UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket Nos. 50-247/286-LR
	)	
(Indian Point Nuclear Generating	)	
Units 2 and 3)	)	

NRC STAFF TESTIMONY OF CLIFF DOUTT AND DUC NGUYEN
CONCERNING NYS CONTENTION 6 AND 7 (LACK OF A SPECIFIC PLAN FOR
THE AGING MANAGEMENT OF NON-ENVIRONMENTALLY-QUALIFIED INACCESSIBLE
MEDIUM AND LOW-VOLTAGE CABLES AND WIRING)

Q1: Please state your name, occupation, and by whom you are employed.

A1: My name is Cliff K. Doutt ("Doutt").[1] I am employed by the NRC as an electrical engineer in the Division of License Renewal (DLR) in the Office of Nuclear Reactor Regulation (NRR). Previously I was employed as a reliability and risk analyst in the NRR Division of Risk Assessment (DRA) and prior to that, as an electrical engineer in the NRR Division of Engineering (DE) instrumentation and controls branch. A statement of my professional qualification is provided. (Ex. NRC000078).

A1: My name is Duc Nguyen ("Nguyen"). I am employed by the NRC as an electrical engineer in the Division of License Renewal (DLR) in the Office of Nuclear Reactor Regulation (NRR). Previously I was employed as an electrical engineer in the NRR Division of Engineering (DE). A statement of my professional qualification is provided. (Ex. NRC000079)

[1] In this testimony, the sponsors of each numbered response are identified by their last name; if no such designation is provided, then the paragraph is sponsored by all witnesses.

Q2: Please explain your duties in connection with the Staff's review of the License Renewal Application ("LRA") submitted by Entergy Indian Point Nuclear Generating Units 2 and 3 and Entergy Nuclear Operations, Inc. ("Entergy," "Applicant"," "Licensee," or "Indian Point") (Ex. ENT00015A and ENT00015B)

A2: (Doutt) In connection with the Staff's review of the aging management programs (AMPs) in the LRA, including "B.1.23, Non-EQ Inaccessible Medium-Voltage Cable Program." I served as the electrical technical lead for activities related to the Indian Point LRA subsequent request for additional information concerning inaccessible low voltage power cable. As the electrical lead, I developed and wrote the request for additional information (RAI) related to the aging management of low and medium voltage power cables (NYS000150). And I reviewed the responses from Entergy (Entergy Response (NL-11-032) to Request for Additional Information (RAI), Aging Management Programs, Indian Point Nuclear Generating Unit Nos. 2 & 3, Docket Nos. 50-247 and 50-286, License Nos. DPR-26 and DPR-643 (Mar. 28, 2011) ("Entergy's March 28 Response") (ex. NYS000151); Entergy Response (NL-11-074) to Request for Additional Information (RAI), Aging Management Programs, Indian Point Nuclear Generating Unit Nos. 2 & 3, Docket Nos. 50-247 and 50-286, License Nos. DPR-26 and DPR-64 (Jul. 14, 2011) ("Entergy's July 14 Response") (ex. NYS000152); Entergy Response (NL-11-090) to Request for Additional Information for the Review Of The Indian Point Nuclear Generating Unit Number 2 and 3 (Jul. 27, 2011) ("Entergy's July 27 Response") (ex. NYS000153); and Entergy Clarification (NL-11-096) for Request for Additional Information (RAI), Aging Management Programs, Indian Point Nuclear Generating Unit Nos. 2 & 3, Docket Nos. 50-247 and 50-286, License Nos. DPR-26 and DPR-64 (Aug. 9, 2011) ("Entergy's August 9 Response") (ex. NYS000154)) and subsequently wrote the electrical portion of the NUREG-1930, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos.

2 and 3, Supplement No. 1, Docket Nos. 50-247 and 50-286 (August 2011) ("SSER") (ex. NYS000160).

A2: (Nguyen) In connection with the Staff's review of the LRA, I was as an audit team member for the license renewal safety audit at Indian Point. I reviewed various portions of Entergy's LRA related to aging management of electrical cables, connectors and components; the aging management programs included: B.1.10, "Environmental Qualification of Electric Components Program"; B.1.20, "Metal-Enclosed Bus Inspection Program"; B1.22, "Non-EQ Bolted Cable Connections Program"; B.1.23, "Non-EQ Inaccessible Medium-Voltage Cable Program"; B.1.24, "Non-EQ Instrumentation Test Review Program"; B.1.25, "Non-EQ Insulated Cables and Connections Program"; and Section 3.6, "Electrical and Instrumentation and Controls." Entergy (NL-07-153) Amendment 1 to License Renewal Application, Excerpted: Attachment 3 - AMP Audit at 32-33 (Dec. 18, 2007) ("LRA Amendment 1") (ex. NYS000159) was reviewed by me.

I authored portions of NUREG-1930, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3, Docket Nos. 50-247 and 50-286 (Nov. 2009)(Ex. NYS00326A- NYS00326F) including sections 3.0.3.1.4, "Environmental Qualification of Electric Components Program"; 3.0.3.2.11, "Metal-Enclosed Bus Inspection Program"; 3.0.3.3.6, "Non-EQ Bolted Cable Connections Program"; 3.0.3.1.6, "Non-EQ Inaccessible Medium-Voltage Cable Program"; 3.0.3.1.7, "Non-EQ Instrumentation Circuits Test Review Program"; 3.0.3.1.8, "Non-EQ Insulated Cables and Connections Program"; and Section 3.6, "Aging Management of Electrical and Instrumentation and Control System" of the Safety Evaluation Report, and 4.4, "Environmental Qualification of Electric Equipment."

Q3: What is the purpose of your testimony?

A3: (Both). The purpose of this testimony is to present the Staff's position regarding NYS Contentions 6 and 7 (lack of a specific plan for the aging management of non-EQ inaccessible medium- and low-voltage cables and wiring). NYS's contention alleges that the license renewal application for Indian Point 2 (IP2) and Indian Point 3 (IP3) fails to comply with the requirements of 10 C.F.R. § 54.21(a) and 54.29 because the applicant has not proposed a specific plan for aging management of non-environmentally qualified inaccessible medium and low-voltage cables and wiring for which such aging management is required. *Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 and 3), LBP-08-13, 68 NRC 43, 36-41 (2008). We have read relevant portions of LPB-08-13 (2008) (admitting NYS Contentions 6 and 7) as well as the State of New York's Initial Statement of Position Contentions NYS-6 and 7 dated December 15, 2011 ("NYS-6/7 SOP") (ex. NYS000135) and Pre-filed Testimony of Earle Bascom ("Bascom PFT") (ex. NYS000136) and Report of Earle Bascom in Support of Contentions NYS-6/7 ("2011 Bascom Report") (ex. NYS000138), and have familiarized ourselves with NYS's other exhibits. We have also read the relevant portions of NUREG-1801, Rev. 1, *Generic Aging Lessons Learned (GALL) Report*, (Sept. 2005), Vol. 1 (ML052770419) & Vol. 2 (ML052110006) ("GALL Report Rev. 1" or "Gall Rev. 1"); (Ex. NYS00146A- NYS00146C) and NUREG-1801, Rev. 2, *Generic Aging Lessons Learned (GALL) Report – Final Report,* ("GALL Report Rev. 2" or "GALL Rev. 2") (Ex. NYS00147A-NYS00147D); NUREG-1800, Rev. 1, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, (Sept. 2005) (ML052770566) ("Standard Review Plan Rev. 1" or "SRP-LR Rev. 1")(Ex. NYS000195), and NUREG-1800, Rev. 2, *Standard Review Plan for Review of License Renewal Applications for Nuclear Plants*, (Dec. 2010) ("SRP-LR Rev 2") (Ex. NYS000161).

We disagree with New York State's conclusions regarding the AMP, as described below.

Q4: Have you formed an opinion on the NYS 6/7?

A4: (Both)Yes.

Contention NYS-6 is

> The license renewal application for IP2 and IP3 fails to comply with the requirements of 10 C.F.R. §§ 54.21(a) and 54.29 because applicant has not proposed a specific plan for aging management of non-environmentally qualified inaccessible medium-voltage cables and wiring for which such aging management is required.

New York State Notice of Intention to Participate and Petition to Intervene at 92 (Nov. 30, 2007) (ML073400187) (NYS Petition); NYS-6/7 SOP at 7 (ex. NYS000135).

Contention NYS-7 is

> The license renewal application for IP2 and IP3 fails to comply with the requirements of 10 C.F.R. §§ 54.21(a) and 54.29 because applicant has not proposed a specific plan for aging management of non-environmentally qualified inaccessible low-voltage cables and wiring for which such aging management is required.

NYS Petition at 100; NYS6/7 AT 7-8 (ex. NYS000135).

NYS's position is that the AMP is deficient based on two main points (Points I & II). Point I is that the AMP does not demonstrate that the effects of aging will be managed due to a lack of details on A) corrective actions associated with water, B) cable characteristics, C) tests to be selected, D) acceptance criteria, E) corrective actions associated with insulation, and F) ability to take actions before the period of extended operations. NYS-6/7 SOP at 15-25 (ex. NYS000135). Point II is that Entergy has not provided an AMP for non-EQ inaccessible cables exposed to "excessive heat." *Id.* at 25-28.

From our review of NYS's testimony and exhibits, we disagree with New York's two main points. First, contrary to New York's "Point I" arguments (NYS-6/7 SOP at 15-25 ((NYS000135)), we find that Entergy’s revised AMP for non-EQ inaccessible low- and medium-voltage power cables

exposed to significant moisture demonstrates that the effects of aging on the cables' intended function will be adequately managed for the period of extended operation and is consistent with the GALL Report Rev. 2 (ex. NYS00147A - NYS00147D) . Therefore, it is not necessary for Entergy to describe: A) the corrective actions the Applicant will take if inspections reveal that water is accumulating in manholes or other accessible locations of inaccessible cable circuits, B) the characteristics of the relevant cables and associated cable testing methods, C) whether it will select tests with trendable results where possible, D) the cable testing acceptance criteria, E) the corrective actions for discovery of degraded cable insulation, nor F) to demonstrate that it will be capable of testing all non-EQ inaccessible power cables prior to the period of extended operation. The applicant wrote its AMP to be consistent with the GALL Report Rev. 1 (ex. NYS00146A - NYS00146C), then revised it to be consistent with GALL Report Rev. 2 (ex. NYS00147A - NYS00147D), and, as the Commission has recently reiterated on a similar contention in the Seabrook proceeding, a license renewal applicant who commits to implement an AMP that is consistent with the corresponding AMP in the GALL Report has demonstrated reasonable assurance under 10 C.F.R. § 54.29(a) that the aging effects will be adequately managed during the period of extended operation. *NextEra Energy Seabrook, LLC (*Seabrook Station, Unit 1), CLI-12-05, 75 NRC __, __ (March 8, 2012) (slip op. at 18).

Second, we disagree that Entergy was required to provide an AMP for non-EQ inaccessible power cables exposed to excessive heat because "excessive heat" is not an expected adverse localized environment aging effect for non-EQ inaccessible power cables and therefore it is unnecessary to provide aging management of excessive heat in Entergy's Non-EQ Inaccessible Medium-Voltage Cable Program. Heat is, of course, an aging mechanism addressed by various AMPs such as B.1.25, "Non-EQ Insulated Cables and Connections Program where this adverse localized environment is applicable. There is no need for a separate consideration of

"excessive" heat in Entergy's AMPs. We find that NYS's "excessive" heat refers to heat beyond the levels anticipated in the plant's current design and licensing bases.

Q5: What is an adverse localized environment?

A5: (Both). An adverse localized environment is a condition in a limited plant area that is significantly more severe than the plant design environment for cable insulation material that could increase the rate of aging of a component or have an adverse effect on operability. As defined in the GALL Rev. 1, at XI-E1,

> An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable. An adverse variation in environment is significant if it could appreciably increase the rate of aging of a component or have an immediate adverse effect on operability.

GALL Rev. 1, at XI-E1 (ex. NYS00146C)

These conditions are plant-specific.

<u>SUMMARY OF THE DISPUTED SECTIONS OF THE LRA</u>

Q6: What is the AMP which NYS states is insufficiently presented in the LRA?

A6: (Both) It is "B.1.23 Non-EQ Inaccessible Medium-Voltage Cable Program." The original LRA, at App. B, B-81, (ex. ENT00015B) describes the program thusly:

> The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program that entails periodic inspections for water collection in cable manholes and periodic testing of cables. In scope medium-voltage cables (cables with operating voltage from 2kV to 35kV) exposed to significant moisture and voltage will be tested at least once every ten years to provide an indication of the condition of the conductor insulation. The program includes inspections for water accumulation in manholes at least once every two years.

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

LRA at App. B, B-81 (ex. ENT00015B)

We find that NYS Statement of Position correctly described how, by letters dated March 28, 2011 (ex. NYS000151), July 14, 2011 (ex. NYS000152), July 27, 2011 (ex. NYS000153), and Aug. 9, 2011 (ex. NYS000154), Entergy expanded its program "to incorporate the more stringent manhole inspection and cable testing schedule in the New GALL's AMP for non-EQ, inaccessible low and medium voltage power cables exposed to significant moisture." NYS-6/7 SOP at 13 (ex. NYS000135).

We also find that NYS correctly summarized the AMP's main points from the LRA. Specifically, NYS wrote:

> In sum, Entergy's new AMP applies to medium and low voltage cables and requires: (i) periodic inspection of manholes for water accumulation based on specific operating experience with water accumulation but at least annually, instead of every two years; (ii) event driven inspections of manholes after heavy rain or flooding; (iii) increased frequency of periodic manhole inspections if necessary based on previous inspection results; (iv) cable testing at least every six years, instead of every ten, to provide information about the condition of the conductor insulation; and (v) increased frequency of periodic cable testing, if necessary, based on test results and operating experience.

NYS-6/7 SOP at 14 (citing Entergy March 28, 2011 Response (Ex. NYS000151)) (ex. NYS000135).

We note that in addition to the summary points above, Entergy also expanded the scope of covered inaccessible non-EQ power cables by expanding the range of normal cable voltages addressed in the program, and removing a previous limitation based upon how often the cable is energized.

Entergy's March 28 Response at 11-14 (ex. NYS000151).

Q7: The AMP refers to non-EQ cables. What is "EQ?"

A7: (Both) "EQ" means "environmental qualification." It is not used in the AMP as a generic descriptor, but is a very precise term, explicitly referring to the environmental qualification of electrical equipment important to safety in nuclear power plants. The requirements for environmental qualification of electrical equipment important to safety for nuclear power plants are described in 10 C.F.R. § 50.49. The electrical equipment qualification program must include and be based upon 1) temperature and pressure, 2) humidity, 3) chemical effects, 4) radiation, 5) aging, 6) submergence (if applicable), 7) synergistic effects, and 8) margins. 10 C.F.R. § 50.49(e). The requirements apply to listed types of equipment which are important to safety and are relied upon following design basis events (e.g. conditions of normal operation, anticipated operational occurrences, design basis accidents, external events, and natural phenomena) to ensure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and to maintain it in a safe shutdown condition, to prevent or mitigate the consequences of accidents, or to monitor an accident. 10 C.F.R. § 50.49(b)(1)-(3). Environmental qualification of electric equipment important to safety located in a "mild environment" is not included within the scope of § 50.49. 10 C.F.R. § 50.49(c). A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation. *Id.*

Q8: NYS's expert stated that a cable is non-environmentally qualified if it is not designed to withstand the adverse effects of the environment in which it is located. Is NYS's expert correct?

A8: (Both). No, his discussion does not match the NRC's rule in 10 C.F.R. § 50.49 described above. Mr. Bascom incorrectly states that a "cable is non-environmentally qualified if it is not designed to withstand the adverse effects of the environment in which it is located." Bascom PFT at 6 (ex. NYS000136). Mr. Bascom's understanding of how the NRC uses the term "environmentally-qualified" (EQ) is incorrect and inconsistent with the Commission's regulations. Mr. Bascom does not refer to 10 C.F.R. § 50.49, the general design criteria in 10 C.F.R. Part 50 Appendix A, or any other regulation to support his description of non-EQ. There is no logical reason to conclude that being outside the scope of 10 C.F.R. § 50.49 is synonymous with being insufficiently designed and unable to withstand the environment where the cable is installed.

We note that a separate AMP, X.E1, “Environmental Qualification (EQ) of Electric Components,” is listed in the GALL Report for aging management of electrical components subject to 10 C.F.R. § 50.49. *See* e.g. GALL Report Rev. 1 at App. B. X E-3 (stating scope of program) (ex. NYS0146C).

Q9: How do you believe Mr. Bascom's misunderstanding of "EQ" altered his position on the adequacy of the AMP?

A9: (Both) New York's position is that problems that can arise when inaccessible cables are subject to adverse environments that they were not designed to withstand (NYS-6/7 SOP at 2 (ex. NYS000135)); the position is based upon an incorrect understanding of the EQ regulations. We do not believe his concerns about details in the AMP would be changed by his use of the correct definition of EQ.

Q10: What are "inaccessible power cables"?

A10: (Both) Power cables as included in the scope of GALL Report AMP XI.E3, are cables that are inaccessible or underground such as cables installed in conduits, cable trenches, cable troughs, duct banks, underground vaults, or directly buried in soil installations.

The two contentions, NYS 6 and 7, referred to medium- and low-voltage cables (i.e., "power cables"), respectively. However, with the modifications to the LRA made by Entergy in its March 28, 2011, letter (ex. NYS000151), the medium-voltage AMP now includes low voltage cables. Therefore, any concern that the AMP is inadequate because it does not include low-voltage cables is moot.

Q11: What are the potential aging effects addressed by Entergy's AMP for inaccessible power cables?

A11: (Both) The AMP addresses aging from the adverse localized environment associated with wetting or submergence. By design, the AMP does not address "excessive heat" as contemplated by the State; this adverse localized environment is not anticipated as a condition to which the inaccessible non-EQ cables would be exposed. None of the previous research that led to the issuance of the Commission-approved GALL Report and SRP-LR found that excessive heat was causing unanticipated aging for inaccessible non-EQ power cables.

Q12: What is the aging concern associated with wetting or submergence?

A12: (Both). Wetting or submergence of cables when energized could produce an aging mechanism referred to as “water treeing.” This leads to failure of the cable’s insulation system. If the insulation fails, the cable may not be able to perform its intended function of providing

power to a pump, valve or other component because the cable will short out or experience a "ground fault."

Water treeing is the major cause of insulation degradation in inaccessible medium-voltage cables, and has been documented for medium-voltage electrical cable with certain extruded polyethylene insulations and ethylene propylene rubber (EPR) insulations. Water trees occur in hydrophobic polymers used as insulating materials when the materials are exposed to electrical stress and significant moisture; water trees eventually result in breakdown of the dielectric and possibly failure of the cable. Water trees may occur in several insulation materials; however, it appears to be associated most often with cross link polyethylene (XLPE) or high-molecular weight polyethylene (HMWPE) insulation. This is further described in SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations (September 1996) ("SAND96-0344") at 4-24 - 4-26 (ex. NYS000156B).

Wetting or submergence of non-energized cables that lasts more than a few days could also result in a decrease in the dielectric strength of the conductor insulation. This could result in short circuits or grounds and impede the cable's normal function.

Q13: Why is moisture that lasts less than a few days not considered significant?

A13: (Both). An inaccessible medium-voltage cable subject to moisture that lasts less than a few days is not considered significant moisture. Exposure of medium-voltage cable to wetting or submergence for short periods is not considered an adverse localized environment with respect to cable degradation. Significant degradation of cable insulation material in this environment is not expected. As discussed in SAND96-0344 (ex. NYS000156B), water tree formation is generally negligible in low-moisture environments (i.e., it requires ingress of moisture/ions to the

insulation). Accordingly, wetting or submergence of insulation that is susceptible to water trees for a sustained period should be avoided SAND96-0344 at 4-26 (ex. NYS00156).

Q14: Describe the Staff's method of review for Indian Point's inaccessible non-EQ power cable program.

A14: (Both) The Staff reviews the LRA AMPs described therein, and commitments made by the applicant. The Staff asks formal questions or "requests for additional information" where the LRA is incomplete or if subsequently-developed operating experience indicates the need for new information. In other words, the Staff does not simply take the applicant at its word, but instead draws its own independent conclusion as to whether the applicant's programs are adequate.

The Staff conducted a scoping and screening methodology audit at IP2 and IP3, located outside Buchanan, NY, during the week of October 8-12, 2007. The audit focused on ensuring that the applicant had developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the LRA and the requirements of the 10 C.F.R. § 50.54 The Staff reviewed implementation of the project-level guidelines and topical reports describing the applicant's license renewal scoping and screening methodology. The Staff conducted detailed discussions with the applicant on the implementation and control of the license renewal program and reviewed the administrative control documentation used by the applicant during the scoping and screening process, the quality practices used by the applicant to develop the LRA, and the training and qualification of the LRA development team. The Staff evaluated the quality attributes of the applicant's AMP activities described in Appendix A, "Updated Final Safety Analysis Report Supplement," and Appendix B, "Aging Management Programs and Activities," to the LRA.

In support of the Staff's safety review of the LRA for IP2 and IP3, the Division of License Renewal (DLR), led a project team that audited and reviewed selected aging management reviews (AMRs) and associated AMPs, and time-limited aging analyses (TLAAs) developed by the applicant to support its LRA for IP2 and IP3. The results of the project team's audit work are documented in the Staff's Audit Report for Plant Aging Management Programs and Reviews ("AMP Audit Report") (ex. ENT000041). The project team included NRC Staff and engineers provided by Brookhaven National Laboratory (BNL), the technical contractor. AMP Audit Report at 1 (ex. ENT000041). The project team performed its work in accordance with the requirements of the Staff's SRP-LR and other guidance documents. *Id.* The project team performed its work at NRC Headquarters, Rockville, Maryland; at the BNL office in Long Island, New York; and at the IP2 and IP3 site in Buchanan, New York. *Id.* The project team conducted onsite visits during the weeks of August 27 - 31, 2007, October 22 - 26, 2007, November 27 - 29, 2007, and February 19 - 21, 2008. *Id.*

During the on-site AMP audit, the Staff audited applicant records supporting the applicant's conclusion that the program elements (1) "scope of program," (2) "preventive actions," (3) "parameters monitored or inspected," (4) "detection of aging effects," (5) "monitoring and trending," and (6) "acceptance criteria," are consistent with the corresponding elements in the GALL Report AMP. AMP Audit Report at 4-5 (ex. ENT00041). In addition, the Staff asked questions to obtain clarification and/or additional details about certain aspects of the AMP. *Id.* at 5. The Staff's acceptance of the "operating experience" element is documented in the Staff's SER for the Indian Point LRA. *Id.* at 5. During the audits, the Staff verified that elements (1) through (6) of the Non-EQ Inaccessible Medium-Voltage Cable Program are consistent with the corresponding elements of the XI.E3 AMP in the GALL Report. AMP Audit Report at 23 (ex. ENT00041) . At the time of the audits, the applicant had not yet developed procedures for this

new program; and the Staff's audit addressed only the applicant's program elements and the corresponding program in the GALL Report. *Id.*

The Staff's evaluation of the Quality Assurance program includes assessment of program elements (7) "corrective actions," (8) "confirmation process," and (9) "administrative controls." The Staff's review of these elements, as part of the applicant's Quality Assurance program are documented in SER Section 3.0.4. AMP Audit Report at 5 (ex. ENT00041). The AMP Audit Report notes that the staff's evaluation of the operating experience element will be documented in the staff's SER for the Indian Point LRA. *Id.*

Entergy's subsequent decision to expand the non-EQ inaccessible medium voltage cable program to include low voltage cables did not prompt the Staff to re-audit because, as discussed above, the Staff was satisfied with the applicant's actions with respect to the original AMP for inaccessible non-EQ medium-voltage cables. No complex changes to the program were anticipated to be necessary for the applicant to expand the program to include inaccessible non-EQ low-voltage cables.

Q15: Does the LRA contain finalized new implementing procedures for the Staff to review?

A15: For the new Non-EQ Inaccessible Medium-Voltage Cable Program AMP, the Staff does not review each and every procedure being developed by the applicant. The AMP gives general descriptions of acceptable inspection techniques and these tests are typical of the power industry. Furthermore, the Commission-approved GALL Report AMP XI.E3 contemplates that the tests will be "state of the art" at the time they are performed. GALL

Report, Rev. 1 at XI E-7[2] (ex. NYS000146C); Gall Report, Rev. 2 at XI E3-1 (ex. NYS000147D). Therefore, the Staff does not find it necessary for LRAs to include current finalized detailed procedures for the Staff to review and approve in light of the latitude provided for using "state of the art" tests in the future. Instead, Entergy's LRA committed to complete the implementation process, and put the programs and procedures into place prior to the period of extended operation.

Q16: What did the Staff conclude about Indian Point's Non-EQ Inaccessible Medium-Voltage Cable Program?

A16: (Both) Based on its review of IP2 and IP3's LRA, as supplemented, the results of the AMP Audit, the AMR Audit, which included interviews with the applicant's technical Staff, as well as the applicant's responses to the Staff's request for additional information, the Staff determined that the applicant's 10 program elements are consistent with the GALL Report AMP elements. *See* NUREG-1930 at 3-33 (ex. NYS00326B) & SSER at 3-9 (ex. NYS000160). The applicant's program, including enhancements that incorporate 400 V to 2 kV inaccessible power cables, are consistent with industry operating experience and current Staff positions. SSER at 3-9 (ex. NYS000160). The Staff concluded that Entergy demonstrated that the effect of aging will be adequately managed so that the inaccessible power cable intended function(s) will be maintained consistent with the current license basis for the period of extended operation. *Id.*

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[2] The GALL Report says:

> [T]he specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, . . . or other testing that is state-of-the-art at the time the test is performed.

GALL Report Rev. 1 at XI E-8 (Element 3 "Parameters Monitored/Inspected.") (ex. NYS000146C).

Q17: What is NYS expert's conclusion about Entergy's AMP?

A17: (Both) Mr. Bascom states that the AMP is inadequate because it lacks the following details: a) the age of the cable circuits, b) the number of cable circuits, c) the lengths of cable circuits, d) the voltage class of the cables, e) the types of cables, including insulation type, f) the types of testing that will be performed, g) the acceptance criteria for each of the tests, h) the corrective actions, i) the management of the effects of aging due to thermal stress, and j) justification for failing to consider aging due to thermal stress. Bascom PFT at 34-35 (ex. NYS000136).

Q18: Is Mr. Bascom correct that the LRA did not provide the details he listed in his testimony?

A18: (Both) Mr. Bascom is correct; however, we do not believe that this information is necessary to determine whether Entergy's AMP is adequate.

Q19: What reasons does Mr. Bascom give for requiring the AMP to include the age of cable circuits? Does the Staff agree with his reasons?

A19: (Both): Mr. Bascom testifies (Bascom PFT at 34) that the age of cable circuits is needed but doesn't explain his reasoning.

The Staff does not agree that cable age is needed as part of an AMP. The LRA is not proposing an AMP that treats younger or recently-manufactured cables differently than older cables from original construction, therefore there's no reason to review what a particular cable's age is. The age of the cable could be useful if the applicant's program identified a particular

cable as being addressed by an existing time-limited aging analysis (TLAA), and the LRA was using the cable's age as part of the demonstration that the TLAA remains valid for the period of extended operation (10 C.F.R. § 54.21(c)(1)(i)), or the applicant used the cable's age as part of a projection of a TLAA to the end of the period of extended operation (10 C.F.R. § 54.21(c)(1)(ii)). However, that's not what Entergy's LRA proposes to do. Instead, Entergy's AMP is to demonstrate that the effects of aging of the cables will be managed such that the intended functions of the cables will remain consistent with the CLB. The applicant is not basing its program upon the age of in-scope cables. Thus, contrary to the position of Mr. Bascom, the age of a given cable is not needed as part of the demonstration of an adequate AMP. The ages of cables are irrelevant because inspection and test frequency are established based on test and inspection results and industry and plant-specific operating experience.

Q20: What reasons does Mr. Bascom give for requiring the AMP to include the number of cable circuits?

A20: (Both): Mr. Bascom observes that Entergy committed to implement its AMP for non-EQ inaccessible power cables prior to the period of extended operation for each unit. Bascom PFT at 25. From this, he concludes that to fulfill its commitment, Entergy will have to test all the relevant cables at IP 2 by September 23, 2013. *Id*. He says the detail on the number of cables is needed because otherwise Mr. Bascom cannot determine if Entergy will be able to test all of its cables. *Id.* at 26.

Q21: Is Mr. Bascom correct that Entergy's commitment requires it to test all the cables before the PEO?

A21: (Both): Yes. Entergy's LRA states that the Non-EQ Inaccessible Medium-Voltage Cable Program will be implemented prior to the period of extended operation and will be consistent with the corresponding program described in NUREG-1801, Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 C.F.R. § 50.49 Environmental Qualification Requirements. Entergy's March 28 Response, Attachment 1, at 12. (ex. NYS000151). NUREG-1801, Section XI.E3, Element 4 "Detection of Aging Effects" states that the first tests for license renewal are to be completed before the period of extended operation. GALL Report Rev. 2 at E3-2 (ex. NYS000147D).

Q22: Mr. Bascom testifies that the number of cables should be given in the LRA because, without this information, he cannot assess whether Entergy will be able to test all the relevant cables at IP2 before the period of extended operation. Bascom PFT at 25-26 (NYS000136). Does the Staff agree?

A22: (Both): No, there is no purpose in having the applicant provide the number of cables for the purpose of developing a detailed testing schedule. Entergy committed to perform the tests and implement the program prior to the PEO. We do not believe the LRA needs to state the number of cable circuits; the adequacy of the AMP is not tied to the number of cable circuits being managed. There is no lower or upper limit to how many cables can be managed by the proposed AMP.

Entergy has committed to test the in-scope cables prior to the PEO; in Commitment 15, Entergy stated its implementation schedule of Sept. 28, 2013 for Unit 2, and Dec. 12, 2015 for Unit 3. Entergy's March 28 Response, att. 2 at 9 (ex. NYS000151). Although not part of the consideration for a decision on an LRA, the Staff will use inspection procedure IP 71003, “Post-Approval Site Inspection for License Renewal,” (ML082830294) (ex. _____) to verify, on a

sampling basis, that license conditions and commitments are implemented, that any newly-identified systems, structures, and components (SSCs) are included in the appropriate AMPs, and the updated final safety analysis report (UFSAR) is properly updated.

Q23: What reason does Mr. Bascom give for requiring the AMP to include the length of cable circuits? Does the Staff agree with this reasoning?

A23: (Both): Mr. Bascom testifies that the information is needed because cable length may determine which test methods may be used. Bascom PFT at 35 (ex. NYS000136).

The Staff disagrees that the LRA must specify each cable length to decide which test to use. This level of detail is unnecessary in the LRA because the determination of which test method to be used is not controlled strictly by cable length. Instead, as described in the GALL Report, the applicant may use "testing that is state-of-the-art at the time the test is performed." NUREG-1801, Rev. 1 at XI E3-2 (ex. NYS000147D).

Furthermore, in this instance the applicant has chosen to use a "commodity" approach. Under this approach, the LRA does not list each cable, but instead identifies electrical commodity groups (e.g., cables, connections) as similar electrical and instrumentation and control components with common characteristics.

The "commodity group cables, connections, bus, and electrical portions of I&C penetration assemblies" was further divided into the smaller sets which included: "inaccessible medium-voltage (2 kV to 35 kV) cables (e.g., installed underground in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements." LRA at 2.5-2 (ex. ENT00015A). Under this

approach, "[e]ach of these commodity groups [except as noted] is subject to aging management review." *Id.*

The use of commodity groups is consistent with the GALL Report Rev. 2 which states,

> Electrical cables and their required terminations (i.e., connections) are typically reviewed as a single commodity. . . . This common review is translated into program actions, which treat cables and connections in the same manner.

Gall Report Rev. 2 at at VI A-1 (ex. NYS00147B).

The SRP-LR likewise allows that an applicant may group components into commodity groups saying:

> The applicant may also group like structures and components into commodity groups. Examples of commodity groups are pipe supports and cable trays. The basis for grouping structures and components can be determined by such characteristics as similar function, similar design, similar materials of construction, similar aging management practices, or similar environments. If the applicant uses commodity groups, the reviewer verifies that the applicant has described the basis for the groups.

SRP-LR Rev. 2 at 2.1-14 (ex. NYS000161); *see* also SRP-LR Rev. 2 at 2.1-23 (Table 2.1-5 Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment." (ex. NYS000161).

Thus, with respect to listing each cable length to assure that it has the right test, the commodity approach makes such detail unnecessary. The applicant will age-manage cables as groups, not individuals. This is an approach consistent with *Seabrook,* which the Commission found to be acceptable. *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC __, __ (Slip op) (March 8, 2012) (slip op. at 18).

Q24: What is your opinion of the reasons Mr. Bascom gives for requiring the AMP to include the voltage class of the cables? Does the Staff agree with his reasons?

A24: (Both): Mr. Bascom testifies that the information is needed for selection of an appropriate testing technique. Bascom PFT at 27 (ex. NYS000136).

Entergy's AMP, as updated through its various additional responses, includes cables operating at a wide range of voltages from 400 V to 35 kV. *See* Entergy's March 28 Response (ex. NYS000151), Entergy's July 14 Response (ex. NYS000152), Entergy's July 27 Response (ex. NYS000153), and Entergy's August 9 Response (ex. NYS000154).

The GALL Report allows for the licensee to select a test that is "state of the art." See e.g. GALL Report Rev. 1 at XI E-8 (ex. NYS000146C). The NRC does not require the LRA to include details of each test selected, and similarly the particular cable. The details on voltage class are not needed. As explained above in A23, the staff reviewed the applicant's commodity group approach and concluded that the applicant's "methodology for identifying electrical commodity groups within the scope of license renewal and subject to AMR [aging management review] is consistent with the requirements of 10 C.F.R. § 54.21(a)(1)." Thus, with respect to listing each cable voltage to assure that it has the right test, the commodity approach makes such detail unnecessary. The applicant will age-manage cables as groups, not individuals. This is an approach consistent with *Seabrook,* which the Commission found to be acceptable. *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC __, __ (Slip op) (March 8, 2012) (slip op. at 18).

Q25: Mr. Bascom also testifies that cable type is needed. Bascom PFT at 27 (ex. NYS000136) What is your opinion on this?

A25: (Both): Mr. Bascom testifies that the information is needed for selection of an appropriate testing technique. Bascom PFT at 27 (ex. NYS000136).

For the reasons stated above in A23, this information is not needed. The GALL Report allows for the licensee to select a test that is "state of the art;" the applicant has chosen to use a "commodity" approach. This is an approach consistent with *Seabrook,* which the Commission found to be acceptable. *Seabrook,* CLI-12-05, 75 NRC __, __ (March 8, 2012) (slip op. at 18).

Q26: Mr. Bascom asserts that the LRA is deficient for failing to specify the types of testing that will be performed. What is your opinion on this issue?

A26: (Both): Mr. Bascom in his testimony says the information is needed to determine if the testing methods are appropriate for the types of cable the AMP will manage. Bascom PFT at 26 (ex. NYS000136)

Although the specific test method is not identified by the applicant, the determination of what test method would be appropriate will be determined by the applicant based on NRC and industry standards and guidance prior to the period of extended operation; the GALL Report allows for the licensee to select a test that is "state of the art." See e.g. GALL Report Rev. 1 at XI E-8 (ex. NYS000146C). The test method will be a proven test for detecting deterioration of the insulation due to wetting or submergence.

Q27: Mr. Bascom asserts that the LRA is deficient for failing to specify the acceptance criteria for each of the tests. What is your opinion on this issue?

A27: (Both): Mr. Bascom in his report says that because Entergy has not identified which test methods it will use, Entergy cannot identify the acceptance or pass/fail criteria it will use for whatever test it eventually selects. Bascom PFT at 26 (ex. NYS000138).

Although the specific test method is not identified by the applicant, the determination of what test method and associated acceptance criteria would be appropriate will be determined by the applicant based on NRC and industry standards and guidance prior to the period of extended operation; the GALL Report allows for the licensee to select a test that is "state of the art." See e.g. GALL Report Rev. 1 at XI E-8 (ex. NYS000146C). Because the acceptance criteria for each test are defined by the specific type of test performed and the specific cable tested, specific acceptance criteria in the LRA are not appropriate.

Q28: Mr. Bascom asserts that the LRA is deficient for failing to specify the corrective actions. What is your opinion on this issue?

A28: (Both): Mr. Bascom in his report says that because Entergy does not describe or commit to the corrective actions it will use, there remains the possibility that it will do nothing to prevent cables from being repetitively exposed to significant moisture. Bascom PFTat 26 (ex. NYS000138).

We find no merit in his speculation about corrective actions associated with repetitive failures. But, as we previously stated, corrective actions are fact-dependent and not one-size-fits-all. No purpose would be served with requiring the LRA to include a table or list specifying all corrective actions for all conditions adverse to quality. As described in the GALL Report Rev. 1 and Rev. 2, there are many factors that must be considered when formulating corrective actions and these factors include: the significance of the test results, the operability of the component,

the potential root cause, the likelihood of recurrence, and a whether the same condition or situation is applicable to other inaccessible, in-scope power cables. E.g. GALL Report Rev. 1 at Section XI E-8 to XI E-9 (ex. NYS000146C). The LRA describes that if the test acceptance criteria are not met, the requirements of 10 C.F.R. Part 50, Appendix B, will be used to address corrective actions.

The existing 10 C.F.R. Part 50 Appendix B program is the same program for repairs and replacements of failed components under the existing licenses. It is subject to NRC inspection and enforcement under the current licensing basis. In addition, any concerns with the Appendix B programs would need to be addressed now, because it would be a concern with current compliance under the CLB.

The Staff reviewed the corrective actions program, and concluded that the quality assurance (QA) attribute "corrective action" of the applicant's programs is consistent with 10 C.F.R. § 54.21(a)(3). SER at 3-220 to 3-222 (ex. NYS000326C).

Q29: Mr. Bascom asserts that the LRA is deficient for failing to specify the management of the aging caused by thermal stress. What is your opinion on this issue? Bascom PFT at 30 (ex. NYS000136).

A29: (Both): Mr. Bascom in his testimony states that the thermal resistance of the environment through which an underground cable passes may be too high for the heat generated by the current to pass out of the cable and into the surrounding soil. Bascom PFT at 30 (ex. NYS000136). Second, the ambient temperature around the cable may be greater than the cable was designed to withstand because of an external heat source. *Id.* And third, heat from

other cables in close proximity, particularly in underground conduits, will cause temperature to rise in the vicinity of the subject cable and cause mutual heating effect. *Id.*

The NRC's significant research in the area of license renewal reviews and aging concerns has not shown the three issues discussed by Mr. Bascom to be a concern at operating plants. Thus, while other AMPs directly address the issue of adverse localized environments caused by heat, radiation, or moisture, the available data and information do not identify heat as a significant concern for the inaccessible non-EQ cables. *See e.g.* Gall Report Rev. 2 at XI E-1 (XI.E1, "Insulation Material for Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements") (ex. NYS000147D).

It is true that Indian Point had some cable failures, but they were not caused by heat. For example, the Staff's SSER notes that IP3 had experienced two cable failures and IP2 had experienced no aging-related failures based on recent operating experience and the scoping criteria of the Generic Letter 2007-01 (ex. NYS000149). SSER at 3-7 (ex. NYS000160).

Mr. Bascom notes that SAND96-0344 concluded thermal embrittlement was one of the most significant aging mechanisms for insulation of low voltage cables. Bascom PFT at 31 (ex NYS000136). The Staff notes that in context the report says:

> Thermal embrittlement of insulation is one of the most significant aging mechanisms for low-voltage cable. Mechanical stress (vibration, etc.) was also frequently cited as a cause for failure. These thermal and mechanical aging mechanisms occur predominantly near end devices or connected loads. Thermal aging results largely from localized hot spots; aging due to the ambient environment or ohmic heating may also be present.

SAND96-0344 at 1-3 (ex. NYS00156A). Thus, the issue is not a concern for inaccessible non-EQ power cables; the inaccessible portions are not the ends of the cables. Regarding aging

from "localized hot spots" related to ambient environments or ohmic heating, the NRC research documented in the GALL Report and SRP-LR has not shown localized hot spots to be an issue for inaccessible cables. The cable's original design, selection, and installation, which would have considered the ampacity limits, conductor size and resistance, cable material, installation geometry, and ambient temperature in which the cable operates, thus addressing (or precluding) localized hot spots. But these considerations would be addressed at the design stage of a reactor, and not as a new aging effect requiring management. The fact that the cables were designed for their installed environments explains why ohmic heating has not been shown to be a significant aging mechanism.

With regard to an “excessive heat” being potentially applicable to inaccessible power cables, notwithstanding the significant NRC experience to the contrary, Mr. Bascom states that the ambient temperature around the cables could be greater than the cable was designed to withstand because of an external source such as a steam line, hot water pipe, or inadequate ventilation. Bascom PFT at 30 (ex. NYS000136). We note that these external sources are not typically near inaccessible non-EQ power cables. Additionally, as previously stated, no failures attributed to hot environments for non-EQ inaccessible power cables have been identified by the licensee for IP 2 and 3.

Q30: Please summarize your position about whether Entergy has demonstrated that it will manage the aging effects of non-environmentally qualified inaccessible power cables exposed to significant moisture.

A30: (Both): The Staff concluded that the AMP meets all ten program elements. *See* NUREG - 1930 at 3-33 (ex. NYS000326B) and SSER at 3-9.(ex. NYS000160) .

Q31: Does this conclude your testimony?

A31: (Both): Yes.

March 30, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket Nos. 50-247-LR/ 50-286-LR
	)	
(Indian Point Nuclear Generating	)	
Units 2 and 3)	)	

AFFIDAVIT OF CLIFFORD DOUTT

I, CLIFFORD K. DOUTT, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 C.F.R. § 2.304(d)

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Dated at Rockville, Maryland
This 30th day of March, 2012

March 30, 2012

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NUCLEAR REGULATORY COMMISSION

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AFFIDAVIT OF DUC NGUYEN

I, Duc Nguyen, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 C.F.R. § 2.304(d)

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Dated at Rockville, Maryland
This 30th day of March, 2012