From: Peter Wen
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Date: 08/03/2006 1:20:30 PM
Subject: Duc's Audit and Review Report Input

Mark/Joe,

Attached is Duc's input for the revised 5 AMPs and AMR 3.6, incorporating the information provided in the applicant's 07/19/2006 letter. Please process this input from your ends. Thank you.

Peter

CC: Duc Nguyen; James Davis

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Subject: Duc's Audit and Review Report Input
Creation Date 08/03/2006 1:20:23 PM
From: Peter Wen

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MESSAGE	593	08/03/2006 1:20:23 PM
B.1.11 EQ of Electric Components Prog (3.0.3.1.3)_Revised.wpd	22983	08/03/2006 12:59:12 PM
B.1.18 ME Bus Inspection Prog (3.0.3.2.12)_Revised.wpd	28865	08/03/2006 1:06:22 PM
B.1.21 Non-EQ InInsulated Cables and Conns Prog (3.0.3.1.7)_Revised.wpd	20599	08/03/2006 1:04:38 PM
B.1.19 Non-EQ Inaccessible Medium-Vol Cable Prog (3.0.3.1.5)_Revised.wpd	27845	08/03/2006 1:01:12 PM
B.1.20 Non-EQ Instrumentation CKT Test Review Prog (3.0.3.1.6)_Revised.wpd	24323	08/03/2006 1:03:06 PM
PNPS AMR Section 3.6_Duc_Revised.wpd	72505	08/03/2006 1:08:36 PM

Options
Expiration Date: None
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Junk Mail Handling Evaluation Results
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3.0.3.1.3 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRIC COMPONENTS PROGRAM (PNPS AMP B.1.11)

In PNPS LRA, Appendix B, Section B1.11, the applicant stated that PNPS AMP B1.11, "Environmental Qualification (EQ) of Electric Components Program," is an existing plant program that is consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

3.0.3.1.3.1 Program Description

The applicant stated, in the PNPS LRA, that 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 (i.e., 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 PNPS 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 is 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.

3.0.3.1.3.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B1.11 is consistent with GALL AMP X.E1. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report PNPS AMP B1.11, including LRPD-02, Revision 1, Section 4.10, "Environmental Qualification (EQ) of Electrical Components Program," which provides an assessment of the AMP elements' consistency with GALL AMP X.E1. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B1.11 and associated bases documents to determine consistency with GALL AMP X.E1.

Also, the project team reviewed LRPD-03, "TLAA and Exemption Evaluation," Volume 2.

During the audit and review, the project team noted that the results of electrical equipment in LRA Section 4.4 indicate that the aging effects of the EQ electrical equipment identified as TLAA will be managed during the extended period of operation under 10 CFR 54.21(c)(1)(iii). However, no information is provided on the attribute of a reanalysis of aging evaluation to extend the qualification life of electrical identified as TLAA. The important attributes of a reanalysis are the analytical methods, the data collection, the reduction methods, the underlying assumptions, the acceptance criteria, and corrective actions. The project team requested the applicant to provide information on these important attributes of re-analysis of an aging evaluation of electrical equipment identifed in the TLAA to extend the qualification under 10 CFR 50.49(e). In its response, the applicant stated that it adds the following text to LRA

Appendix B.1.11 to include the "EQ Component Renalysis Attributes" specified in NUREG-1801 Vol. 2 Section X.E1:

EQ Component Reanalysis Attributes:

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, suchas the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements, which requires the verification of assumption and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (that is 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other methods may be justified on a case-by-case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (for example, temperature, radiation, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is to be conservative and based on plant design temperatures or on atual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance, other installed monitors, measurement made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurement are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperature for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluation can be used for radiation and cyclical aging.

Underlying Assumption: EQ component aging evaluation contain sufficient conservatism

to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating 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.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or re-qualified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace, or re-qualify the component is the reanalysis is unsuccessful.

The project team found the change acceptable. In a letter dated July 19, 2006, the applicant revised the LRA Appendix B.1.11 as described above.

GALL AMP X.E1 under preventive actions states that 10 CFR 50.49 does not require actions that prevent aging effects. EQ program 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 of the qualification basis. PNPS LRPD-02 Section 4.10 under same attribute did not provide EQ program actions that could be viewed as preventive actions. The project team requested the applicant to provide a description of preventive actions for the PNPS EQ program. In its respone, the applicant stated that 10 CFR 50.49 does not require actions that prevent aging effects. However, LRPD-02 will be revised to read as follow:

(Section 4.10.b.2.b - Preventive Actions - add to the end of first sentence)

The program actions that could be viewed as preventive actions are the identification of *qualified life and specific maintenance/installation requirements.*

The project team verified that LRPD-02 Rev.2 under Section 4.10.b.2.b was revised as described above. The project team found the applicant's response acceptable because the applicant described the actions in PNPS EQ program that could be viewed preventive actions.

The project team reviewed those portions of the applicant's Environmental Qualification (EQ) of Electric Components Program for which the applicant claims consistency with GALL AMP X.E1 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Environmental Qualification (EQ) of Electric Components Program provided reasonable assurance that the aging effects of thermal, radiation, and cyclical for electrical equipment, important to safety and located in harsh environments will be managed. The project team found the applicant's Environmental Qualification (EQ) of Electric Components Program acceptable because it conforms to the recommended GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

3.0.3.1.3.3 Exceptions to the GALL Report

None.

3.0.3.1.3.4 Enhancements

None.

3.0.3.1.3.5 Operating Experience

The applicant stated, in the PNPS LRA, that 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 team reviewed the EQ Program Self Assessment (January 28, 2002 to February 01, 2002) The assessment identified EQ files that had not been updated at the time of the assessment. The EQ files needed to be updated due to the implementation of a plant design change 01-03, Cycle 14 Reload Design. The impact of the reload design on the EQ program was evaluated in EQ document file Reference 420D and 420E prior to Refueling Outage 13. All EQ components were identified to remain qualified for the Cycle 14 reload design. As a result of the EQ Program Assessment Program, LO-PNPLO-2002-0011 CA-09 was initiated to track and enforce work down of remaining EQ document file's per established work down curves. This LO action was closed on 10/7/2002.

The project team also interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review and discussions with the applicant's technical staff, the project team concluded that the applicant's Environmental Qualification (EQ) of Electric Components Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.3.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Environmental Qualification (EQ) of Electric Components Program in PNPS LRA, Appendix A, Section A.2.1.11, which states that the 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 evaluations. Aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

The project team reviewed the UFSAR Supplement PNPS AMP B1.11, and determined that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team found that the applicant has

demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the UFSAR Supplement for this program, the project team found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 METAL-ENCLOSED BUS INSPECTION PROGRAM (PNPS AMP B.1.18)

In PNPS LRA, Appendix B, Section B.1.18, the applicant stated that PNPS AMP B.1.18, "Metal-Enclosed Bus Inspection Program," is a new plant program that is consistent with GALL AMP XI.E4, "Metal-Enclosed Bus," with exceptions.

3.0.3.2.12.1 Program Description

The applicant stated, in the PNPS LRA, that this program will manage the effects of aging on non-segregated phase bus which connects the 4.16 kV switchgear (A3 through A6) through visual inspection of enclosure assemblies and interior portions of the bus. This inspection will also verify the absence of water or debris.

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

3.0.3.2.12.2 Consistency with the GALL Report

In the PNPS LRA, the applicant stated that PNPS AMP B.1.18 is consistent with GALL AMP XI.E4, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.18, including LRPD-02, Revision 1, Section 3.3, "Metal-Enclosed Bus Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E4. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.18 and associated bases documents to determine consistency with GALL AMP XI.E4.

Also, the project team reviewed AMRE-01, Rev. 2, Electrical Screening and Aging Management Reviews and LRPD-05, Rev. 0, Operating Experience Reviews.

The project team reviewed those portions of the Metal-Enclosed Bus Inspection Program for which the applicant claims consistency with GALL AMP XI.E4 and found that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Metal-Enclosed Bus Inspection Program provides reasonable assurance that aging effects of metal enclosed bus caused by cracked insulation and moisture or debris in the bus enclosure, loosening of bolted connections will be managed to be consistent with CLB during the extended period of operation The project team found the applicant's Metal-Enclosed Bus Inspection Program acceptable because it conforms to the recommended GALL AMP XI.E4, "Metal-Enclosed Bus," with exceptions as described below.

3.0.3.2.12.3 Exceptions to the GALL Report

The applicant stated, in the PNPS LRA, that the exception to the GALL Report program elements is as follows:

Exception 1

Elements: 3: Parameters Monitored/Inspected
4: Detection of Aging Effects

Exception: MEB enclosure assemblies will be inspected in addition to internal surfaces.

The GALL Report identified the following recommendations for the "Parameters Monitored/Inspected" and "Detection of Aging Effects" program elements associated with the exception taken:

> **Parameters Monitored/Inspected:** A sample of accessible bolted connections will be checked for loose connection. Alternatively, bolted connections covered with heat shrink tape, sleeving, insulating boots, etc., may be visually inspected for insulation material surface anomalies. This program provides for the inspection of the internal portion of the MEBs for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulation will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The internal bus supports will be inspected for structural integrity and signs of cracks.
>
> **Detection of Aging Effects:** A sample of accessible bolted connections will be checked for loose connection by using thermography or by measuring connection resistance using a low-range ohmmeter. MEB internal surfaces will be visually inspected for aging degradation of insulating material and for foreign debris and excessive dust buildup, and evidence of moisture intrusion. Bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports will be visually inspected for structural integrity and signs of cracks. This program will be completed before the period of extended operation and every 10 years thereafter provided visual inspection is not used to check bolted connections. A 10-year inspection interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. This is an adequate period to preclude failures of the MEBs since experience has shown that aging degradation is a slow process.
>
> As an alternative to thermography or measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulating boots, etc., the applicant may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination. When this alternative visual inspection is used to check bolted connections, the first inspection will be completed before the period of extended operation and every five years thereafter.

The applicant stated in the PNPS LRA, under Exception Note 1, that inspection of MEB enclosure under the Metal-Enclosure Bus Inspection Program assures that effects of aging will be identified prior to loss of intended functions.

GALL (NUREG-1801, Rev. 1, Section VI, Items VI.A-12 and VI-13) refereed structure monitoring program for inspecting the external of MEB for loss of material due to general

corrosion and inspecting the enclosure seals for hardening and loss of strength due to elastomers degradation. In LRA, Section B.1.18, the applicant stated that the program attribute of MEB inspection program would be consistent with the program attribute in NUREG-1801, Section XI.E4 with an exception. The exception is to inspect MEB enclosure assemblies in addition to internal surfaces using the MEB inspection program. The project team asked the applicant if the enclosure seals were included in the scope of MEB inspection program and what was the acceptance criteria for inspecting the external of enclosure assemblies. In its response, the applicant stated that the PNPS MEB program will visually inspect the enclosure assemblies for evidence of loss of material and enclosure assembly elastomers will be visually inspected and manually flexed. The applicant will revise LRPD-02 to read as follows:

(Section 3.3.B.6.b - Acceptance Criteria - add after first paragraph)

> The acceptance criteria for enclosure assemblies will be no loss of material due to general corrosion. The acceptance criteria for elastomers will be no hardening and loss of strength due to degradation.

The project team found that the applicant's response acceptable because it will inspect external of MEB including seals and the acceptance criteria for the inspecting the components of external of MEB will be provided in the plant's basis document (LRPD). The project team verified that LRPD-02 was revised as described. On this basis, the project team found this exception acceptable.

Exception 2

Elements: 4: Detection of Aging Effects

Exception: MEB bolted connections will be visually inspected every 10 years, rather than every five years as stated in NUREG-1801.

The GALL Report identified the following recommendation for the "Detection of Aging Effects" program element associated with the exception taken:

> **Detection of Aging Effects:** A sample of accessible bolted connections will be checked for loose connection by using thermography or by measuring connection resistance using a low-range ohmmeter. MEB internal surfaces will be visually inspected for aging degradation of insulating material and for foreign debris and excessive dust buildup, and evidence of moisture intrusion. Bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports will be visually inspected for structural integrity and signs of cracks. This program will be completed before the period of extended operation and every 10 years thereafter provided visual inspection is not used to check bolted connections. A 10-year inspection interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. This is an adequate period to preclude failures of the MEBs since experience has shown that aging degradation is a slow process.

> As an alternative to thermography or measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulating boots, etc., the applicant may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination. When this alternative visual inspection is used to check bolted connections, the first inspection will be completed before the period of extended operation and every five years thereafter.

The applicant stated, in the PNPS LRA, under Foot Note 2 that in NUREG-1801 for the other inspections, a 10 year inspection interval will provide two data points during a 20-year period, which can be used to characterize the degradation rate. This is an adequate period to preclude failures of the MEBs since experience has shown that aging degradation is slow process.

GALL AMP XI.E4 states that as an alternate to thermography or measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulated boots, etc; the applicant may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination. When this alternate visual inspection is used to check bolted connections, the first inspection will be completed before the period of extended operation and every five years thereafter. Since the visual inspection is less effective than testing, this inspection (visual) is to be performed once every five years instead of once every ten years. In the LRA, the applicant stated that visual inspection of MEB bolted connections will occur every ten years. The project team asked the applicant if all bolted connections are covered with heat shrink tape, sleeving, or insulated boots and if it does, it requested the applicant to justify the 10 years inspection frequency vs. the five years as recommended by GALL XI.E4. In its response, the applicant stated that sine MEB bolted connections are covered with heat shrink tape or insulating boots per manufacturer's recommendations, a sample of accessible bolted connections will be visually inspected for insulation material surface anomalies. Internal portions of the MEBs will be inspected for cracks, corrosion, foreign debris, excessive bust buildup, and evidence of water intrusion. Bus insulation will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports will be inspected for structural integrity and signs of cracking. An inspection will occur before the initial 40-year license term and every 5-years thereafter. If degradation is found in the MEB materials, an engineering evaluation will be performed when the inspection acceptance criteria are not met in order to ensure that the intended functions of the MEB can be maintained consistent with the current license basis. This evaluation is performed in accordance with the Entergy correction process per procedure EN-LI-102. This procedure provides the stated elements to consider including the extend of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective action required, and likelihood of recurrence. This engineering evaluation will determine the frequency of the next inspection, which will not exceed 5 years. In addition, the applicant also responded that it will revise LRA Section A.2.1.20 to "5 years". The applicant will revise LRA Appendix B.1.18 to remove the exception to 5 years. On this basis, the project team found the applicant response acceptable. In a letter dated July 19, 2006, the applicant revised LRA Section A.2.1.20 and Section B.1.18 as described above.

3.0.3.2.12.4 Enhancements

None.

3.0.3.2.12.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Metal-Enclosed Bus Inspection Program at PNPS is a new program for which there is no operating experience.

GALL XI.E4 indicates that operating experience has shown that degradation of MEB within the scope of XI.E4 may exist. The project team requested the applicant to provide industrial and plant operating experience associated with this program. In its response, the applicant stated that the Metal-Enclosed Bus Inspection program is a new program. Plant and industry operating experience will be considered when developing this program. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. PNPS plant-specific operating experience is consistent with the operating experience in the NUREG-1801 program description

The PNPS program is based on the program description in NUREG-1801, which in turn is based on relevant industry operating experience. As such, operating experience provides reasonable assurance that effects of aging will be managed such that applicable component will continue perform their intended functions consistent with the current licensing basis for the period of extended operation. The team found the applicant response acceptable because the applicant has reviewed the plant specific operating experience against the industry experience identified in GALL Report. As additional operating experience is obtained, lesson learned can be used to adjust the program elements.

Operating experience at VY is controlled by procedure EN-OP-100, Operating Experience Program. The program includes the following components: Operating experience - Information received from various industry sources that describes events, issues, equipment failures, that may represent opportunities to apply lessons learned to avoid negative consequences or to recreate positive experience as applicable. Internal operating experience - Operating experience (OE) that originates as a condition report or request from plant personnel which warrants consideration for possible Entergy-wide distribution. Internal OE can originate from any Entergy plant or headquarters. Impact Evaluation - Analysis of an OE event or problem that requires additional information and research to determine impact or potential impact, as it relates to plant condition and/or configuration. Impact evaluation are typically documented with a condition report. Condition report action items and corrective actions are used to confirm program effectiveness and to modify the program as needed.

The project team also reviewed the basis document LRPD-05 to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concluded that the applicant's Metal-Enclosed Bus Inspection Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.2.12.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Metal-Enclosed Bus Inspection Program in PNPS LRA, Appendix A, Section A.2.1.20, which states that under the Metal-Enclosed Bus

Inspection Program, internal portions of the nonsegregated phase bus which connects the 4.16kV switchgear (A3 through A6) are inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. Bus insulation is inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. Internal bus supports are inspected for structural integrity and signs of cracks. Since bolted connections are covered with heat shrink tape or insulating boots per manufacturer's recommendations, a sample of accessible bolted connections is visually inspected for insulation material surface anomalies. Enclosure assemblies are visually inspected for evidence of loss of material and, where applicable, enclosure assembly elastomers are visually inspected and manually flexed to manage cracking and change in material properties. These inspections are performed at least once every 10 years.

As described above, the applicant will revise the inspection frequency described in UFSAR supplement, Appendix A.2.1.20 to "5 years". The project team reviewed the proposed revised UFSAR Supplement for PNPS AMP B.1.18, and determined that it provides an adequate summary description of the program as required by 10 CFR 54.21(d). In a letter dated July 19, 2006, the applicant revised LRA Appendix A.2.1.20 to change the inspection frequency to at least once every 5 years. Also, in this letter, the applicant provide a list of commitment. In Commitment Number 14, the applicant will implement the Metal-Enclosed Inspection Program as described in LRA Section B.1.18 by June 8, 2012

3.0.3.2.12.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team found that those program elements for which the applicant claims consistency with the GALL Report, are consistent with the GALL Report. In addition, the project team has reviewed the exception and the associated justifications and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the UFSAR Supplement for this AMP and found that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 NON-EQ INSULATED CABLES AND CONNECTIONS PROGRAM (PNPS AMP B.1.21)

In PNPS LRA, Appendix B, Section B.1.21, the applicant stated that PNPS AMP B.1.21, "Non-EQ Insulated Cables and Connections Program," is an existing plant program that is consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

3.0.3.1.7.1 Program Description

The applicant stated, in the PNPS LRA, that this 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 cables or connections.

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.

3.0.3.1.7.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.21 is consistent with GALL AMP XI.E1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report PNPS AMP B.1.21, including LRPD-02, Revision 1, Section 3.6, "Non-EQ Insulated Cables and Connections Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E1. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.21 and associated bases documents to determine consistency with GALL AMP XI.E1.

Also, the project team reviewed AMRE-01, Rev. 2, Electrical Screening and Aging Management Reviews and LRPD-05, Rev. 0, Operating Experience Review Results.

During the audit and review, the project team noted that GALL XI.E1 under program description states that the program described herein is written specifically to address cables and connections at plants whose configuration is such that most (if not all) cables and connections installed in adverse localized environments are accessible. This program, as describe, can be thought of as a sampling program. Selected cables and connections from accessible areas (the inspection sample) are inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connection. In PNPS AMP B.1.21 under the same element, it states that a representative

sample of accessible insulated cables and connections, within the scope fo license renewal, will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The project team requested the applicant to explain the technical basis for cable sampling. In its response, the applicant stated that the LRA Appendix B.1.19 program description will be changed to read as follow:

> This program addresses cables and connections at plants whose configuration is such that most cables and connections installed in adverse localized environments are accessible. This program can be thought of as a sampling program. Selected cables and connections from accessible areas will be inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspecting sample, a determination will be made as to whether the same condition or situation is applicable to other accessible cables or connections. The sample size will be increased based on an evaluation per the corrective program.

The project team found the applicant's response acceptable because it provided the technical basis for cable sampling; these basis are consistent with GALL Report. In a letter dated July 19, 2006, the applicant revised LRA Section B.1.21 as described above.

GALL XI.E1 under the scope of program states that the inspection program applies to accessible electrical cables and connections within the scope of license renewal that are *installed in adverse localized environment caused by heat or radiation in the presence of* oxygen. PNPS LRPD-02, Section 3.6, under the same element states that this program will include accessible insulated cables and connections installed in structures within the scope of license renewal and prone to adverse localized environments. It was not clear to the project team if the scope of the program only includes insulated cables and connections installed within scope structures located in an adverse localized environment or insulated cables and connections installed within the scope of license renewal that are installed in adverse localized environments. The team requested the applicant to explain what "in a structure" meant and why structures were included in the scope of non-EQ cables and connections AMP. In its response, the applicant stated that "in a structure" means inside the plant not outside. The LRPD-02 Section 3.6.B.1.b - Scope of Program will be revised to state that the 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. The team found the applicant's response acceptable because it is consistent with the scope of GALL XI.E1 and it will remove the confusion as described above. The project team verified that the applicant revised the LRPD-02 Rev. 2 to incorporated the changes.

The project team reviewed those portions of the applicant's "Non-EQ Insulated Cables and Connections Program for which the applicant claims consistency with GALL AMP XI.E1 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's "Non-EQ Insulated Cables and Connections Program provided reasonable assurance that aging effects of cables and connectors within the scope of license renewal exposed to adverse localized environments due to temperature, moisture, or radiation with the presence of oxygen will be managed to be consistent with CLB during extended period of operation. The project team found the applicant's "Non-EQ Insulated Cables and Connections Program" acceptable because it conforms to the recommended GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualifications Requirements."

3.0.3.1.7.3 Exceptions to the GALL Report

None.

3.0.3.1.7.4 Enhancements

None.

3.0.3.1.7.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Non-EQ Insulated Cables and Connections Program at PNPS is a new program for which there is no operating experience.

GALL AMP XI.E1 indicated that operating experience had shown that degradation of cables and connection within the scope of XI.E1 may exist. Operating experience has shown that adverse localized environments caused by heat or radiation for electrical cables and connection 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. The project team requested the applicant to provide industrial and plant operating experience for this program. In its response, the applicant stated that the non-EQ Insulated Cables and Connections Program at PNPS is a new program. Industry and plant-specific operating experience will be considered in the development of this program. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. PNPS plant-specific operating experience is consistent with the operating experience in the NUREG-1801 program description.

The PNPS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience. As such, the operating experience used for implementation of the Non-EQ Insulated Cables and Connection Program will provide reasonable assurance that effects of aging will be managed such that applicable component will continue perform their intended functions consistent with the current licensing basis for the period of extended operation. The team found the applicant response acceptable because the applicant has reviewed the plant specific operating experience against the industry experience identified in GALL. As additional operating experience is obtained, lesson learned can be used to adjust the program elements. In a letter dated July 19, 2006, the applicant revised LRA Appendix B.1.21 operating experience as described above.

The project team also reviewed basis document LRPD-05 to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The project team found that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concluded that the applicant's Non-EQ Insulated Cables and Connections Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.7.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Non-EQ Insulated Cables and Connections Program in PNPS LRA, Appendix A, Section A.2.1.23, which states that the Non-EQ Insulated Cables and Connections Program provides 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 in adverse localized environments is visually inspected at least once every 10 years for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.21, and determined that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

In a letter dated July 19, 2006, the applicant provide a list of commitment. In Commitment 17, the applicant will implement the Non-EQ Insulated Cables and Connections Program as described in LRA Section B.1.21 by June 8, 2012.

3.0.3.1.7.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the UFSAR Supplement for this program, the project team found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 NON-EQ INACCESSIBLE MEDIUM-VOLTAGE CABLE PROGRAM (PNPS AMP B.1.19)

In PNPS LRA, Appendix B, Section B.1.19, the applicant stated that PNPS AMP B.1.19, "Non-EQ Inaccessible Medium-Voltage Cable Program," is a new plant program that will be consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

3.0.3.1.5.1 Program Description

The applicant stated, in the PNPS LRA, that periodic actions will be taken in the program 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 exposed to significant moisture and voltage will be tested at least once every 10 years 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.

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

3.0.3.1.5.2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.19 is consistent with GALL AMP XI.E3.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.19, including LRPD-02, Rev. 1, Section 3.4 "Non-EQ Inaccessible Medium-Voltage Cable Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E3. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.19 and associated bases documents to determine consistency with GALL AMP XI.E3.

Also, the project team reviewed AMRE-01, Rev. 2, Electrical Screening and Aging Management Reviews.

During the audit and review, the project team noted that GALL XI.E3 under detection of aging effects recommended that the inspection for water collection should be performed based on actual plant experience with water accumulation in the manholes. However, the inspection frequency should be at least once every two years. The PNPS non-EQ inaccessible medium-voltage cable program, under the same attribute, states that inspection for water collection in cable manholes and conduit occur at least once every two years. The team requested the applicant to explain how operating experience is considered in manhole inspection frequency. In its response, the applicant stated that LRPD-02 will be revised to include the following:

> The inspection will be based on actual plant experience with water accumulation in the manholes and the frequency of inspection will be adjusted based on the results of the evaluation, but the frequency will be at least once every two years.

The team found the applicant's response acceptable because the criteria for inspection for water collection in the manholes will be based on actual plant experience with water

accumulation. This criteria is consistent with GALL's. The project team verified that LRPD-02 Rev. 2 was revised to reflect the change as described above.

GALL XI.E3 under scope of program defines significant moisture as periodic exposure to moisture that last less than few days (e.g., cable in standing water). Significant voltage exposure is defined as being subject to system voltage for more than twenty-five percent of the time. PNPS LRPD-02, Rev. 1, under same attribute, states that this program will include inaccessible (i.e., in conduit or direct buried) medium-voltage cable within the scope of license renewal that are exposed to significant moisture simultaneously with applied voltage. It did not define what is the significant voltage and moisture. In addition, AMRE-01, Rev. 2, Section 3.4.1.5, Non-EQ Inaccessible Medium-Voltage Cable Screening, states that the cable that are susceptible to water treeing are those exposed to significant moisture (submerged for years). The team requested the applicant to revise the AMP B.1.19 basis document to be consistent with GALL's scope or explain how inaccessible medium-voltage exposed significant moisture more than few days and less than few years is not susceptible to water tree. In its response, the applicant stated that it would revise the LRPD as follows:

> 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 exposure to moisture that last more than a few days (e.g., cable in standing water). Periodic exposure to moisture that lasts 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 team found the applicant's response acceptable because the scope of the program is consistent with GALL's. The project team verified that LRPD-02 Rev. 2 was revised as described above.

Under program description, GALL states that periodic actions such as inspecting for water collection in cable manholes, and draining water, as needed to prevent cable from being exposed to significant moisture. The above actions are not sufficient to assure water is not trapped elsewhere in raceways. In addition to above periodic actions, in-scope medium-voltage cables are tested to provide and indication of the condition of the conductor insulation. PNPS LRPD, under the same attribute, stated that periodic actions will be taken to prevent cables from being expose to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In-scope medium-voltage cable exposed to significant moisture and voltage will be tested to provide an indication of the conductor insulation. The team requested the applicant to confirm that the intend of the AMP is to inspect for water in manholes and to test all in-scope medium-voltage cables. In its response, the applicant confirmed that the intent of the PNPS is to inspect for water in manholes and to test all of the in-scope medium-voltage cables.

The team also asked the applicant if the plant currently inspects water in the manholes and if there are any existing procedures for inspecting manholes. If it does, the project team requested the applicant to provide a copy of these procedures. In its response, the applicant stated that although not a formal procedure, PNPS has an existing repetitive task and job plan for inspecting manholes. The applicant committed to develop a formal procedure to inspect manholes for in-scope medium voltage cable. In a letter dated July 19, 2006 (ML....), the applicant provided a list of commitments. Commitment Number 15 on the commitment list

identifies this item. Also, the applicant will revise LRPD-02, Section 3.4.B.10 - Operating Experience to discuss the process for considering plant operating experience plant operating experience that will be used during implementation of the Non-EQ Medium-Voltage Cable Program. The project team found the applicant's response acceptable because the applicant currently inspect manholes for water collection in the manholes and committed to develop a formal procedure to prevent cables from being exposed to significant moisture. The project team verified LRPD-02 was revised as stated above.

GALL XI.E3 defines medium-voltage is from 2 kV to 35 kV . AMRE-01, Rev. 2, Aging Management Review Report Electrical, lists medium voltage cables from 2 kV to 23 kV. The project team requested the applicant to provide the definition of medium-voltage cable in the LRA to be consistent with GALL or provide a justification of why water tree (the effects of significant moisture to energized medium-voltage cables) is not applicable to inaccessible medium-voltage cable greater than 23 kV. In its response, the applicant stated that LRA Appendix B.1.19 will be revised to define medium-voltage cables as follows:

- In scope medium-voltage includes cable with operating voltage from 2 kV to 35 kV.

The team found the applicant's response acceptable because the definition of medium voltage is consistent with the GALL Report. In a letter dated July 19, 2006 the applicant revised LRA Section B.1.19 program description as described above.

Under parameters monitored/inspected, GALL states that 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 test, or polarization index, as described in EPRI TR-103834-P1, or other testing that is state-of-the-art at the time the test is performing. PNPS LRPD under the same attribute only stated that the specific type of test performed will be determined prior to the initial test. The project team requested the applicant to revise the LRPD to be consistent with GALL or explain how it ensured that the test to be performed would be in accordance with industrial guideline. In its response, the applicant stated that LRPD-02 Section 3.4.B. 3.b will be revised to read the specific type of test to be 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 as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. The project team found the applicant's response acceptable because the test to be performed will be in accordance with industry guideline. The project team verified that LRPD-02 Rev. 2 was revised as described above.

The electrical screening and aging management reviews (AMRE-01) provides a list of in-scope inaccessible medium-voltage cables. However, it does not include the service water cables. The project team requested the applicant to explain why these cables are not in-scope of the non-EQ inaccessible medium-voltage cable AMP. In its response, the applicant stated that since medium-voltage cables are defined as 2 kV to 35 kV, the service water cables are not in scope because they run on a system voltage of 480 V. The project team found the applicant's response acceptable because the system voltage of 480 V is not considered medium-voltage and therefore, the service water cables are not in-scope of the non-EQ inaccessible medium-voltage AMP.

The project team reviewed those portions of the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program for which the applicant claims consistency with GALL

AMP XI.E3 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program at PNPS 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 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 addition, in scope medium-voltage cables exposed to significant moisture and voltage will be tested at least once every 10 years 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 will be in accordance with industry guideline.

The program will be initiated prior to the period of extended operation. The Non-EQ Inaccessible Medium-Voltage Cable Program provided reasonable assurance that the aging effects of inaccessible medium-voltage cables due to significant moisture and voltage will be managed and that the in-scope components will continue to perform their intended function for the period of extended operation. The project team found the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program acceptable because it conforms to the recommended GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

3.0.3.1.5.3 Exceptions to the GALL Report

None.

3.0.3.1.5.4 Enhancements

None.

3.0.3.1.5.5 Operating Experience

In the LRA, the applicant stated that Non-EQ Inaccessible Medium-Voltage Cable Program at PNPS is a new program for which there is no operating experience. GALL XI.E3 indicates that operating experience has shown that degradation of cables and connections within the scope of XI.E3 may exist. 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 tree 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. The project team requested the applicant to provide industrial and plant operating experience for this program. In its response, the applicant stated that LRA Section B.1.19 will be revised to state that the non-EQ Inaccessible Medium-Voltage Cable Program at PNPS is a new program. Industry and plant-specific operating experience will be considered in the development of this program. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. PNPS plant-specific operating experience is consistent with the operating experience in the NUREG-1801 program description.

The PNPS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience. As such, the operating experience used for implementation of

the Non-EQ Inaccessible Medium-Voltage Cable program will provide reasonable assurance that effects of aging will be managed such that applicable component will continue perform their intended functions consistent with the current licensing basis for the period of extended operation. The team found the applicant response acceptable because the applicant has reviewed the plant specific operating experience against the industry experience identified in GALL. As additional operating experience is obtained, lesson learned can be used to adjust the program elements. In a letter dated July 19, 2006 the applicant revised LRA Section B.1.19 operating experience as described above.

Operating experience at PNPS is controlled by procedure EN-OP-100, Operating Experience Program. The program includes the following components: Operating experience - Information received from various industry sources that describes events, issues, equipment failures, that may represent opportunities to apply lessons learned to avoid negative consequences or to recreate positive experience as applicable. Internal operating experience - Operating experience (OE) that originates as a condition report or request from plant personnel which warrants consideration for possible Entergy-wide distribution. Internal OE can originate from any Entergy plant or headquarters. Impact Evaluation - Analysis of an OE event or problem that requires additional information and research to determine impact or potential impact, as it relates to plant condition and/or configuration. Impact evaluation are typically documented with a condition report. Condition report action items and corrective actions are used to confirm program effectiveness and to modify the program as needed.

The project team also reviewed basis document LRPD-05 and confirmed that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The project team found that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concluded that the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.5.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Non-EQ Inaccessible Medium-Voltage Cable Program in PNPS LRA, Appendix A, Section A.2.1.21, which states that in scope medium-voltage cables, not designed for, but exposed to significant moisture and voltage are tested at least once every 10 years to provide an indication of the condition of the conductor insulation. The specific test performed is a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed. Significant moisture is defined as periodic exposures that last more than a few days. Significant voltage exposure is defined as being subjected to system voltage for more than 25 percent of the time.

Inspections for water collection in cable manholes and conduit occur at least once every two years. In a letter dated July 19, 2006 (ML...), the applicant provided a list of commitment. In Commitment Number 15, the applicant committed to implement the Non-EQ Inaccessible

Medium-Voltage Cable Program as describe in LRA Section B.1.19 including developing a formal procedure to inspect manholes for in-scope medium voltage cable by June 8, 2012.

The project team reviewed the UFSAR Supplement for PNPS AMP B.1.19, and determined that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the UFSAR Supplement for this program, the project team found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 NON-EQ INSTRUMENTATION CIRCUITS TEST REVIEW PROGRAM (PNPS AMP B.1.20)

In PNPS LRA, Appendix B, Section B.1.20, the applicant stated that PNPS AMP B.1.20, "Non-EQ Instrumentation Circuits Test Review Program," is a new plant program that is consistent with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

3.0.3.1.6.1 Program Description

The applicant stated, in the PNPS LRA, that this 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.

3.0.3.1.6 2 Consistency with the GALL Report

In PNPS LRA, the applicant stated that PNPS AMP B.1.20 is consistent with GALL AMP XI.E2.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNPS AMP B.1.20, including LRPD-02, Section 3.5, "Non-EQ Instrumentation Circuits Test Review Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.E2. Specifically, the project team reviewed the program elements (see Section 3.0.2.1 of this audit and review report) contained in PNPS AMP B.1.20 and associated bases documents to determine consistency with GALL AMP XI.E2.

Also, the project team reviewed AMRE-01, Rev. 2, Electrical Screening and Aging Management Reviews and LRPD-05, Rev. 0, Operating Experience Review Results.

During the audit and review, the project team noted that GALL XI.E2 recommends that the test frequency shall be determined by the applicant based on engineering evaluation, but the test frequency shall be at least once every ten years. In PNPS LRPD-02 Section 3.5, under the same attribute, states that for neutron flux monitoring system cables that are disconnected during instrument calibration, testing is performed at least once every ten years. The project team requested the applicant to explain how engineering evaluation is considered in the test frequency. In its response, the applicant stated that to clarify that the PNPS AMP is consistent with GALL recommendation, LRPD-02 will be revised as follows:

> The first test of neutron monitoring system cables that are disconnected during instrument calibrations shall be completed before the period of extended operation and subsequent tests will occur at least every ten years. In accordance with the corrective action program, an engineering evaluation will be performed when test acceptance criteria are not met and corrective actions, including modified inspection frequency, will be implemented to ensure that the intended functions of the cables can be maintained

consistent with the current license basis (CLB) for the period of extended operation.

The project team found the applicant's response acceptable because testing frequency will be at least once every ten years and modified testing frequency based on an engineering evaluation will be implemented when acceptance criteria is not met, to ensure intended functions of the cables can be maintained consistent with the CLB. This action is consistent with the intend of GALL AMP XI.E2 in regard to testing frequency. The project team verified that the applicant revised the LRPD-02 Rev. 2 to incorporated this change.

The scope of GALL AMP XI.E2 applies to cable system (cables and connections). The project team requested the applicant to confirm that the test include both cables and connections. In its response, the applicant confirmed that the non-EQ instrumentation circuits test review program includes both cables and connections that are in scope of license renewal.

GALL AMP XI.E2 under scope of program states that this program applies to cable system used in circuits with sensitive, high voltage, low-level signal such as radiation monitoring and nuclear instrumentation that are subject to an AMR. PNPS LRPD-02, Section 3.5 under the same attribute states that this program will include non-EQ electrical cables used in circuits with sensitive, high voltage, low-level signal, i.e., neutron flux monitoring instrumentation. The program did not include high-range radiation monitor cables. The project team requested the applicant to explain why high-range radiation monitor cables are not in scope of the non-EQ instrumentation circuits test review program. In its response, the applicant stated that the high-range radiation monitoring system monitors radiation levels inside containment (drywell and torus areas) during and following a design basis event. The monitors (RE 1001-606A/B and RE 1001-607A/B) are safety-related. The cables from the detectors to the cabinets in the control room are EQ and therefore, are replaced based on qualified life, so these cables are not subject to an AMR. The project team found the applicant response acceptable because the high-range radiation monitoring cables are EQ, they are not in-scope of the non-EQ instrumentation circuits test review program.

GALL XI.E2 under parameter monitored/inspected states that the parameter monitored are determined from the specific calibration, surveillance or testing performed and are based on the specific instrumentation under surveillance or being calibrated as documented in plant procedures. VY LRPD-02 Section 3.5 under same attribute states that the results from calibration or surveillance of components within the scope of license renewal will be reviewed. The parameters reviewed will be based on the specific instrumentation circuit under surveillance or being calibrated, as document in the plant calibration or surveillance procedures. The team requested the applicant to explain why the review of calibration results belong to parameter monitored/inspected attribute and why parameter for cable testing was not mentioned. The team also requested the applicant to confirm that cable testing will be performed on in-scope cables disconnected during instrument calibration. In its response, the applicant stated that LRPD-02 Section 3.5.B.3.b - Parameters Monitored/Inspected) will be revised (replace 2nd sentence) to read as follows:

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

The applicant also confirmed that cable testing is performed by plant procedures on cables in-scope of XI.E2 that are disconnected during instrument calibration.

The team verified that the applicant incorporated this change in LRPD-02. The team found the applicant's response acceptable because the revised program parameter monitored/inspected was consistent with GALL XI.E2.

The project team reviewed those portions of the applicant's Non-EQ Instrumentation Circuits Test Review Program for which the applicant claims consistency with GALL AMP XI.E2 and found that they are consistent with this GALL Report AMP. On the basis of its review, the project team concluded that the applicant's Non-EQ Instrumentation Circuits Test Review Program provided reasonable assurance that instrument cables exposed to adverse localized equipments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation.. The project team found the applicant's Non-EQ Instrumentation Circuits Test Review Program acceptable because it conforms to the recommended GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

3.0.3.1.6 3 Exceptions to the GALL Report

None.

3.0.3.1.6 4 Enhancements

None.

3.0.3.1.6.5 Operating Experience

The applicant stated, in the PNPS LRA, that the Non-EQ Instrumentation Circuits Test Review Program at PNPS 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.

GALL AMP XI.E2 indicates that operating experience has shown that degradation of cables and connections within the scope of XI.E2 may exist. Operating experience has identified a case where a change in temperature across a high range 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. The project team requested the applicant to provide industrial and plant operating experience for this program. In its response, the applicant stated that LRA Section B.1.20 will be revised to state that the non-EQ Instrumentation Circuits Test Review Program at PNPS is a new program. Industry and plant-specific operating experience will be considered in the development of this program . Industry operating experience that form the basis for the program is described in the operating experience of the NUREG-1801 program description. PNPS plant-specific operating experience is consistent with operating experience in the NUREG-1801 program description.

The PNPS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience. As such, the operating experience used for

implementation of the Non-EQ Instrumentation Circuits Test Review Program will provide reasonable assurance that effects of aging will be managed such that applicable component will continue perform their intended functions consistent with the current licensing basis for the period of extended operation. The team found the applicant response acceptable because the applicant has reviewed the plant specific operating experience against the industry experience identified in GALL. As additional operating experience is obtained, lesson learned can be used to adjust the program elements. In a letter dated July 19, 2006, the applicant revised the LRA Appendix B.1.20 operating experience as described above.

Operating experience at PNPS is controlled by procedure EN-OP-100, Operating Experience Program. The program includes the following components: Operating experience - Information received from various industry sources that describes events, issues, equipment failures, that may represent opportunities to apply lessons learned to avoid negative consequences or to recreate positive experience as applicable. Internal operating experience - Operating experience (OE) that originates as a condition report or request from plant personnel which warrants consideration for possible Entergy-wide distribution. Internal OE can originate from any Entergy plant or headquarters. Impact Evaluation - Analysis of an OE event or problem that requires additional information and research to determine impact or potential impact, as it relates to plant condition and/or configuration. Impact evaluation are typically documented with a condition report. Condition report action items and corrective actions are used to confirm program effectiveness and to modify the program as needed.

The project team also reviewed the basis document LRPD-05 to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The project team found that the corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and incorporated in the future to provide objective evidence to support the conclusion that the effects of aging are adequately managed.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concluded that the applicant's Non-EQ Instrumentation Circuits Test Review Program will adequately manage the aging effects that are identified in the PNPS LRA for which this AMP is credited.

3.0.3.1.6.6 UFSAR Supplement

The applicant provided its UFSAR Supplement for the Non-EQ Instrumentation Circuits Test Review Program in PNPS LRA, Appendix A, Section A.2.1.22, which states that the program calibration or surveillance results for non-EQ electrical cables in circuits with sensitive, high voltage, low-level signals; (i.e., neutron flux monitoring instrumentation); are reviewed. Most neutron flux monitoring system cables and connections are calibrated as part of the instrumentation loop calibration at the normal calibration frequency, which provides sufficient indication of the need for corrective actions based on acceptance criteria related to instrumentation loop performance. The review of calibration results is performed once every 10 years.

For neutron flux monitoring system cables that are disconnected during instrument calibrations, testing is performed at least once every 10 years using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests, or time domain

reflectometry).

The project team reviewed the UFSAR Supplement PNPS AMP B.1.20, and determined that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

In a letter dated July 19, 2006, the applicant provided a list of commitment. Under Commitment 16, the applicant will implement the Non-EQ Instrumentation Circuit Test Review Program as described in LRA Section B.1.20 by June 8, 2006.

3.0.3.1.6.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team found that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the UFSAR Supplement for this program, the project team found that it provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.6 Aging Management of Electrical Components

This section of the audit and review report document the project team's review and evaluation of PNPS aging management review (AMR) results for the aging management of the electrical component and component groups associated with the following systems:

- high voltage insulators
- insulated cables and connectors
- phase bus
- switchyard bus

3.6.1 Summary of Technical Information in the Application

In the PNPS LRA Section 3.6, the applicant provided the results of its AMRs for the electrical components and component groups.

In PNPS LRA Table 3.6.1, "Summary of Aging Management Evaluations for the Electrical Components and I&C Components Evaluated in Chapter VI of NUREG-1801," the applicant provided a summary comparison of its AMR line-items with the AMR line-items evaluated in the GALL Report for the electrical components and component groups. The applicant also identified for each component type in the PNPS LRA Table 3.6.1 those components that are consistent with the GALL Report, those for which the GALL Report recommends further evaluation, and those components that are not addressed in the GALL Report together with the basis for their exclusion.

In the PNPS LRA Table 3.6.2-1 the applicant provided a summary of the AMR results for component types associated with (1) high voltage insulators, (2) insulated cables and connectors, (3) phase bus, and (4) switchyard bus. Specifically, the information for each component type included intended function, material, environment, aging effect requiring management, AMPs, the GALL Report Volume 2 item, cross reference to the PNPS LRA Table 3.6.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effect requiring managements (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Project Team Evaluation

The project team reviewed PNPS LRA Section 3.6 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the electrical components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team reviewed certain identified AMR line-items to confirm the applicant's claim that these AMR line-items were consistent with the GALL Report. The project team did not repeat its review of the matters described in the GALL Report. However, the project team did verify that the material presented in the PNPS LRA was applicable and that the applicant had identified the appropriate GALL

Report AMR line-items. The project team's audit evaluation is documented in Section 3.6.2.1 of this audit and review report. In addition, the project team's evaluations of the AMPs are documented in Section 3.0.3 of this audit and review report.

The project team reviewed those selected AMR line-items for which further evaluation is recommended by the GALL Report. The project team confirmed that the applicant's further evaluations were in accordance with the acceptance criteria in SRP-LR. The project team's audit evaluation is documented in Section 3.6.2.2 of this audit and review report.

The project team also reviewed of the remaining AMR line-items that were not consistent with or not addressed in the GALL Report based on NRC-approved precedents. The audit included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The project team's evaluation is documented in Section 3.6.2.3 of this audit and review report.

Finally, the project team reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the electrical components.

Table 3.6-1 below provides a summary of the project team's evaluation of components, aging effects/aging mechanisms, and AMPs listed in LRA Section 3.6 that are addressed in the GALL Report. It also includes the section of the audit and review report in which the project team's evaluation is documented.

Table 3.6-1 Staff Evaluation for Electrical Components in the GALL Report

Item No.	Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
3.6.1-1	Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	TLAA B.1.11	Consistent with GALL, which recommends further evaluation (See Section 3.6.2.2.1
3.6.1-2	Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements	B.1.21	Consistent with GALL (See Section 3.6.2.1)
3.6.1-3	Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables And Connections Used In Instrumentation Circuits Not Subject To 10 CFR 50.49 EQ Requirements	B.1.20	Consistent with GALL (See Section 3.6.2.1)

3.6.1-4	Conductor insulation for inaccessible medium voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	B.1.19	Consistent with GALL (See Section 3.6.2.1)
3.6.1-5	PWR Only				
3.6.1-6	Fuse Holders (Not Part of a Larger Assembly): Fuse holders - metallic clamp	Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders	None	Not consistent with GALL (see Section 3.6.2.3)
3.6.1-7	Metal enclosed bus - Bus/connection	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	B.1.18	Consistent with GALL (See Section 3.6.2.1)
3.6.1-8	Metal enclosed bus - Insulation/ insulators	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	B.1.18	Consistent with GALL (See Section 3.6.2.1)
3.6.1-9	Metal enclosed bus - Enclosure assemblies	Loss of material due to general corrosion	Structures Monitoring Program	B.1.18	Consistent with GALL on material, environment, and aging effects but different program is credited. See Section 3.6.2.1)
3.6.1-10	Metal enclosed bus - Enclosure assemblies	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	B.1.18	Consistent with GALL on material, environment, and aging effects but different program is credited. See Section 3.6.2.1)
3.6.1-11	High voltage insulators	Degradation of insulation quality due to presence of any salt deposits and surface contamination; Loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	None	Consistent with GALL, which recommends further evaluation (See Section 3.6.2.2.2)

3.6.1-12	Transmission conductors and connections; switchyard bus and connections	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; *increased resistance* of connection due to oxidation or loss of preload	A plant-specific aging management program is to be evaluated	None	Consistent with GALL, which recommends further evaluation (See Section 3.6.2.2.2)
3.6.1-13	Cable Connections - Metallic parts	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	None	Not consistent with GALL (See Section 3.6.2.3

3.6.2.1 AMR Results That Are Consistent with The GALL Report

Summary of Information in the Application

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNPS LRA is acceptable.

In PNPS LRA Section 3.6.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the (1) insulated cables and connectors, and (2) phase bus:

- Metal-Enclosed Bus Inspection Program (B.1.18)
- Non-EQ Inaccessible Medium-Voltage Cable Program (B.1.19)
- Non-EQ Instrumentation Circuits Test Review Program (B.1.20)
- Non-EQ Insulated Cables and Connections Program (B.1.21)

Project Team Evaluation

The project team reviewed its assigned PNPS LRA AMR line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the insulated cables and connectors and metal enclosed bus that are subject to an AMR.

3.6.2.1.1 *Loss of material due to general corrosion*

In the discussion section of Table 3.6.1, Item 3.6.1-9 of the PNPS LRA, the applicant stated that loss of material of metal enclosed bus - enclosure assemblies is managed by the Metal-Enclosed Bus Inspection Program. During the audit and review, the project team noted that the AMR results line that points to Table 3.6.1, Item 3.6.1-9, the applicant included a reference to Note E.

The project team reviewed the AMR results lines referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends the AMP XI.S6, "Structures Monitoring Program", the applicant has proposed the Metal-Enclosed Bus Inspection Program.

GALL (NUREG-1801, Rev. 1, Section VI, Items VI.A-12 and VI-13) refereed structure monitoring program for inspecting the external of MEB for loss of material due to general corrosion and inspecting the enclosure seals for hardening and loss of strength due to elastomers degradation. In LRA, Section B.1.18, the applicant stated that the program attribute of MEB inspection program would be consistent with the program attribute in NUREG-1801, Section XI.E4 with an exception. The exception is to inspect MEB enclosure assemblies in addition to internal surfaces using the MEB inspection program. The project team asked the applicant if the enclosure seals were included in the scope of MEB inspection program and what was the acceptance criteria for inspecting the external of enclosure assemblies. In its response, the applicant stated that the PNPS MEB program will visually inspect the enclosure assemblies for evidence of loss of material and enclosure assembly elastomers will be visually inspected and manually flexed. The applicant will revise LRPD-02 to read as follows:

(Section 3.3.B.6.b - Acceptance Criteria - add after first paragraph)

> The acceptance criteria for enclosure assemblies will be no loss of material due to general corrosion. The acceptance criteria for elastomers will be no hardening and loss of strength due to degradation.

The project team found that the applicant's response acceptable because it will inspect external of MEB including seals and the acceptance criteria for the inspecting the components of external of MEB will be provided in the plant's basis document (LRPD). The project team verified that LRPD-02 was revised as described. On this basis, the project team found this exception acceptable.

3.6.2.1.2 Hardening and loss of strength due to elastomer degradation

In the discussion section of Table 3.6.1, Item 3.6.1-10 of the PNPS LRA, the applicant stated that elastomer degradation of metal enclosed bus - enclosure assemblies is managed by the Metal-Enclosed Bus Inspection Program. During the audit and review, the project team noted that the AMR results line that points to Table 3.6.1, Item 3.6.1-9, the applicant included a reference to Note E.

The project team reviewed the AMR results lines referenced to Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends the AMP XI.S6, "Structures Monitoring Program", the applicant has proposed the Metal-Enclosed Bus Inspection Program.

As discussed in Section 3.6.2.1.1, the project team found the Metal-Enclosed Bus Inspection Program acceptable to inspect the elastomer degradation.

Conclusion

The project team has evaluated the applicant's claim of consistency with the GALL Report. The project team also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the project team found that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team found that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results For Which Further Evaluation Is Recommended By The GALL Report

Summary of Information in the Application

In PNPS LRA Section 3.6.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for transmission conductors, switchyard bus, and high voltage insulators components groups. The applicant also provided information concerning how it will manage the related aging effects.

Project Team Evaluation

For some AMR line-items assigned to the project team in the PNPS LRA Tables 3.6.1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNPS LRA Section 3.6.2.2 against the criteria provided in the SRP-LR Section 3.6.2.2. The project team's assessmentd of these evaluation are documented in this section. These assessments are applicable to each Table 2 AMR line-item in Section 3.6 citing the item in Table 1.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

PNPS LRA Section 3.6.2.2.1 is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The project team's evaluation of this TLAA is addressed separately in Section 4.4 of this audit and review report.

3.6.2.2.2 Degradation of Insulator Quality Due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material Due to Mechanical Wear

The project team reviewed PNPS LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2.

SRP-LR Section 3.6.2.2.2 states that the degradation of insulator quality due to presence of any salt deposits and surface contamination could occur in high voltage insulators. The GALL Report recommends further evaluation of a plant-specific aging management program for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high voltage insulators. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.6.2.2.2, the applicant states that high voltage insulators supporting

conductors that provide recovery of offsite power following SBO include those associated with the switchyard bus located between switchyard breakers 352-2 / 352-3 and startup transformer X4. High voltage insulators associated with this path are subject to aging management review. Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination in most areas is washed away by rain. The glazed and coated insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. PNPS is located near the seacoast where salt spray is considered. However, salt spray buildup is a short-term concern based on local weather conditions (event-driven). Under conducive weather conditions, salt buildup occurs in a matter of hours or days. Therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators at PNPS. Mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for the period of extended operation surface rust would not cause a loss of intended function and thus, is not a significant concern. Loss of material due to wear will not cause a loss of intended function of the insulators. Therefore, loss of material is not an aging effect requiring management for insulators.

The staff noted that industry operating experience has shown that the potential of loss of offsite power due to salt deposit to switchyard insulators exists. On March 17, 1993, Crystal River Unit 3 experienced a loss of the 230 kV switchyard (normal offsite power to safety-related busses) when a light rain caused arcing across salt-laden 230 kV insulators and opened breakers in switchyard. In March 1993, the Brunswick Unit 2 siwtchyard experienced a flash over of some high-voltage insulators. The incident was attributed to a winter storm in the area. Since 1982, Pilgrim station has also experienced several loss of offsite power events when ocean storms deposited salt on the 345 switchyard causing the insulator to arc to ground. In light of these industry and plant operating experience, the project team requested the applicant to provide a justification of why an AMP is not necessary. In its response, the applicant stated that as shown by operating experience cited in this question, flashover due to salt contamination of insulators is caused by events, typically storms, regardless of the age of the insulators. This is clearly not an effect of aging. Therefore, surface contamination is not an applicable aging mechanism for high-voltage insulator at PNPS. Since the condition is caused by severe weather condition unrelated to aging, an aging management program is not appropriate to address this concern. However, while salt spray buildup is a short-term concern based on local weather condition (event-driven), such buildup can cause problem with the offsite power supply system. Because of this operating experience, PNPS has applied Sylgard (RTV silicone) coating to some switchyard insulator to reduce flashover. The addition of RTV silicone to the insulator has reduced the likehood of insulator flashover. In addition, system walkdowns are performed at least one per refueling cycle and are normally performed more frequently to do a visual inspection on the switchyard high-voltage insulators that are in-scope of license renewal in accordance with EN-DC-178. These walkdowns will continue to be performed into the period of extended operation. The staff found the applicant response acceptable because visual inspection of insulator are performed by the system walkdowns. These walkdowns will detect any aging degradation due to the presence of salt deposits.

In LRA, Section 3.6.2.2.2, the applicant stated that mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for the period of extended operation surface rust would not cause a loss of intended function and thus, is not a significant concern. Loss of material due to mechanical wear caused by wind blowing on transmission conductors occurs in

high voltage insulators. The project team requested the applicant to provide a technical justification of why loss of material is not an significant aging effect requiring management at PNPS. Also, the project team requested the applicant to provide a technical justification of why surface rust would not cause a loss of intended function for high-voltage insulators if left unmanaged for the period of extended operation. In ists response, the applicant stated that loss of material due to mechanical wear is an aging effect for strain and suspension insulators if they are subject to significant movement. A possible cause for movement of the insulators is wind blowing the supported transmission conductor, allowing the conductor to swing from side to side. Although this mechanism is possible, industry experience has shown transmission conductors do not normally swing and that when they do, due to substantial wind, they do not continue to swing for very long once the wind has subsided. PNPS has no transmission conductors supported by high-voltage insulators in-scope of license renewal and therefore loss of material due to wear of high-voltage insulators is not an aging effect requiring management for the period of extended operation. Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas washed away by rain, while the glazed and coated insulator surfaces at PNPS aids in contamination removal. The applicant applied Slygard (RTV silicone) coatings to some switchyard insulators to reduce flashover. Surface contamination can be a problem in areas where there are greater concentration of airborne particles such as near any facilities that discharge soot. PNPS is not located near any facilities that produce airborne particles such as soot. Therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators at PNPS. The project team found the applicant response acceptable because PNPS has no transmission conductors supported by high-voltage insulators in-scope of license renewal. Therefore, aging effect due to mechanical wear of high-voltage insulator is not an applicable aging effect. The project team also found that surface contamination of high-voltage insulator can be a problem in areas where there are greater concentration of airborne particles such as near facilities that discharge soot. Sine PNPS is not located near any those environments, therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators at PNPS.

Regarding surface rust aging effect, the applicant responded that LRA Section 3.6.2.2.2 has a typo in the fourth paragraph. The applicant will amend the LRA to read as follows: Mechanical wear is an aging effect for strain and suspension insulator in that they are subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for period of extended operation, surface contamination would not cause a loss of intended function and thus, is not a significant concern. In a letter dated July 19, 2006, the applicant revised LRA Section 3.6.2.2.2 as described above.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.6.2.2.2 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.3 Loss of Material Due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, an Increased Resistance of Connection Due to Oxidation or Loss of Pre-Load

The project team reviewed PNPS LRA Section 3.6.2.2.3 against the criteria in SRP-LR

Section 3.6.2.2.3.

SRP-LR Section 3.6.2.2.3 states that a loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1

In the PNPS LRA Section 3.6.2.2.3, the applicant states that transmission conductors are uninsulated, stranded electrical cables used outside buildings in high voltage applications. The transmission conductor commodity group includes the associated fastening hardware, but excludes the high-voltage insulators. Major active equipment assemblies include their associated transmission conductor terminations.

The applicant also states in the LRA that transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following an SBO. However, PNPS does not utilize transmission conductors in the circuits for recovery of offsite power following an SBO. Other transmission conductors are not subject to aging management review since they do not perform a license renewal intended function. Switchyard bus is uninsulated, un-enclosed, rigid electrical conductors used in medium and high voltage applications. Switchyard bus includes the hardware used to secure the bus to high-voltage insulators. Switchyard bus establishes electrical connections to disconnect switches, switchyard breakers, and transformers to support recovery of offsite power following SBO. Connection surface oxidation for aluminum switchyard bus is not applicable since switchyard bus connections requiring AMR are welded connections. For ambient environmental conditions at PNPS, no aging effects have been identified that could cause a loss of intended function for the period of extended operation. Vibration is not applicable since flexible connectors connect switchyard bus. Therefore, there are no aging effects requiring management for aluminum switchyard bus.

The team noted that torque relaxation for bolted connection is a concern for switchyard bus connections . An electrical connection must be designed to remain tight and maintain good conductivity through a large temperature range. Meeting this design requirement is difficult if the material specified for the bolt and the conductor are different and have different rates of thermal expansion. For example, copper or aluminum bus/conductor materials expand faster than most bolting materials. If thermal stress is added to stresses inherent at assembly, the join member or fasteners can yield. If plastic deformation occurs during thermal loading (i.e., heatup) when the connection cools, the joint will be loose. EPRI document TR-104213, "Bolted Joint Maintenance & Application Guide," recommends inspection of bolted joints for evidence of overheating, signs of burning or discoloration, and indication of loose bolts. The project team requested the applicant to provide a technical discussion of why torque relaxation for bolted connection of switchyard bus is not a concern for PNPS. In its response, the applicant stated that at PNPS bus to bus connections are welded instead of bolted. Switchyard buses are connected by flexible connectors to insulator and active components. Since switchyard bus is typically under a constant load, thermal cycling that could cause torque relaxation is infrequent. With no connection to vibrating equipment, vibration is not an aging mechanism for switchyard bus. The switchyard connection to the startup transformer as part of active assembly maintained by the plant maintenance program. Therefore, torque relaxation is not an aging effects requiring management for switchyard bus. In addition, Thermography is performed at

least 6 months to maintain the integrity of the connections. This program will continue into the period of extended operation. The project team found the applicant's response acceptable because thermography is performed to detect the heat created by high resistance due to bolt loosening of switchyard bus connections. The project team reviewed Procedure No. 3.M.3-60, Infrared Thermography, and verified that switchyard bus connections to starup transformers and air circuit breakers within the scope of license renewal are inspected for bolt loosening.

The project team also noted that increased resistance of switchyard bus connections due to oxidation is a potential aging effect. The project team requested the applicant to provide a technical justification of why increased resistance of connection due oxidation is not an aging effect requiring management. In its response, the applicant stated that a potential mechanism contributing to aging of switchyard bus connection is surface oxidation, which can lead to increased contact or connection resistance. Connection surface oxidation is not significant for switchyard bus connections at PNPS since the switchyard bus connections are welded. Therefore, no aging effects due to surface oxidation are required to be managed for the period of extended operation. The connections to active devices are inspected under Maintenance Rule Program. In addition, thermography is performed at least once every 6 months to maintain the integrity of the connections. This program will continue into period of extended operation. The project team found the applicant response acceptable because heat created by increased resistance of switchyard bus connections due to corrosion will be detected using thermography. This method will maintain the integrity of the connections.

The project team found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.6.2.2.3 for further evaluation. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determined that the applicant adequately addressed the issues that were further evaluated. The project team found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3 AMR Results That are not Consistent With the GALL Report or not Addressed In the GALL Report

Summary of Information in the Application

In PNPS LRA Table 3.6.1, Summary of Aging Management Evaluations for the Electrical Components, the applicant provided information regarding components or material/environment combination in the GALL Report that it evaluated and identified as not applicable to its plant.

In PNPS LRA Table 3.6.2-1, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report. Specifically, the applicant indicated, via Notes F through J, that neither the identified component nor the material/environment combination is

evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.

Project Team Evaluation

The project team reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In PNPS LRA Table 3.6.1 Item 3.6.1-6 discussion column, the applicant stated that fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation of fuse holders (not part of a larger assembly) metallic clamp is not applicable to PNPS because a review of PNPS documents indicates that fuse holders using metallic clamps are either part of an active device or located in circuits that perform no intended function. Therefore, fuse holders with metallic clamps at PNPS are not subject to aging management review at PNPS.

On the basis that fuse holders are either part of an active assembly or located in circuits that perform no license renewal intended function, the project team found that an AMR is not required for fuse holders (insulation and metallic parts) at PNPS. The project team also found that, for this component type, aging effect is not applicable to PNPS.

In PNPS Table 3.6.1 Item 3.6.1-13 discussion column the applicant states that the loosening of bolting connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation of the metallic parts of cable connections is not applicable to PNPS because cable connectors outside of active devices are taped or sleeved for protection. Operating experience with metallic pins on electrical cable connections at PNPS indicated no aging effects requiring management.

The project team noted that electrical cable connections are subject to the above aging stressors. NUREG-1801, Revision 1, AMP XI.E6, "Electrical Cable Connection not Subject to 10 CFR 50.49 Environmental Qualification Requirements," specifies that connections associated with cables within the scope of license renewal are part of this program, regardless of their association with active or passive components. The project team requested the applicant to provide a basis document including an AMP with the ten elements for cable connections or provide a technical justification for why an AMP was not necessary. In its response, the applicant stated that an evaluation of thermal cycling, ohmic heating, electrical transient, vibration, chemical contamination, corrosion, and oxidation stressors for the metallic parts of electrical cable connections identified no aging effects requiring management. Metallic parts of electrical cable connections potentially exposed to thermal cycling and ohmic heating are those carrying significant current in power supply circuits. Typically, power cables are in a continuous run from the supply to the load. Therefore, the connections are part of an active component that is controlled by maintenance rule and is not subject to an AMR. The fast action of circuit protective devices at high currents mitigates stresses associated with electrical faults and transients. In addition, mechanical stress associated with electrical faults is not a credible aging mechanism because of the low frequency of occurrence for such faults. Therefore, electrical transient are not applicable stressors. Metallic parts of electrical cable connections exposed to vibration are those associated with active components that cause vibration. Since active components are controlled by maintenance rule, they are not subject to AMR. Corrosive chemicals are not stored in most areas of the plant. Routine releases of corrosive chemicals to

areas inside plant building do not occur during plant operation. Such a release, and its effects, would be an event, not an effect of aging. The location of electrical connections inside active components protects the metallic parts from contamination. Therefore, this stressor is not applicable. Oxidation and corrosion usually occur in the presence of moisture or contamination such as industrial pollutants and salt deposits. Enclosures or spice materials protect metal connections from moisture or contamination. Therefore, oxidation and corrosion are not applicable stressors. Based on the above evaluation, the applicant concluded that there are no aging effects requiring management for metallic components of connections and no AMP is required.

The project team disagreed with the applicant's determination. Connections are passive components and in-scope of license renewal. Loosening of bolted connections is the aging effect. These aging effects need to be managed. Thermal cycling, ohmic heating, electrical transients, vibrations, chemical contamination, corrosion, and oxidation are aging mechanism. Connections associated with cables in scope of license renewal are part of this program, regardless of their association with active or passive components. Cable lugs are integral part of cables. Integrity of lugs can be verified by testing connections. GALL XI.E1 manages connections in adverse locations only and inspects insulation degradation. Most connections are not located in adverse locations. SAND 96-0344, "Aging Management Guidelines For Electrical Cable and Terminations," indicated loose terminations were identified by several plants. EPRI-TR-104213, "Bolted Joint Maintenance & Application Guide," indicates that it is difficult to maintain tightness of electrical connections and good conductivity through a large temperature range if the materials for the bolt connections and conductors are different and have different rates of thermal expansion. For example, copper and aluminum expand faster than most bolting materials. The project team was not aware of any action taken to manage the aging effects of cable connections. Several licensee event reports reported loose connections due to corrosion, vibration, thermal cycling, etc. In past precedence, other applicants have been using thermography to detect weak/loose connections and correct them as soon as possible and provide GALL XI.E6 to manage aging effects of bolted connections. The project team issued RAI Number 3.6.2.2.N-01. **{Open Item}**.

On the basis of its audit and review of the applicant's program, the project team found that pending resolution of RAI 3.6.2.2.N-01, the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3 Conclusion

On the basis of its review, the project team concluded that pending resolution of RAI 3.6.2.2.N-01, the aging effects associated with the electrical components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable UFSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of electrical components, as required by 10 CFR 54.21(d).