ENT000565
Submitted: August 20, 2012

Dominion Energy Kewaunee, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion®

September 23, 2010

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 10-548
LR/MWH R0
Docket No.: 50-305
License No.: DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE KEWAUNEE POWER STATION LICENSE RENEWAL APPLICATION

By letter dated September 10, 2010 (reference 1), the NRC transmitted a request for additional information regarding the review of the license renewal application (LRA) for Kewaunee Power Station (KPS) (reference 2). The NRC staff indicated that a response to each request for additional information (RAI) is needed to complete the review of the KPS LRA. Attachment 1 to this letter provides the Dominion Energy Kewaunee, Inc. (DEK) responses to the RAIs transmitted in reference 1.

By letter dated February 2, 2010 (reference 3), DEK provided a supplemental response to RAI B2.1.2-2 related to examinations of ASME Class 1 small-bore socket welds. During a telephone conference between NRC and DEK staff members on September 20, 2010, DEK committed to amend the supplemental response and clarify license renewal commitment 43, which was included in the RAI B2.1.2-2 supplemental response. Attachment 2 to this letter provides the amended supplemental response to RAI B2.1.2-2.

Should you have any questions regarding this submittal, please contact Mr. Paul C. Aitken at (804) 273-2818.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Support Services

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and State aforesaid, today by Leslie N. Hartz, who is Vice President – Nuclear Support Services of Dominion Energy Kewaunee, Inc. She has affirmed before me that she is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 23rd day of September 2010.

My Commission Expires: 4/30/13

Ginger L Melton
Notary Public
I was commissioned a notary public as Ginger L. Alligood.

GINGER LYNN MELTON
Notary Public
Commonwealth of Virginia
310847
My Commission Expires Apr 30, 2013

Attachment:

1. Responses to RAIs B2.1.7-3a, B3.2-2a, 3.1.2.2.13-1a, B2.1.32-5a, and B2.1.21-1a
2. Amended Supplemental Response to RAI B2.1.2-2

References:

1. Letter from John Daily (NRC) to David A. Heacock (DEK), "Request for Additional Information for the Review of the Kewaunee Power Station License Renewal Application (TAC No. MD9408)," dated September 10, 2010. [ADAMS Accession No. ML102500357]
2. Letter from D. A. Christian (DEK) to NRC, "Kewaunee Power Station Application for Renewed Operating License," dated August 12, 2008. [ADAMS Accession No. ML082341020]
3. Letter from J. Alan Price (DEK) to NRC, "Response to Request for Additional Information for the Review of the Kewaunee Power Station License Renewal Application – Aging Management Review/Aging Management Program," dated February 2, 2010. [ADAMS Accession No. ML100331879]

Commitments made in this letter:

1. License Renewal Commitment 48 will be added to LRA Table A6.0-1 consistent with the response to RAI B2.1.7-3a. The new commitment is proposed to support approval of the renewed operating license, and may change during the NRC review period.

2. License Renewal Commitment 4 will be revised in LRA Table A6.0-1 consistent with the response to RAI B2.1.7-3a. The revised commitment is proposed to support approval of the renewed operating license, and may change during the NRC review period.

3. License Renewal Commitment 49 will be added to LRA Table A6.0-1 consistent with the response to RAI 3.1.2.2.13-1a. The new commitment is proposed to support approval of the renewed operating license, and may change during the NRC review period.

4. License Renewal Commitment 50 will be added to LRA Table A6.0-1 consistent with the response to RAI B2.1.32-5a. The new commitment is proposed to support approval of the renewed operating license, and may change during the NRC review period.

5. License Renewal Commitment 16 will be revised in LRA Table A6.0-1 consistent with the response to RAI B2.1.21-1a. The revised commitment is proposed to support approval of the renewed operating license, and may change during the NRC review period.

6. License Renewal Commitment 43 will be revised in LRA Table A6.0-1 consistent with the amended supplemental response to RAI B2.1.2-1. The revised commitment is proposed to support approval of the renewed operating license, and may change during the NRC review period.

cc: U.S. Nuclear Regulatory Commission
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ATTACHMENT 1

RESPONSES TO RAIs B2.1.7-3a, B3.2-2a, 3.1.2.2.13-1a, B2.1.32-5a, and B2.1.21-1a

KEWAUNEE POWER STATION
DOMINION ENERGY KEWAUNEE, INC.

RAI B2.1.7-3a Concerns Regarding Buried and Underground Piping and Tanks, Kewaunee LRA – Follow-up

Background

The staff of the U.S. Nuclear Regulatory Commission (the staff) evaluated the Dominion Energy Kewaunee, Inc's (the applicant's) response to RAI B2.1.7-3 which requested the applicant to provide a list and brief summary of any leaks or adverse conditions discovered during inspections of buried and underground piping and tanks, and how the aging management programs (AMPs) that manage buried and underground piping will address plant-specific and industry operating experience (OE). The staff conducted a follow-up conference call with the applicant on August 5, 2010.

Issue

In the RAI response, while the applicant stated that all in scope circulating water system buried piping and all but 100 feet of the buried diesel fuel oil piping are cathodically protected, it is not clear to the staff that the applicant has committed to maintaining the cathodic protection available; at what frequency the periodic National Association of Corrosion Engineers (NACE) surveys are performed; and if the performance of these surveys is a commitment. During the conference call, based on inspections of other portions of the buried diesel fuel oil piping, the applicant discussed the expected condition of the quality of coating for the 100 feet of buried diesel fuel oil piping that is not cathodically protected, but it did not propose any further preventive measures or augmented condition monitoring for this piping. Also during the conference call, the staff discussed the performance of similar buried pipe inspections during the final 10 years of the period of extended operation, for which no commitments have been currently proposed by the applicant.

Request

1. *Provide a commitment to maintain the existing cathodic protection system available 90 percent of the time.*
2. *Provide a commitment to perform annual NACE cathodic protection surveys.*
3. *Discuss any enhancements that may be developed for the preventive measures (e.g., cathodic protection) and clarify that the planned inspection of diesel fuel oil piping will occur in the 100' of buried diesel fuel oil piping which is not cathodically protected.*
4. *Clarify the commitment to perform inspections of buried piping and tanks to also include inspections in the 50 – 60 year period.*

DEK Response

1. The cathodic protection system for the diesel generator fuel oil storage tanks and fuel oil lines, and the circulating water system recirculation piping, is maintained and tested using approved plant procedures that are based on the requirements and recommendations included in the NACE Standard RP0169-02. The performance goal for the cathodic protection system is 100% availability. Therefore, there is reasonable assurance that these portions of the cathodic protection system will each be maintained available and functional a minimum of 90% of the time during the period of extended operation. See new LR Commitment 48 below.
2. NACE cathodic protection surveys are performed at least annually in accordance with approved plant procedures. See new LR Commitment 48 below.
3. There are no current plans to install additional cathodic protection for in-scope plant piping. In order to provide inspection of the most susceptible portion of the in-scope DG fuel oil piping, the committed inspections will be performed on the non-cathodically protected portion of the buried piping. See revised LR Commitment 4 below.
4. The inspections identified in LR Commitment 4, as revised in DEK letter 10-366 dated July 22, 2010 [ADAMS ML102240062], will be also be performed during the second 10-years of the period of extended operation. See revised LR Commitment 4 below.

The following commitment will be added to LRA Appendix A, USAR Supplement, Table A6.0-1:

Item	Commitment	Source	Schedule
48	The cathodic protection system associated with the diesel generator fuel oil storage tanks and protected portions of the fuel oil lines, and the circulating water system recirculation piping, will each be maintained available a minimum of 90% of the time during the period of extended operation. In addition, NACE cathodic protection system surveys will be performed at least annually during the period of extended operation.	Letter 10-548 Response to RAI B2.1.7-3a	During the Period of Extended Operation

Commitment #4 in LRA Appendix A, USAR Supplement, Table A6.0-1, as replaced by DEK letter 10-366 dated July 22, 2010, is amended as follows:

Item	Commitment	Source	Schedule
4	The *Buried Piping and Tanks Inspection* program will be enhanced to perform visual inspections of a representative sample of material/protective measure combinations for in-scope buried piping and tanks. The following materials are utilized in buried applications with the associated protective measures: • Steel (including cast iron)/coated, • Steel/coated and wrapped, • Steel/uncoated, and • Stainless steel/coated and wrapped Visual inspections of the external surface of the components will be performed to identify damaged wrapping (if present), degraded or damaged coating (if present), and evidence of loss of material. Each piping inspection will include a minimum of ten linear feet of piping. The following inspections will be performed: The Circulating Water System 30" diameter recirculation line, which is coated and wrapped carbon steel, will receive one inspection prior to the period of extended operation and ~~an~~ additional inspections within the first ten years and second ten years of the period of extended operation. The Circulating Water System recirculation line vent piping, which is coated and wrapped stainless steel, will receive one inspection prior to the period of extended operation and ~~an~~ additional inspections within the first ten years and second ten years of the period of extended operation. The Diesel Generator System fuel oil piping, which includes coated and wrapped carbon steel fuel oil supply and return piping, storage tank vent piping, and day tank vent piping, will receive one inspection prior to the period of extended operation and ~~an~~ additional inspections within the first ten years and second ten years of the period of extended operation. The inspections will be performed in the non-cathodically protected portion of the piping. The Diesel Generator System fuel oil storage tanks, which are coated carbon steel, will receive one inspection of one tank prior to the period of extended operation. An additional tank inspection will be performed within each of the first and second ten years of the period of extended operation. The Diesel Generator System fuel oil storage tanks hold down straps, which are uncoated carbon steel, will be inspected in conjunction with the associated fuel oil storage tank inspection. One set will be inspected prior to the period of extended operation and one set will be inspected within each of the first and second ten years of the period of extended operation. The Fire Protection System piping, which is coated ductile iron, will receive three inspections prior to the period of extended operation and three additional inspections within each of the first and second ten years of the period of extended operation.	Letter 10-548 Response to RAI B2.1.7-3a.	Prior to the Period of Extended Operation, and During the first ten (10) years of the Period of Extended Operation and During the second ten (10) years of the Period of Extended Operation

RAI B3.2-2a: FatiguePro™ and Metal Fatigue Aging Management Program – Follow-up

Background

LRA Section B3.2 states that the Metal Fatigue of Reactor Coolant Pressure Boundary Program uses all three modules of Electric Power Research Institute (EPRI) software FatiguePro™ to perform cycle counting, cycle-based fatigue monitoring, and stress-based fatigue (SBF) monitoring. As discussed in RAI B3.2-2, FatiguePro™ takes a simplified approach, in its SBF monitoring module, by producing only one stress component and using that single stress component for fatigue usage evaluation. Commitment 41 was provided by the applicant by letter dated February 2, 2010.

The applicant submitted a summary report, by letter dated June 1, 2010, of the 60-year environmentally-assisted fatigue analysis. The applicant provided the analysis results for the two locations, the surge line hot leg nozzle and the charging line nozzle, for which EPRI FatiguePro's™ SBF monitoring method was originally used in the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program. The applicant's submittal of the analysis for these locations was in fulfillment of Commitment No. 41.

Issue

As indicated in the summary report submitted, all six components of the transient stress tensor were used throughout the evaluation in accordance with American Society of Mechanical Engineers (ASME) Code Section III requirements. The summary report concluded that, including the consideration of environmental effects, the fatigue usage factors for the two locations are less than the ASME Code Section III allowable value. However, the report did not demonstrate that the simplified analysis in the FatiguePro™ SBF monitoring methods will provide acceptable results. In particular, the staff noted that for the surge line hot leg nozzle, the cumulative usage factor (CUF) and environmentally-assisted usage factor in the summary report are greater than in LRA Table 4.3-2. However, for the charging line nozzle, the CUF and environmentally-assisted usage factor in the summary report are less than those in LRA Table 4.3-2. Furthermore, the summary report did not demonstrate or justify that the input parameters and assumptions are the same as those in the FatiguePro™ SBF monitoring. It is also not clear to the staff if the SBF monitoring method utilizing FatiguePro™ will continue to be used by the applicant in the Metal Fatigue of Reactor Coolant Pressure Boundary Program during the period of extended operation.

Request

1. *Clarify whether the SBF monitoring module in EPRI FatiguePro™ will be used in the Metal Fatigue of Reactor Coolant Pressure Boundary Program.*

2. *If this module will be used, justify its use for monitoring fatigue usage for the charging line nozzle and surge line hot leg nozzle. Specifically, demonstrate that the fatigue analyses performed by the FatiguePro™ software are conservative when compared to the fatigue analyses that were performed consistent with ASME Code Section III, Subsection NB-3200, for the charging line nozzle and surge line hot leg nozzle. Clarify if relevant input parameters and assumptions used in both fatigue analyses (those performed by the FatiguePro™ software and those performed consistent with ASME Code Section III, Subsection NB-3200) are the same; if not, provide justification for any differences.*

3. *If this module will not be used, clarify the monitoring method (including but not limited to software that incorporates a six-component stress tensor method meeting ASME Section III NB-3200 requirements) that will be used to manage the effects of fatigue for the charging line nozzle and the surge line hot leg nozzle, and justify the use of this method.*

DEK Response

The EPRI FatiguePro software is used as part of the *Metal Fatigue of Reactor Coolant Pressure Boundary* program. However, the stress-based fatigue monitoring module will not be used to monitor fatigue usage for the pressurizer surge line hot-leg nozzle or the charging line nozzle. These locations were analyzed in accordance with ASME B&PV Code, Section III, Subsection NB-3200 and a summary of the analysis was provided for NRC staff review in DEK letter 10-324 dated June 1, 2010 [ADAMS ML101610233]. The results of the fatigue analysis, along with the evaluation of environmental effects, provide the basis that these components are acceptable for the period of extended operation, subject to thermal and pressure transient occurrences within the limits of the analysis as confirmed through the *Metal Fatigue of Reactor Coolant Pressure Boundary* program. No fatigue monitoring software application is required to monitor fatigue usage for the surge line hot-leg nozzle and charging line nozzle since the analysis was performed for a 60-year lifetime and determined that the fatigue usage, including environmental effects, remains within the ASME Code limit of 1.0.

RAI 3.1.2.2.13-1a: Ni-Alloy Steam Generator Divider Plate Cracking Due to PWSCC – Follow-up

Background

Based on foreign OE, the staff's concern in RAI 3.1.2.2.13-01 was about the potential impact of PWSCC cracks in the steam generator (SG) divider plate assembly. This OE reported detecting these cracks in steam generators that were about 20 years old, through penetrant testing, followed in some cases by other means. The staff's concern is that adjacent components which are part of the reactor coolant pressure boundary (channel head, tubesheet, tube-to-tubesheet weld…) could be impacted by such cracks. In its answer dated July 22, 2010, the applicant describes the materials of its SG divider plate assemblies, which are nickel alloy 600 for the stub runner and the divider plate, and alloy 52/152 for the welds between the divider plate and the stub runner, and between the stub runner and the tubesheet. The applicant also provides additional elements in order to justify why such cracks could not propagate to adjoining elements of the SG divider plate assembly and, consequently, why no inspection would be required.

Issue

Although not considered to be an immediate safety issue, the likely presence of cracks in Alloy 600 steam generator divider plate assemblies may result in a condition where these cracks could propagate into surrounding pressure boundary areas, such as the tube-to-tubesheet welds and the channel head. Although the applicant's prior RAI response provided essentially qualitative arguments for concluding that divider plate crack growth is not a concern, the RAI response does not provide a reasonable and sufficient basis for justifying the applicant's conclusions. Further, the use of analytical tools to predict the behavior of service-induced cracking (in other components) has not always bounded actual service performance of these cracks.

Request:

Provide an AMP, changes to an existing AMP, or a commitment to inspection(s) that would demonstrate the condition of the steam generator divider plate assemblies to support a conclusion that there will be no adverse consequences of divider plate assembly degradation during the renewed license period.

DEK Response

The lower portions of the Kewaunee steam generators, including the divider plate assembly and welds, were replaced in 2001. The steam generators have accumulated less than 10 years of service time since replacement. Based on the foreign operating experience with Alloy 600 divider plate assembly cracking noted in RAI 3.1.2.2.13-01a, approximately 20 years of service time had accumulated before primary water stress corrosion cracking (PWSCC) became detectable. This operating experience provides high confidence that detectable cracks do not exist in the Kewaunee steam generator divider plates.

As noted in the response to RAI 3.1.2.2.13-01 in DEK letter 10-366 dated July 22, 2010 [ADAMS ML102240062], the Electric Power Research Institute (EPRI) has extensively evaluated the foreign operating experience with divider plate cracking and concluded that a cracked divider plate is not a safety concern. (Reference EPRI Report No. 1019040, "Steam Generator Divider Plate Cracking Engineering Study", Technical Update, December 2009).

An initial EPRI evaluation of the potential for divider plate cracks in U.S. plant steam generators to grow into base materials and adversely affect the reactor coolant pressure boundary concluded that the concern was limited based on several factors as described in the response to RAI 3.1.2.2.13-01. The current plans are to continue the industry study of the potential for divider plate crack growth and develop an industry-applied resolution to the concern through the EPRI Steam Generator Management Program (SGMP) Engineering and Regulatory Technical Advisory Group. This industry effort is in the initial stages of scope development and planning, and a final resolution is not expected on a schedule consistent with the review of the Kewaunee license renewal application.

Therefore, recognizing that the EPRI SGMP resolution is still under development, Kewaunee will perform an inspection of each of the steam generators to assess the condition of the divider plate assembly. The examination technique(s) used will be capable of detecting PWSCC in the steam generator divider plate assembly and associated welds. The steam generator divider plate inspections will be completed prior to exceeding 10 years into the period of extended operation.

Kewaunee also plans to remain involved with the on-going industry studies related to divider plate cracking to ensure that any inspection requirements or other resolution actions promulgated to the industry are evaluated and implemented, as appropriate.

The following commitment will be added to LRA Appendix A, USAR Supplement, Table A6.0-1:

Item	Commitment	Source	Schedule
49	Recognizing that the EPRI SGMP resolution is still under development, Kewaunee will perform an inspection of each steam generator to assess the condition of the divider plate assembly. The examination technique(s) will be capable of detecting PWSCC in the divider plate assembly and associated welds. The steam generator divider plate inspections will be completed prior to exceeding 10 years into the period of extended operation. In addition, Dominion will continue to actively participate in the EPRI SGMP studies.	Letter 10-548 Response to RAI 3.1.2.2.13-01a	Prior to 2023

RAI B2.1.32-5a: Review of Work Control Process Program – Follow-up

Background

Dominion Letter Serial No. 09-188, dated April 13, 2009, provided the supporting documentation in an attempt to justify that the past periodic surveillance and preventative maintenance activities for the WCP provide sufficient evidence that ample inspection opportunity would exist for the components that the WCP is credited for managing.

Dominion Letter Seriel No. 09-597, dated September 25, 2009, provided a change in status for the WCP, changing the AMP from a plant-specific AMP to an AMP that, with an enhancement, will be consistent with the criteria in Generic Aging Lessons Learned (GALL) AMP XI.M32, "One Time Inspection," when applied on a one-time inspection basis, and with the criteria in GALL AMP XI.M38, "Internal Inspection of Miscellaneous Piping and Ducting Components," as subject to four exceptions taken to the GALL AMP XI.M38 criteria. Dominion Letter Serial No. 09-777, dated January 21, 2010, provides the applicant's responses to RAI Nos. B2.1.32-1, B2.1.32-2, B2.1.32-3, and B2.1.32-4. Dominion Letter Serial No. 10-286, dated May 13, 2010, provides the applicant's responses to RAI B2.1.32-5, Requests 1 – 4.

In RAI B2.1.32-5, Request 2, the staff asked the applicant: (1) to specify and justify the minimum percentage of components that will be used to establish the sample sizes for the component populations that are associated with the WCP and that will be managed by the WCP on a periodic condition monitoring basis, and (2) for these component populations, to specify and justify the maximum frequency that would be applied to the components in the sample sets for the populations. The applicant replied to RAI B2.1.32-5, Request 2, in Dominion Letter Serial No. 10-286. In its response to RAI B2.1.32-5, Request 2, the applicant continues to use a historical basis to support its position that the sample sizes and visual examination frequencies did not need to be defined for the material-environment-aging effect combinations that the AMP will manage on a period condition monitoring basis.

In RAI B2.1.32-5, Request 4, the staff asked the applicant to resolve several inconsistencies with the Updated Final Safety Analysis Report (UFSAR) Supplement A2.1.32, and the applicant's enhancement of the WCP, as given in LRA AMP B2.1.32, and amended in Serial Letter No. 09-777, and as reflected in LRA Commitment No. 25, which has been placed in LRA UFSAR Supplement Table A6.0-1. The applicant replied to RAI B2.1.32-5, Request 4, in Dominion Serial Letter No. 10-286.

Title 10 of the Code of Federal Regulations (10 CFR) 54.21(a)(3) requires that, for each structure and component that is scoped in for license renewal in accordance with one of the LRA scoping requirements in 10 CFR 54.4 and that is required to be screened in for an aging management review (AMR) in accordance with the LRA screening requirements in 10 CFR 54.21(a)(1), the applicant must "demonstrate that the effects of

aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) for the period of extended operation."

Issue

The request in RAI B2.1.32-5, Request 2, reflects an unresolved issue that the implementation of the WCP, when applied as a periodic condition monitoring program, could leave some doubt as to what the samples sizes would be for material-environment-aging effect component populations that the AMP manages, and whether the components in the sample sets would actually ever be scheduled for periodic inspection during the period of extended operation. The staff notes that the current basis for the program, as supplemented in the response to RAI B2.1.32-5, Request 2, still cannot ensure that the components in the sample sets will be inspected at least twice during the period of extended operation without the need to establish a limit criterion on the maximum amount of time that could elapse before the components in the sample sets would need to be scheduled (with certainty) for inspection on a periodic basis. Thus, the response to RAI B2.1.32-5 does not resolve the staff's concern that the WCP's sampling-based, condition monitoring basis may not ever actually schedule the components in these sample sets for inspection or perform inspections of the components in the sample set more than once during the period of extended operation.

Request

Since implementation of the WCP does not assure that the components in the sample sets will be inspected at any point during the period of extended operation, describe how the WCP will be modified to ensure a limit on the maximum amount of time that will elapse before the components in the sample sets will be inspected (e.g., one time each during the first and the last ten years of the period of extended operation).

DEK Response

Prior to the period of extended operation, the inspections performed in accordance with the Internal Surfaces Monitoring portion of the Work Control Process program will be audited. The audit will confirm that inspections have been performed for each material/environment combination credited in the Work Control Process program for the inspection of internal surfaces. If a material/environment combination has not been inspected prior to the period of extended operation, supplemental inspections will be planned. Any identified supplemental inspections will be performed within 5 years from completion of the audit.

Additionally, to confirm that the Internal Surfaces Monitoring portion of the Work Control Process program continues to adequately manage aging of the components for which it is credited, this audit will be repeated during each 10 years of the period of extended operation. As with the initial audit, additional supplemental inspections will be performed if any material/environment combinations have not been inspected at least once during the 10-year period.

The following commitment will be added to LRA Appendix A, Table A6.0-1:

Item	Commitment	Source	Schedule
50	Perform an audit of the Internal Surfaces Monitoring portion of the Work Control Process program inspections to confirm that all of the material/environment combinations credited for internal surface inspections have been inspected during the audit period at least once. Determine the need for and perform supplemental inspections, as necessary.	Letter 10-548 (Response to RAI B2.1.32-5a)	Prior to the Period of Extended operation and every 10 years thereafter. Supplemental inspections will be performed within 5 years of completion of the audits.

RAI B2.1.21-1a: Kewaunee RAI on Submerged Inaccessible Low Voltage Cables

Background

NUREG-1801, Rev. 1, "Generic Aging Lessons Learned," addresses inaccessible medium voltage cables in AMP XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The purpose of this program is to provide reasonable assurance that the intended functions of inaccessible medium voltage cables (2 kV to 35 kV) that are not subject to environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by moisture while energized, will be maintained consistent with the current licensing basis. The scope of the program applies to inaccessible (in conduits, cable trenches, cable troughs, duct banks, underground vaults or direct buried installations) medium-voltage cables within the scope of license renewal that are subject to significant moisture simultaneously with significant voltage.

The application of AMP XI.E3 to medium voltage cables was based on the OE available at the time Revision 1 of the GALL Report was developed. However, recently identified industry OE indicates that the presence of water or moisture can be a contributing factor in inaccessible power cables failures at lower service voltages (480 V to 2 kV). Applicable OE was identified in licensee responses to Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cable operating at service voltages of less than 2 kV where water was considered a contributing factor.

Recently identified industry OE provided by NRC licensees in response to GL 2007-01 has shown: (a) that there is an increasing trend of cable failures with length of service beginning in the sixth through tenth years of operation, and (b) that moisture intrusion is the predominant factor contributing to cable failure. The staff has determined, based on the review of the cable failure distribution, that a combination of annual inspection of manholes and cable testing frequencies of at least every six years is a conservative approach to ensuring the operability of power cables, and therefore should be considered.

In addition, recently identified industry OE has shown that some NRC licensees may experience events, such as flooding or heavy rain, that subject cables within the scope of GALL AMP XI.E3 to significant moisture. The staff has determined that event-driven inspections in addition to a one year periodic inspection frequency is a conservative approach and, therefore, should be considered.

Issue

The staff has concluded, based on recently identified industry OE concerning the failure of inaccessible low voltage power cables (480 V to 2 kV) in the presence of significant moisture, that these cables can potentially experience age-related degradation. The

staff noted that the applicant's Inaccessible Medium-Voltage Cables Program does not address inaccessible low voltage power cables (400 V (Nominally 480 V) to 2 kV inclusive). In addition, an evaluation of an increase in cable test and inspection frequencies (e.g., from 10 and two years, respectively, to six and one years, respectively) should be performed to ensure that the Inaccessible Medium Voltage Program test and inspection frequencies reflect industry and plant-specific OE and that test and inspection frequencies may be increased based on future industry and plant-specific OE.

Request

1. *Provide a summary of your evaluation of recently identified industry OE and any plant-specific OE concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 environmental qualification requirements), and how this OE applies to the need for additional aging management activities at your plant for such cables.*

2. *Provide a discussion of how you will manage the effects of aging on Kewaunee Power Station's inaccessible low voltage power cables within the scope of license renewal and subject to AMR; with consideration of recently identified industry OE and any plant-specific OE. The discussion should include assessment of your AMP description, program elements (i.e., Scope of Program, Parameters Monitored/Inspected, Detection of Aging Effects, and Corrective Actions), and updated safety analysis report summary description to demonstrate reasonable assurance that the intended functions of inaccessible low voltage power cables subject to adverse localized environments will be maintained consistent with the current licensing basis through the period of extended operation.*

3. *Provide an evaluation showing that your Inaccessible Medium Voltage Program test and inspection frequencies, including event-driven inspections, incorporate recent industry and plant-specific OE for both inaccessible low and medium voltage cable. Discuss how your Inaccessible Medium Voltage Program will ensure that future industry and plant-specific OE will be incorporated into the program such that inspection and test frequencies may be increased based on test and inspection results.*

DEK Response:

1. In response to NRC Generic Letter 2007-01, *Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients*, a review was performed of the Kewaunee operating experience related to replacement of inaccessible power cables operating at service voltages greater than or equal to 480 volts due to failure. The results of this review were submitted to the NRC in DEK letter 07-0268 dated May 7, 2007 [ADAMS ML071270786]. No failures

of inaccessible, low-voltage power cables were identified at Kewaunee as a result of this review. In addition, there have been no failures of inaccessible, low voltage power cables at Kewaunee since that review was completed.

A review of industry operating experience that was submitted in response to NRC GL 2007-01 is summarized in an NRC memorandum from P. Hiland to G. Wilson, "Generic Letter 2007-01, Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients: Summary Report," dated November 12,.2008 (ADAMS ML082760385). No failures of this type have been identified at Kewaunee. However, DEK will include the inaccessible, low-voltage power cables (i.e., cables with service voltage less than 2kV) that are within the scope of license renewal, and are not subject to 10 CFR 50.49 environmental qualification (non-EQ), within the *Non-EQ Inaccessible Medium-Voltage Cables* aging management program.

2. As stated above, non-EQ, inaccessible, low-voltage power cables that are within the scope of license renewal will be managed for the effects of aging by the *Non-EQ Inaccessible Medium-Voltage Cables* program. A review has determined that the following in-scope, low-voltage cables are routed in inaccessible areas and will be included in the program:

Cable	Service Voltage	Routing
Power feed to Fire Pump 1B Control Cabinet	480V	Underground Duct Bank / Conduit
Power feed to MCC 1-62D	480V	Underground Duct Bank / Conduit
Power to Emergency Diesel Generator Fuel Oil Transfer Pump 1A and 1B	480V	Underground Duct Bank / Conduit, EDG FOST Access Manholes

As noted above, the power cables for the fuel oil transfer pumps are routed in the Emergency Diesel Generator (EDG) Fuel Oil Storage Tank (FOST) access manholes, which are described in LRA Section 2.4.2.7. Inspection of these manholes for water accumulation will also be included in the program. Additionally, the provision in the *Non-EQ Inaccessible Medium Voltage Cables* program limiting its applicability to cable exposed to significant voltage is being eliminated.

The in-scope, low-voltage cables that are exposed to significant moisture will be tested to provide an indication of the condition of the conductor insulation consistent with the Parameters Monitored/Inspected program element of NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Volume II, Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental

Qualification Requirements. Testing of the in-scope, low-voltage cables will be performed prior to the period of extended operation and at least once every ten years during the period of extended operation, consistent with the Detection of Aging Effects program element of NUREG-1801, Section XI.E3. Also, consistent with the Detection of Aging Effects program element, the EDG FOST access manholes will be inspected for water collection. The inspections will be performed based on actual plant experience with water accumulation in the manholes. However, the inspection will be performed at least every two years. The first inspection for license renewal will be performed prior to the period of extended operation. Adverse conditions identified during cable testing or manhole inspections will be evaluated through the 10 CFR 50, Appendix B Corrective Action Program, which is consistent with the Corrective Actions program element of NUREG-1801, Section XI.E3.

3. As noted in the response to request 1. above, no failures of inaccessible, low-voltage power cables were identified at Kewaunee as a result of the review performed for NRC GL 2007-01. In addition, underground cable access areas (i.e., one electrical manhole, two emergency diesel generator fuel oil storage tank access manholes, and a cable pulling pit) through which in-scope 480V – 13.8kV cables are routed have been inspected for the accumulation of water. Only minimal indications of water accumulation were identified, and there were no indications of cable wetting or submergence. The grade in the vicinity of the manholes is sloped to promote surface water flow away from the manholes, which prevents surface runoff from entering the manhole in the event of a significant rainfall or other flooding event. The grade around the pulling pit is not sloped away from the pit. However, the pulling pit is provided with drains in the floor of the pit and is located in an area with minimal water ponding and runoff. The manholes and pulling pit are provided with access covers that serve to limit water intrusion from the top. The manholes and the pulling pit are located above the groundwater table, such that groundwater accumulation within the manhole / pulling pit does not occur. Therefore, water accumulation within the manholes and pulling pit leading to potential exposure of the cables to wetting is not expected.

   The initial cable testing and manhole / pulling pit inspections will occur prior to the period of extended operation as indicated in LRA Appendix A, *USAR Supplement*, Table A6.0-1, Commitment 16. Subsequent cable testing will be performed on a 10 year frequency. Subsequent manhole / pulling pit inspections for water accumulation will occur at least every two years, with more frequent inspections in the event of discovery of adverse water accumulation. This testing and inspection frequency is justified based on Kewaunee plant specific operating experience with underground cable performance and based on the design of the manholes and pulling pit described above.

The following LRA sections are amended by this response.

1. LRA Section A2.1.21, Non-EQ Inaccessible Medium-Voltage Cables.
2. Commitment 16 in LRA Appendix A, USAR Supplement, Table A6.0-1.
3. LRA Section B2.1.21, Non-EQ Inaccessible Medium-Voltage Cables.

The LRA sections above are amended as follows:

A2.1.21 NON-EQ INACCESSIBLE MEDIUM-VOLTAGE CABLES

Program Description

The *Non-EQ Inaccessible Medium-Voltage Cables* program is a new program that will correspond to NUREG-1801, Section XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The *Non-EQ Inaccessible Medium-Voltage Cables* program will manage the aging effects of localized damage and breakdown of insulation leading to electrical failure for non-EQ, inaccessible, low and medium-voltage (≥ 480 volts) cables within the scope of license renewal that are subject to an adverse localized environment caused by exposure to significant moisture ~~simultaneously with significant voltage~~.

Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. ~~Significant voltage exposure is defined as being subjected to system voltage for more than twenty five percent of the time.~~ An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cables (power, control, and instrumentation) and connections. An adverse localized environment is significant if it could appreciably increase the rate of aging of a component, or has an immediate adverse effect on operability.

The program will inspect the in-scope manhole east of the tertiary auxiliary transformer ~~and~~, the pulling pit, and the EDG fuel oil storage tank access manholes for water collection that could cause the in-scope cables to be exposed to significant moisture and will remove water, if required. The program will perform a test on the in-scope non-EQ inaccessible low and medium-voltage cables to provide an indication of the condition of the conductor insulation.

Inspection of the in-scope manhole east of the tertiary auxiliary transformer ~~and~~, the pulling pit, and the EDG fuel oil storage tank access manholes for water collection will be performed based on actual plant experience with water accumulation in the pulling pit and manholes. However, the inspection will be performed at least every two years. The first inspection for license renewal will be performed prior to the period of extended operation.

Testing of the in-scope inaccessible low and medium-voltage cables exposed to significant moisture ~~and significant voltage~~ will be performed prior to the period of extended operation, and the tests will be repeated every ten years thereafter.

Commitments

Program Implementation

The *Non-EQ Inaccessible Medium-Voltage Cables* program will be established. This commitment is identified in Appendix A, Table A6.0-1 License Renewal Commitments, Item 16.

Item	Commitment	Source	Schedule
16	The *Non-EQ Inaccessible Medium-Voltage Cables* program will be established. The program will periodically inspect the in-scope manholes/pulling pit for water collection and will remove water, if required. The program will periodically perform a test on the in-scope cables to provide an indication of the condition of the conductor insulation.	Non-EQ Inaccessible Medium-Voltage Cables	Prior to the Period of Extended Operation Thereafter, the manhole/pulling pit inspections will not exceed a 2-year interval. Thereafter, the cable testing will not exceed a 10-year interval.

B2.1.21 NON-EQ INACCESSIBLE MEDIUM-VOLTAGE CABLES

Program Description

The *Non-EQ Inaccessible Medium-Voltage Cables* program will manage the aging effects of localized damage and breakdown of insulation leading to

electrical failure for non-EQ, inaccessible, low and medium-voltage cables within the scope of license renewal that are subject to an adverse localized environment caused by exposure to significant moisture ~~simultaneously with significant voltage~~.

Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. ~~Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time.~~ An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cables (power, control, and instrumentation) and connections. An adverse localized environment is significant if it could appreciably increase the rate of aging of a component, or has an immediate adverse effect on operability.

The program will inspect the in-scope manhole east of the tertiary auxiliary transformer ~~and~~, the in-scope pulling pit, and the EDG fuel oil storage tank access manholes for water collection that could cause the in-scope cables to be exposed to significant moisture and will remove water, if required. The program will perform a test on the in-scope non-EQ inaccessible low and medium-voltage cables 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 a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, "Effects of Moisture on the Life of Power Plant Cables, Part 1, Medium-Voltage Cables, Part 2, Low-Voltage Cables, Electric Power Research Institute," or other testing that is state-of-the-art at the time the test is performed.

Inspection of the in-scope manhole east of the tertiary auxiliary transformer ~~and~~, the in-scope pulling pit, and the EDG fuel oil storage tank access manholes for water collection will be performed based on actual plant experience with water accumulation in the pulling pit and manholes. However, the inspection will be performed at least every two years. The first inspection for license renewal will be performed prior to the period of extended operation.

Testing of the in-scope inaccessible low and medium-voltage cables exposed to significant moisture ~~and significant voltage~~ will be performed prior to the period of extended operation, and the tests will be repeated every ten years thereafter.

NUREG-1801 Consistency

The *Non-EQ Inaccessible Medium-Voltage Cables* program is a new program that will be consistent with the recommendations of NUREG-1801, Section XI.E3,

"Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

Exceptions to NUREG-1801

The *Non-EQ Inaccessible Medium-Voltage Cables* program takes no exceptions to the recommendations of NUREG-1801, Section XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

Enhancements

The *Non-EQ Inaccessible Medium-Voltage Cables* program is a new program that will be consistent with the recommendations of NUREG-1801, Section XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

This commitment is identified in Appendix A, Table A6.0-1 License Renewal Commitments, Item 16.

Operating Experience

Industry operating experience has shown that cross linked polyethylene or high molecular weight polyethylene insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Water treeing is much less prevalent in 4kV cables than those operated at 13 or 35kV. Also, minimizing exposure to moisture minimizes the potential for the development of water treeing.

Although the *Non-EQ Inaccessible Medium-Voltage Cables* program is a new program, the following representative example of internal operating experience is based on a review of Corrective Action Program and was considered in evaluating the future effectiveness of the program:

In February 2007, in response to NRC GL-2007-01, a review was performed of the Corrective Action Program for replacement of power cables (120 VAC - 4160 Volts) due to failure. No failures of the in-scope cables were identified.

Additionally, based on inspections and interviews, no water accumulation in the in-scope manhole east of the tertiary auxiliary transformer, the in-scope pulling pit, and the EDG fuel oil storage tank access manholes that may have caused the in-scope cables to be exposed to significant moisture was identified.

As operating experience is obtained, lessons learned will be used to adjust this program as needed.

The Operating Experience Program ensures that additional operating experience is factored into the aging management programs to ensure program effectiveness.

Conclusion

The *Non-EQ Inaccessible Medium-Voltage Cables* program ensures that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

ATTACHMENT 2

AMENDED SUPPLEMENTAL RESPONSE to RAI B2.1.2-2

KEWAUNEE POWER STATION
DOMINION ENERGY KEWAUNEE, INC.

NRC Request

During a telephone conference between NRC and DEK staff members on September 20, 2010, NRC staff requested that DEK clarify the supplemental response to RAI B2.1.2-2 as follows:

1. Clarify the plan for the one-time inspection of socket welds regarding volumetric techniques.
2. Clarify the total number of welds that will be included in the inspection should the option of performing opportunistic destructive examinations be chosen.

DEK Response

The supplemental response to RAI B2.1.2-2, provided in DEK letter 10-033, dated February 2, 2010 [ADAMS ML100331879], is amended as follows:

The original response to RAI B2.1.2-2, included in DEK letter 09-469 dated August 17, 2009 [ADAMS ML092320093], is supplemented to include performance of five volumetric examinations of ASME Class 1 socket welds using a ~~qualified~~ demonstrated, nuclear-industry endorsed, inspection methodology that can accurately detect ~~and size discontinuities~~ cracking within the specified examination volume, if a ~~qualified~~ methodology becomes available. The welds selected for the volumetric examinations will be five of the twenty socket welds identified for Inservice Inspection (ISI) Program examination in the fourth inspection interval, as described in the original response to RAI B2.1.2-2, which were selected based on susceptibility, inspectability, dose considerations, and operating experience.

One destructive examination, consisting of a minimum of two welds, will be performed in lieu of the volumetric examinations in the event that a ~~qualified~~ demonstrated, nuclear industry endorsed, socket weld inspection methodology is not available prior to the period of extended operation.

Commitment 43 in LRA Appendix A, USAR Supplement, Table A6.0-1 is amended as follows:

Item	Commitment	Source	Schedule
43	Five volumetric examinations of ASME Class 1 small-bore socket welds will be performed using a ~~qualified~~ demonstrated, nuclear-industry endorsed, inspection methodology that can detect ~~and size discontinuities~~ cracking within the specified examination volume, if a ~~qualified~~ methodology becomes available. One destructive examination, consisting of a minimum of two welds, will be performed in lieu of this inspection in the event that a ~~qualified~~ demonstrated, nuclear industry endorsed, inspection methodology is not available prior to the period of extended operation.	Letter 10-~~033~~548; Amended Supplemental Response to RAI B2.1.2-2	Prior to the period of extended operation.