, such as vent components. The examinations identified in GL 88-01 are performed in accordance with the staff positions on schedule, method, personnel qualification, and sample expansion included in the generic letter or with the staff-approved BWRVIP-75 report.
(Ref. Section 3/4.6.E, VYNPS Technical Specification)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The comprehensive program outlined in NUREG-0313 and NRC GL 88-01 addresses improvements in all three elements that, in combination, cause IGSCC. These elements consist of a susceptible (sensitized) material, a significant tensile stress, and an aggressive environment. Sensitization of nonstabilized austenitic SSs containing greater than 0.03 wt% carbon involves precipitation of chromium carbides at the grain boundaries during certain fabrication or welding processes. The formation of carbides creates an envelope of chromium depleted region that, in certain environments, is susceptible to stress corrosion cracking (SCC). Residual tensile stresses are introduced from fabrication processes, such as welding, surface grinding, or forming. High levels of dissolved oxygen or aggressive contaminants, such as sulfates or chlorides, accelerate the SCC processes.

The program delineated in NUREG-0313 and NRC GL 88-01 and in the staff-approved BWRVIP-75 report includes recommendations regarding selection of materials that are resistant to sensitization, use of special processes that reduce residual tensile stresses, and monitoring and maintenance of coolant chemistry. The resistant materials are used for new and replacement components and include low-carbon grades of austenitic SS and weld metal, with a maximum carbon of 0.035 wt.% and a minimum ferrite of 7.5% in weld metal and cast austenitic stainless steel (CASS). Inconel 82 is the only commonly used nickel-base weld metal considered to be resistant to SCC; other nickel-alloys, such as Alloy 600 are evaluated on an individual basis. Special processes are used for existing, new, and replacement components. These processes include solution heat treatment, heat sink welding, induction heating, and mechanical stress improvement.

The program delineated in NUREG-0313 and NRC GL 88-01 does not provide specific guidelines for controlling reactor water chemistry to mitigate IGSCC. Maintaining high water purity reduces susceptibility to SCC or IGSCC. The program description, and evaluation and technical basis of monitoring and maintaining reactor water chemistry are addressed through implementation of Section XI.M2, "Water Chemistry."

b. Comparison to VYNPS Preventive Actions

VYNPS has taken actions to prevent IGSCC and will continue to use materials resistant to IGSCC for component replacements and repairs following the recommendations delineated in NUREG-0313, Generic Letter 88-01, and the staff-approved BWRVIP-75 report. Extensive piping replacement and mitigating treatments were applied throughout the austenitic piping system during the decade from 1977 to 1986. The result of these actions is that nearly all piping, nozzles, and welds in the austenitic system are composed of resistant materials.
(Ref. Section 2.3.2, NRC SER for VYNPS GL 88-01 Response)

The VYNPS program includes preventive measures to mitigate aging by maintaining water chemistry in accordance with the Water Chemistry Control – BWR Program, Section 4.23.2.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program detects and sizes cracks and detects leakage by using the examination and inspection guidelines delineated in NUREG 0313, Rev. 2, and NRC GL 88-01 or the referenced BWRVIP-75 guideline as approved by the NRC staff."

b. Comparison to VYNPS Parameters Monitored/Inspected

Inspection of piping identified in NRC Generic Letter 88-01 to detect and size cracks is performed in accordance with the staff positions on schedule, method, personnel qualification and sample expansion included in the generic letter and the staff-approved BWRVIP-75 report.
(Ref. Section 3/4.6.E, VYNPS Technical Specification)

VYNPS monitors reactor coolant leakage as recommended by Generic Letter 88-01.
(Ref. Section 3/4.6.C.1.b, VYNPS Technical Specification)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The extent, method, and schedule of the inspection and test techniques delineated in NRC GL 88-01 or BWRVIP-75 are designed to maintain

structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of the component. The inspection guidance in approved BWRVIP-75 replaces the extent and schedule of inspection in NRC GL 88-01. The program uses volumetric examinations to detect IGSCC.

The NRC GL 88-01 recommends that the detailed inspection procedure, components, and examination personnel be qualified by a formal program approved by the NRC. These inspection guidelines, updated in the approved BWRVIP-75 document, provide the technical basis for revisions to NRC GL 88-01 inspection schedules. Inspection can reveal cracking and leakage of coolant. The extent and frequency of inspection recommended by the program are based on the condition of each weld (e.g., whether the weldments were made from IGSCC-resistant material, whether a stress improvement process was applied to a weldment to reduce residual stresses, and how the weld was repaired if it had been cracked)."

b. Comparison to VYNPS Detection of Aging Effects

Inspection of piping identified in Generic Letter 88-01 to detect and size cracks is performed in accordance with the staff positions on schedule, methods, and personnel and sample expansion included in the generic letter and BWRVIP-75.
(Ref. Section 3/4.6.E, VYNPS Technical Specification)

VYNPS has been granted two relief requests to use BWRVIP-75 criteria in lieu of Generic Letter 88-01 criteria for the fourth ten-year interval (9/1/03 through 8/31/13). Relief request ISI-02 allows use of a risk-informed program to select not less than 10% of category B-J piping welds for examination rather than the 25% required by ASME Section XI. Relief request ISI-07 allows inspection of 25% of the category B-F dissimilar metal weld population every interval rather than the 100% required by ASME Section XI.
(Ref. App. A, PP 7015; NVY 04-016; and SER for BWRVIP-75)

This program is credited with managing the following aging effects.

- cracking of piping and safe ends of greater than 4 inches nominal diameter (AMRM-31)
- cracking of piping, valves, pumps and fittings of greater than 4 inches nominal diameter (AMRM-33)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"The extent and schedule for inspection, in accordance with the recommendations of NRC GL 88-01 or approved BWRVIP-75 guidelines,

provide timely detection of cracks and leakage of coolant. Based on inspection results, NRC GL 88-01 or approved BWRVIP-75 guidelines provide guidelines for additional samples of welds to be inspected when one or more cracked welds are found in a weld category."

b. Comparison to VYNPS Monitoring and Trending

Sample expansion occurs per Generic Letter 88-01 and approved BWRVIP-75 guidelines if indications are found.
(Ref. Section 3/4.6.E, VYNPS Technical Specification)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"As recommended in NRC GL 88-01, any indication detected is evaluated in accordance with the ASME Section XI, IWB-3600 of Section XI of the 1986 Edition of the ASME Boiler and Pressure Vessel Code and the guidelines of NUREG-0313.

Applicable and approved BWRVIP-14, BWRVIP-59, BWRVIP-60, and BWRVIP-62 documents provide guidelines for evaluation of crack growth in SSs, nickel alloys, and low-alloy steels. An applicant may use BWRVIP-61 guidelines for BWR vessel and internals induction heating stress improvement effectiveness on crack growth in operating plants."

b. Comparison to VYNPS Acceptance Criteria

Indications found during inservice inspection are evaluated in accordance with ASME Section XI, Subsection IWB-3640 (1998 edition with 2000 addenda) and the guidelines of NUREG-0313.
(Ref. Sections 1.2 and 4.5, PP 7015)

VYNPS acceptance criteria are not consistent with NUREG-1801because the 1998 edition with 2000 addenda of ASME Section XI, Subsection IWB-3600 is used for flaw evaluation, while NUREG-1801 specifies the 1986 edition of ASME Section XI, Subsection IWB-3600 for flaw evaluation. Since ASME Section XI through the 2003 Addenda has been accept by NRC in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of subsection IWB-3600 from the 1998 edition with 2000 addenda, use of this version for flaw evaluation is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

7. **Corrective Actions**

   a. NUREG-1801, Corrective Actions

   "The guidance for weld overlay repair and stress improvement or replacement is provided in NRC GL 88-01; ASME Section XI, Subsections IWB-4000 and IWB-7000, IWC-4000 and IWC-7000, or IWD-4000 and IWD-7000, respectively for Class 1, 2, or 3 components; and ASME Code Case N 504-1. 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

   VYNPS repair and replacement procedure is in conformance with ASME Section XI repair and replacement criteria or the applicable code for the indication. The VYNPS Corrective Action Program is also applicable. ***(Ref. AP 0070)***

   VYNPS corrective actions are consistent with 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

   "Intergranular stress corrosion cracking has occurred in small- and large-diameter BWR piping made of austenitic stainless steel and nickel-base alloys. Cracking has occurred in recirculation, core spray, residual heat removal (RHR), control rod drive (CRD) return line penetrations, and reactor water cleanup (RWCU) system piping welds (NRC GL 88-01, NRC Information Notices [INs] 82-39, 84-41, and 04-08). The comprehensive program outlined in NRC GL 88-01, NUREG-0313, and in the staff-approved BWRVIP-75 report addresses mitigating measures for SCC or IGSCC (e.g., susceptible material, significant tensile stress, and an aggressive environment). The GL 88-01 program has been effective in managing IGSCC in BWR reactor coolant pressure-retaining components and the revision to the GL 88-01 program, according to the staff-approved BWRVIP-75 report, will adequately manage IGSCC degradation."

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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

NRC Final SER for BWRVIP-75, W. H. Bateman to C. Terry, 14 May 2002, "Final Safety Evaluation of the "BWRVIP Vessel and Internals Project, BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules (BWRVIP-75), EPRI Report TR-113932, October 1999 (TAC NO. MA5012)"

NRC SER for VYNPS GL 88-01 response, 15 Feb 1990, M. B. Fairtile to L. A. Tremblay, "Review of Response to Generic Letter (GL) 88-01, NRC Position on IGSCC in BWR Stainless Steel Piping (TAC NO. 69160)"

NVY 04-016, NRC letter, D. J. Roberts to M. Kansler, 5 March 2004, "Safety Evaluation of Relief Requests for the Fourth 10-Year Interval of the Inservice Inspection Program – Vermont Yankee Nuclear Power Station (TAC NOS. MB8349 through MB8358)"

PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program

VYNPS Technical Specification, Amendment 228

D. Summary

The BWR Stress Corrosion Cracking Program has been effective at managing aging effects. The BWR Stress Corrosion Cracking 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 BWR Stress Corrosion Cracking Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking with the following exception.

BWR Stress Corrosion Cracking Program

Attributes Affected	Exception
6. Acceptance Criteria	The 1998 edition with 2000 addenda of ASME Section XI, Subsection IWB-3600 is used for flaw evaluation, while NUREG-1801 specifies the 1986 edition of ASME Section XI, Subsection IWB-3600 for flaw evaluation. (Note 1)

Exception Notes

1. Since ASME Section XI through the 2003 Addenda has been accept by NRC in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of subsection IWB-3600 from the 1998 edition with 2000 addenda, use of this version for flaw evaluation is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

4.6 BWR Vessel ID Attachment Welds Program

A. Program Description

The BWR Vessel ID Attachment Welds Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds.

The program includes (a) inspection and flaw evaluation in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) BWRVIP-48 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192) to ensure the long-term integrity and safe operation of reactor vessel inside diameter (ID) attachment welds and support pads.
(Ref. PP 7027)

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program is focused on managing the effects of cracking due to stress corrosion cracking (SCC), including intergranular stress corrosion cracking (IGSCC). The program contains preventive measures to mitigate SCC; inservice inspection (ISI) to detect cracking and monitor the effects of cracking on the intended function of the components; and repair and/or replacement, as needed, to maintain the ability to perform the intended function.

The guidelines of BWRVIP-48 include inspection recommendations and evaluation methodologies for the attachment welds between the vessel wall and vessel ID brackets that attach safety-related components to the vessel (e.g., jet pump riser braces and core-spray piping brackets). In some cases, the attachment is a simple weld; in others, it includes a weld build-up pad on the vessel. The BWRVIP-48 guidelines include information on the geometry of the vessel ID attachments, evaluate susceptible locations and safety consequence of failure, provide recommendations regarding the method, extent, and frequency of inspection, and discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations."

b. Comparison to VYNPS Scope

The VYNPS program manages the effects of crack initiation and growth for the attachment welds between the vessel wall and vessel ID brackets that attach safety-related components to the vessel (i.e., core spray piping brackets, feedwater sparger end bracket-to-vessel attachment, jet pump riser braces, steam dryer support attachment, surveillance specimen holder bracket attachment, steam dryer hold-down bracket attachment, and guide rod bracket attachment) by mitigation, detection and monitoring.
(Ref. App. A, PP 7027)

Mitigation is achieved by maintaining water quality in accordance with the Water Chemistry Control – BWR Program, Section 4.23.2.

Detection and monitoring is accomplished by performing inspections in accordance with the method, extent and frequency described in BWRVIP-48.
(Ref. Sections 1.3 and 3.2.6.5, PP 7027 and NE 8067)

Repair or replacement occurs as needed to maintain the ability to perform the intended function.
(Ref. AP 0070)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The BWRVIP-48 provides guidance on detection, but does not provide guidance on methods to mitigate cracking. Maintaining high water purity reduces susceptibility to SCC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515). The program description and evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in Section XI.M2, "Water Chemistry."

b. Comparison to VYNPS Preventive Actions

VYNPS monitors and controls reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192), which supercedes BWRVIP-29. Further details may be found in the discussion of the Water Chemistry Control – BWR Program, Section 4.23.2.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program monitors the effects of SCC and IGSCC on the intended function of vessel attachment welds by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-48 and the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB 2500-1 (2001 edition[3] including the 2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry provided that such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff."

[3] An applicant may rely on a different version of the ASME Code, but should justify such use. An applicant may wish to refer to the SOC for an update of 10 C.F.R. § 50.55a to justify use of a more recent edition of the Code.

b. Comparison to VYNPS Parameters Monitored/Inspected

The VYNPS program detects and sizes cracks in accordance with BWRVIP-48 and ASME Section XI Table IWB-2500-1 (1998 Edition with 2000 Addenda). Indications found during reactor vessel internals inspection are documented and evaluated in accordance with the applicable code for the indication.
(Ref. Section 4.9, PP 7027)

To date, VYNPS has not sought inspection relief for vessel ID attachment welds based on the use of hydrogen water chemistry. If inspection relief is sought in the future, the guidelines of BWRVIP-62 will be followed.
(Ref. App. C, PP 7027)

VYNPS parameters monitored and inspected are not consistent with NUREG-1801 because Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b)(2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The extent and schedule of the inspection and test techniques prescribed by BWRVIP-48 guidelines are designed to maintain structural integrity and

ensure that aging effects will be discovered and repaired before the loss of intended function. Inspection can reveal cracking. Vessel ID attachment welds are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-2. The Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections on the surfaces of components and visual VT-3 examination to determine the general mechanical and structural condition of the component supports. The inspection and evaluation guidelines of BWRVIP-48 recommend more stringent inspections for certain attachments. The guidelines recommend enhanced visual VT-1 examination of all safety-related attachments and those nonsafety-related attachments identified as being susceptible to IGSCC. Visual VT-1 examination is capable of achieving 1/32 in. resolution; the enhanced visual VT-1 examination method is capable of achieving a 1-mil wire resolution. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03."

b. Comparison to VYNPS Detection of Aging Effects

Vessel ID attachment welds for the surveillance specimen holder bracket attachment, steam dryer hold-down bracket attachment, and guide rod bracket attachment are visually inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-2.
(Ref. App. A, PP 7027)

Enhanced visual inspections are performed on the vessel ID attachment welds for the core spray piping brackets, jet pump riser brackets, feedwater sparger end bracket-to-vessel attachment, and the steam dryer support attachment in accordance with the guidelines of BWRVIP-48. The enhanced visual examination method is capable of achieving at least a 1-mil wire resolution as recommended by BWRVIP-48.
(Ref. App. A, PP 7027)

This program is credited with managing the following aging effects.

- cracking for pressure vessel inside diameter (ID) attachment welds (AMRM-31)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Inspections scheduled in accordance with IWB-2400 and approved BWRVIP-48 guidelines provide timely detection of cracks. If flaws are detected, the scope of examination is expanded."

b. Comparison to VYNPS Monitoring and Trending

Inspections are scheduled in accordance with the requirements of ASME Section XI and BWRVIP-48. The program requires expanded inspection scope and re-inspection if flaws are detected.
(Ref. Section 4.10 and App. A, PP 7027)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Any indication detected is evaluated in accordance with ASME Section XI or the staff-approved BWRVIP-48 guidelines. Applicable and approved BWRVIP-14, BWRVIP-59, and BWRVIP-60 documents provide guidelines for evaluation of crack growth in stainless steels (SSs), nickel alloys, and low-alloy steels, respectively."

b. Comparison to VYNPS Acceptance Criteria

Indications found during reactor vessel internals inspection are documented and evaluated in accordance with the applicable code for the indication.
(Ref. Section 4.9, PP 7027)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair and replacement procedures are equivalent to those requirements in the ASME Section XI. Repair is performed in conformance with IWB-4000 and replacement occurs according to IWB-7000. As discussed in the appendix to this report, the staff finds that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions."

b. Comparison to VYNPS Corrective Actions

VYNPS repair and replacement procedure is in conformance with ASME Section XI and BWRVIP-48 repair and replacement criteria. The VYNPS Corrective Action Program is also applicable.
(Ref. Section 4.11, PP 7027; and AP 0070)

VYNPS corrective actions are consistent with 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

"Cracking due to SCC, including IGSCC, has occurred in BWR components. The program guidelines are based on evaluation of available information, including BWR inspection data and information on the elements that cause IGSCC, to determine which attachment welds may be susceptible to cracking. Implementation of the program provides reasonable assurance that cracking will be adequately managed and the intended functions of the vessel ID attachments will be maintained consistent with the current licensing basis (CLB) for the period of extended operation."

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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

BWRVIP-48, Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines, EPRI Report TR-108724, February, 1998

NE 8067, Rev 03, LPC 00, Reactor Vessel Internals Inspection Details

PP 7027, Rev. 03, LPC 00, Reactor Vessel Internals Management Program

D. Summary

The BWR Vessel ID Attachment Welds Program has been effective at managing aging effects. The BWR Vessel ID Attachment Welds 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.

BWR Vessel ID Attachment Welds Program

The BWR Vessel ID Attachment Welds Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds with the following exception.

Attributes Affected	Exception
3. Parameters Monitored/Inspected	Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda. (Note 1)

Exception Notes

1. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

4.7 BWR Vessel Internals Program

A. Program Description

The BWR Vessel Internals Program at VYNPS is comparable to the program described in NUREG-1801, Section XI. M9, BWR Vessel Internals.

The program includes (a) inspection, flaw evaluation, and repair in conformance with the applicable, staff-approved, industry BWR Vessel and Internals Project (BWRVIP) documents and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internal components.

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel
- AMRM-32, Reactor Vessel Internals

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program is focused on managing the effects of cracking due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), or irradiation assisted stress corrosion cracking (IASCC). The program contains preventive measures to mitigate SCC, IGSCC, or IASCC; inservice inspection (ISI) to monitor the effects of cracking on the intended function of the components; and repair and/or replacement as needed to maintain the ability to perform the intended function.

The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The guidelines include information on component description and function; evaluate susceptible locations and safety consequences of failure; provide recommendations for methods, extent, and frequency of inspection; discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations; and recommend repair and replacement procedures.

The various applicable BWRVIP guidelines are as follows.

Core shroud: BWRVIPs-07, -63, and -76 provide guidelines for inspection and evaluation; BWRVIP-02, Rev. 2, provides guidelines for repair design criteria.

BWR Vessel Internals Program

Core plate: BWRVIP-25 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria.

Shroud support: BWRVIP-38 provides guidelines for inspection and evaluation; BWRVIP-52 provides guidelines for repair design criteria.

Low-pressure coolant injection (LPCI) coupling: BWRVIP-42 provides guidelines for inspection and evaluation; BWRVIP-56 provides guidelines for repair design criteria.

Top guide: BWRVIP-26 provides guidelines for inspection and evaluation; BWRVIP-50 provides guidelines for repair design criteria. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>I MeV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation. An additional 5% of the top guide locations will be inspected within twelve years after entering the period of extended operation.

Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5% of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5% of the top guide locations will be inspected within twelve years after the date projected for exceeding the threshold.

The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a ten percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

Core spray: BWRVIP-18 provides guidelines for inspection and evaluation; BWRVIP-16 and 19 provides guidelines for replacement and repair design criteria, respectively.

Jet pump assembly: BWRVIP-41 provides guidelines for inspection and evaluation; BWRVIP-51 provides guidelines for repair design criteria.

Control rod drive (CRD) housing: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-58 provides guidelines for repair design criteria.

Lower plenum: BWRVIP-47 provides guidelines for inspection and evaluation; BWRVIP-57 provides guidelines for repair design criteria for instrument penetrations.

In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; BWRVIP-45 provides guidelines for weldability of irradiated structural components."

b. Comparison to VYNPS Scope

The VYNPS program manages cracking of reactor internal components. It identifies the components to be inspected and their inspection requirements. It provides direction for evaluation of flaws and repair of reactor internals components.
(Ref. Section 1.1, PP 7027)

The BWR Vessel Internals Program includes all of the reactor vessel internals, except components that are periodically replaced, such as fuel bundles, control rods, and in-core instruments.
(Ref. Section 1.2, PP 7027)

The BWR Vessel Internals Program implements BWRVIP recommendations and includes provisions to notify the NRC if VYNPS does not implement a BWRVIP recommendation.
(Ref. Sections 4.1.2 and 4.2, PP 7027)

VYNPS repair design criteria are consistent with NUREG-1801, because the applicable BWRVIP document will be used for the vessel internals component to be repaired or replaced.
(Ref. Section 4.11, PP 7027)

VYNPS scope of inspection and evaluation is not consistent with NUREG-1801 due to exceptions to specific BWRVIP guidelines. The BWRVIP inspection and evaluation guidelines followed by VYNPS, with specific exceptions, are as follows.

Core shroud: BWRVIP-76, issued in November 1999 with the intent of subsuming BWRVIP-01, BWRVIP-07 and BWRVIP-63, provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-76 guidelines with one exception,

For shroud horizontal welds H1, H2 and H3, VYNPS inspects 18 inches in length in each of the four quadrants from the outside diameter using EVT-1 methods. If cracks are found in a quadrant, the length is expanded in that quadrant to detect 18 inches of unflawed weld. Thus, VYNPS does not meet the BWRVIP-76 requirement to inspect both the outside and inside diameter of the welds and does not meet the requirement to inspect 100% of the length of the welds. The core spray spargers cover H1 and H2, and grating covers the periphery of the top guide. Therefore, access to the shroud inside diameter would be through vacated fuel cells, which would result in the camera being too distant from the inspection surfaces to perform an adequate EVT-1 of H1, H2, or H3. Although no BWRVIP guidance is given for one-sided visual examinations of horizontal welds, they are inspected on a six-year frequency following the BWRVIP guidance for a one-sided EVT-1 of vertical welds. The excellent results obtained in the 1995 ultrasonic examination of welds H1, H2, and H3 (very limited indications) and the 1996

ultrasonic examination of the vertical and ring segment welds (no indications) provide additional assurance that a one sided EVT-1 is acceptable.
(Ref. TE-2004-0018, PP 7027)

Core plate: BWRVIP-25 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-25 guidelines with one exception,

VYNPS performs VT-3 inspection of 50% (15) of the top of the core plate rim hold-down bolts every other refueling outage. If access to the lower plenum becomes available, VYNPS plans to perform a VT-3 inspection of accessible rim hold-down bolt bottom locking engagement and accessible aligner pin assemblies. Thus, VYNPS does not meet the BWRVIP-25 requirement to perform enhanced VT-1 from below the core plate of 50% of the hold-down bolts every other refueling outage. A baseline VT-3 examination of the tops of all 30 bolted connections was performed in 1996. Follow-up VT-3 examinations of tops of 50% of the bolted connections were performed in 1999, 2000 and 2001. None of the exams found evidence of cracking or bolting disassembly. Since the lower bolted connections are similar to the top, and there are no failed connections in the sample that is inspected, it is unlikely that a significant number of failed connections could exist in the remainder of the population. Therefore, the VYNPS inspection plan is adequate for ensuring the structural integrity of the core plate configuration to resist sliding against shear loads.
(Ref. TJ-2004-01, PP 7027)

Shroud support: BWRVIP-38 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-38 guidelines.

Low-pressure coolant injection (LPCI) coupling: BWRVIP-42 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-42 guidelines.

Top guide: BWRVIP-26 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-26 guidelines.

Enhancement: The VYNPS top guide fluence is projected to exceed the threshold for IASCC ($5x10^{20}$ n/cm^2) prior to the period of extended operation. Therefore, ten (10) percent of the top guide locations will be inspected using enhanced visual inspection technique, EVT-1, within the first 12 years of the period of extended operation, with one-half of the inspections (50 percent of locations) to be completed within the first 6 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold. ***(Ref. LRPD-03)***

Core spray: BWRVIP-18 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-18 guidelines with one exception,

VYNPS defers inspection of the three inaccessible welds inside each of the two core spray nozzles, and the P9 welds inside the core spray shroud

collars, until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, VYNPS does not meet the BWRVIP-18 requirement to perform an ultrasonic inspection of a full target weld set every other refueling outage. The three core spray thermal sleeve welds in each of the two core spray nozzles are full penetration butt welds, which decreases the likelihood of cracking. Inspection of similar core spray piping welds, such as junction box-to-pipe and upper elbow welds, showed no indication of cracking. Integrity of the P9 welds must be considered because indications have been recorded during ultrasonic examination of collar-to-shroud welds at VYNPS. The P9 welds are creviced. All other creviced core spray welds at VYNPS – the junction box cover plate welds, P1 welds and downcomer sleeve welds – show no indications of cracking. Therefore, deferral of inspection of the inaccessible welds is justified.
(Ref. TJ-2004-002, PP 7027)

Jet pump assembly: BWRVIP-41 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-41 guidelines with two exceptions,

VYNPS uses EVT-1 inspection of six jet pump welds with UT indications. Thus, VYNPS does not meet guidance implied in BWRVIP-41 that when flaws are identified, subsequent examinations should use the same technique that originally found the flaw.
(Ref. TE-2003-0021, PP 7027)

VYNPS defers inspection of jet pump inaccessible welds, until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, VYNPS does not meet the BWRVIP-41 requirement to perform a modified VT-1 of 100% of these welds over two 6-year inspection cycles and 25% per inspection cycle thereafter. The hidden jet pump welds are far enough into the nozzle that failure at these welds would not result in the thermal sleeve disengaging from the nozzle before the riser contacted the shroud. If the jet pump thermal sleeve or riser piping severed, it would be detected through jet pump monitoring, which alarms if the riser pipe moves more than 10% while at or above a core flow of 42 Mlb/hr. Therefore, deferral of inspection of the inaccessible welds is justified.
(Ref. TJ-2004-002, PP 7027)

Control rod drive (CRD) housing: BWRVIP-47 provides guidelines for inspection and evaluation. VYNPS follows BWRVIP-47 guidelines for control rod drive housings, with one exception,

VYNPS performed less than 5% of the CRD guide tube weld exams within the first six-year interval. Thus, VYNPS does not meet the BWRVIP-47 requirement to inspect 5% of the CRD guide tube welds within the first six years. To meet the BWRVIP-47 requirement to inspect 5% of the CRD guide tube welds within the first six years, VYNPS would have to inspect five guide tubes. Four CRD guide tube assemblies were inspected during the first six-year period, for a total of 4.5% of the welds. The inspections began in RFO 22 (2001), when four guide tube assemblies were inspected, and were

expected to be completed during RFO 23 (2002). Control blade change-out allows access to the interior of the CRD guide tube and, typically, there are between three and ten blade change-outs each outage. However, no control blades were changed during RFO 23. Inspecting one guide tube during RFO 23 to attain the 5% sample level would have required vacating an additional fuel cell (more fuel moves) and an added three hours for disassembly and reassembly (not counting inspection time). This hardship is not justified in terms of safety in order to raise the inspection sample from 4.5% to 5%. The BWRVIP-47 requirement to inspect 10% of the CRD guide tubes over the first twelve years will be met.
(Ref. TJ-2003-03, PP 7027)

Lower plenum: BWRVIP-47 provides guidelines for inspection and evaluation. VYNPS follows the guidelines of BWRVIP-47 for the lower plenum.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Maintaining high water purity reduces susceptibility to cracking due to SCC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515). The program description and evaluation, and technical basis of monitoring and maintaining reactor water chemistry are presented in Chapter XI.M2, 'Water Chemistry.' "

b. Comparison to VYNPS Preventive Actions

VYNPS monitors and controls reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192), which supercedes BWRVIP-29. Further details may be found in the discussion of the Water Chemistry Control – BWR Program, Section 4.23.2.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by inspection in accordance with the guidelines of applicable and approved BWRVIP documents and the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB 2500-1 (2001 edition[7] including the 2002 and 2003 Addenda). An applicant may use the guidelines of BWRVIP-62 for inspection relief for vessel internal components with hydrogen water chemistry provided such relief is submitted under the provisions of 10 CFR 50.55a and approved by the staff."

[7] An applicant may rely on a different version of the ASME Code, but should justify such use. An applicant may wish to refer to the SOC for an update of 10 C.F.R. § 50.55a to justify use of a more recent edition of the Code.

b. Comparison to VYNPS Parameters Monitored/Inspected

The VYNPS BWR Vessel Internals Program detects and sizes cracks in accordance with BWRVIP guidelines and ASME Section XI Table IWB-2500-1 (1998 Edition with 2000 Addenda). Indications found during reactor vessel internals inspection are documented and evaluated in accordance with the applicable code for the indication.
(Ref. Sections 1.3 and 4.9, PP 7027)

To date, VYNPS has not sought inspection relief for reactor vessel internals based on the use of hydrogen water chemistry. If inspection relief is sought in the future, the guidelines of BWRVIP-62 will be followed.
(Ref. App. C, PP 7027)

VYNPS parameters monitored and inspected are not consistent with NUREG-1801 because Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b)(2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The extent and schedule of the inspection and test techniques prescribed by the applicable and approved BWRVIP guidelines are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of BWR vessel internals. Inspection can reveal cracking. Vessel internal components are inspected in accordance with the requirements of ASME Section XI, Subsection IWB examination category B-N-2. The ASME Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections, such as cracks, corrosion, wear, or erosion, on the surfaces of components. This inspection also specifies visual VT-3 examination to determine the general mechanical and structural condition of the component supports by (a) verifying parameters, such as clearances, settings, and physical displacements, and (b) detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion.

The applicable and approved BWRVIP guidelines recommend more stringent inspections, such as enhanced visual VT-1 examinations or ultrasonic methods of volumetric inspection, for certain selected components and locations. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03."

b. Comparison to VYNPS Detection of Aging Effects

The VYNPS program detects aging effects using the appropriate NDE techniques as outlined in ASME Section XI, Subsection IWB, and applicable BWRVIP documents.
(Ref. Section 1.3, PP 7027)

This program is credited with managing the following aging effects.

- cracking for stainless steel and nickel based alloy subcomponents in the reactor pressure vessel – CRD housings, CRD stub tubes, in-core housings, and vessel nozzle thermal sleeves (AMRM-31)
- cracking for stainless steel, CASS, and nickel based alloy subcomponents in the reactor vessel internals (AMRM-32)

VYNPS detection of aging effects is not consistent with NUREG-1801 due to exceptions to specific BWRVIP guidelines listed in Scope of Program attribute.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Inspections scheduled in accordance with the applicable and approved BWRVIP guidelines provide timely detection of cracks. The scope of examination and reinspection must be expanded beyond the baseline inspection if flaws are detected."

b. Comparison to VYNPS Monitoring and Trending

Upon discovery of indications which do not meet established acceptance standards, additional (reinspection and expanded sample) examinations are performed in accordance with ASME Section XI or BWRVIP inspection and evaluation guidelines, as appropriate.
(Ref. Section 4.10, PP 7027)

VYNPS monitoring and trending is consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Any indication detected is evaluated in accordance with ASME Section XI or the applicable staff-approved BWRVIP guidelines. Approved BWRVIP-14, BWRVIP-59, and BWRVIP-60 documents provide guidelines for evaluation of crack growth in stainless steels (SSs), nickel alloys, and low-alloy steels, respectively."

b. Comparison to VYNPS Acceptance Criteria

Indications found during reactor vessel internals inspection are documented and evaluated in accordance with ASME Section XI or the applicable staff-approved BWRVIP guidelines.
(Ref. Section 4.9, PP 7027)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair and replacement procedures are equivalent to those requirements in ASME Section XI. Repair and replacement is performed in conformance with the applicable and approved BWRVIP guidelines listed above. As discussed in the appendix to this report, the staff finds that licensee implementation of the guidelines in the staff-approved BWRVIP reports will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions."

b. Comparison to VYNPS Corrective Actions

VYNPS repair and replacement procedure is in conformance with the applicable and approved BWRVIP guidelines listed above. The VYNPS Corrective Action Program is also applicable.
(Ref. Section 4.11, PP 7027 and AP 0070)

VYNPS corrective actions are consistent with 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

"Extensive cracking has been observed in core shrouds at both horizontal (Nuclear Regulatory Commission [NRC] Generic Letter [GL] 94-03) and vertical (NRC Information Notice [IN] 97-17) welds. It has affected shrouds fabricated from Type 304 and Type 304L SS, which is generally considered to be more resistant to SCC. Weld regions are most susceptible to SCC, although it is not clear whether this is due to sensitization and/or impurities associated with the welds or the high residual stresses in the weld regions. This experience is reviewed in NRC GL 94-03 and NUREG-1544; some experiences with visual inspections are discussed in NRC IN 94-42.

Both circumferential (NRC IN 88-03) and radial cracking (NRC IN 92-57) has been observed in the shroud support access hole cover made from Alloy 600. Instances of cracking in core spray spargers have been reviewed in NRC IE Bulletin 80-13.

Cracking of the core plate has not been reported, but the creviced regions beneath the plate are difficult to inspect. NRC IN 95-17 discusses cracking in top guides of United States and overseas BWRs. Related experience in other components is reviewed in NRC GL 94-03 and NUREG-1544. Cracking has also been observed in the top guide of a Swedish BWR.

Instances of cracking have occurred in the jet pump assembly (NRC Bulletin 80-07), hold-down beam (NRC IN 93-101), and jet pump riser pipe elbows (NRC IN 97-02).

Cracking of dry tubes has been observed at 14 or more BWRs. The cracking is intergranular and has been observed in dry tubes without apparent sensitization, suggesting that IASCC may also play a role in the cracking.

The program guidelines outlined in applicable and approved BWRVIP documents are based on an evaluation of available information, including BWR inspection data and information on the elements that cause SCC, IGSCC, or IASCC, to determine which components may be susceptible to cracking. Implementation of the program provides reasonable assurance that cracking will be adequately managed so the intended functions of the vessel internal components will be maintained consistent with the current licensing basis (CLB) for the period of extended operation."

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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

BWRVIP-79, BWR Water Chemistry Guidelines - 2000 Revision, EPRI Report TR-103515-R2, March 2000

NE 8067, Rev 03, LPC 00, Reactor Vessel Internals Inspection Details

PP 7027, Rev. 03, LPC 00, Reactor Vessel Internals Management Program

D. Summary

The BWR Vessel Internals Program has been effective at managing aging effects. The BWR Vessel Internals 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 BWR Vessel Internals Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M9, BWR Vessel Internals with the following exceptions and enhancement.

Attributes Affected	Exceptions
1. Scope of Program 4. Detection of Aging Effects	**Core Shroud** For shroud horizontal welds H1, H2 and H3, VYNPS inspects 18 inches in length in each of the four quadrants from the outside diameter using EVT-1 methods. If cracks are found in a quadrant, the length is expanded in that quadrant to detect 18 inches of unflawed weld. Thus, VYNPS does not meet the BWRVIP-76 requirement to inspect both the outside and inside diameter of the welds and does not meet the requirement to inspect 100% of the length of the welds. (Note 1)

BWR Vessel Internals Program

Attributes Affected	Exceptions
1. Scope of Program 4. Detection of Aging Effects	**Core Plate** VYNPS performs VT-3 inspection of 50% (15) of the top of the core plate rim hold-down bolts every other refueling outage. If access to the lower plenum becomes available, VYNPS plans to perform a VT-3 inspection of accessible rim hold-down bolt bottom locking engagement and accessible aligner pin assemblies. Thus, VYNPS does not meet the BWRVIP-25 requirement to perform enhanced VT-1 from below the core plate of 50% of the hold-down bolts. (Note 2)
1. Scope of Program 4. Detection of Aging Effects	**Core Spray** VYNPS defers inspection of the three inaccessible welds inside each of the two core spray nozzles, and the P9 welds inside the core spray shroud collars, until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, VYNPS does not meet the BWRVIP-18 requirement to perform an ultrasonic inspection of a full target weld set every other refueling outage. (Note 3)
1. Scope of Program 4. Detection of Aging Effects	**Jet Pump Assembly** VYNPS uses EVT-1 inspection of six jet pump welds with UT indications. Thus, VYNPS does not meet guidance implied in BWRVIP-41 that when flaws are identified, subsequent examinations should use the same technique that originally found the flaw. (Note 4) VYNPS defers inspection of jet pump inaccessible welds, until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, VYNPS does not meet the BWRVIP-41 requirement to perform a modified VT-1 of 100% of these welds over two 6-year inspection cycles and 25% per inspection cycle thereafter. (Note 3)

BWR Vessel Internals Program

Attributes Affected	Exceptions
1. Scope of Program 4. Detection of Aging Effects	**Control Rod Drive Housing** VYNPS performed less than 5% of the CRD guide tube weld exams within the first six-year interval. Thus, VYNPS does not meet the BWRVIP-47 requirement to inspect 5% of the CRD guide tube welds within the first six years. (Note 5)
3. Parameters Monitored/Inspected	Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda. (Note 6)

Exception Notes

1. The core spray spargers cover H1 and H2, and grating covers the periphery of the top guide. Therefore, access to the shroud inside diameter would be through vacated fuel cells, which would result in the camera being too distant from the inspection surfaces to perform an adequate EVT-1 of H1, H2, or H3. Although no BWRVIP guidance is given for one-sided visual examinations of horizontal welds, they are inspected on a six-year frequency following the BWRVIP guidance for a one-sided EVT-1 of vertical welds. The excellent results obtained in the 1995 ultrasonic examination of welds H1, H2, and H3 (very limited indications) and the 1996 ultrasonic examination of the vertical and ring segment welds (no indications) provide additional assurance that a one sided EVT-1 is acceptable.
2. A baseline VT-3 examination of the tops of all 30 bolted connections was performed in 1996. Follow-up VT-3 examinations of tops of 50% of the bolted connections were performed in 1999, 2000 and 2001. None of the exams found evidence of cracking or bolting disassembly. Since the lower bolted connections are similar to the top, and there are no failed connections in the sample that is inspected, it is unlikely that a significant number of failed connections could exist in the remainder of the population. Therefore, the VYNPS inspection plan is adequate for ensuring the structural integrity of the core plate configuration to resist sliding against shear loads.
3. The three core spray thermal sleeve welds in each of the two core spray nozzles are full penetration butt welds, which decreases the likelihood of cracking. Inspection of similar core spray piping welds, such as junction box-to-pipe and upper elbow welds, showed no indication of cracking. Integrity of the P9 welds must be considered because indications have been recorded during ultrasonic examination of collar-to-shroud welds at VYNPS. The P9 welds are creviced. All other creviced core spray welds at VYNPS – the junction box cover plate welds, P1 welds and downcomer sleeve welds – show no indications of cracking. The hidden jet pump welds are far enough into the nozzle that failure at these welds would not result in the thermal sleeve disengaging from the nozzle before the riser contacted the shroud. If the jet pump thermal sleeve or riser piping severed, it would be detected through jet pump monitoring, which alarms if the riser pipe moves more than 10% while at or above a core flow of 42 Mlb/hr. Therefore, deferral of inspection of the inaccessible welds is justified.
4. For jet pump welds, BWRVIP-41 finds EVT-1 or UT to be acceptable examination techniques. In 1996, VYNPS performed UT examinations and recorded indications in six jet pump welds. All six welds were reinspected by UT after two cycles of operation and

there were no new indications or growth of existing indications. Since the reinspection demonstrated that there is no active cracking in these welds, and EVT-1 inspection will reveal cracking prior to encroachment on the weld structural integrity limit, performing subsequent inspections using the EVT-1 technique is acceptable. VYNPS will perform the EVT-1 inspections every two cycles until three successive inspections confirm no indications of cracks, at which time VYNPS will revert to the six-year inspection interval specified in BWRVIP-41.

5. To meet the BWRVIP-47 requirement to inspect 5% of the CRD guide tube welds within the first six years, VYNPS would have to inspect five guide tubes. Four CRD guide tube assemblies were inspected during the first six-year period, for a total of 4.5% of the welds. The inspections began in RFO 22 (2001), when four guide tube assemblies were inspected, and were expected to be completed during RFO 23 (2002). Control blade change-out allows access to the interior of the CRD guide tube and, typically, there are between three and ten blade change-outs each outage. However, no control blades were changed during RFO 23. Inspecting one guide tube during RFO 23 to attain the 5% sample level would have required vacating an additional fuel cell (more fuel moves) and an added three hours for disassembly and reassembly (not counting inspection time). This hardship is not justified in terms of safety in order to raise the inspection sample from 4.5% to 5%. The BWRVIP-47 requirement to inspect 10% of the CRD guide tubes over the first twelve years will be met.
6. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

Attributes Affected	Enhancement
1. Scope of Program	The VYNPS top guide fluence is projected to exceed the threshold for IASCC ($5x10^{20}$ n/cm^2) prior to the period of extended operation. Therefore, ten (10) percent of the top guide locations will be inspected using enhanced visual inspection technique, EVT-1, within the first 12 years of the period of extended operation, with one-half of the inspections (50 percent of locations) to be completed within the first 6 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold. ***(Ref. LRPD-03)***

4.8 Containment Leak Rate Program

A. Program Description

The Containment Leak Rate Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.S4, 10 CFR 50, Appendix J.

As described in 10 CFR Part 50, Appendix J, containment leak rate tests are required to assure that (a) leakage through primary reactor containment and systems and components penetrating primary containment shall not exceed allowable values specified in technical specifications or associated bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating primary containment.

This program is credited in the following.

- AMRC-01, Primary Containment
- AMRM-20, Primary Containment Penetrations

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The scope of the containment LRT program includes all pressure-retaining components. Two types of tests are implemented. Type A tests are performed to measure the overall primary containment integrated leakage rate, which is obtained by summing leakage through all potential leakage paths, including containment welds, valves, fittings, and components that penetrate containment. Type B tests are performed to measure local leakage rates across each pressure-containing or leakage-limiting boundary for containment penetrations. Type A and B tests described in 10 CFR Part 50, Appendix J, are acceptable methods for performing these LRTs. Leakage testing for containment isolation valves (normally performed under Type C tests), if not included under this program, is included under LRT programs for systems containing the isolation valves."

b. Comparison to VYNPS Scope

The Containment Leak Rate Program includes Type A, Type B, and Type C tests of primary containment pressure-retaining components as described in 10 CFR Part 50, Appendix J.
(Ref. Section 1.0, ENN-DC-334)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"No preventive actions are specified; the containment LRT program is a monitoring program."

b. Comparison to VYNPS Preventive Actions

The VYNPS program is a monitoring program.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The parameters to be monitored are leakage rates through containment shells; containment liners; and associated welds, penetrations, fittings, and other access openings."

b. Comparison to VYNPS Parameters Monitored/Inspected

Parameters monitored are leakage rates through containment shells; containment liners; and associated welds, penetrations, fittings, and other access openings.
(Ref. Sections 3.0[40] through 3.0[42], ENN-DC-334)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"A containment LRT program is effective in detecting degradation of containment shells, liners, and components that compromise *(sic)* the containment pressure boundary, including seals and gaskets. While the calculation of leakage rates demonstrates the leak-tightness and structural integrity of the containment, it does not by itself provide information that would indicate that aging degradation has initiated or that the capacity of the containment may have been reduced for other types of loads, such as seismic loading. This would be achieved with the additional implementation of an acceptable containment inservice inspection program as described in XI.S1 and XI.S2."

b. Comparison to VYNPS Detection of Aging Effects

The VYNPS Containment Inservice Inspection Program supplements the Containment Leak Rate Program in detecting effects of aging.
(Ref. Section 4.4.4.3, PP 7006 and section 5.4[11], ENN-DC-334)

This program is credited with managing the following aging effects.

- loss of material and cracking for carbon and stainless steel components (AMRC-01)
- cracking and change in material properties for primary containment elastomer electrical penetration sealant (AMRC-01)
- loss of material for carbon steel containment penetration components (AMRM-20)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Because the LRT program is repeated throughout the operating license period, the entire pressure boundary is monitored over time. The frequency of these tests depends on which option (A or B) is selected. With Option A, testing is performed on a regular fixed time interval as defined in 10 CFR Part 50, Appendix J. In the case of Option B, the interval for testing may be increased on the basis of acceptable performance in meeting leakage limits in prior tests. Additional details for implementing Option B are provided in NRC Regulatory Guide 1.163 and NEI 94-01, Rev.0."

b. Comparison to VYNPS Monitoring and Trending

The VYNPS program utilizes Option B and the guidance in NRC Regulatory Guide 1.163 and NEI 94-01. For VYNPS, the first Type A test after the April 1995 Type A test shall be performed no later than April 2010. NRC approved Amendment 227 to Facility Operating License DPR-28 for VYNPS to extend the primary containment integrated leak rate testing interval from 10 years to no longer than 15 years on a one-time basis. During the period of extended operation, the Type A test interval will be 10 years.
(Ref. Section 6.7.C, VYNPS Technical Specification; Section 5.2, ENN-DC-334; Sections 1.1 and 4.4.1.4, PP 7006; and NVY 05-108)

VYNPS monitoring and trending are not consistent with NUREG-1801 due to this one-time exception.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Acceptance criteria for leakage rates are defined in plant technical specifications. These acceptance criteria meet the requirements in 10 CFR Part 50, Appendix J, and are part of each plant's current licensing basis. The current licensing basis carries forward to the period of extended operation."

b. Comparison to VYNPS Acceptance Criteria

VYNPS acceptance criteria are defined in plant technical specifications.
(Ref. Section 6.7.C, VYNPS Technical Specification; Sections 5.4[3] and 5.5[5], ENN-DC-334; and Section 4.5.5, PP 7006)

VYNPS acceptance criteria are not consistent with NUREG-1801 because main steam pathway leakage contributions (leakage through all four main steam lines and the main steam drain line) are excluded from the overall integrated leakage rate Type A test measurement and from the sum of the leakage rates from Type B and Type C tests. NRC approved Amendment 223 to Facility Operating License DPR-28 allowing this exemption from the requirements of Sections III.A and III.B of 10 CFR 50 Appendix J, Option B because a separate radiological consequence term has been provided for these pathways. The revised design basis radiological consequences analyses address leakage through these pathways as individual factors, exclusive of the primary containment leakage.
(Ref. NVY 05-040 and NVY 05-045)

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Corrective actions are taken in accordance with 10 CFR Part 50, Appendix J, and NEI 94-01. When leakage rates do not meet the acceptance criteria, an evaluation is performed to identify the cause of the unacceptable performance, and appropriate corrective actions must be taken. 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

Corrective actions are taken in accordance with 10 CFR Part 50, Appendix J, and NEI 94-01 and with the VYNPS corrective action program.
(Ref. Sections 5.4[8], 5.5[7] and 5.5[8], ENN-DC-334)

VYNPS corrective actions are consistent with 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

"To date, the 10 CFR Part 50, Appendix J, LRT program has been effective in preventing unacceptable leakage through the containment pressure boundary. Implementation of Option B for testing frequency must be consistent with plant-specific operating experience."

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 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

ENN-DC-334, Rev. 0, Primary Containment Leakage Rate Testing (Appendix J), Entergy Nuclear Northeast Nuclear Management Manual

NVY 05-040, Vermont Yankee Nuclear Power Station - Issuance of Exemption from 10 CFR Part 50, Appendix J (TAC No. MC0253), March 17, 2005

NVY 05-045, Vermont Yankee Nuclear Power Station - Issuance of Amendment Re: Alternative Source Term (TAC No. MC0253), March 29, 2005

NVY 05-108, Vermont Yankee Nuclear Power Station - Issuance of Amendment Re: One-Time Extension of Integrated Leak Rate Test Interval (TAC No. MC4662), August 31, 2005

PP 7006, Rev. 09, LPC 01, Primary Containment Leakage Rate Testing Program

VYNPS Technical Specification, Amendment 228

Containment Leak Rate Program

D. Summary

The Containment Leak Rate Program has been effective at managing aging effects. The Containment Leak Rate 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 Containment Leak Rate Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.S4, 10 CFR Part 50, Appendix J, with the following exceptions.

Attributes Affected	Exceptions
5. Monitoring and Trending	The first Type A test after the April 1995 Type A test shall be performed no later than April 2010. This is a one-time extension of the NEI 94-01, 10 year Type A test interval to 15 years. (Note 1)
6. Acceptance Criteria	Main steam pathway leakage contributions (leakage through all four main steam lines and the main steam drain line) are excluded from the overall integrated leakage rate Type A test measurement and from the sum of the leakage rates from Type B and Type C tests. (Note 2)

Exception Notes

1. NRC approved Amendment 227 to Facility Operating License DPR-28 for VYNPS to extend the primary containment integrated leak rate testing interval from 10 years to no longer than 15 years on a one-time basis. **(Ref. NVY 05-108)**
2. NRC approved Amendment 223 to Facility Operating License DPR-28 allowing this exemption from the requirements of Sections III.A and III.B of 10 CFR 50 Appendix J, Option B because a separate radiological consequence term has been provided for these pathways. The revised design basis radiological consequences analyses address leakage through these pathways as individual factors, exclusive of the primary containment leakage. **(Ref. *NVY 05-040 and NVY 05-045*)**

4.9 Diesel Fuel Monitoring Program

A. Program Description

The Diesel Fuel Monitoring Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M30, Fuel Oil Chemistry Program.

The Diesel Fuel Monitoring Program entails sampling to ensure that adequate diesel fuel quality is maintained to prevent corrosion of fuel systems. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic draining and cleaning of tanks and by verifying the quality of new oil before its introduction into storage tanks. Sampling and analysis activities are in accordance with technical specifications on fuel oil purity and the guidelines of ASTM Standards D4057-88 and D975-02 (or later revisions of these standards).

This program is credited in the following.

- AMRM-15, Fuel Oil System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program is focused on managing the conditions that cause general, pitting, and microbiologically influenced corrosion (MIC) of the diesel fuel tank internal surfaces in accordance with the plant's technical specifications (i.e., NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433) on fuel oil purity and the guidelines of ASTM Standards D1796, D2276, D2709, D6217, and D4057. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms."

b. Comparison to VYNPS Scope

The Diesel Fuel Monitoring Program includes sampling activities and analysis on the following tanks.

- fuel oil storage tank
- EDG fuel oil day tanks
- fire pump fuel oil day tank
- John Deere diesel fuel oil day tank

VYNPS scope is not consistent with NUREG-1801 because the guidelines of ASTM Standard D6217 are not used along with those of D2276 for determination of particulates. VYNPS technical specifications specify use of

ASTM D975-02, which recommends use of ASTM D2276. Therefore, the guidelines of D2276 are appropriate for determination of particulates. ***(Ref. OP 4613)***

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms."

b. Comparison to VYNPS Preventive Actions

The main diesel fuel storage tank is cleaned and inspected every ten years to remove sludge, debris and water. Fuel oil tanks are periodically sampled, near the bottom of the tanks, to determine water content. ***(Ref. OP 4613; PM Activity 3, PM Basis M118; and WO 94-08951)***

The VYNPS preventive action is not consistent with NUREG-1801, in that VYNPS does not use additives beyond those added by the refiner during production. VYNPS does not treat diesel fuel for microbiological organisms since plant-specific operating experience has not indicated significant problems related to MIC.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The AMP monitors fuel oil quality and the levels of water and microbiological organisms in the fuel oil, which cause the loss of material of the tank internal surfaces. The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel. For determination of particulates, *modified* ASTM D 2276, Method A, is used. The modification consists of using a filter with a pore size of 3.0 μm, instead of 0.8 μm. These are the principal parameters relevant to tank structural integrity."

b. Comparison to VYNPS Parameters Monitored/Inspected

This program monitors fuel oil quality and levels of water in the fuel oil. ASTM D4057-88 (or a later revision of this standard), Standard Practice for Manual Sampling of Petroleum and Petroleum Products, is used for guidance

on oil sampling. Safety-related diesel fuel oil is analyzed according to ASTM D975-02 (or a later revision of this standard). ASTM D1796 is used to check for water and sediment. Determination of particulates is according to ASTM Standard D2276.
(Ref. OP 4613)

VYNPS parameters monitored and inspected are not consistent with NUREG-1801 because NUREG-1801 states that ASTM Standards D1796 and D2709 are used for determination of water and sediment. However, these standards describe the determination of water and sediment for oils with different viscosities. Either standard is applicable to the #2 diesel fuel oil used at VYNPS. VYNPS uses ASTM Standard D1796 for determination of water and sediment. Also, determination of particulates may be according to ASTM Standard D2276 which conducts particulate analysis using a 0.8 micron filter, rather than the 3.0 micron filter specified in NUREG-1801. Use of a filter with a smaller pore size results in a larger sample of particulates since smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Degradation of the diesel fuel oil tank cannot occur without exposure of the tank internal surfaces to contaminants in the fuel oil, such as water and microbiological organisms. Compliance with diesel fuel oil standards in item 3, above, and periodic multilevel sampling provide assurance that fuel oil contaminants are below unacceptable levels. Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring."

b. Comparison to VYNPS Detection of Aging Effects

VYNPS complies with diesel fuel oil standards and performs periodic multilevel sampling to provide assurance that fuel oil contaminants are within acceptable limits. The fuel oil storage tank is periodically drained, cleaned and visually inspected to detect potential degradation. An ultrasonic thickness measurement of the tank bottom surface is also performed to ensure that significant degradation is not occurring.
(Ref. OP 4613; PM Activity 3, PM Basis M118; and WO 94-08951)

This program is credited with managing the following aging effects.

- loss of material and cracking for fuel oil system components exposed to fuel oil (AMRM-15)

- loss of material for fuel oil system components exposed to fuel oil (AMRM-30)

Enhancement: Ultrasonic thickness measurement of the fuel oil storage tank bottom surface will be performed every 10 years during tank cleaning and inspection.
(Ref. PM Activity 3, PM Basis M118 and WO 94-08951)

VYNPS detection of aging effects will be consistent with NUREG-1801.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Water and biological activity or particulate contamination concentrations are monitored and trended in accordance with the plant's technical specifications or at least quarterly. Based on industry operating experience, quarterly sampling and analysis of fuel oil provide for timely detection of conditions conducive to corrosion of the internal surface of the diesel fuel oil tank before the potential loss of its intended function."

b. Comparison to VYNPS Monitoring and Trending

Water and particulate concentrations are monitored and trended at least quarterly, and in accordance with technical specifications.
(Ref. OP 4613)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for guidance on the determination of water and sediment contamination in diesel fuel. ASTM D 6217 and Modified D 2276, Method A are used for guidance for determination of particulates. The modification to D 2276 consists of using a filter with a pore size of 3.0 μm, instead of 0.8 μm."

b. Comparison to VYNPS Acceptance Criteria

ASTM D4057-88 (or a later revision of this standard), Standard Practice for Manual Sampling of Petroleum and Petroleum Products, is used for guidance on oil sampling. Safety-related diesel fuel oil is analyzed according to ASTM D975-02 (or a later revision of this standard). Determination of particulates is according to ASTM Standard D2276. ASTM D1796 is used to check for water and sediment.
(Ref. OP 4613)

Filterable solids acceptance criterion is ≤10 mg/l.
(Ref. OP 4613)

Water and sediment acceptance criterion is ≤ 0.05%.
(Ref. OP 4613)

Enhancement: UT measurements of the fuel oil storage tank bottom surface will have acceptance criterion ≥ 60% Tnom.
(Ref. PM Activity 3, PM Basis M118 and WO 94-08951)

VYNPS acceptance criteria are not consistent with NUREG-1801 because NUREG-1801 states that ASTM Standards D1796 and D2709 are used for determination of water and sediment. However, these standards describe the determination of water and sediment for oils with different viscosities. Either standard is applicable to the #2 diesel fuel oil used at VYNPS. VYNPS uses ASTM Standard D1796 for determination of water and sediment. Also, determination of particulates may be according to ASTM Standard D2276 which conducts particulate analysis using a 0.8 micron filter, rather than the 3.0 micron filter specified in NUREG-1801. Use of a filter with a smaller pore size results in a larger sample of particulates since smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in NUREG-1801. Finally, the guidelines of ASTM Standard D6217 are not used along with those of D2276 for determination of particulates. VYNPS technical specifications specify use of ASTM D975-02, which recommends use of ASTM D2276. Therefore, the guidelines of D2276 are appropriate for determination of particulates.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Specific corrective actions are implemented in accordance with the plant quality assurance (QA) program. For example, corrective actions are taken to prevent recurrence when the specified limits for fuel oil standards are exceeded or when water is drained during periodic surveillance. Also, when the presence of biological activity is confirmed, a biocide is added to fuel oil. 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

When specified limits for fuel oil standards are exceeded, a condition report is issued in accordance with the Corrective Action Program. The Corrective Action Program ensures that the cause of the nonconformance is determined and that corrective action is taken to preclude recurrence.
(Ref. OP 4613)

VYNPS corrective actions are consistent with 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

"The operating experience at some plants has included identification of water in the fuel, particulate contamination, and biological fouling. However, no instances of fuel oil system component failures attributed to contamination have been identified."

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 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

M118, Rev. 1, PM Basis Activity 3, Every 10 years, drain, clean and inspect diesel fuel oil tank TK-40-1A

OP 4613, Rev. 35, LPC 00, Sampling and Testing of Diesel Fuel Oil

WO 94-08951, Drain, clean and inspect diesel fuel oil tank TK-40-1A

D. Summary

The Diesel Fuel Monitoring Program has been effective at managing aging effects. The program has been improved through evaluation of site and industry operating experience. The Diesel Fuel Monitoring Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

The Diesel Fuel Monitoring Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M30, Fuel Oil Chemistry Program, with the following exceptions and enhancements.

Diesel Fuel Monitoring Program

Attributes Affected	Exceptions
1. Scope of Program 6. Acceptance Criteria	The guidelines of ASTM Standard D6217 are not used along with those of D2276 for determination of particulates. (Note 1)
2. Preventive Actions	No additives are used beyond what the refiner adds during production. (Note 2)
3. Parameters Monitored / Inspected 6. Acceptance Criteria	Only ASTM Standard D1796 is used for determination of water and sediment, rather than Standards D1796 and D2709. (Note 3)
3. Parameters Monitored / Inspected 6. Acceptance Criteria	Determination of particulates may be according to ASTM Standard D2276, rather than modified ASTM D2276 Method A. (Note 4)

Exception Notes

1. VYNPS technical specifications specify use of ASTM D975-02, which recommends use of ASTM D2276. Therefore, the guidelines of D2276 are appropriate for determination of particulates.
2. VYNPS does not add biocides, stabilizers, or corrosion inhibitors to the diesel fuel. Plant-specific operating experience has not indicated significant problems related to MIC. Since water contamination in the diesel fuel storage tanks is minimized, the potential for MIC is limited.
3. NUREG-1801 states that ASTM Standards D1796 and D2709 are used for determination of water and sediment. However, these standards describe the determination of water and sediment for oils with different viscosities. Either standard is applicable to the #2 diesel fuel oil used at VYNPS. VYNPS uses ASTM Standard D1796 for determination of water and sediment.
4. Determination of particulates may be according to ASTM Standard D2276 which conducts particulate analysis using a 0.8 micron filter, rather than the 3.0 micron filter specified in NUREG-1801. Use of a filter with a smaller pore size results in a larger sample of particulates since smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in NUREG-1801.

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements
4. Detection of Aging Effects	Ultrasonic thickness measurement of the fuel oil storage tank bottom surface will be performed every 10 years during tank cleaning and inspection.
6. Acceptance Criteria	UT measurements of the fuel oil storage tank bottom surface will have acceptance criterion ≥ 60% Tnom.

4.10 Environmental Qualification (EQ) of Electric Components Program

A. Program Description

The Environmental Qualification (EQ) of Electric Components Program at VYNPS is comparable to the program described in NUREG-1801, Section X.E1, Environmental Qualification (EQ) of Electric Components.

The Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (that is, those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident [LOCA], high energy line breaks [HELBs] or post-LOCA radiation) are qualified to perform their safety function in those harsh environments. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

The VYNPS EQ program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are refurbished, replaced, or their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

This program is credited in the following.

- LRPD-03, TLAA and Exemption Evaluation Results

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"EQ programs apply to certain electrical components that are important to safety and could be exposed to harsh environment accident conditions, as defined in 10 CFR 50.49 and Regulatory Guide 1.89, Rev.1."

b. Comparison to VYNPS Scope

The VYNPS EQ Program provides the requirements for the environmental qualification of electrical equipment important to safety as required by 10 CFR 50.49 and Regulatory Guide 1.89, Rev. 1.
(Ref. Section 5.3[1], ENN-DC-164)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"10 CFR 50.49 does not require actions that prevent aging effects. EQ program actions that could be viewed as preventive actions include (a) establishing the component service condition tolerance and aging limits (for example, qualified life or condition limit), and (b) where applicable, requiring specific installation, inspection, monitoring or periodic maintenance actions to maintain component aging effects within the bounds of the qualification basis."

b. Comparison to VYNPS Preventive Actions

The VYNPS EQ Program includes the 10 CFR 50.49 actions that could be viewed as preventive actions.
(Ref. Section 5, ENN-DC-164)

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"EQ component qualified life is not based on condition or performance monitoring. However, pursuant to Regulatory Guide 1.89, Rev. 1, such monitoring programs are an acceptable basis to modify a qualified life through reanalysis. Monitoring or inspection of certain environmental conditions or component parameters may be used to ensure that the component is within the bounds of its qualification basis, or as a means to modify the qualified life."

b. Comparison to VYNPS Parameters Monitored/Inspected

The VYNPS EQ Program provides EQ related surveillance and maintenance requirements for EQ equipment. Monitoring or inspection of certain environmental conditions or component parameters may be used to ensure that the component is within the bounds of its qualification basis, or as a means to modify the qualified life.
(Ref. Section 5, ENN-DC-164)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"10 CFR 50.49 does not require the detection of aging effects for in-service components. Monitoring or inspection of certain environmental conditions or component parameters may be used to ensure that the component is within the bounds of its qualification basis, or as a means to modify the qualified life."

b. Comparison to VYNPS Detection of Aging Effects

Consistent with NUREG-1801, the detection of aging effects is not required for compliance with 10 CFR 50.49 at VYNPS. Monitoring or inspection of certain environmental conditions or component parameters may be used to ensure that the component is within the bounds of its qualification basis, or as a means to modify the qualified life.
(Ref. Section 5, ENN-DC-164)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"10 CFR 50.49 does not require monitoring and trending of component condition or performance parameters of in-service components to manage the effects of aging. EQ program actions that could be viewed as monitoring include monitoring how long qualified components have been installed. Monitoring or inspection of certain environmental, condition, or component parameters may be used to ensure that a component is within the bounds of its qualification basis, or as a means to modify the qualification."

b. Comparison to VYNPS Monitoring and Trending

The VYNPS EQ Program does not require monitoring and trending of EQ equipment. The EQ program provides surveillance and maintenance requirements for EQ equipment and verifies that the required activities are performed. Monitoring the service life of qualified components is part of the VYNPS program.
(Ref. Section 5, ENN-DC-164)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"10 CFR 50.49 acceptance criteria are that an inservice EQ component is maintained within the bounds of its qualification basis, including (a) its established qualified life and (b) continued qualification for the projected accident conditions. 10 CFR 50.49 requires refurbishment, replacement, or requalification prior to exceeding the qualified life of each installed device. When monitoring is used to modify a component qualified life, plant-specific acceptance criteria are established based on applicable 10 CFR 50.49(f) qualification methods."

b. Comparison to VYNPS Acceptance Criteria

The VYNPS EQ Program provides surveillance and maintenance activities to assure that EQ equipment is maintained within its qualification basis and qualified life. The EQ program provides that EQ equipment shall be replaced, refurbished or requalified prior to exceeding the qualified life of the equipment. If monitoring is used to modify a component qualified life, appropriate plant-specific acceptance criteria will be established based on applicable 10 CFR 50.49(f) qualification methods.
(Ref. Section 5, ENN-DC-164)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"If an EQ component is found to be outside the bounds of its qualification basis, corrective actions are implemented in accordance with the station's corrective action program. When unexpected adverse conditions are identified during operational or maintenance activities that affect the environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. When an emerging industry aging issue is identified that affects the qualification of an EQ component, the affected component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. Confirmatory actions, as needed, are implemented as part of the station's corrective action program, pursuant to 10 CFR 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 corrective actions."

b. Comparison to VYNPS Corrective Actions

If an EQ component is found to be outside the bounds of its qualification basis, unexpected adverse conditions are identified during operational or

maintenance activities that affect the environment of a qualified component, or an emerging industry aging issue is identified that affects the qualification of an EQ component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. The requirements of 10 CFR Part 50, Appendix B, are applied through implementation of the VYNPS corrective action program.
(Ref. Section 5, ENN-DC-164)

VYNPS corrective actions are consistent with 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

"EQ programs include consideration of operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of inservice aging."

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 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

ENN-DC-164, Rev. 02, Environmental Qualification (EQ) Program, Entergy Nuclear Northeast Nuclear Management Manual

D. Summary

The Environmental Qualification (EQ) of Electric Components Program at VYNPS is consistent with the program described in NUREG-1801, Section X.E1, Environmental Qualification (EQ) of Electric Components.

Environmental Qualification (EQ) of Electric Components Program

The overall effectiveness of the Environmental Qualification (EQ) of Electric Components Program is demonstrated by the excellent operating experience for systems, structures, and components in the program. The program has been subject to periodic internal and external assessments that have resulted in program improvement. The Environmental Qualification (EQ) of Electric Components Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

4.11 Fatigue Monitoring Program

A. Program Description

The Fatigue Monitoring Program at VYNPS is comparable to the program described in NUREG-1801, Section X.M1, Metal Fatigue of Reactor Coolant Pressure Boundary.

In order not to exceed design limits on fatigue usage, the Fatigue Monitoring Program tracks the number of critical thermal and pressure transients for selected reactor coolant system components. The program ensures the validity of analyses that explicitly assumed a specified number of thermal and pressure fatigue transients by assuring that the actual effective number of transients is not exceeded.

This program is credited in the following.

- LRPD-03, TLAA and Exemption Evaluation Results
- LRPD-04, TLAA – Mechanical Fatigue

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program includes preventive measures to mitigate fatigue cracking of metal components of the reactor coolant pressure boundary caused by anticipated cyclic strains in the material".

b. Comparison to VYNPS Scope

The Fatigue Monitoring Program tracks transient cycles to ensure RCS components remain within their design fatigue usage limits. The Fatigue Monitoring Program utilizes the systematic counting of design cycles to ensure that component design fatigue usage limits are not exceeded.

Fatigue analyses validated by this monitoring program are associated with the reactor vessel, reactor vessel internals, and Class 1 RCS piping. The transient cycles tracked by this program are referenced in VYNPS UFSAR, Section 4.2.5 and identified in VYNPS calculation VYC-378.
(Ref. VYNPS UFSAR and VYC-378)

VYNPS scope is consistent with NUREG-1801.

Fatigue Monitoring Program

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Maintaining the fatigue usage factor below the design code limit and considering the effect of the reactor water environment, as described under the program description, will provide adequate margin against fatigue cracking of reactor coolant system components due to anticipated cyclic strains".

b. Comparison to VYNPS Preventive Actions

The Fatigue Monitoring Program uses the systematic counting of design cycles and the evaluation of operating data to ensure that component design fatigue usage limits are not exceeded.
(Ref. AP 0145)

VYNPS preventive actions are not consistent with NUREG-1801. The Fatigue Monitoring Program only involves tracking the number of transient cycles and does not include assessment of the impact of reactor water environment on critical components. The effect of the reactor water environment on fatigue is addressed as described in Section 2.5.2 of LRPD-04.
(Ref. Section 2.5.2, LRPD-04)

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The program monitors all plant transients that cause cyclic strains, which are significant contributions to the fatigue usage factor. The number of plant transients that cause significant fatigue usage for each reactor coolant pressure boundary component is to be monitored. Alternatively, more detailed local monitoring of the plant transient may be used to compute the actual fatigue usage for each transient".

b. Comparison to VYNPS Parameters Monitored/Inspected

The Fatigue Monitoring Program monitors the fatigue-sensitive design cycles assumed in the RCS component design analyses. The design cycles are listed and detailed in VYNPS calculation VYC-0378. Some of the cycles are monitored by counting; others are monitored by analysis of operational data and calculation of an effective number of transients.
(Ref. AP 0145)

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

Fatigue Monitoring Program

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The program provides for periodic update of the fatigue usage calculations".

b. Comparison to VYNPS Detection of Aging Effects

No actions are taken as part of this program to detect aging effects. VYNPS monitors plant operating transient cycles. While the accumulated cycles remain less than the design cycles, the reactor coolant system components remain bound by the current fatigue usage calculations. When the accumulated cycles approach the component design cycles, corrective action is required to ensure the design cycle limit is not exceeded.
(Ref. Section A.2, AP 0145)

Enhancement: The VYNPS program will be modified to either require periodic update of cumulative fatigue usage factors (CUFs), or to require update of CUFs if the number of accumulated cycles approaches the number assumed in the design calculation.

VYNPS detection of aging effects is not consistent with NUREG-1801, in that the VYNPS program does not provide for periodic update of the fatigue usage calculations. Updates of fatigue usage calculations are not necessary unless the number of accumulated fatigue cycles approaches the number of assumed design cycles. The VYNPS program provides for periodic assessment of the number of accumulated cycles. If a design cycle assumption is approached, corrective action is taken which may include update of the fatigue usage calculation.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"The program monitors a sample of high fatigue usage locations. This sample is to include the locations identified in NUREG/CR-6260, as minimum, or propose alternatives based on plant configuration."

b. Comparison to VYNPS Monitoring and Trending

The Fatigue Monitoring Program monitors the number of pressure and temperature transient cycles and periodically compares this cycle count with the design cycle count to ensure that the fatigue sensitive components remain within their allowable design. Monitoring the cycle count according to the Fatigue Monitoring Program will ensure that the pressure and thermal cycles are maintained within their design limits and tracked to identify abnormal trends toward their design limits.

Fatigue Monitoring Program

The Fatigue Monitoring Program monitors the number of transient cycles that are considered in the fatigue analyses of record (VYC-0378). This analysis covers all fatigue usage locations, including the locations identified in NUREG/CR-6260.

Enhancement: A computerized monitoring program (e.g., FatiguePro) will be used to directly determine cumulative fatigue usage factors (CUFs) for locations of interest.

VYNPS monitoring and trending will be consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"The acceptance criteria involves maintaining the fatigue usage below the design code limit considering environmental fatigue effects as described under the program description".

b. Comparison to VYNPS Acceptance Criteria

The Fatigue Monitoring Program acceptance criteria are to maintain the number of counted transient cycles below the allowable number of design cycles for each transient. The transient characteristics and allowable number of design cycles are specified in VYNPS calculation VYC-378. Maintaining the actual cycle count below the design cycle count will ensure that the component cumulative usage factors remain below the 1.0 limit. To prevent exceeding cycle design limits, VYNPS takes corrective action when the accumulated cycles approach the component design cycles.
(Ref. VYC-378 and AP-0145)

Enhancement: AP-0145 and VYC-0378 have specific limits for the number of counted cycles; however, they do not have limits for the effective transients calculated from plant data. The allowable number of effective transients will be established for every transient monitored by AP 0145. This will allow quantitative projection of future margin.

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"The program provides for corrective actions to prevent the usage factor from exceeding the design code limit during the period of extended operation. Acceptable corrective actions include repair of the component, replacement of the component, and a more rigorous analysis of the component to demonstrate that the design code limit will not be exceeded during the extended period of operation. For programs that monitor a sample of high

fatigue usage locations, corrective actions include a review of additional affected reactor coolant pressure boundary locations. 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

To prevent exceeding fatigue design limits, VYNPS takes corrective action when the accumulated cycles approach the component design cycles. Acceptable corrective actions include a more rigorous analysis of the component to demonstrate that the design code limit will not be exceeded, repair, or replacement of the component.
(Ref. AP 0145)

VYNPS corrective actions are consistent with 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

"The program reviews industry experience regarding fatigue cracking. Applicable experience with fatigue cracking is to be considered in selecting the monitored locations".

b. Comparison to VYNPS Operating Experience

Industry experience has been factored into the VYNPS fatigue monitoring program through incorporation of Regulatory Guides and BWRVIP documents. The locations at which CUFs are calculated include those identified in NUREG/CR-0620. Further discussion can be found in Section 3 of VYNPS Report LRPD-04, TLAA - Mechanical Fatigue.

Industry experience has identified thermal stresses that were not considered in the original design of VYNPS. These thermal stresses have been evaluated in VYNPS Report LRPD-04, "TLAA - Mechanical Fatigue". VYNPS will continue to evaluate future industry experience on fatigue of Class 1 components.

Operating experience associated with the Fatigue Monitoring Program has demonstrated that the program continues to monitor plant transients and track the accumulation of these transients. Even though the number of

design cycles considered in the fatigue analyses appears to be sufficient for the extended period of operation, the VYNPS program will track and trend these transients and ensure that appropriate corrective actions are taken if a design code limits is approached.
(Ref. LRPD-04)

The Fatigue Monitoring Program effectively monitors plant transients. It has been effective at managing aging effects. The continued implementation of this program provides reasonable assurance that the aging effects will be managed so that the applicable structures and components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. For more information on applicable operating experience, see VYNPS Report LRPD-05, Operating Experience Review Results.

C. References

AP 0145, Rev. 08, LPC 03, Equipment Cycle Record Keeping

LRPD-04, TLAA – Mechanical Fatigue

VYNPS UFSAR, Rev. 19-1, Updated Final Safety Analysis Report

VYC-378, Rev. 01, Vermont Yankee Reactor Cyclic Limits for Transient Events

D. Summary

The Fatigue Monitoring Program has been demonstrated to maintain the validity of the fatigue design basis for reactor coolant system components designed to withstand the effects of cyclic loads due to reactor system temperature and pressure changes.

The Fatigue Monitoring Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

The Fatigue Monitoring Program at VYNPS will be consistent with the program described in NUREG-1801, Section X.M1, Metal Fatigue of Reactor Coolant Pressure Boundary, with the following exceptions and enhancements.

Attributes Affected	Exceptions
2. Preventive Actions	The Fatigue Monitoring Program only involves tracking the number of transient cycles and does not include assessment of the impact of reactor water environment on critical components. (Note 1)

Fatigue Monitoring Program

4. Detection of Aging Effects	The VYNPS program does not provide for periodic update of the fatigue usage calculations. (Note 2)

Exception Notes

1. The effect of the reactor water environment on fatigue is addressed as described in Section 2.5.2 of LRPD-04.
2. Updates of fatigue usage calculations are not necessary unless the number of accumulated fatigue cycles approaches the number of assumed design cycles. The VYNPS program provides for periodic assessment of the number of accumulated cycles. If a design cycle assumption is approached, corrective action is taken which may include update of the fatigue usage calculation.

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements
4. Detection of Aging Effects	The VYNPS program will be modified to either require periodic update of cumulative fatigue usage factors (CUFs), or to require update of CUFs if the number of accumulated cycles approaches the number assumed in the design calculation.
5. Monitoring and Trending	A computerized monitoring program (e.g., FatiguePro) will be used to directly determine cumulative fatigue usage factors (CUFs) for locations of interest.
6. Acceptance Criteria	The allowable number of effective transients will be established for every transient monitored by AP 0145. This will allow quantitative projection of future margin.

4.12 Fire Protection Programs

The fire protection programs for VYNPS include the Fire Protection Program and the Fire Water System Program. These two programs are comparable to NUREG-1801, Section XI.M26, Fire Protection and NUREG-1801, Section XI.M27, Fire Water System, respectively.

The fire protection program includes a fire barrier inspection and a diesel-driven fire pump inspection. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire rated doors to ensure that their operability is maintained. The diesel-driven fire pump inspection requires that the pump be periodically tested to ensure that the fuel supply line can perform its intended function.

The Fire Protection programs are discussed in more detail in the following Subsections

- Fire Protection Program
- Fire Water System Program

4.12.1 Fire Protection Program

A. Program Description

The Fire Protection Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M26, Fire Protection.

The fire protection program includes a fire barrier inspection and a diesel-driven fire pump inspection. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire rated doors to ensure that their operability is maintained. The diesel-driven fire pump inspection requires that the pump be periodically tested to ensure that the fuel supply line can perform its intended function.

Corrective actions, confirmation process, and administrative controls in accordance with the requirements of 10CFR Part 50 Appendix B are applied to the Fire Protection Program.

This program is credited in the following.

- AMRC-02, Reactor Building
- AMRC-03, Intake Structure
- AMRC-04, Process Facilities
- AMRC-06, Bulk Commodities
- AMRM-17, Fire Protection – Water System

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"For operating plants, the AMP manages the aging effects on the intended function of the penetration seals, fire barrier walls, ceilings, and floors, and all fire rated doors (automatic or manual) that perform a fire barrier function. It also manages the aging effects on the intended function of the fuel supply line. The AMP also includes management of the aging effects on the intended function of the halon/CO_2 fire suppression system."

b. Comparison to VYNPS Scope

The Fire Protection Program manages aging effects for penetration seals, fire barriers, fire doors and the diesel driven fire pump and its fuel supply line. ***(Ref. OP 4019; OP 4105; and Sections 4.13.B.2 and 4.13.E, VYNPS TRM)***

VYNPS scope is not consistent with NUREG-1801 because this program is not necessary to manage aging effects for halon or carbon dioxide fire protection system components. The Halon 1301 suppression system is not subject to aging management review. Aging effects for components in the CO_2 system are managed by the System Walkdown Program.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"For operating plants, the fire hazard analysis assesses the fire potential and fire hazard in all plant areas. It also specifies measures for fire prevention, fire detection, fire suppression, and fire containment and alternative shutdown capability for each fire area containing structures, systems, and components important to safety."

b. Comparison to VYNPS Preventive Actions

The NUREG-1801 Preventive Actions do not specify any measures for preventing aging effects of fire protection structures, systems or components.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"Visual inspection of approximately 10% of each type of penetration seal is performed during walkdowns carried out at least once every refueling outage. These inspections examine any sign of degradation such as cracking, seal

separation from walls and components, separation of layers of material, rupture and puncture of seals which are directly caused by increased hardness, and shrinkage of seal material due to weathering. Visual inspection of fire barrier walls, ceilings, and floors examines any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. Hollow metal fire doors are visually inspected on a plant-specific interval to verify the integrity of door surfaces and for clearances. The plant-specific inspection intervals are to be determined by engineering evaluation to detect degradation of the fire doors prior to the loss of intended function.

The diesel-driven fire pump is under observation during performance tests such as flow and discharge tests, sequential starting capability tests, and controller function tests for detection of any degradation of the fuel supply line.

The periodic visual inspection and function test is performed at least once every six months to examine the signs of degradation of the halon/CO_2 fire suppression system. Material conditions that may affect the performance of the system, such as corrosion, mechanical damage, or damage to dampers, are observed during these tests."

b. Comparison to VYNPS Parameters Monitored/Inspected

Fire barrier penetration seals are inspected for signs of degradation such as cracks, gaps, voids, holes or missing material. Fire barrier walls, ceilings, and floors are inspected for signs of degradation such as cracks, holes, spalling, or gouges.
(Ref. Procedure Section 1 and Appendix B, OP 4019 and Section 4.13.E.1, VYNPS TRM)

Enhancement: Procedure OP 4019 will be enhanced to specify that fire damper frames in fire barriers shall be inspected for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.

Each fire door is tested for operability of closure and latching mechanisms and inspected for integrity. Fire door clearances are also checked.
(Ref. Procedure Section 3, OP 4019)

The diesel-driven fire pump is observed to detect degradation of diesel engine sub-systems including the fuel supply line.
(Ref. Procedure Sections A and D, OP 4105)

Enhancement: Procedure OP 4105 will be enhanced to state that the diesel engine sub-systems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running; such as fuel oil, lube oil, coolant, or exhaust gas leakage.

VYNPS parameters monitored and inspected will be consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Visual inspection of penetration seals detects cracking, seal separation from walls and components, and rupture and puncture of seals. Visual inspection by fire protection qualified inspectors of approximately 10% of each type of seal in walkdowns is performed at least once every refueling outage. If any sign of degradation is detected within that sample, the scope of the inspection is expanded to include additional seals. Visual inspection by fire protection qualified inspectors of the fire barrier walls, ceilings, and floors performed in walkdowns at least once every refueling outage ensures timely detection of concrete cracking, spalling, and loss of material. Visual inspection by fire protection qualified inspectors detects any sign of degradation of the fire door such as wear and missing parts. Periodic visual inspection and function tests detect degradation of the fire doors before there is a loss of intended function.

Periodic tests performed at least once every refueling outage, such as flow and discharge tests, sequential starting capability tests, and controller function tests performed on diesel-driven fire pump ensure fuel supply line performance. The performance tests detect degradation of the fuel supply lines before the loss of the component intended function.

Visual inspections of the halon/CO_2 fire suppression system detect any sign of added degradation, such as corrosion, mechanical damage, or damage to dampers. The periodic function test and inspection performed at least once every six months detects degradation of the halon/CO_2 fire suppression system before the loss of the component intended function."

b. Comparison to VYNPS Detection of Aging Effects

This program is credited with managing the following aging effects.

- loss of material for metal partition walls (AMRC-02)
- loss of material for RCIC steel enclosure (AMRC-02)
- For un-submerged concrete, no aging effects requiring management are identified. However, in compliance with the NRC position on concrete aging, un-submerged concrete that is subject to aging management review is included in the Fire Protection Program to confirm that aging effects are not occurring. (AMRC-02, 03, 04, 06)
- cracking of masonry walls (AMRC-02, 03, 04)
- loss of material for carbon steel fire doors and fire damper frames (AMRC-06)
- cracking and change in material properties for penetration sealants and seismic isolation joints (AMRC-06)

- cracking/delamination separation for fire stops (AMRC-06)
- loss of material for fire wraps (AMRC-06)
- loss of material for fire pump diesel engine subsystem components (AMRM-17)
- cracking of carbon steel, stainless steel, and copper alloy components in the diesel-driven fire pump subsystem (AMRM-17)
- fouling of copper alloy heat transfer surfaces in the diesel-driven fire pump subsystem (AMRM-17)

This program is also credited with confirming the absence of aging effects for pryocrete fire proofing (AMRC-06).

All accessible fire barrier penetration seals are visually inspected at least once every four operating cycles (approximately 25% per operating cycle). Fire barrier walls, ceilings, and floors are inspected, at least once each operating cycle, for signs of degradation such as cracks, holes, spalling, or gouges.
(Ref. Procedure Section 1 and Appendix B, OP 4019 and Section 4.13.E.1, VYNPS TRM)

Visual inspection detects any sign of degradation of fire doors, such as wear and missing parts. Visual inspection and functional tests, at least once each operating cycle, detect degradation of fire doors before there is a loss of intended function.
(Ref. Procedure Section 3, OP 4019)

The diesel-driven fire pump is observed during performance tests, at least once each operating cycle, to detect degradation of diesel engine sub-systems including the fuel supply line.
(Ref. Procedure Sections A and D, OP 4105)

VYNPS detection of aging effects is <u>not</u> consistent with NUREG-1801 due to the following exceptions.

> The NUREG-1801 program states that 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The VYNPS program specifies inspection of approximately 25% of the seals (regardless of seal type) each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every four operating cycles. Since aging effects are typically manifested over several years, this variation in inspection frequency is insignificant.

5. **Monitoring and Trending**

a. NUREG-1801, Monitoring and Trending

"The aging effects of weathering on fire barrier penetration seals are detectable by visual inspection and, based on operating experience, visual inspections are performed at least once every refueling outage to detect any sign of degradation of fire barrier penetration seals prior to loss of the intended function.

Concrete cracking, spalling, and loss of material are detectable by visual inspection and, based on operating experience, visual inspection performed at least once every refueling outage detects any sign of degradation of the fire barrier walls, ceilings, and floors before there is a loss of the intended function. Based on operating experience, degraded integrity or clearances in the fire door are detectable by visual inspection performed on a plant-specific frequency. The visual inspections detect degradation of the fire doors prior to loss of the intended function.

The performance of the fire pump is monitored during the periodic test to detect any degradation in the fuel supply lines. Periodic testing provides data (e.g., pressure) for trending, if necessary.

The performance of the halon/ CO_2 fire suppression system is monitored during the periodic test to detect any degradation in the system. These periodic tests provide data necessary for trending."

b. Comparison to VYNPS Monitoring and Trending

The aging effects on fire barrier penetration seals and fire barrier walls, ceilings, and floors are detectable by visual inspection. Visual inspections of fire barrier penetration seals at least once every four operating cycles (approximately 25% per operating cycle) detect signs of degradation prior to loss of intended function. Visual inspections performed at least once every cycle detect signs of degradation of fire barrier walls, ceilings and floors prior to loss of intended function.
(Ref. Procedure Section 1 and Appendix B, OP 4019 and Section 4.13.E.1, VYNPS TRM)

Wear, missing parts, or holes in fire doors are detectable by visual inspection. Inspections and functional tests, at least once each operating cycle, detect degradation of the fire doors prior to loss of intended function.
(Ref. Procedure Section 3, OP 4019)

The performance of the diesel fire pump is monitored during the periodic test to detect any degradation in fuel supply lines. Periodic testing provides data (e.g., pressure) for trending, if necessary.
(Ref. Procedure Sections A and D, OP 4105)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Inspection results are acceptable if there are no visual indications (outside those allowed by approved penetration seal configurations) of cracking, separation of seals from walls and components, separation of layers of material, or ruptures or punctures of seals; no visual indications of concrete cracking, spalling and loss of material of fire barrier walls, ceilings, and floors; no visual indications of missing parts, holes, and wear and no deficiencies in the functional tests of fire doors. No corrosion is acceptable in the fuel supply line for the diesel-driven fire pump. Also, any signs of corrosion and mechanical damage of the halon/CO_2 fire suppression system are not acceptable."

b. Comparison to VYNPS Acceptance Criteria

Seal inspection results are acceptable if there are no visual indications of cracking, separation of seals from walls and components, separation of layers of material, or ruptures or punctures of seals.
(Ref. Acceptance Criteria Section 1 and Appendix B, OP 4019)

Fire barrier inspection results are acceptable if there are no visual indications of concrete cracking, spalling and loss of material of fire barrier walls, ceilings, and floors.
(Ref. Acceptance Criteria Section 1 and Appendix B, OP 4019)

Enhancement: Procedure OP 4019 will be enhanced to specify that fire damper frames in fire barriers shall be inspected for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.

Fire door inspection results are acceptable if there are no visual indications of missing parts, holes, and wear and no deficiencies in functional tests of fire doors.
(Ref. Section 3, OP 4019)

Any sign of degradation in fuel supply lines or other diesel engine sub-systems is unacceptable.
(Ref. Procedure Sections A and D, OP 4105)

Enhancement: Procedure OP 4105 will be enhanced to state that the diesel engine sub-systems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running; such as fuel oil, lube oil, coolant, or exhaust gas leakage.

VYNPS acceptance criteria will be consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"For fire protection structures and components identified within scope that are subject to an AMR for license renewal, the applicant's 10 CFR Part 50, Appendix B, program is used for corrective actions, confirmation process, and administrative controls for aging management during the period of extended operation. This commitment is documented in the final safety analysis report (FSAR) supplement in accordance with 10 CFR 54.21(d). As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions, confirmation process, and administrative controls."

b. Comparison to VYNPS Corrective Actions

VYNPS applies the requirements of 10 CFR Part 50 Appendix B to the Fire Protection Program through use of the VYNPS Corrective Action Program.

VYNPS corrective actions are consistent with 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

"Silicone foam fire barrier penetration seals have experienced splits, shrinkage, voids, lack of fill, and other failure modes (IN 88-56, IN 94-28, and IN 97-70). Degradation of electrical racing way fire barrier such as small holes, cracking, and unfilled seals are found on routine walkdown (IN 91-47 and GL 92-08). Fire doors have experienced wear of the hinges and handles."

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 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

OP 4019, Rev. 16, LPC 01, Surveillance of Plant Fire Barriers and Fire Rated Assemblies

OP 4105, Rev. 13, LPC 05, Fire Protection Systems Surveillance

VYNPS TRM, Rev. 24, Vermont Yankee Technical Requirements Manual

D. Summary

The Fire Protection 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 Fire Protection Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M26, Fire Protection with the following exceptions and enhancements.

Attributes Affected	Exceptions
1. Scope of Program	This program is not necessary to manage aging effects for halon or carbon dioxide fire protection system components. (Note 1)
4. Detection of Aging Effects	The NUREG-1801 program states that 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The VYNPS program specifies inspection of approximately 25% of the seals (regardless of seal type) each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every four operating cycles. (Note 2)

Exception Notes

1. The Halon 1301 suppression system is not subject to aging management review. Aging effects for components in the CO_2 system are managed by the System Walkdown Program.
2. Since aging effects are typically manifested over several years, this variation in inspection frequency is insignificant.

Fire Protection Program

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements
3. Parameters Monitored/Inspected 6. Acceptance Criteria	Procedures will be enhanced to specify that fire damper frames in fire barriers shall be inspected for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.
3. Parameters Monitored/Inspected 6. Acceptance Criteria	Procedures will be enhanced to state that the diesel engine sub-systems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running; such as fuel oil, lube oil, coolant, or exhaust gas leakage.

4.12.2 Fire Water System Program

A. Program Description

The Fire Water System Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M27, Fire Water System.

This aging management program applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and aboveground and underground piping and components that are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures functionality of systems. Also, many of these systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated.

In addition, a sample of sprinkler heads will be inspected using the guidance of NFPA 25 (2002 edition), Section 5.3.1.1.1. NFPA 25 states that, "where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing." NFPA 25 also contains guidance to perform this sampling every 10 years after initial field service testing.

This program is credited in the following.

- AMRC-06, Bulk Commodities
- AMRM-17, Fire Protection – Water System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation and Technical Basis

1. Scope of Program

a. NUREG-1801, Scope

"The AMP focuses on managing loss of material due to corrosion, MIC, or biofouling of carbon steel and cast-iron components in fire protection systems exposed to water. Hose station and standpipe are considered as piping in the AMP."

b. Comparison to VYNPS Scope

The Fire Water System Program manages loss of material in fire protection system components exposed to water. These include the fire suppression water system, spray and sprinkler systems, and fire hose stations.
(Ref. OP 4103 and OP 4105)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"To ensure no significant corrosion, MIC, or biofouling has occurred in water-based fire protection systems, periodic flushing, system performance testing, and inspections may be conducted."

b. Comparison to VYNPS Preventive Actions

The Fire Water System Program is a condition monitoring program that does not include preventive actions. To determine if significant corrosion has occurred in water-based fire protection systems, periodic flushing, system performance testing and inspections are conducted as discussed in Detection of Aging Effects.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"Loss of material due to corrosion and biofouling could reduce wall thickness of the fire protection piping system and result in system failure. Therefore, the parameters monitored are the system's ability to maintain pressure and internal system corrosion conditions. Periodic flow testing of the fire water system is performed using the guidelines of NFPA 25, or wall thickness evaluations may be performed to ensure that the system maintains its intended function."

b. Comparison to VYNPS Parameters Monitored/Inspected

The Fire Water System Program parameters monitored include the system's ability to maintain pressure and internal system corrosion conditions. Specific parameters monitored/inspected include:

> Fire suppression water system – parameters monitored are flow and pressure. Every fire main segment (excluding individual system supplies) is verified to be clear of obstruction by a full flow test using the guidelines of NFPA 25 at least once every 3 years.
> ***(Ref. Section F, OP 4105 and Section 4.13.B.1.f, VYNPS TRM)***
>
> Fire hose stations – parameters monitored are pressure and leakage. Visual inspections check for leakage and missing or degraded equipment.
> ***(Ref. Sections C, D, and F, OP 4103, OP 4104 and Section 4.13.C, VYNPS TRM)***

Spray and sprinkler systems – parameter monitored is flow. Visual inspections check for cracks, corrosion, deformation, leaks, or obstruction.
(Ref. Section G, OP 4105 and Section 4.13.F, VYNPS TRM)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Fire protection system testing is performed to assure that the system functions by maintaining required operating pressures. Wall thickness evaluations of fire protection piping are performed on system components using non- intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections are performed before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation. As an alternative to non-intrusive testing, the plant maintenance process may include a visual inspection of the internal surface of the fire protection piping upon each entry to the system for routine or corrective maintenance, as long as it can be demonstrated that inspections are performed (based on past maintenance history) on a representative number of locations on a reasonable basis. These inspections must be capable of evaluating (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the piping as it applies to the design flow of the fire protection system. If the environmental and material conditions that exist on the interior surface of the below grade fire protection piping are similar to the conditions that exist within the above grade fire protection piping, the results of the inspections of the above grade fire protection piping can be extrapolated to evaluate the condition of below grade fire protection piping. If not, additional inspection activities are needed to ensure that the intended function of below grade fire protection piping will be maintained consistent with the current licensing basis for the period of extended operation. Continuous system pressure monitoring, system flow testing, and wall thickness evaluations of piping are effective means to ensure that corrosion and biofouling are not occurring and the system's intended function is maintained.

General requirements of existing fire protection programs include testing and maintenance of fire detection and protection systems and surveillance procedures to ensure that fire detectors, as well as fire protection systems and components are operable.

Visual inspection of yard fire hydrants performed annually in accordance with NFPA 25 ensures timely detection of signs of degradation, such as corrosion. Fire hydrant hose hydrostatic tests, gasket inspections, and fire hydrant flow tests, performed annually, ensure that fire hydrants can perform their

intended function and provide opportunities for degradation to be detected before a loss of intended function can occur.

Sprinkler systems are inspected before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner."

b. Comparison to VYNPS Detection of Aging Effects

This program is credited with managing the following aging effects.

- loss of material from internal and external surfaces of buried and above-ground water suppression fire protection system components (AMRC-06 and AMRM-17, 30)

Fire suppression water system flush of distribution headers and fire hydrants at least once per year; system functional test at least once per 18 months; and full flow test at least once per 3 years ensure aging effects are detected.
(Ref. OP 4105 and Section 4.13.B, VYNPS TRM)

General requirements of the fire protection program include testing and maintenance of fire detection instrumentation and surveillance procedures to ensure that fire detectors are operable.
(Ref. Section 4.13.A, VYNPS TRM)

Fire hose stations are visually inspected at least once per 6 months; visual inspection, re-racking and replacement of gaskets in couplings occurs at least once per 18 months; verification of operability and no flow blockage occurs at least once every 3 years; hydrostatic test of outside hoses occurs once per 24 months; and hydrostatic test of inside hoses occurs once per 3 years.
(Ref. OP 4103, OP 4104 and Section 4.13.C, VYNPS TRM)

Spray and sprinkler systems are functionally tested at least once per 18 months; visual inspection of deluge and pre-action system piping to verify their integrity occurs at least once per 24 months; inspection of each open head deluge nozzle to verify that there is no blockage occurs at least once per 24 months; and air flow test through piping of each open head deluge system to verify that each open head deluge nozzle is unobstructed occurs at least once per 3 years.
(Ref. OP 4105 and Section 4.13.F, VYNPS TRM)

Enhancement: A sample of sprinkler heads will be inspected using guidance of NFPA 25 (2002 edition), Section 5.3.1.1.1. NFPA 25 also contains guidance to repeat this sampling every 10 years after initial field service testing.

Enhancement: Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g.,

volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.

VYNPS detection of aging effects is not consistent with NUREG-1801 due to differences in test and inspection frequencies. Since aging effects are typically manifested over several years, differences in inspection and testing frequencies are insignificant. Specifically,

NUREG-1801 specifies annual fire hydrant hose hydrostatic tests. Under the VYNPS program, hydrostatic test of outside hoses occurs once per 24 months; and hydrostatic test of inside hoses occurs once per 3 years.

NUREG-1801 specifies annual gasket inspections. Under the VYNPS program, visual inspection, re-racking and replacement of gaskets in couplings occurs at least once per 18 months.

NUREG-1801 specifies annual fire hydrant flow tests. Under the VYNPS program, verification of operability and no flow blockage occurs at least once every 3 years.

NUREG-1801 specifies sprinkler systems inspections once every refueling outage. Under the VYNPS program, visual inspection of deluge and pre-action system piping to verify their integrity occurs at least once per 24 months.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"System discharge pressure is monitored continuously. Results of system performance testing are monitored and trended as specified by the associated plant commitments pertaining to NFPA codes and standards. Degradation identified by non-intrusive or internal inspection is evaluated."

b. Comparison to VYNPS Monitoring and Trending

System discharge pressure is monitored continuously.
(Ref. Drawing G-191159, Sh. 1)

Results of system performance testing are monitored and trended as specified by NFPA codes and standards.
(Ref. OP 4105 and Section 3/4.13.B, VYNPS TRM)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"The acceptance criteria are (a) the ability of a fire protection system to maintain required pressure, (b) no unacceptable signs of degradation observed during non-intrusive or visual assessment of internal system conditions, and (c) that no biofouling exists in the sprinkler systems that could cause corrosion in the sprinkler heads."

b. Comparison to VYNPS Acceptance Criteria

The Fire Water System Program acceptance criteria include the ability of a fire protection system to maintain the required pressure, absence of unacceptable signs of degradation during non-intrusive and visual inspections, and absence of corrosion in the sprinkler systems.
(Ref. OP 4103 and OP 4105)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair and replacement actions are initiated as necessary. For fire water systems and components identified within scope that are subject to an AMR for license renewal, the applicant's 10 CFR Part 50, Appendix B, program is used for corrective actions, confirmation process, and administrative controls for aging management during the period of extended operation. 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, confirmation process, and administrative controls."

b. Comparison to VYNPS Corrective Actions

VYNPS applies the requirements of 10 CFR Part 50 Appendix B to the Fire Water System Program through use of the VYNPS Corrective Action Program.

VYNPS corrective actions are consistent with 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*

"Water-based fire protection systems designed, inspected, tested and maintained in accordance with the NFPA minimum standards have demonstrated reliable performance."

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 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

Drawing G-191159, Sh. 1, Rev. 72, Flow Diagram Service Water System

OP 4103, Rev. 13, LPC 01, Fire Protection Equipment Surveillance

OP 4104, Rev. 07, LPC 05, Fire Hose Hydro Test Surveillance

OP 4105, Rev. 13, LPC 05, Fire Protection Systems Surveillance

VYNPS TRM, Rev. 24, Vermont Yankee Technical Requirements Manual

D. Summary

The Fire Water System Program has been demonstrated capable of managing aging effects on fire protection components. The Fire Water System Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

The Fire Water System Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M27, Fire Water System, with the following exception and enhancements.

Fire Water System Program

Attributes Affected	Exception
4. Detection of Aging Effects	NUREG-1801 specifies annual fire hydrant hose hydrostatic tests. Under the VYNPS program, hydrostatic test of outside hoses occurs once per 24 months; and hydrostatic test of inside hoses occurs once per 3 years. NUREG-1801 specifies annual gasket inspections. Under the VYNPS program, visual inspection, re-racking and replacement of gaskets in couplings occurs at least once per 18 months. NUREG-1801 specifies annual fire hydrant flow tests. Under the VYNPS program, verification of operability and no flow blockage occurs at least once every 3 years. NUREG-1801 specifies sprinkler systems inspections once every refueling outage. Under the VYNPS program, visual inspection of deluge and pre-action system piping to verify their integrity occurs at least once per 24 months. (Note 1)

Exception Notes

1. Since aging effects are typically manifested over several years, differences in inspection and testing frequencies are insignificant.

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements
4. Detection of Aging Effects	A sample of sprinkler heads will be inspected using guidance of NFPA 25 (2002 edition), Section 5.3.1.1.1. NFPA 25 also contains guidance to repeat this sampling every 10 years after initial field service testing.

Fire Water System Program

Attributes Affected	Enhancements
4. Detection of Aging Effects	Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.

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 ≥ 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-

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 ≥ 2% of plant operating time.
(Ref. Appendix C, PP 7028)

The program, based on the recommendations of EPRI Report, NSAC-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 CFR 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 FAC."

b. Comparison to VYNPS Preventive Actions

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

VYNPS preventive actions are consistent with NUREG-1801.

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 VYNPS Parameters Monitored/Inspected

The VYNPS 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)

VYNPS 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 VYNPS 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)

VYNPS 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.

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.

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

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.

4.14 Inservice Inspection Programs

Regulation 10 CFR 50.55a, imposes inservice inspection (ISI) requirements of ASME Code, Section XI, for Class 1, 2, and 3 pressure-retaining components and their integral attachments in light-water cooled power plants. Inspection, repair, and replacement of these components are covered in Subsections IWB, IWC, and IWD, respectively. The program includes periodic visual, surface, and volumetric examination and leakage tests of Class 1, 2, and 3 pressure-retaining components and their integral attachments.

Inservice inspection of supports for ASME piping and components is addressed in Section XI, Subsection IWF. ASME Code Section XI, Subsection IWF constitutes an existing mandated program applicable to managing aging of ASME Class 1, 2, 3, and MC supports for license renewal.

Additionally, 10 CFR 50.55a imposes inservice inspection requirements of ASME Code Section XI for class MC and class CC containment structures. Subsection IWE is for class MC containments and for steel liners for concrete containments (Class CC). The scope of IWE includes steel liners for concrete containment and their integral attachments; containment hatches and airlocks; moisture barriers; and pressure-retaining bolting.

The program uses nondestructive examination (NDE) techniques to detect and characterize flaws. Three different types of examinations are volumetric, surface, and visual. Volumetric examinations are the most extensive, using methods such as radiographic, ultrasonic or eddy current examinations to locate surface and subsurface flaws. Surface examinations, such as magnetic particle or dye penetrant testing, are used to locate surface flaws.

Three levels of visual examinations are specified. VT-1 visual examination is conducted to assess condition of the surface of the part being examined, looking for cracks and symptoms of wear, corrosion, erosion or physical damage. It can be done with either direct visual observation or with remote examination using various optical/video devices. The VT-2 examination is conducted specifically to locate evidence of leakage from pressure retaining components (period pressure tests). While the system is under pressure for a leakage test, visual examinations are conducted to detect direct or indirect indication of leakage. The VT-3 examination is conducted to determine the general mechanical and structural condition of components and supports and to detect discontinuities and imperfections. For containment inservice inspection, general visual and detailed visual examinations are used in addition to VT examinations as allowed by 10 CFR 50.55a to include applicable relief requests.

The inservice inspection programs are discussed in more detail in the following Subsections

- Inservice Inspection (ISI) Program
- Containment Inservice Inspection (CII) Program

4.14.1 Inservice Inspection (ISI) Program

A. Program Description

The VYNPS ISI Program is a plant-specific program encompassing ASME Section XI Subsection IWA, IWB, IWC, IWD and IWF requirements.

The VYNPS ISI Program is based on ASME Inspection Program B (IWA-2432), which has 10-year inspection intervals. Every 10 years the program is updated to the latest ASME Section XI code edition and addendum approved by the Nuclear Regulatory Commission in 10CFR50.55a. On September 1, 2003 VYNPS entered the fourth ISI interval. The Code Edition and Addenda used for the fourth interval are the 1998 Edition with 2000 addenda. The current program ensures that the structural integrity of Class 1, 2, and 3 systems and associated supports is maintained at the level required by the Code of Federal Regulations, 10CFR50.55a. ***(Ref. Section 1.3, PP 7015)***

This program is credited in the following.

- AMRC-01, Primary Containment
- AMRC-06, Bulk Commodities
- AMRM-31, Reactor Pressure Vessel
- AMRM-33, Reactor Coolant System Pressure Boundary

B. Evaluation

1. Scope of Program

The ISI Program manages cracking, loss of material, and reduction of fracture toughness of reactor coolant system piping, components, and supports. The program implements applicable requirements of ASME Section XI, Subsections IWA, IWB, IWC, IWD and IWF, and other requirements specified in 10CFR50.55a with approved NRC alternatives and relief requests. Every 10 years the ISI Program is updated to the latest ASME Section XI code edition and addendum approved by the Nuclear Regulatory Commission in 10CFR50.55a. ***(Ref. Section 1, PP 7015)***

Inservice Inspection (ISI) Program

ASME Section XI inspection requirements for Reactor Vessel Internals, (Subsection IWB, Categories B-N-1 and B-N-2) are not in the ISI Program, but are included in the BWR Vessel Internals Program. For more information on the BWR Vessel Internals Program, see section 4.7 of this report.

2. Preventive Actions

The Inservice Inspection Program is a condition monitoring program that does not include preventive actions.

3. Parameters Monitored/Inspected

The program uses nondestructive examination (NDE) techniques to detect and characterize flaws. Volumetric examinations such as radiographic, ultrasonic or eddy current examinations are used to locate surface and subsurface flaws. Surface examinations, such as magnetic particle or dye penetrant testing, are used to locate surface flaws.

Three levels of visual examinations are specified. VT-1 visual examination is conducted to assess the condition of the surface of the part being examined, looking for cracks and symptoms of wear, corrosion, erosion or physical damage. It can be done with either direct visual observation or with remote examination using various optical and video devices. VT-2 visual examination is conducted specifically to locate evidence of leakage from pressure retaining components (period pressure tests). While the system is under pressure for a leakage test, visual examinations are conducted to detect direct or indirect indication of leakage. VT-3 visual examination is conducted to determine general mechanical and structural condition of components and supports and to detect discontinuities and imperfections.
(Ref. ASME Section XI)

4. Detection of Aging Effects

The ISI Program manages cracking and loss of material, as applicable, for carbon steel, low alloy steel and stainless steel/nickel based alloy subcomponents of the reactor pressure vessel using NDE techniques specified in ASME Section XI, Subsections IWB, IWC, and IWD examination categories
(Ref. Attachment 1, AMRM-31; Section 4, PP 7015; and Appendix C, Vermont Yankee ISI Database)

Inservice Inspection (ISI) Program

The ISI Program manages cracking, loss of material, and reduction of fracture toughness, as applicable, of reactor coolant system components using NDE techniques specified in ASME Section XI, Subsections IWB, IWC and IWD examination categories.
(Ref. Attachment 1, AMRM-33; Section 4, PP 7015; and Appendix C, Vermont Yankee ISI Database)

No aging effects requiring management are identified for lubrite sliding supports. However, the ISI Program will confirm the absence of aging effects for the period of extended operation.
(Ref. Attachment 1, AMRC-01)

The ISI Program manages loss of material for ASME Class 1, 2, and 3 steel piping supports and steel component supports, using NDE techniques specified in ASME Section XI, Subsection IWF examination categories.
(Ref. Attachment 1, AMRC-01; Attachment 1, AMRC-06; Section 4, PP 7015; and Appendix C, Vermont Yankee ISI Database)

5. **Monitoring and Trending**

Results are compared, as appropriate, to baseline data and other previous test results. If indications are accepted for continued use by analytical evaluation, the areas containing such flaws are monitored during successive inspection periods.
(Ref. Section 4.5, PP 7015)

ISI results are recorded every operating cycle and provided to the NRC after each refueling outage via Owner's Activity Reports prepared by the ISI Program Coordinator. These detailed reports include scope of inspection and significant inspection results.
(Ref. Sections 3.1.8 and 6.3.3, PP 7015)

6. **Acceptance Criteria**

A preservice, or baseline, inspection of program components was performed prior to startup to assure freedom from defects greater than code-allowable. This baseline data also provides a basis for evaluating subsequent inservice inspection results. Since plant startup, additional inspection criteria for Class 2 and 3 components have been imposed by 10CFR50.55a for which baseline and inservice data has also been obtained. Results of inservice inspections are compared, as appropriate, to baseline data, other previous test results, and acceptance criteria of the ASME Section XI, 1998 Edition, 2000 Addenda, for evaluation of any evidence of degradation.
(Ref. Section 1.3, PP 7015)

7. **Corrective Action**

If a flaw is discovered during an ISI examination, an evaluation is conducted in accordance with articles IWA-3000, IWB-3000, IWC-3000, IWD-3000 or IWF-

3000 as appropriate. If flaws exceed acceptance standards, such flaws are removed, repaired, or the component is replaced prior to its return to service. For Class 1, 2, and 3, repair and replacement is in conformance with IWA-4000. Acceptance of flaws which exceed acceptance criteria may be accomplished through analytical evaluation without repair, removal or replacement of the flawed component if the evaluation meets the criteria specified in the applicable article of the code.
(Ref. Section 4.5, PP 7015 and AP 0070)

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**

    Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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

AMRC-01, Aging Management Review of the Primary Containment

AMRC-06, Aging Management Review of Bulk Commodities

AMRM-31, Aging Management Review of the Reactor Pressure Vessel

AMRM-33, Aging Management Review of the Reactor Coolant System Pressure Boundary

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program

Vermont Yankee ISI Database

D. Summary

The Inservice Inspection 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.

4.14.2 Containment Inservice Inspection (CII) Program

A. Program Description

The VYNPS Containment Inservice Inspection (CII) Program is a plant-specific program encompassing the requirements for the inspection of Class MC pressure-retaining components (Primary Containment) and their integral attachments in accordance with the requirements of 10CFR50.55a(b)(2) and the 1998 Edition of ASME Section XI with 2000 Addenda, Inspection Program B. Subarticle IWA-4540 of the 2003 Addenda of the 2001 Edition of ASME Section XI has also been adopted.
(Ref. Section 1.3, PP 7024)

This program is credited in the following.

- AMRC-01, Primary Containment

B. Evaluation

1. Scope of Program

The CII Program, under ASME Section XI Subsection IWE, manages loss of material and cracking for the primary containment and its integral attachments. The primary containment is a General Electric Mark I pressure suppression containment system. The system consists of a drywell (housing the reactor vessel and reactor coolant recirculation loops), a pressure suppression chamber (housing a water pool), and the connecting vent system between the drywell and the water pool, isolation valves, and containment cooling systems. The code of construction for the containment structure is the ASME Section III, 1965 with winter addenda.
(Ref. Section 1.2, PP 7024)

2. Preventive Actions

The CII Program is a monitoring program that does not include preventive actions.

3. Parameters Monitored/Inspected

The primary containment and its attachments are inspected for evidence of cracks, wear, and corrosion.
(Ref. Section 5.1.2, ENN-EP-S-001 and Section 4.2, PP 7024)

4. Detection of Aging Effects

The CII Program manages loss of material and cracking for the primary containment and its integral attachments.
(Ref. AMRC-01)

The primary inspection method for the primary containment and its integral attachments is visual examination. Visual examinations are performed either directly or remotely with sufficient illumination and resolution suitable for the local environment to assess general conditions that may affect either the containment structural integrity or leak tightness of the pressure retaining component. The program includes augmented ultrasonic exams to measure wall thickness of the containment structure.
(Ref. Section 5.1.1, ENN-EP-S-001 and Sections 1.3 and 4, PP 7024)

5. **Monitoring and Trending**

Results are compared, as appropriate, to baseline data and, other previous test results. If indications are accepted for continued use by analytical evaluation, the areas containing such flaws are monitored during successive inspection periods.
(Ref. Section 5.1.5, ENN-EP-S-001)

6. **Acceptance Criteria**

Results are compared, as appropriate, to baseline data, other previous test results, and acceptance criteria of the ASME Section XI, Subsection IWE for evaluation of any evidence of degradation.
(Ref. Section 5.2, ENN-EP-S-001)

7. **Corrective Actions**

Subsection IWE states that components whose examination results indicate flaws or areas of degradation that do not meet the acceptance standards are acceptable if an engineering evaluation indicates that the flaw or area of degradation is nonstructural in nature or has no effect on the structural integrity of the containment. Except as permitted by 10 CFR 50.55a(b)(ix)(D), components that do not meet the acceptance standards are subject to additional examination requirements, and the components are repaired or replaced to the extent necessary to meet the acceptance standards.
(Ref. Section 5.2, ENN-EP-S-001 and Section 4.2.4, PP 7024)

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**

Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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

ENN-EP-S-001, Rev. 00, ENN Engineering Standard – IWE General Visual Containment Inspection

PP 7024, Rev. 04, LPC 01, Containment Inservice Inspection Program (IWE)

D. Summary

The Containment Inservice Inspection 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.

4.15 Instrument Air Quality Program

A. Program Description

The Instrument Air Quality Program is a plant-specific program which ensures that instrument air supplied to components is maintained free of water and significant contaminants, thereby preserving an environment that is not conducive to loss of material. Dewpoint, particulate contamination, and hydrocarbon concentration are periodically checked to verify instrument air quality is maintained.

This program is credited in the following.

- AMRM-16, Instrument Air System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

This program applies to components within the scope of license renewal and subject to aging management review that are supplied with instrument air, for which pressure boundary integrity is required for the component to perform its intended function.

2. Preventive Actions

System air quality is monitored and maintained within specified limits to ensure that instrument air supplied to components is maintained free of water and significant contaminants, thereby preventing loss of material.
(Ref. RP 4620)

3. Parameters Monitored/Inspected

Dewpoint, particulate contamination and hydrocarbon concentration are periodically checked to verify instrument air quality is maintained.
(Ref. RP 4620)

4. Detection of Aging Effects

Dewpoint, particulate contamination and hydrocarbon concentration are periodically checked to verify instrument air quality is maintained, thereby preventing loss of material. At least once per 18 months, dew point, particulate contamination and hydrocarbon concentration are monitored at several locations in the instrument air system.
(Ref. RP 4620)

Instrument Air Quality Program

This program is credited with managing the following aging effects.

- Loss of material for components in the instrument air system (AMRM-16, 30)

5. Monitoring and Trending

Results of sample analyses are maintained in the chemistry log. A condition report is issued if data indicates deteriorating instrument air quality.
(Ref. RP 4620)

6. Acceptance Criteria

- dew point ≤ -40°C
- maximum particle size is 3 micrometers
- hydrocarbon content ≤ 1ppm

(Ref. RP 4620)

7. Corrective Actions

Corrective actions are carried out in accordance with the VYNPS 10 CFR Part 50, Appendix B, Corrective Action Program.
(Ref. RP 4620)

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

Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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

RP 4620, Rev. 17, LPC 00, Sampling and Analysis of Instrument and Containment Instrument Air Supplies

D. Summary

Operating experience verifies instrument air quality is being maintained. Based on this information, continued implementation of the Instrument Air Quality Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

4.16 Oil Analysis Program

A. Program Description

The Oil Analysis Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M39, Lubricating Oil Analysis.

The Oil Analysis Program maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling.

Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.

This program is credited in the following.

- AMRM-01, Standby Liquid Control System
- AMRM-05, High Pressure Coolant Injection System
- AMRM-06, Reactor Core Isolation Cooling and Condensate Storage and Transfer Systems
- AMRM-11, Service Water System
- AMRM-12, Reactor Building Closed Cooling Water System
- AMRM-13, Emergency Diesel Generator System
- AMRM-17, Fire Protection – Water System
- AMRM-21, John Deere Diesel
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"On a periodic basis, this program samples lubricating oil from plant components subject to aging management review."

b. Comparison to VYNPS Scope

This program applies to components within the scope of license renewal and subject to aging management review, that are exposed to lube oil, for which pressure boundary integrity or heat transfer is required for the component to perform its intended function.

VYNPS scope will be consistent with NUREG-1801.

Oil Analysis Program

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The lubricating oil analysis program maintains oil systems contaminants (primarily water and particulates) within acceptable limits."

b. Comparison to VYNPS Preventive Actions

Oil systems are monitored to detect and control abnormal levels of contaminants (primarily water and particulates), thereby preserving an environment that is not conducive to loss of material, cracking or fouling.
(Ref. DP 0213)

VYNPS preventive actions are consistent with NUREG-1801

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"For components with periodic oil changes in accordance with manufacturer's recommendations, a particle count and check for water are performed to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion. For components that do not have regular oil changes, viscosity, neutralization number, and flash point are also determined to verify the oil is suitable for continued use. In addition, analytical ferrography and elemental analysis are performed to identify wear particles."

b. Comparison to VYNPS Parameters Monitored/Inspected

For components with periodic oil changes in accordance with manufacturer's recommendations, a particle count and check for water are performed to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion. For components that do not have regular oil changes, oil is analyzed for particle count, viscosity, total acid/base (neutralization number), water content, and metals content.
(Ref. Appendix A, DP 0213)

VYNPS parameters monitored and inspected are not consistent with NUREG-1801 because flash point is not determined for sampled oil. Analyses of particle count, viscosity, total acid/base (neutralization number), water content, and metals content provide sufficient information to verify the oil is suitable for continued use.

Oil Analysis Program

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Periodic sampling and compliance with the acceptance criteria provide assurance that lube oil contaminants do not exceed acceptable levels, thereby preserving an environment that is not conducive to aging mechanisms that could lead to the aging effects of loss of material, cracking and reduction of heat transfer."

b. Comparison to VYNPS Detection of Aging Effects

Periodic sampling and compliance with acceptance criteria provide assurance that lube oil contaminants do not exceed acceptable levels, thereby preventing cracking, loss of material, and fouling. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.
(Ref. DP 0213)

This program is credited with managing the following aging effects.

- loss of material for components wetted by oil (AMRM-01, 05, 06, 11, 12, 13, 17, 21, 30)
- cracking of stainless steel components wetted by oil (AMRM-05, 13)
- fouling on heat exchanger tubes wetted by oil (AMRM-05, 06, 11, 13, 17, 21)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Oil analysis results are reviewed to determine if alert levels or limits have been reached or exceeded. This review also checks for unusual trends."

b. Comparison to VYNPS Monitoring and Trending

Oil analysis results are reviewed and trended to determine adverse trends in parameters.
(Ref. Procedure Section 3, DP 0213)

VYNPS monitoring and trending are consistent with NUREG-1801

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Particle concentration will be determined in accordance with industry standards such as SAE749D, ISO 4406, ISO 112218, and NAS 1638. Water and particle concentration will not exceed limits based on manufacturer's recommendations or industry standards recommended for each components type. Viscosity bands are based on a tolerance around the base viscosity of the lubricating oil as recommended by the components manufacturer or industry standards. Metal limits as determined by spectral analysis and ferrography will be based on original baseline data and manufacturer's recommendations, industry standards, or other justified basis."

b. Comparison to VYNPS Acceptance Criteria

The Oil Analysis Program at VYNPS is designed to function as a screening tool to help identify adverse lube oil conditions or trends. Consideration is given to the results for all measured parameters, and to parameter trends, before a decision is made to drain, flush and change out the lubricant for a component. Acceptance criteria resulting in resampling and increased sampling frequency include:

particulates > ISO 16/13 (SAE contamination class 4)
viscosity increase of 20% from viscosity grade
viscosity decrease of 10% from viscosity grade
water content above 2000 ppm or trend increasing levels > 0.05%

(Ref. Procedure Section 3 and Appendix A, DP 0213)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Pursuant to 10 CFR Part 50, Appendix B, specific corrective actions are implemented in accordance with the plant quality assurance (QA) program. For example, if a limit is reached or exceeded, actions to address the condition are taken. These may include increased monitoring, vibration analysis, corrective maintenance, further laboratory analysis, and engineering evaluation. 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

Initial corrective actions include resampling and increasing sampling frequency. If trending indicates degradation, the oil system may be drained,

flushed and refilled with new oil. Additional corrective actions are carried out in accordance with the VYNPS 10 CFR Part 50, Appendix B, Corrective Action Program.
(Ref. Procedure Section 3 and Appendix A, DP 0213)

VYNPS corrective actions are consistent with 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

"The operating experience at some plants has identified water in the lubricating oil, and particulate contamination. However, no instances of component failures attributed to lubricating oil contamination have been identified."

b. Comparison to VYNPS Operating Experience

Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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 0213, Rev. 06, LPC 00, Lube Oil Analysis Program

D. Summary

The Oil Analysis Program activities are preventive aging management activities that assure potentially detrimental concentrations of water and particulates are not present in the oil. The Oil Analysis Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

The Oil Analysis Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M39, Lubricating Oil Analysis, with the following exception.

Oil Analysis Program

Attributes Affected	Exception
3. Parameters Monitored/Inspected	Flash point is not determined for sampled oil. (Note 1)

Exception Notes

1. Analyses of filter residue or particle count, viscosity, total acid/base (neutralization number), water content, and metals content provide sufficient information to verify the oil is suitable for continued use.

4.17 Periodic Surveillance and Preventive Maintenance Program

A. Program Description

There is no corresponding NUREG-1801 program.

The Periodic Surveillance and Preventive Maintenance Program includes periodic inspections and tests that manage aging effects not managed by other aging management programs. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations.

This program is credited in the following.

- AMRC-02, Reactor Building
- AMRC-05, Yard Structures
- AMRC-06, Bulk Commodities
- AMRM-05, High Pressure Coolant Injection System
- AMRM-07, Standby Gas Treatment System
- AMRM-08, Primary Containment Atmosphere Control and Containment Atmosphere Dilution Systems
- AMRM-11, Service Water Systems
- AMRM-13, Emergency Diesel Generator System
- AMRM-19, Heating, Ventilation and Air Conditioning System
- AMRM-21, John Deere Diesel
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

The VYNPS Periodic Surveillance and Preventive Maintenance Program, with regard to license renewal, includes those tasks credited with managing aging effects identified in aging management reviews. For a list of activities and the aging effects they address, see Attachment 3, Periodic Surveillance and Preventive Maintenance Activities.

2. Preventive Actions

Inspection and testing activities used to identify component aging effects do not prevent aging effects. However, activities are intended to prevent failures of components that might be caused by aging effects.

3. Parameters Monitored/Inspected

This program provides instructions for monitoring structures, systems, and components to detect degradation. Inspection and testing activities monitor

various parameters including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking. For a list of activities and parameters monitored and inspected, see Attachment 3, Periodic Surveillance and Preventive Maintenance Activities.

4. Detection of Aging Effects

Preventive maintenance activities and periodic surveillances provide for periodic component inspections and testing to detect aging effects. Inspection intervals are established such that they provide timely detection of degradation. Inspection intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations. Each inspection or test occurs at least once every ten years.

The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions. Established techniques such as visual inspections are used.

See Attachment 3, Periodic Surveillance and Preventive Maintenance Activities, for detection of aging effects for each activity.

5. Monitoring and Trending

Preventive maintenance and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection and testing intervals are established such that they provide for timely detection of component degradation. Inspection and testing intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

6. Acceptance Criteria

Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in specific inspection and testing procedures. The procedures confirm component integrity by verifying the absence of aging effects or by comparing applicable parameters to limits based on applicable intended functions established by plant design basis. For a list of activities and their specific acceptance criteria, see Attachment 3, Periodic Surveillance and Preventive Maintenance Activities.

7. Corrective Actions

The site Corrective Action Program, quality assurance procedures, site review and approval process, and administrative controls are implemented in accordance with requirements of 10 CFR Part 50, Appendix B.

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

Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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

ME039, Rev. 5, PM Basis, Activity 1, Every month, perform surveillance test of diesel generator

ME039, Rev. 5, PM Basis, Activity 4, Every refueling outage, perform inspection/maintenance of diesel generator

ME118, Rev. 1, PM Basis, Activity 3, Every 3 years inspect standby gas system demister, demister compartment and demister drain

ME145, Rev. 3, PM Basis, Activity 2, Every 1.5 years, perform preventive maintenance on heat exchangers, RRU-7 and RRU-8

ME146, Rev. 2, PM Basis, Activity 2, Every 1.5 years, perform preventive maintenance on heat exchangers, RRU-5 and RRU-6

ME153, Rev. 6, PM Basis, Activity 1, Quarterly, perform surveillance testing on air conditioning units

ME153, Rev. 6, PM Basis, Activities 4, 5 & 6, Semi-annually, perform preventive maintenance on air conditioning units

ME163, Rev. 4, PM Basis, Activity 2, Monthly Surveillance Test of the of the John Deere diesel generator

ME163, Rev. 4, PM Basis, Activity 3, Annually, perform preventive maintenance of the John Deere diesel generator

ME163, Rev. 4, PM Basis, Activity 4, Every 3 years, perform preventive maintenance of the John Deere diesel generator heat exchangers

Periodic Surveillance and Preventive Maintenance Program

ME163, Rev. 4, PM Basis, Activity 5, Every 5 years, perform inspection of John Deere diesel engine with factory representative

ME166, Rev. 2, PM Basis, Activity 2, Perform routine preventive maintenance on inner and outer door assemblies

OP 4019, Rev. 16. LPC 01, Surveillance of Plant Fire Barriers and Fire Rated Assemblies

OP 4115, Rev. 43, LPC 08, Primary Containment Surveillance

OP 4116, Rev. 23, LPC 06, Secondary Containment Surveillance

OP 4127, Rev. 09, LPC 03, John Deere Diesel Generator Surveillance

OP 4192, Rev. 15, LPC 00, HVAC Surveillance

OP 5223, Rev. 20, LPC 00, Emergency Diesel Generator Maintenance

OP 5230, Rev. 16, LPC 00, Mechanical PMs and Inspections for Refueling Platform

OP 5240, Rev. 16, LPC 01, Turbine and Reactor Building Bridge Crane Inspection and Maintenance

OP 5265, Rev. 05, LPC 00, Service Water Component Inspection and Acceptance Criteria

PMCR 2003-0724, Annual PM for John Deere Diesel

PMCR 2003-0725, Three Year PM for John Deere Diesel

PMCR 2003-0726, Five Year PM for John Deere Diesel

WO 00-004037-000, RRU-8 outage PM

WO 02-001508-000, Demister/moisture separator and demister drain inspection

WO 02-001334-000, RHR Corner Room RRU-6 PM

WO 02-001335-000, RHR Corner Room RRU-5 PM

WO 03-001108-000, Perform annual PM for John Deere diesel

WO 03-002211-000, RRU-7 outage PM

WO 03-004311-000, Perform visual examination of the reactor building air lock outer sliding door

WO 03-004324-000, Perform visual examination of the reactor building air lock inner sliding door

D. Summary

The Periodic Surveillance and Preventive Maintenance Program has been effective at managing aging effects. The Periodic Surveillance and Preventive Maintenance 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.

4.18 Reactor Head Closure Studs Program

A. Program Description

The Reactor Head Closure Studs Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Studs.

This VYNPS program includes inservice inspection (ISI) in conformance with the requirements of ASME Section XI, Subsection IWB, and preventive measures (e.g. rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program includes (a) ISI to detect cracking due to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC), loss of material due to wear, and coolant leakage from reactor vessel closure stud bolting for both boiling water reactors (BWRs) and pressurized water reactors (PWRs); and (b) preventive measures of NRC Regulatory Guide 1.65 to mitigate cracking. The program is applicable to closure studs and nuts constructed from materials with a maximum tensile strength limited to less than 1,172 MPa (170 ksi) (Nuclear Regulatory Commission [NRC] Regulatory Guide [RG] 1.65)."

b. Comparison to VYNPS Scope

This VYNPS program includes ISI in conformance with the requirements of ASME Section XI, Subsection IWB, and preventive measures to mitigate cracking as described in NRC Regulatory Guide 1.65.

The program applies to the reactor head closure studs, nuts, washers, and bushings, which are A540 Grade B steel with a maximum tensile strength less than 170ksi.
(Ref. VYC-1080 and App. C, Table 5, Vermont Yankee ISI Database)

VYNPS scope is consistent with NUREG-1801.

Reactor Head Closure Studs Program

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"Preventive measures include avoiding the use of metal-plated stud bolting to prevent degradation due to corrosion or hydrogen embrittlement, and to use manganese phosphate or other acceptable surface treatments and stable lubricants (RG 1.65). Implementation of these mitigation measures can reduce SCC or IGSCC, thus making this program effective."

b. Comparison to VYNPS Preventive Actions

VYNPS preventive measures are consistent with those described in Regulatory Guide 1.65. Studs, nuts and washers are not metal-plated. Threaded surfaces of studs, nuts and washers have a phosphate coating to act as a rust inhibitor and lubricant. Also, a stable lubricant compatible with the bolting and vessel materials is applied to the stud threads, the mating surfaces of the washers and the nut threads during assembly.
(Ref. Regulatory Guide 1.65; VYC-1080; Section 7.2.3.6, Specification 21A115; and Section 4.22, OP 1201)

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The ASME Section XI ISI program detects and sizes cracks, detects loss of material, and detects coolant leakage by following the examination and inspection requirements specified in Table IWB-2500-1"

b. Comparison to VYNPS Parameters Monitored/Inspected

The VYNPS Reactor Head Closure Studs Program detects and sizes cracks, detects loss of material, and detects coolant leakage by following the examination and inspection requirements specified in Table IWB-2500-1, as modified in code case N-652.
(Ref. Appendix B, PP 7015)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"The extent and schedule of the inspection and test techniques prescribed by the program are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended

function of the component. Inspection can reveal cracking, loss of material due to corrosion or wear, and leakage of coolant.

The program uses visual, surface, and volumetric examinations in accordance with the general requirements of Subsection IWA-2000. Surface examination uses magnetic particle, liquid penetration, or eddy current examinations to indicate the presence of surface discontinuities and flaws. Volumetric examination uses radiographic or ultrasonic examinations to indicate the presence of discontinuities or flaws throughout the volume of material. Visual VT-2 examination detects evidence of leakage from pressure-retaining components, as required during the system pressure test.

Components are examined and tested as specified in Table IWB-2500-1. Examination category B-G-1, for pressure-retaining bolting greater than 2 in. diameter in reactor vessels specifies volumetric examination of studs in place, from the top of the nut to the bottom of the flange hole, and surface and volumetric examination of studs when removed. Also specified are volumetric examination of flange threads and visual VT-1 examination of surfaces of nuts, washers, and bushings. Examination category B-P for all pressure-retaining components specifies visual VT-2 examination of all pressure-retaining boundary components during the system leakage test and the system hydrostatic test."

b. Comparison to VYNPS Detection of Aging Effects

The VYNPS Reactor Head Closure Studs Program detects and sizes cracks, detects loss of material, and detects coolant leakage by following the examination and inspection requirements specified in Table IWB-2500-1, as modified in code case N-652.
(Ref. Appendix B, PP 7015)

The program uses visual, surface, and volumetric examinations in accordance with the general requirements of ASME Section XI, Subsection IWA-2000. Inspections include ultrasonic testing and magnetic particle testing of the studs, and VT-1 visual examination of the nuts and washers. VT-2 inspections for leak detection are performed during system pressure tests.
(Ref. Appendix B, PP 7015 and OP 4101)

This program is credited with managing the following aging effects.

- cracking and loss of material of the reactor head closure studs, nuts, washers, and bushings (AMRM-31)

VYNPS detection of aging effects is not consistent with NUREG-1801 because, unlike Table IWB-2500-1, code case N-652 allows surface examination to be substituted for volumetric examination when bolting is removed for examination. Cracking initiates on the outside surfaces of bolts and studs. Therefore, a qualified surface examination meeting the acceptance standards of IWB-3515 provides at least the sensitivity for flaw

detection that an end shot ultrasonic examination provides on bolts or studs. Thus, when reactor head closure studs are removed for examination, either a surface or volumetric examination is allowed.
(Ref. App. A, ISI-03, PP 7015 and App. C, Table 5, Vermont Yankee ISI Database)

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"The Inspection schedule of IWB-2400, and the extent and frequency of IWB-2500-1 provide timely detection of cracks, loss of material, and leakage."

b. Comparison to VYNPS Monitoring and Trending

The VYNPS Reactor Head Closure Studs Program detects and sizes cracks, detects loss of material, and detects coolant leakage by following the inspection schedule of IWB-2400 and the examination and inspection requirements specified in Table IWB-2500-1, as modified in code case N-652.
(Ref. Appendix B, PP 7015)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Any indication or relevant condition of degradation in closure stud bolting is evaluated in accordance with IWB-3100 by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3500."

b. Comparison to VYNPS Acceptance Criteria

Degradation of closure stud bolting is evaluated in accordance with appropriate acceptance criteria of ASME Section XI, 1998 Edition, 2000 Addenda.
(Ref. Section 4.5, PP 7015)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Repair and replacement are performed in conformance with the requirements of IWB-400 [*sic*] and IWB-7000, respectively, and the material and inspection guidance of RG 1.65. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions."

b. Comparison to VYNPS Corrective Actions

VYNPS repair and replacement procedure is in conformance with ASME Section XI repair and replacement criteria. The Corrective Action Program is also applicable.
(Ref. AP 0070)

VYNPS corrective actions are consistent with 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

"The SCC has occurred in BWR pressure vessel head studs (Stoller 1991). The aging management program (AMP) has provisions regarding inspection techniques and evaluation, material specifications, corrosion prevention, and other aspects of reactor pressure vessel head stud cracking. Implementation of the program provides reasonable assurance that the effects of cracking due to SCC or IGSCC and loss of material due to wear will be adequately managed so that the intended functions of the reactor head closure studs and bolts will be maintained consistent with the current licensing basis (CLB) for the period of extended operation."

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 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

AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

GE Purchase Specification 21A1115, Revision 3, "Reactor Pressure Vessel"

OP 1201, Rev. 27, LPC 00, Assembly of the Reactor and Drywell Systems

Reactor Head Closure Studs Program

OP 4101, Rev. 26, LPC 05, RPV Operational System Leakage Test

PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program

Regulatory Guide 1.65, Materials and Inspections for Reactor Vessel Closure Studs, October, 1973

Vermont Yankee ISI Database

VYC-1080, Rev. 0, Critical Flaw Size Evaluation for Vermont Yankee Reactor Pressure Vessel Head Studs

D. Summary

The Reactor Head Closure Studs Program has been effective at managing aging effects. The Reactor Head Closure Studs 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 Reactor Head Closure Studs Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Studs, with the following exception.

Attributes Affected	Exception
4. Detection of Aging Effects	When reactor head closure studs are removed for examination, either a surface or volumetric examination is allowed. (Note 1)

Exception Notes

1. Cracking initiates on the outside surfaces of bolts and studs. Therefore, a qualified surface examination meeting the acceptance standards of ASME Section XI, Subsection IWB-3515 provides at least the sensitivity for flaw detection that an end shot ultrasonic examination provides on bolts or studs. Thus, when reactor head closure studs are removed for examination, either a surface or volumetric examination is allowed.

4.19 Reactor Vessel Surveillance Program

A. Program Description

The Reactor Vessel Surveillance Program complies with the guidelines for an acceptable Integrated Surveillance Program described in NUREG-1801, Section XI.M31, Reactor Vessel Surveillance. This program manages reduction in fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor pressure vessel is maintained for the period of extended operation.

VYNPS is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) as approved by License Amendment 218. This program monitors changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. As BWRVIP-ISP capsule test reports become available for RPV materials representative of VYNPS, the actual shift in the reference temperature for nil-ductility transition of the vessel material may be updated. In accordance with 10CFR50 Appendix H, VYNPS reviews relevant test reports to assure compliance with fracture toughness requirements and P-T limits.
(Ref. Bases Section 3/4.6.A, VYNPS Technical Specifications)

BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," describes the design and implementation of the ISP during the period of extended operation. BWRVIP-116 identifies additional capsules, their withdrawal schedule, and contingencies to ensure that the requirements of 10CFR50 Appendix H are met for the period of extended operation.
(Ref. Commitment Report BWRVIP-116-01)

This program is credited in the following.

- AMRM-31, Reactor Pressure Vessel

B. Evaluation

1. Scope of Program

The Reactor Vessel Surveillance Program includes all reactor vessel beltline materials as defined by 10 CFR 50 Appendix G, Section II.F.

2. Preventive Actions

No actions are taken as part of this program to prevent aging effects or mitigate aging degradation.

Reactor Vessel Surveillance Program

3. Parameters Monitored/Inspected

The Reactor Vessel Surveillance Program monitors reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement. The BWRVIP ISP uses existing BWRVIP-ISP surveillance capsules in BWR plants, as well as supplemental capsules irradiated in host plants, to provide data which bounds all operating plants. The capsules in the VYNPS vessel are spares, not currently scheduled for withdrawal. VYNPS plate and weld metal is represented by the surveillance capsule in Susquehanna Unit 1.
(Ref. Section 3.1, BVY 03-29)

4. Detection of Aging Effects

The Reactor Vessel Surveillance Program detects the effects of reduction of fracture toughness prior to loss of the reactor vessel intended function in accordance with the information provided in Monitoring and Trending.

5. Monitoring and Trending

The Reactor Vessel Surveillance Program uses existing BWRVIP-ISP surveillance capsules in BWR plants, as well as supplemental capsules irradiated in host plants, to provide data which bounds all operating plants. The capsules in the VYNPS vessel are spares, not currently scheduled for withdrawal. VYNPS plate and weld metal is represented by the surveillance capsule in Susquehanna Unit 1.
(Ref. Section 3.1, BVY 03-29)

Representative capsule data will be evaluated using the methods in Regulatory Guide 1.99 in accordance with Appendix G to 10CFR50 for the determination of the actual shift in the reference temperature for nil-ductility transition (RT_{NDT}) of the vessel material. Charpy shift results will be used to reevaluate embrittlement projections for vessel beltline materials represented by materials in the capsule. If changes to pressure-temperature limits are required due to a reassessment of limiting RT_{NDT} values, changes to the licensing basis will be requested.
(Ref. Section 3.1, BVY 03-29)

Enhancement: The Reactor Vessel Surveillance Program will be enhanced to proceduralize (in PP 7027 or a new procedure) the data analysis, acceptance criteria, and corrective actions described in this program description.

Although there are no plans to remove additional material surveillance specimens from VYNPS, the remaining two surveillance capsules will continue to reside in the RPV as a contingency.
(Ref. Section 3.1, BVY 03-29)

6. Acceptance Criteria

VYNPS embrittlement projections will comply with 10CFR50 Appendix G limits for the period of extended operation.

RT_{NDT} for material in the beltline will remain below screening criterion using end of life fluence.

Enhancement: The Reactor Vessel Surveillance Program will be enhanced to proceduralize (in PP 7027 or a new procedure) the data analysis, acceptance criteria, and corrective actions described in this program description.

Acceptable pressure-temperature curves for heatup and cooldown of the unit will be maintained in Technical Specifications. The operational EFPY shall not exceed the Technical Specification limits for the pressure-temperature curves. ***(Ref. Section 3/4.6, VYNPS Technical Specifications)***

7. Corrective Actions

Specific corrective action and confirmation will be implemented as follows.

If embrittlement projections drop below 50 ft-lbs, the margins of safety against fracture will be demonstrated to be equivalent to those of Appendix G of ASME Section XI. This could be accomplished by demonstrating that the equivalent Margin Analysis documented in BWRVIP-74 represents a bounding evaluation for the VYNPS reactor vessel.

If RT_{NDT} for material in the beltline is projected to exceed the screening criterion using end of life fluence, VYNPS may implement flux reduction programs that are reasonably practicable to avoid exceeding this criterion. If no reasonably practicable flux reduction program will avoid exceeding the screening criteria, VYNPS will submit a safety analysis to determine actions to prevent potential failure of the reactor vessel as a result of postulated events if continued operation beyond the screening criterion is allowed.

Enhancement: The Reactor Vessel Surveillance Program will be enhanced to proceduralize (in PP 7027 or a new procedure) the data analysis, acceptance criteria, and corrective actions described in this program description.

If a capsule is not withdrawn as scheduled by BWRVIP-ISP, the NRC will be notified and the withdrawal schedule will be updated and submitted to the NRC. ***(Ref. Section 5.7, BWRVIP-86-A)***

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

Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. The fact that VYNPS now participates in the BWRVIP ISP ensures that future operating experience from all participating BWRs will be factored into this program. For more information on applicable operating experience, see VYNPS Report LRPD-05, Operating Experience Review Results.

C. References

10CFR50, Appendix G, Fracture Toughness Requirements, U.S. NRC

10CFR50, Appendix H, Reactor Vessel Material Surveillance Program Requirements, U.S. NRC

BVY 03-29, Technical Specifications Proposed Change No. 258, RPV Fracture Toughness and Material Surveillance Requirements, March 26, 2003

BWRVIP-86-A, BWR Vessel and Internals Project Updated BWR Integrated Surveillance Program (ISP) Implementation Plan, EPRI Report 1003346, October 2002

Commitment Report BWRVIP-116-01, BWRVIP ISI Implementation for License Renewal, 9/17/2003

PP 7027, Rev. 03, LPC 00, Reactor Vessel Internals Management Program

VYNPS Technical Specification, Amendment 228

D. Summary

The Reactor Vessel Surveillance Program ensures that reactor vessel embrittlement is monitored and corrective actions are taken prior to exceeding allowable limits. The Reactor Vessel Surveillance Program provides reasonable assurance that aging effects 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.

Reactor Vessel Surveillance Program

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement
5. Monitoring and Trending 6. Acceptance Criteria 7. Corrective Actions	The Reactor Vessel Surveillance Program will be enhanced to proceduralize (in PP 7027 or a new procedure) the data analysis, acceptance criteria, and corrective actions described in this program description.

4.20 Service Water Integrity Program

A. Program Description

The Service Water Integrity Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M20, Open-Cycle Cooling Water System.

This program relies on implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the service water systems (SWS) will be managed for the period of extended operation. The SWS include the service water, residual heat removal service water, and alternate cooling systems. The program includes surveillance and control techniques to manage aging effects in the SWS or structures and components serviced by the SWS.

This program is credited in the following.

- AMRM-02, Residual Heat Removal System
- AMRM-11, Service Water System
- AMRM-13, Emergency Diesel Generator System
- AMRM-14, Fuel Pool Cooling Systems
- AMRM-19, Heating, Ventilation and Air Conditioning System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program addresses the aging effects of material loss and fouling due to micro- or macro-organisms and various corrosion mechanisms. Because the characteristics of the service water system may be specific to each facility, the OCCW system is defined as a system or systems that transfer heat from safety-related systems, structures, and components (SSC) to the ultimate heat sink (UHS). If an intermediate system is used between the safety-related SSCs and the system rejecting heat to the UHS, that intermediate system performs the function of a service water system and is thus included in the scope of recommendations of NRC GL 89-13. The guidelines of NRC GL 89-13 include (a) surveillance and control of biofouling; (b) a test program to verify heat transfer capabilities; (c) routine inspection and a maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of safety-related systems serviced by OCCW; (d) a system walkdown inspection to ensure compliance with the licensing basis; and (e) a review of maintenance, operating, and training practices and procedures."

b. Comparison to VYNPS Scope

This program addresses aging effects of loss of material, cracking, and fouling due to micro- or macro-organisms and various corrosion mechanisms on SWS components and components cooled by service water. The VYNPS program scope includes the elements defined in NRC GL 89-13.
(Ref. Sections 1.1 and 1.2, PP 7021)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The system components are constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. Implementation of NRC GL 89-13 includes a condition and performance monitoring program; control or preventive measures, such as chemical treatment, whenever the potential for biological fouling species exists; or flushing of infrequently used systems. Treatment with chemicals mitigates microbiologically influenced corrosion (MIC) and buildup of macroscopic biological fouling species, such as blue mussels, oysters, or clams. Periodic flushing of the system removes accumulations of biofouling agents, corrosion products, and silt."

b. Comparison to VYNPS Preventive Actions

The Service Water Integrity Program, in accordance with NRC GL 89-13, includes a condition and performance monitoring program which inspects components for erosion, corrosion, and blockage and verifies the heat transfer capability of safety-related heat exchangers cooled by the SWS. Chemical treatment using biocides and a penetrant-biodispersant and periodic cleaning and flushing of redundant or infrequently used loops control or prevent fouling within heat exchangers and loss of material in SWS components.
(Ref. PP 7021 and PP 7601)

VYNPS preventive actions are not consistent with NUREG-1801, because NUREG-1801 states that system components are lined or coated. Components are lined or coated only where necessary to protect the underlying metal surfaces.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"Adverse effects on system or component performance are caused by accumulations of biofouling agents, corrosion products, and silt. Cleanliness and material integrity of piping, components, heat exchangers, elastomers,

and their internal linings or coatings (when applicable) that are part of the OCCW system or that are cooled by the OCCW system are periodically inspected, monitored, or tested to ensure heat transfer capabilities. The program ensures (a) removal of accumulations of biofouling agents, corrosion products, and silt, and (b) detection of defective protective coatings and corroded OCCW system piping and components that could adversely affect performance of their intended safety functions."

b. Comparison to VYNPS Parameters Monitored/Inspected

The Service Water Integrity Program includes inspections, monitoring, and testing to ensure cleanliness and material integrity of piping, components, heat exchangers, and their internal linings or coatings (when applicable) that are part of the SWS or that are cooled by the SWS. Thus, the program ensures management of aging effects that could adversely affect performance of system intended safety functions.
(Ref. PP 7021)

Since this program ensures removal of accumulations of biofouling agents, corrosion products, and silt, and detection of defective protective coatings and corroded system piping and components that could adversely affect performance, VYNPS parameters monitored and inspected are consistent with NUREG-1801.

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Inspections for biofouling, damaged coatings, and degraded material condition are conducted. Visual inspections are typically performed; however, nondestructive testing, such as ultrasonic testing, eddy current testing, and heat transfer capability testing, are effective methods to measure surface condition and the extent of wall thinning associated with the service water system piping and components, when determined necessary."

b. Comparison to VYNPS Detection of Aging Effects

SWS components are routinely inspected to ensure that erosion, corrosion, coating failures, and silting will not degrade the SWS. The inspection program includes provisions for visual inspections, eddy current testing of heat exchanger tubes, ultrasonic testing, and heat transfer capability testing.
(Ref. Appendices B & D, PP 7021)

This program is credited with managing the following aging effects.

- loss of material, cracking and fouling for residual heat removal heat exchangers (E-14-1A & B) (AMRM-02)
- loss of material and fouling for components in the service water system (AMRM-11)

- loss of material and fouling for emergency diesel generator heat exchangers (AMRM-13)
- loss of material and fouling for standby fuel pool cooling system heat exchangers (E-19-2A & B) (AMRM-14)
- loss of material and fouling for reactor building ECCS corner room recirculation units (RRU-7 and RRU-8) (AMRM-19)
- loss of material for nonsafety-related components exposed to raw water in the HVAC, MGLO, RHRSW, SBFPC, SBGT, and SW systems (AMRM-30)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Inspection scope, method (e.g., visual or nondestructive examination [NDE]), and testing frequencies are in accordance with the utility commitments under NRC GL 89-13. Testing and inspections are done annually and during refueling outages. Inspections or nondestructive testing will determine the extent of biofouling, the condition of the surface coating, the magnitude of localized pitting, and the amount of MIC, if applicable. Heat transfer testing results are documented in plant test procedures and are trended and reviewed by the appropriate group."

b. Comparison to VYNPS Monitoring and Trending

Inspection scope, method, and testing frequencies are in accordance with VYNPS commitments under NRC GL 89-13. Tests and inspections are done during refueling outages and other outages as necessary. SWS components are routinely inspected to ensure that erosion, corrosion, coating failures, and silting will not degrade the SWS. The inspection program includes provisions for visual inspections, eddy current testing of heat exchanger tubes, ultrasonic testing, and heat transfer capability testing. Heat transfer testing results are documented, trended and reviewed by the appropriate group. ***(Ref. Appendices B & D, PP 7021)***

VYNPS monitoring and trending are not consistent with NUREG-1801, in that NUREG-1801 states that testing and inspections are performed annually and during refueling outages. The VYNPS program requires tests and inspections each refueling outage. Since aging effects are typically manifest over several years, the difference in inspection and testing frequency is insignificant.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Biofouling is removed or reduced as part of the surveillance and control process. The program for managing biofouling and aggressive cooling water environments for OCCW systems is preventive. Acceptance criteria are based on effective cleaning of biological fouling organisms and maintenance of protective coatings or linings are emphasized."

b. Comparison to VYNPS Acceptance Criteria

While biofouling is managed as part of the VYNPS program, this is not one of the aging effects to be managed for license renewal (see Detection of Aging Effects). The program for managing fouling within heat exchangers and loss of material in SWS components is preventive. Acceptance criteria are based on effective cleaning; and evidence of degraded components or protective coatings is evaluated.
(Ref. PP 7021 and Appendix A, OP 5265)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Evaluations are performed for test or inspection results that do not satisfy established acceptance criteria and a problem or condition report is initiated to document the concern in accordance with plant administrative procedures. The corrective actions program ensures that the conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. 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

Corrective actions are carried out in accordance with the VYNPS 10 CFR Part 50, Appendix B, Corrective Action Program. This is consistent with 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

"Significant microbiologically influenced corrosion (NRC Information Notice [IN] 85-30), failure of protective coatings (NRC IN 85-24), and fouling (NRC IN 81-21, IN 86-96) have been observed in a number of heat exchangers. The guidance of NRC GL 89-13 has been implemented for approximately 10 years and has been effective in managing aging effects due to biofouling, corrosion, erosion, protective coating failures, and silting in structures and components serviced by OCCW systems."

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 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

OP 5265, Rev. 05, LPC 00, Service Water Component Inspection and Acceptance Criteria

PP 7021, Rev. 02, LPC 00, Service Water Program

PP 7601, Rev. 02, LPC 00, Service Water Chemical Treatment and Monitoring Program

D. Summary

The Service Water Integrity Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

The Service Water Integrity Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M20, Open-Cycle Cooling Water System with the following exceptions.

Service Water Integrity Program

Attributes Affected	Exceptions
2. Preventive Actions	NUREG-1801 states that system components are lined or coated. Components are lined or coated only where necessary to protect the underlying metal surfaces. (Note 1)
5. Monitoring and Trending	NUREG-1801 states that testing and inspections are performed annually and during refueling outages. The VYNPS program requires tests and inspections each refueling outage. (Note 2)

Exception Notes

1. NUREG-1801 states that system components are constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. Not all VYNPS system components are lined or coated. Components are lined or coated only where necessary to protect the underlying metal surfaces.
2. NUREG-1801 program entails testing and inspections performed annually and during refueling outages. The VYNPS program requires tests and inspections each refueling outage, but not annually. Since aging effects are typically manifested over several years, the difference in inspection and testing frequency is insignificant.

4.21 Structures Monitoring Programs

The Structures Monitoring programs are discussed in the following Subsections

- Structures Monitoring Program
- Masonry Wall Program
- Vernon Dam FERC Inspection

4.21.1 Structures Monitoring Program

A. Program Description

The Structures Monitoring Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.S6, Structures Monitoring Program.

Structures monitoring in accordance with 10 CFR 50.65 (Maintenance Rule) is addressed in Regulatory Guide 1.160 and NUMARC 93-01. These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule, such that there is no loss of structure or structural component intended function.

Since protective coatings are not relied upon to manage the effects of aging for structures included in the Structures Monitoring Program, the program does not address protective coating monitoring and maintenance.

This program is credited in the following.

- AMRC-01, Primary Containment
- AMRC-02, Reactor Building
- AMRC-03, Intake Structure
- AMRC-04, Process Facilities
- AMRC-05, Yard Structures
- AMRC-06, Bulk Commodities

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The applicant specifies the structure/aging effect combinations that are managed by its structures monitoring program."

b. Comparison to VYNPS Scope

The Structures Monitoring Program manages the effects of aging on structures and structural components as specified under Detection of Aging Effects.
(Ref. Section 4.2, PP 7030; OP 5240)

Enhancement: The Structures Monitoring Program procedure will be enhanced to specify that process facility crane rails and girders, CST enclosure, CO_2 tank enclosure, N_2 tank enclosure and restraining wall, CST pipe trench, diesel generator cable trench, fuel oil pump house, service water pipe trench, drywell floor liner seal, manway seals and gaskets, and hatch seals and gaskets are inspected.
(Ref. Section 4.2, PP 7030)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

No preventive actions are specified.

b. Comparison to VYNPS Preventive Actions

No preventive actions are specified in NUREG-1801.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"For each structure/aging effect combination, the specific parameters monitored or inspected are selected to ensure that aging degradation leading to loss of intended functions will be detected and the extent of degradation can be determined. Parameters monitored or inspected are to be commensurate with industry codes, standards and guidelines, and are to also consider industry and plant-specific operating experience. Although not required, ACI 349.3R-96 and ANSI/ASCE 11-90 provide an acceptable basis for selection of parameters to be monitored or inspected for concrete and steel structural elements and for steel liners, joints, coatings, and waterproofing membranes (if applicable). If necessary for managing settlement and erosion of porous concrete subfoundations, the continued functionality of a site de-watering system is to be monitored. The plant-specific structures monitoring program is to contain sufficient detail on parameters monitored or inspected to conclude that this program attribute is satisfied."

b. Comparison to VYNPS Parameters Monitored/Inspected

For each structure/aging effect combination, specific parameters monitored or inspected were selected to ensure that aging degradation leading to loss of intended functions is detected and extent of degradation is determined. The parameters monitored or inspected were selected based on information included in industry codes, standards and guidelines, and also consider industry and plant-specific operating experience. VYNPS does not have subfoundation layers of porous concrete, and therefore, does not rely on a site de-watering system for managing settlement and erosion of porous concrete subfoundations.
(Ref. PP 7030; NVY 97-45; Section 12.2, UFSAR; OP 5240)

See Attachment 4, Structures Monitoring Program General Criteria for parameters monitored and inspected.

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"For each structure/aging effect combination, the inspection methods, inspection schedule, and inspector qualifications are selected to ensure that aging degradation will be detected and quantified before there is loss of intended functions. Inspection methods, inspection schedule, and inspector qualifications are to be commensurate with industry codes, standards and guidelines, and are to also consider industry and plant-specific operating experience. Although not required, ACI 349.3R-96 and ANSI/ASCE 11-90 provide an acceptable basis for addressing detection of aging effects. The plant-specific structures monitoring program is to contain sufficient detail on detection to conclude that this program attribute is satisfied."

b. Comparison to VYNPS Detection of Aging Effects

Inspection methods, inspection schedule, and inspector qualifications ensure that aging degradation will be detected and quantified before loss of intended functions. Inspection methods, inspection schedule, and inspector qualifications are based on information provide in industry codes, standards and guidelines, and also consider industry and plant-specific operating experience.
(Ref. PP 7030; OP 5240)

Inspections of accessible plant structures are performed at three-year intervals and inspections of normally inaccessible (insulated or high radiation zone) areas are performed at ten-year intervals. Inspections of buried plant structures are performed when opportunistic excavation occurs. However, more frequent inspections may be performed based on past inspection

results, industry experience, or exposure to a significant event (e.g. tornado, earthquake, fire, chemical spill).
(Ref. Sections 4.5, 4.6 and 4.7, PP 7030)

Inspectors are degreed engineers with a thorough understanding of structures and materials of construction.
(Ref. Section 3.5, PP 7030)

This program is credited with managing the following aging effects.

- No aging effects requiring management are identified for lubrite sliding supports. However, the Structures Monitoring Program will confirm the absence of aging effects for the period of extended operation. (AMRC-01)
- loss of material for steel (AMRC-01, 02, 03, 04, 05, 06)
- loss of material for concrete exposed to fluid environments (AMRC-03, 04, 06)
- loss of material, cracking and change in material properties for wood (AMRC-04)
- For un-submerged concrete, no aging effects requiring management are identified. However, in compliance with the NRC position on concrete aging, un-submerged concrete that is subject to aging management review is included in the Structures Monitoring Program to confirm that aging effects are not occurring. (AMRC-01, 02, 03, 04, 05, 06)
- cracking and change in material properties of elastomers and cooling tower fill (PVC) (AMRC-06)

Enhancement: Guidance for performing visual structural examinations of wood to identify loss of material, cracking and change in material properties will be added to the Structures Monitoring Program procedure.
(Ref. Section 4.3, PP 7030)

Enhancement: Guidance for performing structural examinations of elastomers (drywell floor liner, seals, and gaskets) to identify cracking and change in material properties (cracking when manually flexed) will be enhanced in the Structures Monitoring Program procedure.
(Ref. Section 4.3, PP 7030)

Enhancement: Guidance for performing structural examinations of PVC cooling tower fill to identify cracking and change in material properties will be added to the Structures Monitoring Program procedure.
(Ref. Section 4.3, PP 7030)

See Attachment 4, Structures Monitoring Program General Criteria for detection of aging effects.

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Regulatory Position 1.5, "Monitoring of Structures," in RG 1.160, Rev. 2, provides an acceptable basis for meeting the attribute. A structure is monitored in accordance with 10 CFR 50.65 (a)(2) provided there is no significant degradation of the structure. A structure is monitored in accordance with 10 CFR 50.65 (a)(1) if the extent of degradation is such that the structure may not meet its design basis or, if allowed to continue uncorrected until the next normally scheduled assessment, may not meet its design basis."

b. Comparison to VYNPS Monitoring and Trending

VYNPS structures are monitored in accordance with 10 CFR 50.65 (a)(2) provided there is no significant degradation of the structure. If established criteria as specified in maintenance rule scoping documents are exceeded the affected system is monitored in accordance with a 10 CFR 50.65 (a)(1) action plan.
(Ref. Sections 4.5 and 4.8, PP 7030; OP 5240)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"For each structure/aging effect combination, the acceptance criteria are selected to ensure that the need for corrective actions will be identified before loss of intended functions. Acceptance criteria are to be commensurate with industry codes, standards and guidelines, and are to also consider industry and plant-specific operating experience. Although not required, ACI 349.3R-96 provides an acceptable basis for developing acceptance criteria for concrete structural elements, steel liners, joints, coatings, and waterproofing membranes. The plant-specific structures monitoring program is to contain sufficient detail on acceptance criteria to conclude that this program attribute is satisfied."

b. Comparison to VYNPS Acceptance Criteria

For each structure/aging effect combination, acceptance criteria were selected to ensure that the need for corrective actions is identified before loss of intended functions. Acceptance criteria were established considering information provided in industry codes, standards and guidelines, and also considering industry and plant-specific operating experience.
(Ref. Section 4.8, PP 7030 and OP 5240)

See Attachment 4, Structures Monitoring Program General Criteria for acceptance criteria.

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"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

VYNPS applies requirements of 10 CFR Part 50 Appendix B to the Structures Monitoring Program through use of the VYNPS Corrective Action Program. ***(Ref. Section 4.8, PP 7030)***

VYNPS corrective actions are consistent with 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

"Although in many plants structures monitoring programs have only recently been implemented, plant maintenance has been ongoing since initial plant operation. A plant-specific program that includes the attributes described above will be an effective AMP for license renewal."

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 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

NVY 97-45, NRC Information Notice 97-11: Cement Erosion from Containment Subfoundations at Nuclear Power Plants

OP 5240, Rev. 16, LPC01, Turbine and Reactor Building Bridge Crane Inspection and Maintenance

PP 7030, Rev. 00, LPC 01, Structures Monitoring Program Procedure

VYNPS UFSAR, Rev. 19-1, Updated Final Safety Analysis Report

D. Summary

The Structures Monitoring 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 Structures Monitoring Program is consistent with the program described in NUREG-1801, Section XI.S6, Structures Monitoring Program.

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements
1. Scope of Program	The Structures Monitoring Program will be enhanced to specify that process facility crane rails and girders, CST enclosure, CO_2 tank enclosure, N_2 tank enclosure and restraining wall, CST pipe trench, diesel generator cable trench, fuel oil pump house, service water pipe trench, drywell floor liner seal, manway seals and gaskets, and hatch seals and gaskets are included in the program.
4. Detection of Aging Effects	Guidance for performing structural examinations of wood to identify loss of material, cracking, and change in material properties will be added to the Structures Monitoring Program.

Structures Monitoring Program

Attributes Affected	Enhancements
1. Scope of Program	The Structures Monitoring Program will be enhanced to specify that process facility crane rails and girders, CST enclosure, CO_2 tank enclosure, N_2 tank enclosure and restraining wall, CST pipe trench, diesel generator cable trench, fuel oil pump house, service water pipe trench, drywell floor liner seal, manway seals and gaskets, and hatch seals and gaskets are included in the program.
4. Detection of Aging Effects	Guidance for performing structural examinations of elastomers (drywell floor liner, seals, and gaskets) to identify cracking and change in material properties (cracking when manually flexed) will be enhanced in the Structures Monitoring Program procedure.
4. Detection of Aging Effects	Guidance for performing structural examinations of PVC cooling tower fill to identify cracking and change in material properties will be added to the Structures Monitoring Program procedure.

4.21.2 Masonry Wall Program

A. Program Description

The Masonry Wall Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.S5, Masonry Wall Program.

The objective of the Masonry Wall Program is to manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.
(Ref. PP 7026)

The program includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included walls are the 10CFR50.48-required walls and masonry walls in the reactor building, intake structure, control room building, and turbine building.

Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

This program is credited in the following.

- AMRC-02, Reactor Building
- AMRC-03, Intake Structure
- AMRC-04, Process Facilities

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The scope includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4."

b. Comparison to VYNPS Scope

VYNPS scope includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included walls are the 10CFR50.48-required walls and masonry walls in the reactor building, intake structure, control room building, and turbine building.
(Ref. AMRC-02, 03 and 04; Appendix A, PP 7026)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"No specific preventive actions are required."

b. Comparison to VYNPS Preventive Actions

No specific preventive actions are required in the VYNPS program.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The primary parameter monitored is wall cracking that could potentially invalidate the evaluation basis."

b. Comparison to VYNPS Parameters Monitored/Inspected

The VYNPS program includes monitoring for cracking in joints and blocks that could potentially affect wall qualification.
(Ref. Section 4.4, PP 7026)

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Visual examination of the masonry walls by qualified inspection personnel is sufficient. The frequency of inspection is selected to ensure there is no loss of intended function between inspections. The inspection frequency may vary from wall to wall, depending on the significance of cracking in the evaluation basis. Unreinforced masonry walls, which have not been contained by bracing warrant the most frequent inspection, because the development of cracks may invalidate the existing evaluation basis."

b. Comparison to VYNPS Detection of Aging Effects

Masonry walls are visually examined by qualified inspection personnel. Frequency of inspection is selected to ensure there is no loss of intended function between inspections.
(Ref. Section 4.4, PP 7026)

This program is credited with managing the following aging effects.

- cracking of masonry and block walls (AMRC-02, 03, 04)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Trending is not required. Monitoring is achieved by periodic examination for cracking."

b. Comparison to VYNPS Monitoring and Trending

Trending is not performed. VYNPS periodically examines masonry walls for cracking.
(Ref. PP 7026)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"For each masonry wall, the extent of observed cracking of masonry and degradation of steel edge supports and bracing is not to invalidate the evaluation basis. Corrective actions are taken if the extent of cracking and steel degradation is sufficient to invalidate the evaluation basis. An option is to develop a new evaluation basis that accounts for the degraded condition of the wall (i.e., acceptance by further evaluation)."

b. Comparison to VYNPS Acceptance Criteria

A general examination of each wall is performed to identify indications of degradation, such as cracking, missing mortar, or degraded structural metal components. Potential design non-conforming conditions identified during the course of an inspection are noted and a condition report is initiated.
(Ref. Section 4.6, PP 7026)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"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

VYNPS applies requirements of 10 CFR Part 50 Appendix B to the Masonry Wall Program through use of the VYNPS Corrective Action Program.

VYNPS corrective actions are consistent with 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

"Since 1980, masonry walls that perform an intended function have been systematically identified through licensee programs in response to NRC IEB 80-11, USI A-46, and 10 CFR 50.48. NRC IN 87-67 documented lessons learned from the NRC IEB 80-11 program, and provided recommendations for administrative controls and periodic inspection to ensure that the evaluation basis for each safety-significant masonry wall is maintained. Whether conducted as a stand-alone program or as part of structures monitoring for MR, a masonry wall AMP that incorporates the recommendations delineated in NRC IN 87-67 should ensure that the intended functions of all masonry walls within the scope of license renewal are maintained for the period of extended operation."

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 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

PP 7026, Rev. 01, LPC 00, Masonry Wall Surveillance Program Procedure

D. Summary

The Masonry Wall Program has been effective at managing aging effects. The program employs visual inspection techniques that have proven effective in the

industry at detecting aging effects on masonry walls. The Masonry Wall 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 Masonry Wall Program is consistent with the program described in NUREG-1801, Section XI.S5, Masonry Wall Program.

4.21.3 Vernon Dam FERC Inspection

A. Program Description

The Vernon dam is subject to the Federal Energy Regulatory Commission (FERC) 5-year inspection program. This program consists of a visual inspection by a qualified independent consultant approved by FERC, and is in compliance with Title 18 of the Code of Federal Regulations, Conservation of Power and Water Resources, Part 12 (Safety of Water Power Projects and Project Works), Subpart D (Inspection by Independent Consultant). The NRC has found that mandated FERC 5-year inspection programs are acceptable for aging management.

This program is credited in the following.

- AMRC-05, Yard Structures

B. References

NRC Letter, May 5, 1999, Christopher I. Grimes (NRC) to Douglas J. Walters (NEI), License Renewal Issue No. 98-0100, "Crediting FERC Required Inspection and Maintenance Programs for Dam Aging Management"

C. Summary

The Vernon Dam FERC Inspection (FERC 5-year inspection) has been effective at managing aging effects. The program employs visual inspection techniques that have proven effective at detecting aging effects on hydroelectric dams. The Vernon Dam FERC Inspection 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.

4.22 System Walkdown Program

A. Program Description

The System Walkdown Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M36, External Surfaces Monitoring.

This program entails inspections of external surfaces of components subject to aging management review. The program is also credited with managing loss of material from internal surfaces, for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition.

This program is credited in the following.

- AMRM-01, Standby Liquid Control System
- AMRM-02, Residual Heat Removal System
- AMRM-03, Core Spray System
- AMRM-04, Automatic Depressurization System
- AMRM-05, High Pressure Coolant Injection System
- AMRM-06, Reactor Core Isolation Cooling and Condensate Storage and Transfer Systems
- AMRM-07, Standby Gas Treatment System
- AMRM-08, Primary Containment Atmosphere Control and Containment Atmosphere Dilution Systems
- AMRM-11, Service Water System
- AMRM-12, Reactor Building Closed Cooling Water System
- AMRM-13, Emergency Diesel Generator System
- AMRM-14, Fuel Pool Cooling Systems
- AMRM-15, Fuel Oil System
- AMRM-16, Instrument Air System
- AMRM-17, Fire Protection – Water System
- AMRM-18, Fire Protection – CO_2 System
- AMRM-19, Heating, Ventilation and Air Conditioning System
- AMRM-20, Primary Containment Penetrations
- AMRM-21, John Deere Diesel
- 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

"This program visually inspects the external surface of in-scope components and monitors external surfaces of steel components in systems within the scope of license renewal and subject to AMR for loss of material and leakage. Visual inspections are expected to identify loss of material due to general corrosion in accessible steel components. Loss of material due to pitting and crevice corrosion may not be detectable through these same visual inspections, however, general corrosion is expected to be present and detectable such that, should pitting and crevice corrosion exist, general corrosion will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function. Therefore, this program is acceptable for use in inspecting for loss of material for general, pitting and crevice corrosion.

Surfaces that are inaccessible or not readily visible during plant operations are inspected during refueling outages. Surfaces that are inaccessible or not readily visible during both plant operations and refueling outages are inspected at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.

Surfaces that are insulated may be inspected when the external surface is exposed (i.e., maintenance) at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.

The program may also be credited with managing loss of material from internal surfaces, for situations in which material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition. When credited, the program should describe the component internal environment and the credited similar external component environment inspected."

b. Comparison to VYNPS Scope

This program entails inspections of external surfaces of components within the scope of license renewal and subject to aging management review. The program is also credited with managing loss of material from internal surfaces, for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition.

System Walkdown Program

Enhancement: Enhance system walkdown guidance documents to clarify license renewal committment. The commitment for license renewal is for periodic system engineer inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject system will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).

Surfaces that are inaccessible or not readily visible during plant operations are inspected during refueling outages. Surfaces that are inaccessible or not readily visible during both plant operations and refueling outages are inspected at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.
(Ref. Section 5.2, EN-DC-178)

Surfaces that are insulated are inspected when the external surface is exposed (i.e., maintenance) at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.
(Ref. Section 5.2, EN-DC-178)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The External Surfaces Monitoring Program is a visual monitoring program that does not include preventive actions."

b. Comparison to VYNPS Preventive Actions

The System Walkdown Program is a monitoring program that does not include preventive actions.

VYNPS preventive actions are consistent with NUREG-1801

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The External Surfaces Monitoring Program utilizes periodic plant system inspections and walkdowns to monitor for material degradation and leakage. This program inspects components such as piping, piping components,

ducting and other components. Coatings deterioration is an indicator of possible underlying degradation.

Examples of inspection parameters include:

- corrosion and material wastage (loss of material);
- leakage from or onto external surfaces;
- worn, flaking, or oxide-coated surfaces;
- corrosion stains on thermal insulation;
- protective coating degradation (cracking and flaking)"

b. Comparison to VYNPS Parameters Monitored/Inspected

During system inspections, visual inspections identify items which could affect system performance, safety, or reliability as well as general housekeeping, personnel safety hazards and radiological concerns. Examples of parameters inspected are

- condition and placement of coatings,
- evidence of corrosion, and
- indications of leakage.

(Ref. Attachment 9.1, EN-DC-178)

VYNPS parameters monitored and inspected are consistent with NUREG-1801

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Degradation of steel surfaces cannot occur without the degradation of the paint or coating. Confirmation of the integrity of the paint or coating is an effective method for managing the effects of corrosion on the steel surface. A visual inspection is conducted for component surfaces at least once per refueling cycle. This frequency accommodates inspections of components that may be in locations that are normally only accessible during outages. System walkdowns are normally performed on a frequency that exceeds once per fuel cycle. Surfaces that are inaccessible or not readily visible during plant operations and refueling outages are inspected at such intervals that would ensure the components intended function is maintained. The intervals of inspections may be adjusted as necessary based on plant-specific inspection results and industry experience.

This program is credited with managing the following aging effects.

- loss of material for external surfaces;
- loss of material for internal surfaces exposed to the same environment as the external surface"

b. Comparison to VYNPS Detection of Aging Effects

A general visual inspection is conducted on readily accessible system and component surfaces. System inspections are conducted at least once per refueling cycle and are normally performed more frequently. This frequency is acceptable since aging effects are typically caused by long-term degradation mechanisms such as corrosion. Surfaces that are inaccessible or not readily visible during plant operations and refueling outages are inspected at such intervals that would ensure the components intended function is maintained. The intervals of inspections may be adjusted as necessary based on plant-specific inspection results and industry experience. In addition, all plant personnel are required to identify adverse conditions via the corrective action process. Since adverse conditions include those which the system walkdowns are intended to manage, aging effects may be identified through routine operations and maintenance activities.
(Ref. Section 5.2, EN-DC-178;* Section 5.2 and Attachment 9.2, EN-LI-102*)

This program is credited with managing the following aging effects.

- loss of material for external surfaces by visual inspection (AMRM-01, 03, 04, 05, 06, 11, 13, 14, 16, 17, 21, 26, 33)
- loss of material for internal and external surfaces by visual inspection of external surfaces (AMRM-02, 07, 08, 12, 15, 18, 19, 20, 30)

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

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"Visual inspection activities are performed and associated personnel are qualified in accordance with site controlled procedures and processes. The External Surfaces Monitoring Program uses standardized monitoring and trending activities to track degradation. Deficiencies are documented using approved processes and procedures such that results can be trended. However, the program does not include formal trending. Inspections are performed at frequencies identified in Detection of Aging Effects."

b. Comparison to VYNPS Monitoring and Trending

Visual inspection activities are performed and associated personnel are qualified in accordance with site controlled procedures and processes. The System Walkdown Program uses standardized monitoring and trending activities to track degradation. Deficiencies are documented so that results can be trended.
(Ref. Section 5, EN-DC-178)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"For each component/aging effect combination, the acceptance criteria are defined to ensure that the need for corrective actions will be identified before loss of intended functions. Acceptance criteria include design standards, procedural requirements, current licensing basis, industry codes or standards, and engineering evaluation."

b. Comparison to VYNPS Acceptance Criteria

Engineering evaluations of visual indications of leakage or loss of material consider procedural requirements, current licensing basis, industry codes, and standards to ensure that the need for corrective actions is identified before loss of intended functions.
(Ref. Attachments 9.1, 9.2 and 9.3, EN-DC-178 and Attachment 7.1, EN-MS-S-011-MULTI)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"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 corrective actions, confirmation process, and administrative controls."

b. Comparison to VYNPS Corrective Actions

Deficiencies identified during a walkdown are documented for review and resolution. Corrective actions are accomplished in accordance with the site Corrective Action Program.
(Ref. Sections 5.4 and 5.5 and Attachment 9.3, EN-DC-178)

VYNPS corrective actions are consistent with 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

"External surfaces inspections via system inspections and walkdowns have been in effect at many utilities since the mid 1990's in support of the Maintenance Rule (10 CFR 50.65) and have proven effective in maintaining the material condition of plant systems. The elements that comprise these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice."

b. Comparison to VYNPS Operating Experience

Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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

EN-DC-178, Rev. 0, System Walkdowns

EN-LI-102, Rev. 04, Corrective Action Process

EN-MS-S-011-MULTI, Rev. 0, Conduct of System Engineering

D. Summary

The System Walkdown Program uses visual inspections to identify aging effects and aging mechanisms that could cause aging effects. These include corrosion and indications of leakage. Visual inspections have proven effective throughout the industry in managing aging effects on plant equipment. The System Walkdown 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 System Walkdown Program is consistent with the program described in NUREG-1801, Section XI.M36, External Surfaces Monitoring.

The following enhancement will be initiated prior to the period of extended operation.

System Walkdown Program

Attributes Affected	Enhancement
1. Scope of Program	Enhance system walkdown guidance documents to clarify license renewal committment. The commitment for license renewal is for periodic system engineer inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject system will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).

4.23 Water Chemistry Control Programs

The VYNPS chemistry program is the personnel, programs, policies and procedures designed to control site water chemistry to maximize plant availability, extend operating lifetime, and minimize radiation levels. Based on applicable EPRI Guidelines, the program controls contaminants at lowest practical levels and provides corrosion protection for major systems and components.

The following Subsections address individual VYNPS water chemistry control programs in more detail.

- Water Chemistry Control – Auxiliary Systems Program
- Water Chemistry Control – BWR Program
- Water Chemistry Control – Closed Cooling Water Program

4.23.1 Water Chemistry Control – Auxiliary Systems Program

A. Program Description

There is no corresponding NUREG-1801 program.

The purpose of the Water Chemistry Control – Auxiliary Systems Program is to manage aging effects for components exposed to treated water.

Program activities include sampling and analysis of stator cooling water and plant heating boiler systems, and flushing of the John Deere Diesel cooling water system.

This program is credited in the following.

- AMRM-06, Reactor Core Isolation Cooling and Condensate Storage and Transfer Systems
- AMRM-19, Heating, Ventilation and Air Conditioning System
- AMRM-21, John Deere Diesel
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems

B. Evaluation

1. Scope of Program

Program activities include sampling and analysis of stator cooling water and plant heating boiler systems, and flushing of the John Deere Diesel cooling water system.
(Ref. RP 4604, RP 4621)

Enhancement: Procedures will be enhanced to flush the John Deere diesel cooling water system and replace the coolant and coolant conditioner every three years.

2. **Preventive Actions**

The program includes monitoring and control of stator cooling water and plant heating boiler feedwater to minimize exposure to aggressive environments and application of corrosion inhibitors to manage general, crevice, and pitting corrosion.
(Ref. RP 4604, RP 4621)

John Deere diesel cooling water chemistry is controlled to minimize exposure to aggressive environments by periodic flushing and replacement of the coolant and coolant conditioner.

3. **Parameters Monitored/Inspected**

In accordance with industry recommendations, stator cooling water and plant heating boiler feedwater parameters monitored include conductivity, corrosion products, and dissolved oxygen.
(Ref. RP 4604, RP 4621)

4. **Detection of Aging Effects**

The program manages loss of material for stator cooling water, plant heating boiler, and John Deer diesel system components.

This program is credited with managing the following aging effects.

- loss of material of the condensate storage tank heater system aluminum components (AMRM-06)
- loss of material for control room air supply (SAC-1) heating coils, humidifier (SH-4), reheat steam coils (SRHC-1) and associated piping (AMRM-19)
- loss of material and fouling of John Deere diesel heat exchanger components (AMRM-21)
- loss of material of plant heating boiler components (AMRM-30)
- loss of material of stator cooling water components (AMRM-30)

Section 3.5, One-Time Inspection Program, describes inspections planned to verify the effectiveness of water chemistry control programs to ensure that significant degradation is not occurring and component intended function is maintained during the period of extended operation.

5. **Monitoring and Trending**

Values from analyses are archived for long-term trending and review.
(Ref. DP 0640, RP 4604, RP 4621)

6. **Acceptance Criteria**

Acceptance criteria for chemistry parameters are in accordance with specific manufacturer's recommendations and general guidelines provided in EPRI

Report 1007820, "Revision 1 to TR-107396, Closed Cooling Water Chemistry Guidelines".
(Ref. RP 4604, RP 4621)

7. **Corrective Action**

   If acceptance criteria are not met, chemistry parameters are adjusted as appropriate. Additional sampling and verification is performed if necessary. Corrective actions for unacceptable inspection results are identified and implemented in accordance with the Corrective Action Program.
   (Ref. RP 4604, RP 4621)

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**

    Operating experience provides assurance that the program will be effective in managing effects of aging so that components crediting this program can perform their intended function 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 0640, Rev. 36, LPC 01, Chemistry Department Scheduling

EPRI Report 1007820, "Revision 1 to TR-107396, Closed Cooling Water Chemistry Guidelines", April 2004

RP 4604, Rev. 03, LPC 00, Sampling of Stator Cooling Water & Stator Cooling Makeup Water

RP 4621, Rev. 19, LPC 00, Sampling and Treatment of House Heating Boilers

D. Summary

The Water Chemistry Control – Auxiliary Systems Program has been effective at managing loss of material for components exposed to treated water. The Water Chemistry Control – Auxiliary Systems 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.

Water Chemistry Control – Auxiliary Systems Program

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement
1. Scope of Program	Procedures will be enhanced to flush the John Deere diesel cooling water system and replace the coolant and coolant conditioner every three years.

4.23.2 Water Chemistry Control – BWR Program

A. Program Description

The Water Chemistry Control – BWR Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M2, Water Chemistry.

The objective of this program is to manage aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). BWRVIP-130 has three sets of guidelines: one for primary water, one for condensate and feedwater, and one for control rod drive (CRD) mechanism cooling water. EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in the torus/pressure suppression chamber, condensate storage tank, demineralized water storage tanks, and spent fuel pool.

The VYNPS Water Chemistry Control – BWR Program optimizes the primary water chemistry to minimize the potential for loss of material and cracking. This is accomplished by limiting the levels of contaminants in the RCS that could cause loss of material and cracking. Additionally, VYNPS has instituted hydrogen water chemistry (HWC) with noble metals to limit the potential for intergranular SCC (IGSCC) through the reduction of dissolved oxygen in the treated water.

This program is credited in the following.

- AMRC-02, Reactor Building
- AMRC-06, Bulk Commodities
- AMRM-01, Standby Liquid Control System
- AMRM-02, Residual Heat Removal System
- AMRM-03, Core Spray System
- AMRM-04, Automatic Depressurization System
- AMRM-05, High Pressure Coolant Injection System
- AMRM-06, Reactor Core Isolation Cooling and Condensate Storage and Transfer Systems
- AMRM-08, Primary Containment Atmosphere Control and Containment Atmosphere Dilution Systems
- AMRM-12, Reactor Building Closed Cooling Water
- AMRM-14, Fuel Pool Cooling Systems
- AMRM-20, Primary Containment Penetrations
- AMRM-26, Main Condenser and MSIV Leakage Pathway System
- AMRM-30, Nonsafety-Related Systems and Components Affecting Safety-Related Systems
- AMRM-31, Reactor Pressure Vessel
- AMRM-32, Reactor Vessel Internals
- AMRM-33, Reactor Coolant System Pressure Boundary

B. Evaluation

1. Scope of Program

a. NUREG-1801, Scope

"The program includes periodic monitoring and control of known detrimental contaminants such as chlorides, dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material or cracking. Water chemistry control is in accordance with industry guidelines such as BWRVIP-29 (EPRI TR-103515) for water chemistry in BWRs, EPRI TR-105714 for primary water chemistry in PWRs, and EPRI TR-102134 for secondary water chemistry in PWRs."

b. Comparison to VYNPS Scope

The Water Chemistry Control – BWR Program includes periodic monitoring and control of contaminants in accordance with guidelines in EPRI Report 1008192 (BWRVIP-130), which supercedes BWRVIP-29, for BWR water chemistry.
(Ref. OP 2617, OP 4612, OP 4628, OP 4649, RP 4625, RP 4626, RP 4629)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of reactor water chemistry. System water chemistry is controlled to minimize contaminant concentration and mitigate loss of material due to general, crevice and pitting corrosion and cracking caused by SCC. For BWRs, maintaining high water purity reduces susceptibility to SCC."

b. Comparison to VYNPS Preventive Actions

The Water Chemistry Control – BWR Program includes sampling and analysis frequencies for chemical species, and corrective actions for control of BWR water chemistry. These actions minimize contaminant concentration thereby managing loss of material and stress corrosion cracking.
(Ref. OP 2617, OP 4612, OP 4628, OP 4649, RP 4625, RP 4626, RP 4629)

VYNPS uses hydrogen water chemistry (HWC) with noble metals as described in BWRVIP-130 to lower the corrosion potential and mitigate cracking of components exposed to treated water.

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The concentration of corrosive impurities listed in the EPRI guidelines discussed above, which include chlorides, fluorides (PWRs only), sulfates, dissolved oxygen, and hydrogen peroxide, are monitored to mitigate degradation of structural materials. Water quality (pH and conductivity) is also maintained in accordance with the guidance. Chemical species and water quality are monitored by in-process methods or through sampling. The chemical integrity of the samples is maintained and verified to ensure that the method of sampling and storage will not cause a change in the concentration of the chemical species in the samples.

BWR Water Chemistry: The guidelines in BWRVIP-29 (EPRI TR-103515) for BWR reactor water recommend that the concentration of chlorides, sulfates, and dissolved oxygen are monitored and kept below the recommended levels to mitigate corrosion. The two impurities, chlorides and sulfates, determine the coolant conductivity; dissolved oxygen, hydrogen peroxide, and hydrogen determine electrochemical potential (ECP). The EPRI guidelines recommend that the coolant conductivity and ECP are also monitored and kept below the recommended levels to mitigate SCC and corrosion in BWR plants. The EPRI guidelines in BWRVIP-29 (TR-103515) for BWR feedwater, condensate, and control rod drive water recommend that conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below the recommended levels to mitigate SCC. The EPRI guidelines in BWRVIP-29 (TR-103515) also include recommendations for controlling water chemistry in auxiliary systems: torus/pressure suppression chamber, condensate storage tank, and spent fuel pool.

b. Comparison to VYNPS Parameters Monitored/Inspected

The Water Chemistry Control – BWR Program periodically monitors the concentration of chlorides, sulfates, and dissolved oxygen in reactor water and keeps them below BWRVIP-130 recommended levels to mitigate corrosion. Coolant conductivity and ECP are also monitored and kept below BWRVIP-130 recommended levels to mitigate SCC and corrosion. Feedwater, condensate, and control rod drive water conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below recommended levels to mitigate SCC. Torus/pressure suppression chamber, condensate storage tank, demineralized water storage tank, and spent fuel pool conductivity, chloride, sulfate and total organic compound levels are monitored and kept below BWRVIP-130 recommended levels to mitigate SCC and corrosion.
(Ref. OP 2617, OP 4612, OP 4628, OP 4649, RP 4625, RP 4626, RP 4629)

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

4. **Detection of Aging Effects**

   a. NUREG-1801, Detection of Aging Effects

   "This is a mitigation program and does not provide for detection of any aging effects.

   In certain cases as identified in the NUREG-1801 report, inspection of select components is to be undertaken to verify the effectiveness of the chemistry control program and to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation."

   b. Comparison to VYNPS Detection of Aging Effects

   The Water Chemistry Control – BWR Program is a mitigation program that does not provide for detection of aging effects, such as loss of material and cracking.

   This program is credited with managing the following aging effects.

   - loss of material on spent fuel pool liner, gates, and storage racks (AMRC-02)
   - loss of material on anchorage / embedments of spent fuel pool and torus (AMRC-06)
   - loss of material and cracking of components (AMRM-08, 12, 26, 30, 31, 32, 33)
   - loss of material for components (AMRM-01, 03, 04, 20)
   - loss of material, cracking and fouling of components (AMRM-02, 05, 06, 14)

   Section 3.5, One-Time Inspection Program, describes inspections planned to verify effectiveness of water chemistry control programs to ensure that significant degradation is not occurring and component intended functions are maintained during the period of extended operation.

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

5. **Monitoring and Trending**

   a. NUREG-1801, Monitoring and Trending

   "The frequency of sampling water chemistry varies (e.g., continuous, daily, weekly, or as needed) based on plant operating conditions and the EPRI water chemistry guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions."

b. Comparison to VYNPS Monitoring and Trending

Within the Water Chemistry Control – BWR Program, sampling frequencies vary with plant operating conditions in accordance with EPRI water chemistry guidelines. During an abnormal chemistry condition, corrective action plans include increased sampling as needed to verify effectiveness of corrective actions.
(Ref. DP 0640, OP 2617, OP 4612, OP 4628, OP 4649, RP 4625, RP 4626, RP 4629)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Maximum levels for various contaminants are maintained below the system specific limits as indicated by the limits specified in the corresponding EPRI water chemistry guidelines. Any evidence of aging effects or unacceptable water chemistry results is evaluated, the root cause identified, and the condition corrected."

b. Comparison to VYNPS Acceptance Criteria

The Water Chemistry Control – BWR Program maintains levels of various contaminants below limits specified in BWRVIP-130. Evidence of the presence of aging effects and unacceptable water chemistry results found by chemical analysis are evaluated, root cause is identified, and the condition is corrected.
(Ref. OP 2617, OP 4612, OP 4628, OP 4649, RP 4625, RP 4626, RP 4629)

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Action

a. NUREG-1801, Corrective Actions

"When measured water chemistry parameters are outside the specified range, corrective actions are taken to bring the parameter back within the acceptable range and within the time period specified in the EPRI water chemistry guidelines. 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

When a water chemistry parameter is outside the specified range, corrective actions are taken to bring the parameter back within acceptable range within the time period specified in BWRVIP-130. VYNPS applies requirements of

10 CFR Part 50 Appendix B to the Water Chemistry Control – BWR Program through use of the VYNPS Corrective Action Program.
(Ref. OP 2617, OP 4612, OP 4628, OP 4649, RP 4625, RP 4626, RP 4629)

VYNPS corrective actions are consistent with 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

"The EPRI guideline documents have been developed based on plant experience and have been shown to be effective over time with their widespread use. The specific examples of operating experience are as follows.

BWR: Intergranular stress corrosion cracking (IGSCC) has occurred in small- and large-diameter BWR piping made of austenitic stainless steels and nickel-base alloys. Significant cracking has occurred in recirculation, core spray, residual heat removal (RHR) systems, and reactor water cleanup (RWCU) system piping welds. IGSCC has also occurred in a number of vessel internal components, including core shroud, access hole cover, top guide, and core spray spargers (Nuclear Regulatory Commission [NRC] Bulletin 80-13, NRC Information Notice [IN] 95-17, NRC General Letter [GL] 94-03, and NUREG-1544). No occurrence of SCC in piping and other components in standby liquid control systems exposed to sodium pentaborate solution has ever been reported (NUREG/CR-6001).

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 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

BWRVIP-29, BWR Water Chemistry Guidelines – 2000 Revision, EPRI Report TR-103515

BWRVIP-130, BWR Water Chemistry Guidelines – 2004 Revision, EPRI Report 1008192

DP 0640, Rev. 36, LPC 01, Chemistry Department Scheduling

OP 2617, Rev. 02, LPC 00, Chemistry Action Response Guide

OP 4612, Rev. 26, LPC 00, Reactor Water System Sampling and Treatment

OP 4628, Rev. 05, LPC 00, Sampling and Analysis of the Residual Heat Removal (RHR) Heat Exchanger

OP 4649, Rev. 05, LPC 00, Standby Fuel Pool Cooling Heat Exchanger Sampling

RP 4625, Rev. 17, LPC 00, Sampling of the Reactor Steam System

RP 4626, Rev. 15, LPC 00, Sampling and Treatment of the Condensate and Feedwater Systems

RP 4629, Rev. 07, LPC 00, Sampling of the Makeup Demineralizer System (MUDS)

D. Summary

The Water Chemistry Control – BWR Program at VYNPS 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 Water Chemistry Control – BWR Program is consistent with the program described in NUREG-1801, Section XI.M2, Water Chemistry.

4.23.3 Water Chemistry Control – Closed Cooling Water Program

A. Program Description

The Water Chemistry Control – Closed Cooling Water Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System.

This VYNPS program includes preventive measures that manage loss of material, cracking, and fouling for closed cooling water system systems (reactor building closed cooling water, turbine building closed cooling water, AOG closed cooling water, emergency diesel generator closed cooling water, AOG refrigerant skid water, and chilled water). These chemistry activities provide for monitoring and controlling closed cooling water chemistry using VYNPS procedures and processes based on EPRI guidance for closed cooling water chemistry.

This program is credited in the following.

- AMRM-02, Residual Heat Removal System
- AMRM-11, Service Water Systems
- AMRM-12, Reactor Building Closed Cooling Water System
- AMRM-13, Emergency Diesel Generator System
- AMRM-19, Heating, Ventilation and Air Conditioning System
- 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

"A CCCW system is defined as part of the service water system that is not subject to significant sources of contamination, in which water chemistry is controlled and in which heat is not directly rejected to a heat sink. The program described in this section applies only to such a system. If one or more of these conditions are not satisfied, the system is to be considered an open-cycle cooling water system. The staff notes that if the adequacy of cooling water chemistry control cannot be confirmed, the system is treated as an open-cycle system as indicated in Action III of Generic Letter (GL) 89-13."

b. Comparison to VYNPS Scope

The Water Chemistry Control – Closed Cooling Water Program applies to cooling water systems, which (1) are not subject to significant sources of contamination, (2) have controlled water chemistry and (3) do not reject heat

directly to a heat sink. The Water Chemistry Control – Closed Cooling Water Program applies to the reactor building closed cooling water system (RBCCW), the turbine building closed cooling water system (TBCCW), the AOG closed cooling water system (AOGCCW), the emergency diesel generator closed cooling water system (DGCCW), the AOG refrigerant skid water system and the chilled water system.
(Ref. OP 4623, RP 4652)

VYNPS scope is consistent with NUREG-1801.

2. Preventive Actions

a. NUREG-1801, Preventive Actions

"The program relies on the use of appropriate materials, lining, or coating to protect the underlying metal surfaces and maintain system corrosion inhibitor concentrations within the specified limits of EPRI TR-107396 to minimize corrosion and SCC. The program includes monitoring and control of cooling water chemistry to minimize exposure to aggressive environments and application of corrosion inhibitor in the CCCW system to mitigate general, crevice, and pitting corrosion as well as SCC."

b. Comparison to VYNPS Preventive Actions

Appropriate materials, linings, or coatings were used in design of the system. The corrective action program will address inappropriate materials, linings, or coatings if found during system operation.

The Water Chemistry Control – Closed Cooling Water Program maintains system corrosion inhibitor concentrations within specified guidelines of EPRI Report 1007820 (TR-107396, Rev. 1) to minimize corrosion and SCC. The program includes monitoring and control of cooling water chemistry to minimize exposure to aggressive environments and application of corrosion inhibitors to manage general, crevice, and pitting corrosion.
(Ref. OP 4623, RP 4652)

VYNPS preventive actions are consistent with NUREG-1801.

3. Parameters Monitored/Inspected

a. NUREG-1801, Parameters Monitored/Inspected

"The aging management program monitors the effects of corrosion and SCC by testing and inspection in accordance with guidance in EPRI TR-107396 to evaluate system and component performance. For pumps, the parameters monitored include flow, discharge pressures, and suction pressures. For heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure."

Water Chemistry Control – Closed Cooling Water Program

b. Comparison to VYNPS Parameters Monitored/Inspected

This program consists of chemistry monitoring and controlling activities which minimize the aggressiveness of the environment. Chemistry is based on recommendations of EPRI Report 1007820 (TR-107396, Rev. 1). ***(Ref. OP 4623, RP 4652)***

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

4. Detection of Aging Effects

a. NUREG-1801, Detection of Aging Effects

"Control of water chemistry does not preclude corrosion or SCC at locations of stagnant flow conditions or crevices. Degradation of a component due to corrosion or SCC would result in degradation of system or component performance. The extent and schedule of inspections and testing should assure detection of corrosion or SCC before the loss of the intended function of the component. Performance and functional testing ensures acceptable functioning of the CCCW system or components serviced by the CCCW system. For systems and components in continuous operation, performance adequacy should be verified by monitoring component performance through data trends for evaluation of heat transfer capability, system branch flow changes and chemistry data trends. Components not normally in operation are periodically tested to ensure operability."

b. Comparison to VYNPS Detection of Aging Effects

Water Chemistry Control – Closed Cooling Water Program activities manage loss of material, cracking, and reduction of heat transfer. The program is a preventive program. No credit is taken for detection of aging effects.

This program is credited with managing the following aging effects.

- loss of material and fouling of RHR components (AMRM-02)
- loss of material and fouling of control room chilled water system components (AMRM-19)
- loss of material and cracking of components (AMRM-12, 33)
- loss of material on components (AMRM-11, 26, 30)
- loss of material, cracking, and fouling on EDG system components (AMRM-13)

Section 3.5, One-Time Inspection Program, describes inspections planned to verify effectiveness of the water chemistry control programs to ensure that significant degradation is not occurring and component intended function is maintained during the period of extended operation.

For this attribute, the VYNPS program differs from NUREG-1801 in that it claims no credit for detection of aging effects through performance and functional testing. While NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System endorses EPRI report TR-107396 for performance and functional testing guidance, EPRI report TR-107396 does not recommend that equipment performance and functional testing be part of a water chemistry control program. This appears appropriate since monitoring pump performance parameters is of little value in managing effects of aging on long-lived, passive CCW system components. Rather, EPRI report TR-107396 states in section 5.7 (Section 8.4 in EPRI report 1007820) that performance monitoring is typically part of an engineering program, which would not be part of water chemistry. In most cases, functional and performance testing verifies that component active functions can be accomplished and as such would be included as part of Maintenance Rule (10CFR50.65). Passive intended functions of pumps, heat exchangers and other components will be adequately managed by the closed cooling water chemistry program through monitoring and control of water chemistry parameters.

5. Monitoring and Trending

a. NUREG-1801, Monitoring and Trending

"The frequency of sampling water chemistry varies and can occur on a continuous, daily, weekly, or as needed basis, as indicated by plant operating conditions and the type of chemical treatment. In accordance with EPRI TR-107396, internal visual inspections and performance/functional tests are to be performed periodically to demonstrate system operability and confirm the effectiveness of the program. Tests to evaluate heat removal capability of the system and degradation of system components may also be used. The testing intervals should be established based on plant-specific considerations such as system conditions, trending, and past operating experience, and may be adjusted based on the results of a reliability analysis, type of service, frequency of operation, or age of components and systems."

b. Comparison to VYNPS Monitoring and Trending

Chemistry is monitored to ensure parameters are being maintained within acceptable limits in accordance with EPRI guidelines. Samples are taken and analyzed, and data are trended. Frequency of sampling is based on EPRI Report 1007820 (TR-107396, Rev. 1). Microbiological analysis is performed on closed cooling water systems to monitor levels of microbes that may induce corrosion. Microbe levels are trended and elevated levels are addressed under the corrective action program.
(Ref. DP 0640, OP 4623, RP 4652)

VYNPS monitoring and trending are consistent with NUREG-1801.

6. Acceptance Criteria

a. NUREG-1801, Acceptance Criteria

"Corrosion inhibitor concentrations are maintained within the limits specified in the EPRI water chemistry guidelines for CCCW. System and component performance test results are evaluated in accordance with system and component design basis requirements. Acceptance criteria and tolerances are also based on system design parameters and functions."

b. Comparison to VYNPS Acceptance Criteria

Corrosion inhibitor concentrations, as well as other parameters, are maintained within guidelines specified in EPRI water chemistry guidelines. ***(Ref. OP 4623 and RP 4652)***

VYNPS acceptance criteria are consistent with NUREG-1801.

7. Corrective Actions

a. NUREG-1801, Corrective Actions

"Corrosion inhibitor concentrations outside the allowable limits are returned to the acceptable range within the time period specified in the EPRI water chemistry guidelines for CCCW. If the system or component fails to perform adequately, corrective actions are taken. 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

Corrosion inhibitor concentrations outside allowable limits are returned to acceptable range utilizing chemical additions or feed and bleed.

Corrective actions are taken in accordance with 10 CFR Part 50, Appendix B; EPRI Report 1007820 (TR-107396, Rev. 1); and the VYNPS corrective action program.

VYNPS corrective actions are consistent with 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

"Degradation of closed-cycle cooling water systems due to corrosion product buildup (NRC Licensee Event Report [LER] 50-327/93-029-00) or through-wall cracks in supply lines (NRC 50-280/91-019-00) has been observed in operating plants. Accordingly, operating experience demonstrates the need for this program."

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 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 0640, Rev. 36, LPC 01, Chemistry Department Scheduling

EPRI Report 1007820, "Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline", April 2004

OP 4623, Rev. 29, LPC 00, Sampling and Treatment of Closed Cooling Water Systems

RP 4652, Rev. 05, LPC 00, Sampling and Testing for Microbiologically Induced Corrosion (MIC)

D. Summary

The Water Chemistry Control – Closed Cooling Water 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 Water Chemistry Control – Closed Cooling Water Program is consistent with the program described in NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System, with the following exception.

Water Chemistry Control – Closed Cooling Water Program

Attributes Affected	Exception
4. Detection of Aging Effects	The VYNPS Water Chemistry Control – Closed Cooling Water Program does not include performance and functional testing. (Note 1)

Exception Note:

1. While NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System endorses EPRI report TR-107396 for performance and functional testing guidance, EPRI report TR-107396 does not recommend that equipment performance and functional testing be part of a water chemistry control program. This appears appropriate since monitoring pump performance parameters is of little value in managing effects of aging on long-lived, passive CCW system components. Rather, EPRI report TR-107396 states in section 5.7 (Section 8.4 in EPRI report 1007820) that performance monitoring is typically part of an engineering program, which would not be part of water chemistry. In most cases, functional and performance testing verifies that component active functions can be accomplished and as such would be included as part of Maintenance Rule (10CFR50.65). Passive intended functions of pumps, heat exchangers and other components will be adequately managed by the closed cooling water chemistry program through monitoring and control of water chemistry parameters.

5.0 Summary and Conclusions

In this report, individual programs credited for license renewal are identified and shown to be acceptable to manage aging effects identified in aging management reports. Programs are described in general terms with references to program procedures and controlling documentation. Objective evidence of effectiveness of the programs is provided in VYNPS Report LRPD-05, Operating Experience Review Results. Based on the review documented in this report, identified programs are adequate to manage aging effects to the extent credited in the aging management review reports.

The following new programs or activities are credited in aging management reviews.

- Heat Exchanger Monitoring Program
- Non-EQ Inaccessible Medium-Voltage Cable Program
- Non-EQ Instrumentation Circuits Test Review Program
- Non-EQ Insulated Cables and Connections Program
- One-Time Inspection Program
- Selective Leaching Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

The following existing programs or activities are credited in aging management reviews.

- Buried Piping Inspection Program
- BWR CRD Return Line Nozzle Program
- BWR Feedwater Nozzle Program
- BWR Penetrations Program
- BWR Stress Corrosion Cracking Program
- BWR Vessel ID Attachment Welds Program
- BWR Vessel Internals Program
- Containment Leak Rate Program
- Diesel Fuel Monitoring Program
- Environmental Qualification (EQ) of Electric Components Program
- Fatigue Monitoring Program
- Fire Protection Programs
  - Fire Protection Program
  - Fire Water System Program
- Flow-Accelerated Corrosion Program
- Inservice Inspection Programs
  - Inservice Inspection (ISI) Program
  - Containment Inservice Inspection (CII) Program
- Instrument Air Quality Program
- Oil Analysis Program
- Periodic Surveillance and Preventive Maintenance Program
- Reactor Head Closure Studs Program
- Reactor Vessel Surveillance Program
- Service Water Integrity Program

- Structures Monitoring Programs
  - Structures Monitoring Program
  - Masonry Wall Program
  - Vernon Dam FERC Inspection
- System Walkdown Program
- Water Chemistry Control Programs
  - Water Chemistry Control – Auxiliary Systems Program
  - Water Chemistry Control – BWR Program
  - Water Chemistry Control – Closed Cooling Water Program

6.0 References

1. 10CFR50, Appendix G, Fracture Toughness Requirements, U.S. NRC

2. 10CFR50, Appendix H, Reactor Vessel Material Surveillance Program Requirements, U.S. NRC

3. AMRC-01, Aging Management Review of the Primary Containment

4. AMRC-06, Aging Management Review of Bulk Commodities

5. AMRM-31, Aging Management Review of the Reactor Pressure Vessel

6. AMRM-33, Aging Management Review of the Reactor Coolant System Pressure Boundary

7. AP 0070, Rev. 03, LPC 00, ASME Section XI Repair and Replacement Procedure

8. AP 0145, Rev. 08, LPC 03, Equipment Cycle Record Keeping

9. BVY 03-29, Technical Specifications Proposed Change No. 258, RPV Fracture Toughness and Material Surveillance Requirements, March 26, 2003

10. BWRVIP-27-A, BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines, EPRI Report 1007279, August 2003

11. BWRVIP-29, BWR Water Chemistry Guidelines – 2000 Revision, EPRI Report TR-103515

12. BWRVIP-41, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines

13. BWRVIP-48, Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines, EPRI Report TR-108724, February, 1998

14. BWRVIP-49-A, BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines, EPRI Technical Report 1006602, March 2002

15. BWRVIP-86-A, BWR Vessel and Internals Project Updated BWR Integrated Surveillance Program (ISP) Implementation Plan, EPRI Report 1003346, October 2002

16. BWRVIP-130, BWR Water Chemistry Guidelines – 2004 Revision, EPRI Report 1008192

17. Commitment Report BWRVIP-116-01, BWRVIP ISI Implementation for License Renewal, 9/17/2003

18. CRD, Control Rod Drive Design Basis Document, Rev. 1, 10/4/05

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

20. DP 0213, Rev. 06, LPC 00, Lube Oil Analysis Program

21. DP 0640, Rev. 36, LPC 01, Chemistry Department Scheduling

22. Drawing G-191159, Sh. 1, Rev. 72, Flow Diagram Service Water System

23. EDCR 75-30, FW Sparger Replacement

24. EDCR 79-14, CRD Reroute, 9/28/79

25. EDCR 81-27, Bypass Leak Detection System Installation

26. EN-DC-178, Rev. 0, System Walkdowns

27. EN-LI-102, Rev. 04, Corrective Action Process

28. EN-MS-S-011-MULTI, Rev. 0, Conduct of System Engineering

29. ENN-DC-164, Rev. 02, Environmental Qualification (EQ) Program, Entergy Nuclear Northeast Nuclear Management Manual

30. ENN-DC-334, Rev. 0, Primary Containment Leakage Rate Testing (Appendix J), Entergy Nuclear Northeast Nuclear Management Manual

31. ENN-EP-S-001, Rev. 00, ENN Engineering Standard – IWE General Visual Containment Inspection

32. EPRI Report 1007820, "Revision 1 to TR-107396, Closed Cooling Water Chemistry Guidelines", April 2004

33. EPRI TR-109619, Guideline for the Management of Adverse Localized Equipment Environments, Electric Power Research Institute, Palo Alto, CA, June 1999

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

35. FVY 82-3, Vermont Yankee Position on NUREG-0619 Items Regarding Feedwater System Changes, dated 1/15/82

36. GE Purchase Specification 21A1115, Revision 3, "Reactor Pressure Vessel"

37. IEEE Std. P1205-2000, IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations

38. LRPD-04, TLAA – Mechanical Fatigue

39. M118, Rev. 1, PM Basis, Activity 3, Every 10 years, drain, clean and inspect diesel fuel oil tank TK-40-1A

40. ME039, Rev. 5, PM Basis, Activity 1, Every month, perform surveillance test of diesel generator

41. ME039, Rev. 5, PM Basis, Activity 4, Every refueling outage, perform inspection/maintenance of diesel generator

42. ME118, Rev. 1, PM Basis, Activity 3, Every 3 years inspect standby gas system demister, demister compartment and demister drain

43. ME145, Rev. 3, PM Basis, Activity 2, Every 1.5 years, perform preventive maintenance on heat exchangers, RRU-7 and RRU-8

44. ME146, Rev. 2, PM Basis, Activity 2, Every 1.5 years, perform preventive maintenance on heat exchangers, RRU-5 and RRU-6

45. ME153, Rev. 6, PM Basis, Activity 1, Quarterly, perform surveillance testing on air conditioning units

46. ME153, Rev. 6, PM Basis, Activities 4, 5 & 6, Semi-annually, perform preventive maintenance on air conditioning units

47. ME163, Rev. 4, PM Basis, Activity 2, Monthly Surveillance Test of the of the John Deere diesel generator

48. ME163, Rev. 4, PM Basis, Activity 3, Annually, perform preventive maintenance of the John Deere diesel generator

49. ME163, Rev. 4, PM Basis, Activity 4, Every 3 years, perform preventive maintenance of the John Deere diesel generator heat exchangers

50. ME163, Rev. 4, PM Basis, Activity 5, Every 5 years, perform inspection of John Deere diesel engine with factory representative

51. ME166, Rev. 2, PM Basis, Activity 2, Perform routine preventive maintenance on inner and outer door assemblies

52. NE 8067, Rev 03, LPC 00, Reactor Vessel Internals Inspection Details

53. NRC Final SER for BWRVIP-75, W. H. Bateman to C. Terry, 14 May 2002, "Final Safety Evaluation of the "BWRVIP Vessel and Internals Project, BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules (BWRVIP-75), EPRI Report TR-113932, October 1999 (TAC NO. MA5012)"

54. NRC Letter, May 5, 1999, Christopher I. Grimes (NRC) to Douglas J. Walters (NEI), License Renewal Issue No. 98-0100, "Crediting FERC Required Inspection and Maintenance Programs for Dam Aging Management"

55. NRC SER for VYNPS GL 88-01 response, 15 Feb 1990, M. B. Fairtile to L. A. Tremblay, "Review of Response to Generic Letter (GL) 88-01, NRC Position on IGSCC in BWR Stainless Steel Piping (TAC NO. 69160)"

56. NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," U.S. Nuclear Regulatory Commission, November 1980

57. NUREG/CR-5643, Insights Gained From Aging Research, U. S. Nuclear Regulatory Commission, March 1992

58. NVY 04-016, NRC letter, D. J. Roberts to M. Kansler, 5 March 2004, "Safety Evaluation of Relief Requests for the Fourth 10-Year Interval of the Inservice Inspection Program – Vermont Yankee Nuclear Power Station (TAC NOS. MB8349 through MB8358)"

59. NVY 05-040, Vermont Yankee Nuclear Power Station - Issuance of Exemption from 10 CFR Part 50, Appendix J (TAC No. MC0253), March 17, 2005

60. NVY 05-045, Vermont Yankee Nuclear Power Station - Issuance of Amendment Re: Alternative Source Term (TAC No. MC0253), March 29, 2005

61. NVY 05-108, Vermont Yankee Nuclear Power Station - Issuance of Amendment Re: One-Time Extension of Integrated Leak Rate Test Interval (TAC No. MC4662), August 31, 2005

62. NVY 84-144, NRC letter, Implementation of NUREG-0619, BWR Feedwater and CRD Nozzle Cracking

63. NVY 97-45, NRC Information Notice 97-11: Cement Erosion from Containment Subfoundations at Nuclear Power Plants

64. OP 1201, Rev. 27, LPC 00, Assembly of the Reactor and Drywell Systems

65. OP 2617, Rev. 02, LPC 00, Chemistry Action Response Guide

66. OP 4019, Rev. 16, LPC 01, Surveillance of Plant Fire Barriers and Fire Rated Assemblies

67. OP 4026, Rev. 07, LPC 00, Pressure Boundary Repair Procedure

68. OP 4101, Rev. 26, LPC 05, RPV Operational System Leakage Test

69. OP 4103, Rev. 13, LPC 01, Fire Protection Equipment Surveillance

70. OP 4104, Rev. 07, LPC 05, Fire Hose Hydro Test Surveillance

71. OP 4105, Rev. 13, LPC 05, Fire Protection Systems Surveillance

72. OP 4115, Rev. 43, LPC-08, Primary Containment Surveillance

73. OP 4116, Rev. 23, LPC 06, Secondary Containment Surveillance
74. OP 4127, Rev. 09, LPC 03, John Deere Diesel Generator Surveillance
75. OP 4192, Rev. 15, LPC 00, HVAC Surveillance
76. OP 4612, Rev. 26, LPC 00, Reactor Water System Sampling and Treatment
77. OP 4613, Rev. 35, LPC 00, Sampling and Testing of Diesel Fuel Oil
78. OP 4623, Rev. 29, LPC 00, Sampling and Treatment of Closed Cooling Water Systems
79. OP 4628, Rev. 05, LPC 00, Sampling and Analysis of the Residual Heat Removal (RHR) Heat Exchanger
80. OP 4649, Rev. 05, LPC 00, Standby Fuel Pool Cooling Heat Exchanger Sampling
81. OP 5223, Rev. 20, LPC 00, Emergency Diesel Generator Maintenance
82. OP 5230, Rev. 16, LPC 00, Mechanical PMs and Inspections for Refueling Platforms
83. OP 5240, Rev. 16, LPC 01, Turbine and Reactor Building Bridge Crane Inspection and Maintenance
84. OP 5265, Rev. 05, LPC 00, Service Water Component Inspection and Acceptance Criteria
85. PMCR 2003-0724, Annual PM for John Deere Diesel
86. PMCR 2003-0725, Three Year PM for John Deere Diesel
87. PMCR 2003-0726, Five Year PM for John Deere Diesel
88. PP 7006, Rev. 09, LPC 01, Primary Containment Leakage Rate Testing Program
89. PP 7015, Rev. 05, LPC 00, Vermont Yankee Inservice Inspection Program
90. PP 7021, Rev. 02, LPC 00, Service Water Program
91. PP 7024, Rev. 04, LPC 01, Containment Inservice Inspection Program (IWE)
92. PP 7026, Rev. 01, LPC 00, Masonry Wall Surveillance Program Procedure
93. PP 7027, Rev. 03, LPC 00, Reactor Vessel Internals Management program
94. PP 7028, Rev. 00, LPC 01, Piping Flow Accelerated Corrosion Inspection Program
95. PP 7030, Rev. 00, LPC 01, Structures Monitoring Program Procedure

96. PP 7601, Rev. 02, LPC 00, Service Water Chemical Treatment and Monitoring Program

97. Regulatory Guide 1.65, Materials and Inspections for Reactor Vessel Closure Studs, October, 1973

98. RP 4604, Rev. 03, LPC 00, Sampling of Stator Cooling Water & Stator Cooling Makeup Water

99. RP 4620, Rev. 17, LPC 00, Sampling and Analysis of Instrument and Containment Instrument Air Supplies

100. RP 4621, Rev. 19, LPC 00, Sampling and Treatment of House Heating Boilers

101. RP 4625, Rev. 17, LPC 00, Sampling of the Reactor Steam System

102. RP 4626, Rev. 15, LPC 00, Sampling and Treatment of the Condensate and Feedwater Systems

103. RP 4629, Rev. 07, LPC 00, Sampling of the Makeup Demineralizer System (MUDS)

104. RP 4652, Rev. 05, LPC 00, Sampling and Testing for Microbiologically Induced Corrosion (MIC)

105. SAND96-0344, Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations, prepared by Sandia National Laboratories for the U.S. Department of Energy, September 1996

106. Vermont Yankee ISI Database

107. VYC-378, Rev. 01, Vermont Yankee Reactor Cyclic Limits for Transient Events

108. VYC-1005, Rev. 02, Crack Growth Calculation for the Vermont Yankee FW Nozzles

109. VYC-1080, Rev. 0, Critical Flaw Size Evaluation for Vermont Yankee Reactor Pressure Vessel Head Studs

110. VYNPS Technical Specification, Amendment 228

111. VYNPS TRM, Rev. 24, Vermont Yankee Technical Requirements Manual

112. VYNPS UFSAR, Rev. 19-1, Updated Final Safety Analysis Report

113. WO 00-004037-000, RRU-8 outage PM

114. WO 02-001508-000, Demister/moisture separator and demister drain inspection

115. WO 02-001334-000, RHR Corner Room RRU-6 PM

116. WO 02-001335-000, RHR Corner Room RRU-5 PM

117. WO 03-001108-000, Perform annual PM for John Deere diesel

118. WO 03-002211-000, RRU-7 outage PM

119. WO 03-004311-000, Perform visual examination of the reactor building air lock outer sliding door

120. WO 03-004324-000, Perform visual examination of the reactor building air lock inner sliding door

121. WO 94-08951, Drain, clean and inspect diesel fuel oil tank TK-40-1A

Attachment 1 – Proposed Changes to Implementing Procedures

This attachment is a brief summary of the proposed procedure changes and repetitive task changes for each individual aging management program.

1.0 New Programs or Activities Credited in Aging Management Reviews

1.1 Heat Exchanger Monitoring Program

This new program will be initiated prior to the period of extended operation.

1.2 Non-EQ Inaccessible Medium-Voltage Cable Program

This new program will be initiated prior to the period of extended operation.

1.3 Non-EQ Instrumentation Circuits Test Review Program

This new program will be initiated prior to the period of extended operation.

1.4 Non-EQ Insulated Cables and Connections Program

This new program will be initiated prior to the period of extended operation.

1.5 One-Time Inspection Program

This new program will be initiated prior to the period of extended operation.

1.6 Selective Leaching Program

This new program will be initiated prior to the period of extended operation.

1.7 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

This new program will be initiated prior to the period of extended operation.

2.0 Existing Programs or Activities Credited in Aging Management Reviews

2.1 Buried Piping Inspection Program

The following enhancement will be initiated prior to the period of extended operation.

Attachment 1 – Proposed Changes to Implementing Procedures

Attributes Affected	Enhancement	Procedures Affected
3. Parameters Monitored/ Inspected	Guidance for performing examinations of buried piping will be enhanced to specify that coating degradation and corrosion are attributes to be evaluated.	Section 4.3, PP 7030

2.2 BWR CRD Return Line Nozzle Program

No enhancements are required.

2.3 BWR Feedwater Nozzle Program

No enhancements are required.

2.4 BWR Penetrations Program

No enhancements are required.

2.5 BWR Stress Corrosion Cracking Program

No enhancements are required.

2.6 BWR Vessel ID Attachment Welds Program

No enhancements are required.

2.7 BWR Vessel Internals Program

The following enhancement will be initiated prior to the period of extended operation.

Attachment 1 – Proposed Changes to Implementing Procedures

Attributes Affected	Enhancement	Procedures Affected
1. Scope of Program	The VYNPS top guide fluence is projected to exceed the threshold for IASCC ($5x10^{20}$ n/cm^2) prior to the period of extended operation. Therefore, ten (10) percent of the top guide locations will be inspected using enhanced visual inspection technique, EVT-1, within the first 12 years of the period of extended operation, with one-half of the inspections (50 percent of locations) to be completed within the first 6 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold. ***(Ref. LRPD-03)***	TBD

2.8 Containment Leak Rate Program

No enhancements are required.

2.9 Diesel Fuel Monitoring Program

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement	Procedures Affected
4. Detection of Aging Effects	Ultrasonic thickness measurement of the fuel oil storage tank bottom surface will be performed every 10 years during tank cleaning and inspection.	M118, PM Basis, Activity 3
6. Acceptance Criteria	UT measurements of the fuel oil storage tank bottom surface will have acceptance criterion ≥ 60% Tnom.	WO 94-08951

2.10 Environmental Qualification (EQ) of Electrical Components Program

No enhancements are required.

2.11 Fatigue Monitoring Program

The following enhancements will be initiated prior to the period of extended operation.

Attachment 1 – Proposed Changes to Implementing Procedures

Attributes Affected	Enhancement	Procedures Affected
4. Detection of Aging Effects	The VYNPS program will be modified to either require periodic update of cumulative fatigue usage factors (CUFs), or to require update of CUFs if the number of accumulated cycles approaches the number assumed in the design calculation.	TBD
5. Monitoring and Trending	A computerized monitoring program (e.g., FatiguePro) will be used to directly determine cumulative fatigue usage factors (CUFs) for locations of interest.	TBD
6. Acceptance Criteria	The allowable number of effective transients will be established for every transient monitored by AP 0145. This will allow quantitative projection of future margin.	AP 0145

2.12 Fire Protection Programs

2.12.1 Fire Protection Program

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements	Procedures Affected
3. Parameters Monitored/ Inspected 6. Acceptance Criteria	Procedures will be enhanced to specify that fire damper frames in fire barriers shall be inspected for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.	OP 4019
3. Parameters Monitored/ Inspected 6. Acceptance Criteria	Procedures will be enhanced to state that the diesel engine sub-systems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running; such as fuel oil, lube oil, coolant, or exhaust gas leakage.	OP 4105

Attachment 1 – Proposed Changes to Implementing Procedures

2.12.2 Fire Water System Program

The following enhancements will be initiated prior to the period of extended operation.

Attributes Affected	Enhancements	Procedures Affected
4. Detection of Aging Effects	A sample of sprinkler heads will be inspected using guidance of NFPA 25 (2002 edition), Section 5.3.1.1.1. NFPA 25 also contains guidance to repeat this sampling every 10 years after initial field service testing.	TBD
4. Detection of Aging Effects	Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.	TBD

2.13 Flow Accelerated Corrosion Program

No enhancements are required.

2.14 Inservice Inspection Programs

2.14.1 Inservice Inspection (ISI) Program

No enhancements are required.

2.14.2 Containment Inservice Inspection (CII) Program

No enhancements are required.

2.15 Instrument Air Quality Program

No enhancements are required.

2.16 Oil Analysis Program

No enhancements are required.

Attachment 1 – Proposed Changes to Implementing Procedures

2.17 Periodic Surveillance and Preventive Maintenance Program

See Notes 1 and 2 in Attachment 3, Periodic Surveillance and Preventive Maintenance Activities for required enhancements. Enhancements will be initiated prior to the period of extended operation.

2.18 *Reactor Head Closure Studs Program*

No enhancements are required.

2.19 Reactor Vessel Surveillance Program

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement	Procedure Affected
5. Monitoring and Trending 6. Acceptance Criteria 7. Corrective Actions	The Reactor Vessel Surveillance Program will be enhanced to proceduralize (in PP 7027 or a new procedure) the data analysis, acceptance criteria, and corrective actions described in this program description.	PP 7027

2.20 Service Water Integrity Program

No enhancements are required.

2.21 Structures Monitoring Programs

2.21.1 Structures Monitoring Program

The following enhancements will be initiated prior to the period of extended operation.

Attachment 1 – Proposed Changes to Implementing Procedures

Attributes Affected	Enhancements	Procedure Affected
1. Scope of Program	The Structures Monitoring Program procedure will be enhanced to specify that process facility crane rails and girders, CST enclosure, CO_2 tank enclosure, N_2 tank enclosure and restraining wall, CST pipe trench, diesel generator cable trench, fuel oil pump house, service water pipe trench, drywell floor liner seal, manway seals and gaskets, and hatch seals and gaskets are inspected.	Section 4.2, PP 7030
4. Detection of Aging Effects	Guidance for performing structural examinations of wood to identify loss of material, cracking, and change in material properties will be added to the Structures Monitoring Program.	Section 4.3, PP 7030
4. Detection of Aging Effects	Guidance for performing structural examinations of elastomers (drywell floor liner, seals, and gaskets) to identify cracking and change in material properties (cracking when manually flexed) will be enhanced in the Structures Monitoring Program procedure.	Section 4.3, PP 7030
4. Detection of Aging Effects	Guidance for performing structural examinations of PVC cooling tower fill to identify cracking and change in material properties will be added to the Structures Monitoring Program procedure.	Section 4.3, PP 7030

2.21.2 Masonry Wall Program

No enhancements are required.

Attachment 1 – Proposed Changes to Implementing Procedures

2.21.3 Vernon Dam FERC Inspection

No enhancements are required.

2.22 System Walkdown Program

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement	Procedure Affected
1. Scope of Program	Enhance system walkdown guidance documents to clarify license renewal committment. The commitment for license renewal is for periodic system engineer inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject system will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).	EN-DC-178

Attachment 1 – Proposed Changes to Implementing Procedures

2.23 Water Chemistry Control Programs

2.23.1 Water Chemistry Control – Auxiliary Systems Program

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement	Procedure Affected
1. Scope of Program	Procedures will be enhanced to flush the John Deere diesel cooling water system and replace the coolant and coolant conditioner every three years.	TBD

2.23.2 Water Chemistry Control – BWR Program

No enhancements are required.

2.23.3 Water Chemistry Control – Closed Cooling Water Program

No enhancements are required.

Attachment 2 – One-Time Inspection Activities

Reference	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
Water chemistry control programs (Section 4.23)	A representative sample of components crediting water chemistry control programs for aging management will be inspected.	Presence and extent of cracking Wall thickness Fouling	Combinations of nondestructive examinations (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with Section XI of ASME B&PV Code and 10CFR50, Appendix B. Follow-up of unacceptable inspection findings may include expansion of sample size and locations.	No significant cracking, corrosion, or fouling. Ultrasonic thickness measurements will be compared to predetermined limits and indication of degradation will be evaluated.
AMRM-07, Standby Gas Treatment System	Internal carbon steel surfaces exposed to indoor air	Wall thickness	Visual or other NDE techniques will be used to inspect a representative sample of the internal carbon steel surfaces exposed to indoor air to manage loss of material.	No significant corrosion
AMRM-30, Nonsafety-related Systems and Components Affecting Safety-related Systems)	Carbon steel potable water (PW) system components containing untreated water	Wall thickness	Visual or other NDE techniques will be used to inspect a representative sample of components to manage loss of material.	No significant corrosion
AMRM-30, Nonsafety-related Systems and Components Affecting Safety-related Systems)	Copper and carbon steel components in the radwaste (RDW) system containing untreated water	Wall thickness	Visual or other NDE techniques will be used to inspect a representative sample of components to manage loss of material.	No significant corrosion

Attachment 2 – One-Time Inspection Activities

Reference	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
AMRM-30, Nonsafety-related Systems and Components Affecting Safety-related Systems)	Carbon steel retired in place (RIP) system components in the area around containment penetration X-21	Wall thickness	Visual or other NDE techniques will be used to inspect a representative sample of components to manage loss of material.	No significant corrosion
AMRM-33, Reactor Coolant System Pressure Boundary	Carbon steel scram accumulators remaining for the period of extended operation and small bore piping in the reactor coolant system and associated systems that form the reactor coolant pressure boundary. Small bore piping includes pipe, condensing chambers, filter housings, orifices, fittings, valve bodies, detectors, tanks, thermowells, and any other pressure retaining parts and welds in small bore piping.	Presence and extent of cracking Wall thickness Reduction of fracture toughness (presence and extent of cracking of CASS valve bodies <4" NPS)	Combinations of nondestructive examinations (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with Section XI of ASME B&PV Code and 10CFR50, Appendix B. Actual inspection locations will be based on physical accessibility, exposure levels, NDE techniques, and locations identified in Nuclear Regulatory Commission (NRC) Information Notice (IN) 97-46.	No significant cracking. No significant corrosion. Ultrasonic thickness measurements will be compared to predetermined limits and indication of degradation will be evaluated.

Attachment 2 – One-Time Inspection Activities

Reference	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
AMRM-33, Reactor Coolant System Pressure Boundary	Main steam flow restrictors (CASS)	Presence and extent of cracking Wall thickness Reduction of fracture toughness (presence and extent of cracking)	Combinations of nondestructive examinations (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with Section XI of ASME B&PV Code and 10CFR50, Appendix B.	No significant cracking. No significant corrosion. Ultrasonic thickness measurements will be compared to predetermined limits and indication of degradation will be evaluated.
AMRM-33, Reactor Coolant System Pressure Boundary	RV flange leakoff line.	Presence and extent of cracking	Nondestructive examinations will be performed by qualified personnel following procedures that are consistent with Section XI of ASME B&PV Code and 10CFR50, Appendix B.	No significant cracking.

General Notes

- Attributes 2, 5, 7, 8, 9 & 10 are not represented in this table, because they are evaluated in Program 3.4, One-Time Inspection Program.

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
AMRC-02 credited activities (Reactor Building)				
OP 5240	Reactor building crane, crane rails and girders carbon steel components	Surface condition	Every 5 years perform visual or other non-destructive examination to manage loss of material for crane rails and structural carbon steel components.	No significant corrosion or wear
OP 5230	Refueling platform equipment assembly carbon steel components	Surface condition	Every 5 years inspections and maintenance are performed on the refueling platform. Visual or other non-destructive examination manages loss of material for refueling platform equipment assembly carbon steel components.	No significant corrosion or wear
PM Activity 2, PM Basis ME166; WO 03-004311-000; WO 03-004324-000	Equipment lock sliding doors	Surface condition	**Note 1** Every 5 years perform visual examination to manage loss of material for the carbon steel doors.	**Note 1** No significant corrosion or wear
OP 4116	Reactor building exterior concrete walls	Reactor building vacuum	Every 5 years perform the secondary containment capability check to confirm the absence of aging effects for reactor building exterior concrete walls.	Standby gas treatment train maintains an average reactor building test vacuum of at least 0.21 inches H_2O

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
AMRC-05 credited activities (Yard Structures)				
OP 4019	Yard concrete handholes and manholes	Surface condition	**Note 1** Every 5 years perform visual inspection to confirm the absence of aging effects for yard concrete handholes and manholes.	**Note 1** No significant concrete cracking, spalling, or loss of material
AMRC-06 credited activities (Bulk Commodities)				
OP 4116	Rubber seals for equipment lock doors: • Reactor building railroad inner door • Reactor building railroad outer door	Leak rate	Every 5 years perform leakage test on the equipment lock doors. Satisfactory completion will verify the absence of significant cracking and change in material properties for the rubber seals.	System leak rate ≤ 0.15 SCFH
AMRM-05 credited activities (High Pressure Coolant Injection System)				
Note 2	Gland seal exhauster (FN-2-1A) fan housing and piping	Surface condition	Every 5 years use visual or other NDE techniques to inspect a representative sample of the internals of the gland seal exhauster (FN-2-1A) fan housing and piping to manage loss of material.	No significant corrosion
AMRM-07 credited activities (Standby Gas Treatment System)				
PM activity 3, PM Basis ME118; WO 02-001508-000	Demister : • SBGT-1A-Demister • SBGT-1B-Demister	Surface condition	Every 5 years, use visual or other NDE techniques to inspect internal and external surfaces of the demisters to manage loss of material.	No significant corrosion

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
PM activity 3, PM Basis ME118; WO 02-001508-000	Internals of demister loop seal (drain) components: • V1-125-6A • V1-125-6B • V70-188A • V70-188B • Loop seal tubing/piping	Surface condition	Note 1 Every 5 years, use visual or other NDE techniques to inspect a representative sample of the demister loop seal components to manage loss of material.	Note 1 No significant corrosion
AMRM-08 credited activities (Primary Containment Atmosphere Control and Containment Atmosphere Dilution Systems)				
Note 2	Pre-Cooler (heat exchangers): • SAH-VG-5A • SAH-VG-5B	Surface condition	Every 5 years, visually inspect external surfaces of the hydrogen analyzer pre-cooler (heat exchangers) to manage fouling.	No significant fouling
AMRM-11 credited activities (Service Water Systems)				
PM activity 2, PM Basis ME146; WO 02-001334-000; WO 02-001335-000; OP 5265	RHR corner room heat exchanger housings: • RRU-5 • RRU-6	Surface condition	Every 5 years during refueling outage preventive maintenance on the RHR corner room heat exchangers, RRU-5 and RRU-6, visually inspect the housings of these components to manage loss of material.	No significant corrosion
AMRM-13 credited activities (Emergency Diesel Generator System)				
PM Activity 1, PM Basis ME039	A/B EDG intake air cooler copper alloy tubes	Temperature	Every 5 years, perform EDG operability testing to manage fouling for copper alloy intake air cooler tubes.	Intercooler Air Temperature < 160°F

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
PM Activity 4, PM Basis ME039; OP 5223	A/B EDG intake air components: • intake air cooler copper alloy tubes • intake air cooler aluminum fins • piping • filter housings	Surface condition	**Note 1** Every 5 years, use visual or other NDE techniques to inspect a representative sample of EDG intake air components to manage loss of material. Also inspect the intake air cooler tubes and fins to manage fouling and loss of material due to wear.	**Note 1** No significant corrosion, wear or fouling
PM Activity 4, PM Basis ME039; OP 5223	Internals of A/B EDG air start system copper alloy valves and tubing: • AS-24-1A/B • AS-24-2A/B • AV-24-1A/B • Air start tubing • SR-72-6A/B/C/D • V72-822A/B • V72-823A/B • V72-91A/B/C/D	Surface condition	**Note 1** Every 5 years, use visual or other NDE techniques to inspect a representative sample of internal surfaces of A/B EDG copper alloy valves and tubing to manage loss of material.	**Note 1** No significant corrosion

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
PM Activity 4, PM Basis ME039; OP 5223	Internals of A/B EDG air start system carbon and stainless steel components: • F-24-1A • F-24-1B • piping • TK-80-1A/B/C/D • V72-1010A/B/C/D • V72-1011A/B/C/D • V72-1018A/B • V72-1019A/B/C/D • V72-103A/B/C/D • V72-74A/B • V72-81AX / BX / CX / DX • V72-82AX / BX • V72-83AX / BX • V72-84A/B • V72-980A/C	Surface condition	**Note 1** Every 5 years, use visual or other NDE techniques to inspect a representative sample of internal surfaces of A/B EDG carbon and stainless steel components to manage loss of material.	**Note 1** No significant corrosion
PM Activity 4, PM Basis ME039; OP 5223	Internals of A/B EDG exhaust gas components: • Piping • Exhaust silencer • Expansion joint • Turbocharger	Surface condition	**Note 1** Every 5 years, use visual or other NDE techniques to inspect a representative sample of A/B EDG exhaust gas components to manage loss of material and to inspect A/B EDG exhaust stainless steel expansion joints for cracking.	**Note 1** No significant corrosion or cracking

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
AMRM-19 credited activities (Heating, Ventilation and Air Conditioning System)				
PM activity 2, PM Basis ME145; WO 00-004037-000; WO 03-002211-000; OP 5265	Heat exchanger housings: • RRU-7 • RRU-8	Surface condition	Every 5 years during refueling outage preventive maintenance on the ECCS corner room recirculation units, RRU-7 and RRU-8, visually inspect the housings of these components to manage loss of material.	No significant corrosion
PM activities 4, 5 and 6, PM Basis ME153	Control room HVAC package • heating and cooling coils (SAC-1) • chiller (SCH-1) • chilled water condensers (SACC-1A and SACC-1B) • ductwork flexible connections	• Surface condition • Flexibility	**Note 1** Every 5 years, during semi-annual preventive maintenance on control room HVAC package heating and cooling coils (SAC-1), control room chiller (SCH-1), and control room chilled water condensers (SACC-1A and SACC-1B) visually inspect these components to manage loss of material. At the same time, visually inspect and manually flex the flexible connection between SAC-1A and DUCT-TB-3, flexible connections between SAC-1A/1B and DUCT-TB-1, and flexible connections between SAC-1A/1B and DUCT-TB-2, to verify the absence of cracks and significant change in material properties.	No significant corrosion **Note 1** No significant cracking while flexing elastomer coated fiberglass duct fabric flexible connections

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
PM activity 1, PM Basis ME153; Procedure Section C, OP 4192	Copper alloy heat exchanger tubes in the control room chilled water condensers (SACC-1A & 1B)	Temperature	Every 5 years perform testing of the control room chilled water condensers (SACC-1A and SACC-1B) to verify they are capable of removing the required amount of heat. This testing will manage fouling for these copper alloy heat exchangers.	Outlet from condenser is 10°F cooler than inlet to condenser
AMRM-21 credited activities (John Deere Diesel)				
PM Activity 3, PM Basis ME163; PMCR 2003-0724; WO 03-001108-000	**Note 1** Internals of John Deere diesel exhaust gas components: • Piping • Expansion joint • Muffler • Turbocharger	**Note 1** Surface condition	**Note 1** Every 5 years, use visual or other NDE techniques to inspect a representative sample of John Deere diesel exhaust gas components to manage loss of material and cracking.	**Note 1** No significant corrosion or cracking
PM Activity 5, PM Basis ME163; PMCR 2003-0726	**Note 1** Internals of John Deere diesel intake air components: • Piping • Filter housing	**Note 1** Surface condition	**Note 1** Every 5 years, use visual or other NDE techniques to inspect a representative sample of John Deere diesel intake air components to manage loss of material.	**Note 1** No significant corrosion
PM Activity 2, PM Basis ME163; OP 4127	John Deere diesel heat exchanger components: • Lube oil cooler • Radiator	Temperature	Every 5 years, perform John Deere operability testing to manage fouling for the lube oil cooler and radiator.	Water temperature < 195 °F

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
PM Activity 4, PM Basis ME163; PMCR 2003-0725	Note 1 John Deere diesel heat exchanger components: • Lube oil cooler • Radiator	Note 1 Surface condition	Note 1 Every 5 years, use visual or other NDE techniques to inspect John Deere diesel lube oil cooler and radiator to manage loss of material and fouling.	Note 1 No significant corrosion, wear or fouling
AMRM-30 credited activities (Nonsafety-related Systems and Components Affecting Safety-related Systems)				
Note 2	Carbon steel and copper alloy circulating water system components in cooling tower #2, cell 1	Surface condition	Every 5 years, use visual or other NDE techniques to inspect a representative sample of circulating water system components to manage loss of material.	No significant corrosion
PM Activity 4, PM Basis ME039; OP 5223	Internal surfaces of non-safety related carbon steel components of the diesel generator air start subsystem, including • compressors (C-3-1-A/B) • filters (F-24-2A/B) • piping • valves	Surface condition	Note 1 Every 5 years, use visual or other NDE techniques to inspect a representative sample of nonsafety-related components of the diesel generator air start subsystem to manage loss of material.	Note 1 No significant corrosion

Attachment 3 - Periodic Surveillance and Preventive Maintenance Activities

Suggested Procedure / PM Activity	Attribute 1 Scope of Program	Attribute 3 Parameters Monitored/Inspected	Attribute 4 Detection of Aging Effects	Attribute 6 Acceptance Criteria
Note 2	Internal surfaces of non-safety related carbon steel • tanks (TK-5-1A/B) • traps • valves of the instrument air supply system between, but not including, air compressors (C-1-1A/B/C/D) and air dryers (D-1-1A/B)	Surface condition	Every 5 years, use visual or other NDE techniques to inspect a representative sample of nonsafety-related carbon steel components of the instrument air supply system between, but not including, air compressors (C-1-1A/B/C/D) and air dryers (D-1-1A/B) to manage loss of material.	No significant corrosion

General Notes

- Attributes 2, 5, 7, 8, 9 & 10 are not represented in this table, because they are evaluated in Program 4.11, Periodic Surveillance and Preventive Maintenance Program.
- The procedures / repetitive WOs listed are suggested for managing the aging effects discussed in attributes 1 & 3. Other work orders or procedures may be used as long as all the attributes are satisfied.

Note 1: The listed procedure or PM activity should be enhanced to incorporate the items listed.
Note 2: No applicable procedure/PM activity has been found. Incorporate these attributes in a new or existing procedure/PM activity.

Attachment 4 – Structures Monitoring Program General Criteria

Structural Material	Aging Effect	Attribute 3 Parameters Monitored	Attribute 4 Detection of Aging	Attribute 6 Acceptance Criteria
Concrete	Loss of material	Condition of exposed surfaces	Visual inspection	Absence of the following: excessive rust bleeding, staining or discoloration, abrasion, erosion, cavitation, spalling, scaling, leaching, excessive settlement, corrosion of reinforcing, degraded waterproof membranes **(Note 1)**
Steel (incl. threaded fasteners)	Loss of material	Condition of exposed surfaces, loose/missing bolts	Visual inspection	Absence of the following: Pitting, beam/column deflection, cracks, flaking coatings, excessive rust, loose/missing bolts, peeling paint, wide spread corrosion **(Note 1)**
Wood	Loss of material Cracking Change in material properties	Condition of exposed surfaces	Visual inspection	Absence of cracks, evidence of biological attack, and iron rot
PVC cooling tower fill	Cracking Change in material properties	Condition of exposed surfaces	Visual inspection	Absence of cracks and gaps
Elastomers	Cracking Change in material properties	Condition of exposed surfaces	Visual inspection and manual flexing	Absence of cracks and gaps

Notes

1. Limits should be based upon criteria stated in ACI 349.3R-96 or ANSI/ASCE 11-99 or as identified in specific site procedures.

Attachment 5 - VYNPS Response to BWRVIP Applicant Action Items

Of the BWRVIP documents credited in this report, the following have (or are expected to have) NRC safety evaluation (SE) reports for license renewal.

BWRVIP-18	BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines
BWRVIP-25	BWR Core Plate Inspection and Flaw Evaluation Guidelines
BWRVIP-26	BWR Top Guide Inspection and Flaw Evaluation Guidelines
BWRVIP-27	BWR Standby Liquid Control System / Core Plate ΔP Inspection and Flaw Evaluation Guidelines
BWRVIP-38	BWR Shroud Support Inspection and Flaw Evaluation Guidelines
BWRVIP-41	BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines
BWRVIP-42	LPCI Coupling Inspection and Flaw Evaluation Guidelines
BWRVIP-47	BWR Lower Plenum Inspection and Flaw Evaluation Guidelines
BWRVIP-48	Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines
BWRVIP-49	Instrument Penetration Inspection and Flaw Evaluation Guidelines
BWRVIP-74	BWR Reactor Vessel Inspection and Flaw Evaluation Guidelines
BWRVIP-76	BWR Core Shroud Inspection and Flaw Evaluation Guidelines
BWRVIP-116	BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal

License renewal application action items identified in the corresponding SE report for each of the above reports are addressed in the following table. BWRVIP-76 and BWRVIP-116 are not included in the table because, although they are expected to have SE reports for license renewal, they have not yet been issued. BWRVIP documents without SE reports for license renewal have no applicant action items and are, therefore, not included in the table.

The SE reports contain three common applicant action items, which are addressed only once in the table. For SE reports that contain additional applicant action items, the response is provided separately following the responses to the three common action items.

Action Item Description	Response
Common Action Items from BWRVIP-18, -25, -26, -27, -38, -42, -47, -48, and -49	
BWRVIP-All (1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within these BWRVIP reports described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP reports have been reviewed and VYNPS has been verified to be bounded by the reports. Additionally, VYNPS commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10CFR50, Appendix B. Deviation from a BWRVIP report approved by the NRC will be reported to the NRC within 45 days of receipt of NRC final approval of the guideline. ***(Ref. PP 7027)***
BWRVIP-All (2) 10CFR54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs for the period of extended operation. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the programs and activities specified as necessary in the applicable BWRVIP reports are summarily described in the FSAR supplement.	The FSAR supplement is included as Appendix A of the LRA and includes a summary of the programs and activities specified as necessary for the BWRVIP program.

Action Item Description	Response
BWRVIP-All (3) 10CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. The applicable BWRVIP reports may state that there are no generic changes or additions to technical specifications associated with the report as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the inspection strategy described in the reports does not conflict with or result in any changes to their technical specifications. If technical specification changes or additions do result, then the applicant must ensure that those changes are included in its application for license renewal.	No technical specification changes have been identified for VYNPS based upon the BWRVIP reports. ***(Ref. PP 7027)***
Additional Action Items	
BWRVIP-18, Core Spray Internals Inspection and Flaw Evaluation Guidelines	
BWRVIP-18 (4) Applicants referencing the BWRVIP-18 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components.	There were no TLAA issues identified for VYNPS for BWRVIP-18. ***(Ref. LRPD-03)***
BWRVIP-25, Core Plate Inspection and Flaw Evaluation Guidelines	
BWRVIP-25 (4) Due to susceptibility of the rim hold-down bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue.	The calculation of loss of preload on the core plate rim hold-down bolts is a TLAA. Evaluation of the 60-year projected stress relaxation of the rim hold-down bolts in BWRVIP-25, Appendix B showed that the VYNPS bolts would experience only 5 to 19 percent loss of preload. ***(Ref. LRPD-03)***

Action Item Description	Response
BWRVIP-25 (5) Until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.	VYNPS follows BWRVIP-25 guidelines for rim hold-down bolt inspection under the BWR Vessel Internals Program with one exception. VYNPS performs VT-3 inspection of 50% (15) of the top of the core plate rim hold-down bolts every other refueling outage. If access to the lower plenum becomes available, VYNPS plans to perform a VT-3 inspection of accessible rim hold-down bolt bottom locking engagement and accessible aligner pin assemblies. Thus, VYNPS does not meet the BWRVIP-25 requirement to perform enhanced VT-1 from below the core plate of 50% of the hold-down bolts every other refueling outage. A baseline VT-3 examination of the tops of all 30 bolted connections was performed in 1996. Follow-up VT-3 examinations of tops of 50% of the bolted connections were performed in 1999, 2000 and 2001. None of the exams found evidence of cracking or bolting disassembly. Since the lower bolted connections are similar to the top, and there are no failed connections in the sample that is inspected, it is unlikely that a significant number of failed connections could exist in the remainder of the population. Therefore, the VYNPS inspection plan is adequate for ensuring the structural integrity of the core plate configuration to resist sliding against shear loads. ***(Ref. Section 4.7)***
BWRVIP-26, Top Guide Inspection and Flaw Evaluation Guidelines	
BWRVIP-26 (4) Due to IASCC susceptibility of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue.	Accumulated neutron fluence projected to 60 years for VYNPS exceeds the threshold for IASCC susceptibility for the top guide. Since VYNPS has implemented the inspection requirements of BWRVIP-26, the BWR Vessel Internals Program will adequately manage the effects of aging on the top guide for the period of extended operation. ***(Ref. LRPD-03)***

Action Item Description	Response
BWRVIP-27, Standby Liquid Control System / Core Plate ΔP Internals Inspection and Flaw Evaluation Guidelines	
BWRVIP-27 (4) Due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27 report for license renewal should identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue.	BWRVIP-27 fatigue analysis of the standby liquid control system / core plate ΔP line was identified as a potential TLAA. However, VYNPS fatigue analyses do not provide a CUF for the standby liquid control system / core plate ΔP nozzle. Therefore, VYNPS does not have a TLAA associated with this component. ***(Ref. LRPD-03)***
BWRVIP-42, LPCI Coupling Inspection and Flaw Evaluation Guidelines	
BWRVIP-42 (4) Applicants referencing the BWRVIP-42 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components.	There were no TLAA issues identified for VYNPS for BWRVIP-42. ***(Ref. LRPD-03)***
BWRVIP-42 (5) The BWRVIP committed to address development of the technology to inspect inaccessible welds and to have the individual LR applicant notify the NRC of actions planned. Applicants referencing BWRVIP-42 report for license renewal should identify the action as open and to be addressed once the BWRVIP response to this issue has been reviewed and accepted by the staff.	Inspection of inaccessible welds is a BWRVIP generic open action. VYNPS will address this issue once the BWRVIP response has been reviewed and accepted by the NRC. ***(Ref. PP 7027)***
BWRVIP-47, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines	
BWRVIP-47 (4) Due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for LR should identify and evaluate the projected CUF as a potential TLAA issue.	Fatigue analyses of lower plenum pressure boundary components were identified as TLAA. Fatigue and CUFs are addressed in LRPD-04. ***(Ref. LRPD-03 and LRPD-04)***

Action Item Description	Response
BWRVIP-74, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines	
BWRVIP-74-A (4) The staff is concerned that leakage around the reactor vessel seal rings could accumulate in the VFLD lines, cause an increase in the concentration of contaminants and cause cracking in the VFLD line. The BWRVIP-74 report does not identify this component as within the scope of the report. However, since the VFLD line is attached to the RPV and provides a pressure boundary function, LR applicants should identify an AMP for the VFLD line.	The vessel flange leak detection (VFLD) line is in scope and has loss of material and cracking identified as aging effects requiring management. Aging of the vessel flange leak detection line is managed by the Water Chemistry Control – BWR and One-Time Inspection programs. ***(Ref. AMRM-33)***
BWRVIP-74-A (5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of program, (2) preventative actions, (3) parameters monitored and inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	Descriptions of plant-specific aging management programs, in Sections 3 and 4, address the required ten elements.
BWRVIP-74-A (6) The staff believes inspection by itself is not sufficient to manage cracking. Cracking can be managed by a program that includes inspection and water chemistry. BWRVIP-29 describes a water chemistry program that contains monitoring and control guidelines for BWR water that is acceptable to the staff. BWRVIP-29 is not discussed in the BWRVIP-74 report. Therefore, in addition to the previously discussed BWRVIP reports, LR applicants shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	The Water Chemistry Control – BWR program, described in Section 4.23.2, monitors and controls reactor water chemistry in accordance with the guidelines of BWRVIP-130, which supercedes BWRVIP-29.
BWRVIP-74-A (7) LR applicants shall identify their vessel surveillance program, which is either an ISP or plant-specific-invessel surveillance program, applicable to the LR term.	The Reactor Vessel Surveillance Program, discussed in Section 4.19, is an ISP program.

Action Item Description	Response
BWRVIP-74-A (8) LR applicants should verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue usage is projected to exceed 1.0 will require case-by case staff review and approval. Further, a LR applicant must address environmental fatigue for the components listed in the BWRVIP-74 report for the LR period.	Thermal fatigue (including discussion of cycles, projected cumulative usage factors, environmental fatigue, etc.) is evaluated as a TLAA in LRPD-04. ***(Ref. LRPD-04)***
BWRVIP-74-A (9) Appendix A to the BWRVIP-74 report indicates that a set of P-T curves should be developed for the heat-up and cool-down operating conditions in the plant at a given EFPY in the LR period.	Development of pressure-temperature limits for the period of extended operation is described as a TLAA in LRPD-03. ***(Ref. LRPD-03)***
BWRVIP-74-A (10) To demonstrate that the beltline materials meet the Charpy USE criteria specified in Appendix B of the report, the applicant shall demonstrate that the percent reduction in Charpy USE for their beltline materials are less than those specified for the limiting BWR/3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in RG 1.99, Revision 2.	Discussion of Charpy upper shelf energy for the period of extended operation is described as a TLAA in LRPD-03. ***(Ref. LRPD-03)***
BWRVIP-74-A (11) To obtain relief from the in-service inspection of the circumferential welds during the LR period, the BWRVIP report indicates each licensee will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in the Appendix E for the staff's July 28, 1998, SER, and (2) that they have implemented operator training and established procedures that limit the frequency of cold overpressure events to the amount specified in the staff's FSER.	Discussion of relief from in-service inspection of the circumferential welds for the period of extended operation is included in LRPD-03. ***(Ref. LRPD-03)***

Action Item Description	Response
BWRVIP-74-A (12) As indicated in the staff's March 7, 2000, letter to Carl Terry, a LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine that the mean RTNDT of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of this FSER.	Discussion of axial weld failure probability during the period of extended operation is included in LRPD-03. ***(Ref. LRPD-03)***
BWRVIP-74-A (13) The Charpy USE, P-T limit, circumferential weld and axial weld RPV integrity evaluations are all dependent upon the neutron fluence. The applicant may perform neutron fluence calculations using staff approved methodology or may submit the methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the NRC letter that approved the methodology.	The method used for the neutron flux calculation is documented in GE's Licensing Topical Report NEDC-32983P-A, which was approved by the US NRC for licensing applications in USNRC letter S.A. Richards to J.F. Klapproth, Safety Evaluation for NEDC-32983P, General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation (TAC No. MA9891), MFN 01-050, September 14, 2001. ***(Ref. LRPD-03)***
BWRVIP-74-A (14) Components that have indications that have been previously analytically evaluated in accordance with Subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period shall be reevaluated for the 60-year service period corresponding to the LR term.	Flaw evaluations for previously identified indications are discussed in LRPD-04. ***(Ref. LRPD-04)***