**UNITED STATES**
**NUCLEAR REGULATORY COMMISSION**

**ATOMIC SAFETY AND LICENSING BOARD**

| | |
|---|---|
| In re: | Docket Nos. 50-247-LR; 50-286-LR |
| License Renewal Application Submitted by | ASLBP No. 07-858-03-LR-BD01 |
| Entergy Nuclear Indian Point 2, LLC,<br>Entergy Nuclear Indian Point 3, LLC, and<br>Entergy Nuclear Operations, Inc. | DPR-26, DPR-64<br><br>March 22, 2013 |

# THE STATE OF NEW YORK'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW AS TO CONSOLIDATED CONTENTION NYS-6/7

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## GLOSSARY OF TERMS, ACRONYMS, & ABBREVIATIONS

| | |
|---|---|
| ALEE | adverse localized equipment environment |
| AMP | aging management program |
| FSAR | Final Safety Analysis Report |
| inaccessible cables | cables that are inaccessible or underground; this can include cables installed in conduits, duct banks, cable troughs, underground vaults, cable trenches, or cables directly buried in soil installations |
| IP1 | Indian Point Unit 1 |
| IP2 | Indian Point Unit 2 |
| IP3 | Indian Point Unit 3 |
| LRA | license renewal application |
| Non-EQ | non-environmentally-qualified - that is, not subject to the environmental qualification requirements of 10 C.F.R. § 50.49 |
| UFSAR | Updated Final Safety Analysis Report |

# THE STATE OF NEW YORK'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW AS TO CONSOLIDATED CONTENTION NYS-6/7

1. In accordance with 10 C.F.R. § 2.1209 and the January 15, 2013 Order issued by the Atomic Safety and Licensing Board ("Board"), the State of New York ("State") submits its proposed Findings of Fact and Conclusions of Law on the State's admitted Consolidated Contention 6/7. At issue in this consolidated contention is whether Entergy's proposed aging managing program ("AMP") for inaccessible, Non-Environmentally-Qualified, low-voltage and medium-voltage power cables provides reasonable assurance that these cables can continue to perform their intended function during the period of extended operation. These proposed findings support the Board's determination, under 10 C.F.R. §§ 54.21 and 54.29, that a renewed license should not be issued authorizing Entergy to operate the Indian Point nuclear power plants for additional 20-year terms.

2. Based on the pre-filed testimony and exhibits submitted by the parties, and the testimony provided during the evidentiary hearing held in Tarrytown, New York on December 12, 2012, and for the reasons set forth below, Entergy's proposed AMP for Non-Environmentally-Qualified ("Non-EQ") inaccessible low-voltage and medium-voltage power cables does not "demonstrate that ... [t]he effects of aging on the intended function(s) will be adequately managed for the period of extended operation." 10 C.F.R. § 54.29.

3. As described in detail below, Entergy's proposed AMP for these cables is inadequate. With respect to moisture related degradation for inaccessible underground cables, Entergy's witnesses testified that the proposed aging management program is only sufficient if implemented in accordance with Entergy's implementing procedures, but these implementing procedures are not included in the aging management program, are not enforceable, and were not

reviewed by NRC Staff. Because the implementing procedures, which Entergy's witnesses testified are critical to the adequacy of the AMP, are not part of the AMP, Entergy's AMP will not provide reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the continuing licensing basis. 10 C.F.R § 54.29.

4. As discussed below, with respect to thermal degradation, Entergy's witnesses testified that plant-specific procedures and design criteria would preclude or manage thermally-related age related degradation of inaccessible underground electric cables at the Indian Point facilities. These representations, however, are not included in Entergy's proposed AMP. Accordingly, Entergy's AMP will not provide reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the continuing licensing basis. 10 C.F.R § 54.29.

## I. INTRODUCTION

5. This submission is organized as follows. Section II sets forth the applicable legal and regulatory standards. Section III summarizes the regulatory history of the Indian Point facilities and provides an overview of these types of electrical cables at the facilities. Section IV summarizes the procedural history of this issue and this proceeding. Section V sets out the deficiencies in Entergy's proposed Aging Management Plan for Non-Environmentally-Qualified, Inaccessible Low-Voltage and Medium-Voltage Cables. In Section VI, the State presents its proposed conclusions of law that Entergy's Aging Management Program for Non-Environmentally-Qualified, Inaccessible, Low-Voltage and Medium-Voltage Cables is so devoid of information that it does not provide reasonable assurance that the effects of aging on these cables will be adequately managed during the term of a license renewal. Finally, in Section VII, the State submits a Proposed Order.

## II. LEGAL STANDARD

### A. Burden of Proof

6. "It is well established that the Applicant carries the burden of proof on safety issues." *Duke Power Co.*, (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 N.R.C. 1041 (1983), citing *Consumers Power Co.* (Midland Plant, Units 1 and 2), ALAB-283, 2 N.R.C. 11, 17 (1975). Once the State has "introduced sufficient evidence to establish a prima facie case, the burden then shifts to the applicant who, as part of his overall burden of proof, must provide a sufficient rebuttal to satisfy the Board that it should reject the contention as a basis for denial of the permit or license." *Louisiana Power and Light Co.* (Waterford Steam Electric Station, Unit 3), ALAB-732, 17 N.R.C. 1076, 1093 (1983) (quoting *Consumers Power Co.* (Midland Plant, Units 1 and 2), ALAB–123, 6 A.E.C. 331, 345 (1973)).

### B. Evidentiary Standards

7. The NRC's regulations require Entergy to "demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation." 10 C.F.R. § 54.21(a)(3). Systems, structures, and components ("SSCs") requiring an aging management review perform an intended function, as described in § 54.4:

> (1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions--
>
> (i) The integrity of the reactor coolant pressure boundary;
>
> (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (iii)The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.

> (2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section.
>
> (3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

10 C.F.R. §§ 54.4(1)-(3); *see also Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-10-14, 71 N.R.C. 449 (June 17, 2010). Therefore, those[1] inaccessible low-voltage and medium-voltage cables that are safety-related, or that are non-safety-related but whose failure could affect the reactor pressure boundary's integrity, the capability to safely shut down the plant, or the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures, must be the subject of an aging management program in license renewal.

8. The United States Supreme Court recognized that, pursuant to section 182(a) of the Atomic Energy Act (42 U.S.C. § 2232(a)), definitive safety findings must be made before issuance of an operating license. *Power Reactor Development Co. v. International Union of Elec., Radio and Mach. Workers, AFL-CIO*, 367 U.S. 396, 397 (1961) ("It is clear from this provision that before licensing the operation of PRDC's reactor, the AEC will have to make a positive finding that operation of the facility will 'provide adequate protection to the health and safety of the public.'"); *see also Union of Concerned Scientists v. NRC*, 735 F.2d 1437, 1451

[1] The cables at issue are not subject to the environmental qualifications of 10 C.F.R § 50.49 because they are located in an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences. 10 C.F.R. § 50.49(c)(3).

(D.C. Cir. 1984), *cert. denied*, 469 U.S. 1132 (1985) (holding that material licensing issues may not be excluded from a licensing hearing).

9. Under the Atomic Energy Act and NRC regulations, Entergy's License Renewal Application must contain a proposed aging management program for inaccessible low and medium-voltage power cables, NRC must then review that proposed program, and make an affirmative finding that the proposed program complies with 10 C.F.R. Part 54 and provides reasonable assurance of adequate protection to the health and safety of the public.

10. The regulatory language in § 54.29 obligates Entergy to prove that "actions have been *identified* and . . . will be *taken*" (emphasis added) such that Entergy demonstrates that it will be managing the effects of aging on critical safety components.

11. The NRC has issued three versions of a NUREG document, entitled Generic Aging Lessons Learned ("GALL"), which offers an applicant guidance on Aging Management Programs for in-scope SSCs. *See* NUREG 1801 ("GALL Report"). The Commission has stated that a "license renewal applicant's use of an aging management program identified in the GALL Report constitutes reasonable assurance that it will manage the targeted aging effect during the renewal period." *AmerGen Energy Co.* (Oyster Creek Nuclear Generating Station), CLI-08-23, 68 N.R.C. 461, 468 (2008). The GALL Report, however, is merely a guidance document and consistency with GALL does not foreclose a challenge to the adequacy of an AMP. *Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), CLI-10-17, slip op. at 46-47, 72 N.R.C. 1, 37 (July 8, 2010). Moreover, an applicant's mere assertion that it will comply with GALL does not fulfill its duty to "demonstrate" that it has an adequate AMP. *Id.* at 45 ("We do not simply take the applicant at its word.").

### C. The Legal Significance of the Updated Final Safety Analysis Report and 10 C.F.R § 50.59

12. An applicant for a construction permit for a nuclear power plant must submit a preliminary safety analysis report, which includes a safety assessment of the proposed facility. 10 C.F.R. § 50.34 (a).

13. By regulation, the NRC expects that "reactors will reflect through their design, construction and operation an extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products." 10 C.F.R § 50.34 (a)(1)(ii).

14. Each application for an operating license must include a final safety analysis report ("FSAR"). The FSAR shall include information that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components and of the facility as a whole. 10 C.F.R § 50.34(b).

15. An application for the renewal of an operating license for a nuclear power plant must contain a supplement to the FSAR, also known as the updated final safety analysis report ("UFSAR"). The UFSAR must contain a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses for the period of extended operation. 10 C.F.R § 54.21(d).

16. If an aspect of an AMP or implementing procedure is not explicitly included in the UFSAR or the plant's Technical Specifications ("TS" or "Tech Specs"), then Entergy can change that aspect without first informing NRC Staff or obtaining a license amendment. 10 C.F.R § 50.59(c), (d).

17. If an aspect of an AMP or implementing procedure is explicitly included in the UFSAR or the Technical Specifications, then Entergy, under certain circumstances, may be

required to inform NRC Staff before changing that aspect and to obtain a license amendment pursuant to 10 C.F.R. § 50.59 if Staff agrees to the change.

18. 10 C.F.R. § 50.59(c)(1)(2) permits Entergy to make changes in the UFSAR without prior notice to the NRC and without obtaining a license amendment if there is no change in the Technical Specifications in the license and the change does not meet any of the following eight criteria:

> (i) Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the final safety analysis report (as updated);
>
> (ii) Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated);
>
> (iii) Result in more than a minimal increase in the consequences of an accident previously evaluated in the final safety analysis report (as updated);
>
> (iv) Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the final safety analysis report (as updated);
>
> (v) Create a possibility for an accident of a different type than any previously evaluated in the final safety analysis report (as updated);
>
> (vi) Create a possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the final safety analysis report (as updated);
>
> (vii) Result in a design basis limit for a fission product barrier as described in the FSAR (as updated) being exceeded or altered; or
>
> (viii) Result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.

10 C.F.R § 50.59(c)(1)(2).

19. If Entergy evaluates a change under the criteria of § 50.59 and concludes that it does not meet any of the above criteria, then Entergy can make the change without prior notice to the NRC and without obtaining a license amendment.

20. Entergy must keep a record of such changes and provide them to NRC Staff at least every 24 months. 10 C.F.R. § 50.59(d).

### D. The Regulatory Meaning of Non-Environmentally-Qualified Cables

21. 10 C.F.R. § 50.49 requires that certain electrical equipment, including cables, in a nuclear power plant be qualified for its application and specific performance. Such equipment is characterized as "environmentally qualified" or "EQ." ENT000233 at 19, A.31.

22. Cables that are used in mild plant environments, or are not required to remain functional during or following exposure to environmental conditions caused by a design basis event are not required to be environmentally qualified pursuant to 10 C.F.R. § 50.49. A mild plant environment is defined as "an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences." 10 C.F.R. § 50.49(c).

## III. REGULATORY HISTORY OF THE INDIAN POINT NUCLEAR FACILITIES AND OVERVIEW OF ELECTRICAL CABLES

23. The Indian Point facilities at issue in this proceeding are located on the east bank of the Hudson River at river mile 43 in the Village of Buchanan in Westchester County in the State of New York. NRC000004/NYS00133 A-J (NUREG-1437, Supplement 38, Final Supplemental Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Indian Point Nuclear Generating Units 2 and 3, Volumes 1, 2 and 3 (Dec. 2010) ("FSEIS") at 2-1, 2-27.

24. In March 1955, soon after the enactment of the Atomic Energy Act of 1954, the Consolidated Edison Company initially selected the site for the location of a nuclear power reactor, and the U.S. Atomic Energy Commission approved the Indian Point site for the construction of one of the first commercial reactors in 1956. According to AEC and NRC documents, Consolidated Edison received the following construction permits and operation licenses on the following dates:

| | CONSTRUCTION PERMIT ISSUED | OPERATING LICENSE ISSUED |
|---|---|---|
| IP Unit 1 | May 4, 1956 | March 26, 1962 |
| IP Unit 2 | October 14, 1966 | September 28, 1973 |
| IP Unit 3 | August 13, 1969 | December 12, 1975 |

*See* 21 Fed. Reg. 3,085 (May 9, 1956); 31 Fed. Reg. 13,616-17 (Oct. 21, 1966); 34 Fed. Reg. 13,437 (Aug. 20, 1969); NUREG-1350, Volume 20, *2008 - 2009 Information Digest*, at 103, 113 (Aug. 2008).

25. Indian Point Unit 1 ("IP1") ceased operation in October 1974 and NRC withdrew its conditional operating license in 1980. *Consolidated Edison Co. of New York, Inc.* (Indian Point Nos. 1 and 2), Director's Decision Under 10 C.F.R. § 2,206, DD-80-5, slip op. at 5-6, 11 N.R.C. 351 (Feb.11, 1980).

26. Indian Point Unit 2 ("IP2") received its construction license in October 1966 - - approximately 46 years ago.

27. Indian Point Unit 3 ("IP3") received its construction license in August 1969 - - approximately 44 years ago.

28. Shortly after receiving the AEC construction permits, Consolidated Edison and its contractors began installing systems and components, such as electrical cables, at the Indian Point facilities.

29. The Indian Point reactors and spent fuel pools are approximately 24 miles north of the New York City line, and approximately 37 miles north of Wall Street, in lower Manhattan. Portions of four counties -- Westchester, Rockland, Orange and Putnam -- fall within the inner ten mile Emergency Planning Zone, and significant population centers in New York, Connecticut and New Jersey lie within the 50 mile Emergency Planning Zone. Entergy projected that the total population within a 50 mile radius of Indian Point in the year 2035 will include approximately 19 million people. NYS00133I FSEIS Appendix G at G-20.

30. In the context of electrical cabling, the term "inaccessible" refers to electrical cables that are not accessible – whether aboveground or underground; this can include cables installed in conduits, duct banks, cable troughs, underground vaults, cable trenches, or cables directly buried in soil installations. NYS000138 Bascom Report at 7; NRC000077 Staff Pre-filed Test. at 11, A.10 (Doutt/Nguyen); *see also* ENT000241 EN-DC-348 Rev. 2 Non-EQ Insulated Cables and Connections Inspections (July 5, 2011) at 7, § 3.1[1] (defining "accessible" and "inaccessible" in the context of aboveground cables).

31. When it filed its petition to intervene, the State of New York noted that Indian Point Unit 2 and Unit 3 relied on medium-voltage and low-voltage safety related electrical cables. At that time, as the State noted, Entergy's License Renewal Application did not contain a proposed aging management program to address the age related degradation of inaccessible low-

voltage cables. The State also asserted that the proposed aging management program for inaccessible medium-voltage cables was inadequate.

32. Indian Point Units 2 and 3 have approximately 4,474 feet of inaccessible non-environmentally-qualified medium-voltage power cables and 9,230 feet of inaccessible non-environmentally-qualified low-voltage power cables that are within the scope of license renewal. ENT000242 IPEC Low-Voltage In-Scope Cable List; ENT000243 IPEC Medium-Voltage In-Scope Cable List.

33. Of the 9,230 feet of low-voltage cables, 76 percent, or 7,095 feet are safety-related pursuant to 10 C.F.R. § 50.49 -- that is, they are relied upon to remain functional during and following design basis events to ensure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents which could result in potential off-site exposures. ENT000242; ENT000243; ENT000233 Entergy Pre-filed Test. at 62, A.101; Tr.4168:04-08 (McCaffrey).

34. Indian Point Unit 3 has experienced two electrical cable failures. NYS000160 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) at 3-7.

## III. PROCEDURAL HISTORY

### A. The Board's Admission of Contentions NYS-6 and 7

35. On November 30, 2007, the State of New York submitted a Petition to Intervene to this Board. Contentions 6 and 7 in the State's Petition read in their entirety:

Contention NYS-6

> 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.

Contention NYS-7

> 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.

*New York State Notice of Intention to Participate and Petition to Intervene*, Contentions 6 and 7, at 92-103 (Nov. 30, 2007) (ML073400187).

36. In Contention NYS-6, the State asserted that Entergy's proposed AMP for inaccessible, non-environmentally-qualified, medium-voltage cables lacked any detail and thus did not demonstrate to the Board that the effects of aging would be adequately managed during the extended period of operation. Specifically, the State asserted that Entergy failed to identify which cables it covered, did not address or commit to any of the specific recommendations for the aging management of medium-voltage cables contained in a report, prepared by Sandia National Laboratory (SAND96-0344) and Brookhaven National Laboratory (NUREG/CR-5643) and did not commit to testing the cables using one of the methods recommended by the NRC in Generic Letter 2007-01. *Id.* at 94-100.

37. In Contention NYS-7, the State asserted that Entergy's LRA did not contain any AMP for inaccessible non-environmentally-qualified, low-voltage cables. *Id.* at 100-103. The State further contended that Indian Point Unit 2 and Unit 3 contained a significant number of inaccessible low-voltage safety-related cables.

38. The Board held oral argument on the admissibility of intervenors' proposed contentions on March 10-12, 2008. Tr.179:04-196:02 (March 10, 2008).

39. On July 31, 2008, the Board admitted Contentions NYS-6 and 7 with respect to Entergy's failure to provide a specific plan for the aging management of inaccessible medium-voltage cables and its failure to provide any plan for inaccessible low-voltage cables. The Board stated that "we do not comprehend how a commitment to develop a program can *demonstrate* that the effects of aging will be adequately managed." (emphasis in original). *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), LBP-08-13, slip op. at 41, 68 N.R.C. 43 (July 31, 2008) (ML082130436).

40. The Board also consolidated Contention 6 and Contention 7 into Consolidated Contention 6/7 (NYS-6/7). *Id.* at 38.

**B. The December 2010 GALL Report, Revision 2**

41. After the initial and revised GALL Reports were issued in 2001 and 2005, the NRC learned that some cables that were qualified for 40 years were failing substantially before the end of their qualified life. The NRC issued a Generic Letter in November 2007 to all current licensees, informing them that "in the absence of adequate monitoring of cable insulation, equipment could fail abruptly during service, causing plant transients or disabling accident mitigation systems." NYS000149, NRC Generic Letter 2007-01, Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients, (Feb. 7, 2007) ("Generic Letter 2007-01") (ML070360665). The Generic Letter also asked licensees to provide a history of inaccessible or underground power cable failures for all voltage cables and to describe their inspection, testing and monitoring programs to detect the degradation of inaccessible or underground power cables. *Id.* at 4.

42. After obtaining licensee responses to the Generic Letter, the NRC identified an increasing trend of cable failures beginning in the sixth through tenth years of service and concluded that moisture intrusion into inaccessible cables is the predominant factor contributing to cable failure. NYS000150 Request For Additional Information For The Review Of The Indian Point Nuclear Generating Unit Number 2 and 3, License Renewal Application, ("RAI") (Feb. 10, 2011) (ML103490041) at 5.

43. In January 2010, Brookhaven National Laboratory prepared a report for NRC concerning cable monitoring. NYS000148 NUREG/CR-7000, BNL-NUREG-90318-2009, Essential Elements of an Electric Cable Condition Monitoring Program, Brookhaven National Laboratory, Office of Nuclear Regulatory Research (January 2010) ("NUREG/CR-7000"). That Brookhaven report explained that the selection of an appropriate testing technique depends on cable characteristics such as voltage rating, cable insulation or jacket material, cable shielding and cable location. NYS000148 NUREG/CR-7000 at 3-20.

44. In December 2010, the NRC issued a second revision to the GALL Report, which incorporated information about cable failures contained in the licensee responses to Generic Letter 2007-01. NYS000147, NUREG-1801, Rev. 2, Generic Aging Lessons Learned (GALL) Report, Final Report ("GALL Rev. 2") (Dec. 2010) (ML103490041).

45. GALL Rev. 2's discussion (at § XI.E3) of inaccessible or underground cables was expanded to include low-voltage cables in addition to medium-voltage cables exposed to wetting or submergence and contains more stringent proposals for manhole inspections and cable testing. *Id.* at XI E3-2.

46. GALL Rev. 2 also contains (at § XI.E1) a discussion of accessible aboveground cables that could be exposed to adverse localized environments caused by temperature, radiation, or moisture. *Id*. at XI E1-1–XI E1-3.

47. GALL Rev. 2 was issued after the Board had admitted Consolidated Contention NYS-6/7 challenging Entergy's License Renewal Application because it did not contain an AMP for inaccessible non-environmentally-qualified low-voltage cables. GALL Rev. 2 proposes periodic inspection of cables in manholes based on plant-specific operating experience with water accumulation in the manholes, with inspections at least annually, instead of every two years; additional manhole inspections after events such as heavy rain or flooding; manhole inspection frequencies adjusted based on the results of prior inspections; testing the condition of the cables' insulation at least once every six years, instead of every ten years; and test frequencies adjusted based on test results and operating experience. *Id.* at XI E3-2.

48. GALL Rev. 2 also added a section entitled "Monitoring and Trending" which stated that "trending actions are included" because "results that are trendable provide additional information on the rate of cable insulation degradation." *Id.* at XI E3-3.

49. GALL Rev. 2 does not contain any aging management guidance for inaccessible below-grade or underground low and medium-voltage power cables that are exposed to other adverse environmental conditions, such as thermal stress.

50. NRC Staff testified that they are applying GALL Rev. 2 to Entergy's proposals to manage the aging of inaccessible, non-environmentally-qualified low and medium-voltage power cables exposed to wetting or submergence. Tr. 4185:19-4186:08 (Doutt).

### C. Entergy's Amended License Renewal Application

51. Following the admission of Contention NYS-6/7 and the issuance of GALL Rev. 2, on February 10, 2011, NRC Staff sent Entergy a Request for Additional Information. NYS000150 Request For Additional Information For The Review Of The Indian Point Nuclear Generating Unit Number 2 and 3, License Renewal Application ("RAI 3.0.3.1.2-1"), Feb.10, 2011 (ML110190809). Staff asked Entergy to explain how it would manage the effects of aging on *low* as well as medium-voltage cables and to explain how its proposed AMP for medium-voltage cables incorporates recent industry and plant specific operating experience. NYS000150 at 6.

52. By letters dated March 28, July 14, July 27, and August 9, 2011 responding to the NRC's RAIs, Entergy amended its LRA to incorporate the more stringent manhole inspection and cable testing schedule in GALL Rev. 2 for , inaccessible low and medium-voltage power cables exposed to wetting or submergence. NYS000151 Entergy Response (NL-11-032) to Request for Additional Information (RAI), Aging Management Programs, Indian Point Nuclear Generating Unit Nos. 2 and 3, (Mar. 28, 2011) (ML110960360) ("Entergy March 28 Response"); NYS000152 Entergy Response (NL-11-074) to RAI for the Review of the Indian Point Nuclear Generating Units Nos. 2 and 3, (July 14, 2011) (ML11201A160) ("Entergy July 14 Response"), NYS000153 Entergy Response (NL-11-090) to RAI for the Review of the Indian Point Nuclear Generating Units Nos. 2 and 3, (July 27, 2011) (ML11215A128) ("Entergy July 27 Response"); NYS000154 Entergy Response (NL-11-096) to RAI for the Review of the Indian Point Nuclear Generating Units Nos. 2 and 3, (August 9, 2011) (ML11229A803) ("Entergy August Response").

53. In sum, Entergy's proposed amended AMP applies to medium-voltage and low-voltage cables[2] 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. NYS000151 Entergy March 28 Response. Entergy's amended AMP states that it "will be implemented prior to the period of extended operation." NYS000151, Attachment 1 at 12.

54. In its amended AMP, Entergy provides no information about the location of the relevant cables, or their number, or the number of cable circuits, or the lengths of the cables or their function, or their physical characteristics, or the appropriate cable condition monitoring tests, or the acceptance criteria for the appropriate cable tests or the corrective actions, if any, if cables do not meet the acceptance criteria.

55. Nor did Entergy amend its LRA to include an AMP for inaccessible low-voltage and medium-voltage cables exposed to other localized adverse environmental conditions, such as heat.

[2] Although the proposed amended AMP now covers low-voltage cables, Entergy did not change the name of its AMP to reflect that change. The title of the amended AMP for inaccessible cables remains the Inaccessible Medium-voltage Cable Program. NYS000151 Attachment 1, 12 of 27.

### D. Entergy's August 2011 Updated Final Safety Analysis Report

56. In a letter dated August 9, 2011 in response to Staff's Requests for Additional Information, Entergy supplemented its UFSAR for IP2 and IP3 to include the following description of its amended Inaccessible Medium-Voltage Cable Program.

> The Inaccessible Medium-Voltage Cable Program is a new program that entails periodic and event driven 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) and low-voltage power cables (400V to 2kV) exposed to significant moisture will be tested at least once every six years to provide an indication of the condition of the conductor insulation. Test frequencies are adjusted based on test results and operating experience.
>
> The program includes periodic inspections for water accumulations in manholes at least once every year (annually). In addition to the periodic manhole inspections, manhole inspection for water after events, such as heavy rain or flooding will be performed. Inspection frequency will be increased as necessary based on evaluation of inspection results.
>
> The Inaccessible Medium-Voltage Cable Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements.

NYS00154, Attachment 1 at 1-2.

### E. NRC Staff's Supplemental Safety Evaluation Report

57. On August 30, 2011, the NRC Staff issued a Supplement to its Safety Evaluation Report for IP2 and 3. In the August 30, 2011 Supplemental Safety Evaluation Report, NRC Staff stated that Entergy's proposed AMP for Inaccessible Low-Voltage and Medium-voltage Power Cables was acceptable. NYS000160 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) at 3-5 through 3-8 (ML11201A033).

**F. Pre-filed Testimony**

58. On December 14, 2011, the State submitted pre-filed testimony, an expert report and an initial statement of position on Contention NYS-6/7. NYS000136, NYS000137, NYS000138, NYS 000135. The State argued that Entergy's proposed Aging Management Program for Inaccessible Non-Environmentally-Qualified Medium-Voltage Cables exposed to wetting or submergence did not provide reasonable assurance that the effects of aging would be adequately managed during the period of extended operation because the AMP was almost totally devoid of detail and did not include the effects of aging caused by thermal stress on these cables. The State submitted several additional exhibits in support of its position. NYS000139-NYS000162.

59. On March 30, 2012, Entergy and NRC Staff submitted pre-filed testimony and statements of position. ENT000232, ENT000233, NRC000076, NRC000077. Staff and Entergy both argued that Entergy was not required to provide any more detail in the proposed AMP and was not required to have an AMP to manage the effects of thermal stress on these cables. Entergy also relied on its Cable Reliability Program, a fleet-wide corporate implementing procedure for the proposed AMP that was issued in the summer of 2011 and asserted that it contained the detail that was lacking in the AMP. Entergy and Staff also submitted additional documents as exhibits.

60. On June 29, 2012, the State submitted pre-filed rebuttal testimony, a revised statement of position, and a condition report. NYS000411, NYS000410, NYS000412.

61. Entergy initially designated four documents (ENT000233 (Entergy Pre-filed Testimony), ENT000238, ENT000253, ENT000256) as containing "Entergy-Designated Proprietary Information Subject to Non-Disclosure Agreement" and its pre-filed testimony as

containing "Entergy-Designated Proprietary Information." The State questioned those designations in accordance with the process established by the Board's September 4, 2009 Protective Order (¶ D). After discussions between Entergy and the State, Entergy agreed to remove the "proprietary" designation from three of the four documents (ENT000233, ENT000253, ENT000256). September 14, 2012 letter from State of New York to ASLB, ML12258A380; September 21, 2011, filing by Entergy, ML12265A419. Accordingly, there was no need to close the evidentiary hearing to the public.

## IV. ENTERGY'S PROPOSED AGING MANAGEMENT PROGRAM FOR NON-ENVIRONMENTALLY-QUALIFIED, INACCESSIBLE LOW- AND MEDIUM-VOLTAGE POWER CABLES

### A. Witnesses and Qualifications

#### 1. State of New York Witness

62. The State presented one witness on consolidated NYS Contention 6/7, Earle C. Bascom, III. Mr. Bascom submitted an expert report and both direct and rebuttal written testimony. NYS000138 Report of Earle C. Bascom III, P.E. in Support of Contentions NYS 6/7 (Dec. 15, 2011)); NYS000136 Initial Pre-filed Testimony of New York State Expert Earle C. Bascom III on Contention NYS 6/7 ("Bascom Initial Test.") (Dec. 15, 2011); NYS000411 Rebuttal Pre-filed Testimony of New York State Expert Earle C. Bascom III on Contention NYS 6/7 ("Bascom Rebuttal Test.") (June 29, 012). Mr. Bascom testified in person at the evidentiary hearing in Tarrytown, New York on December 12, 2012. Transcript of Indian Point Evidentiary Hearing ("Tr.") (Dec. 12, 2012).

63. Mr. Bascom is the Principal Engineer with Electrical Consulting Engineers, P.C., a New York professional corporation providing engineering consulting services to the electric power industry. Mr. Bascom received an A.S. in Engineering Science from Hudson Valley

Community College in Troy, New York in 1987, a B.S. and M.E. in Electric Power Engineering from Rensselaer Polytechnic Institute in Troy, New York in, respectively, 1989 and 1990, and an M.B.A from the State University of New York at Albany in 1993. NYS000136 Bascom Initial Test. at 1:21-3:09.

64. Mr. Bascom is a licensed professional engineer in the State of New York and has spent his entire 21-year career focusing on underground power cables in the areas of analysis, design, specification, and assessment. Mr. Bascom is a member of the Institute of Electrical and Electronics Engineers ("IEEE"), its Power & Energy Society, the Insulated Conductors Committee ("ICC") and a voting member of the Standards Association to write, review and approve IEEE guides and standards. He is also a member of CIGRÉ, the International Council on Large Electric Systems. NYS000149, Curriculum Vitae of Earle Bascom.

**2. Entergy's Witnesses**

65. Entergy presented four witnesses on Contention NYS-6/7: (1) Alan B. Cox; (2); Roger B. Rucker; (3) Thomas S. McCaffrey; and (4) Howard G. Sedding. These witnesses provided pre-filed written testimony and testified in person at the evidentiary hearing in Tarrytown, New York, on December 12, 2012. ENT000233 Pre-filed Testimony of Entergy Experts Alan B. Cox, Roger B. Rucker, Thomas S. McCaffrey and Howard G. Sedding on NYS 6/7 ("Entergy Pre-filed Test.") (Mar. 29, 2012).

66. Alan B. Cox is employed by Entergy Nuclear Operations, Inc. as a technical manager for license review. He received a B.S. degree in nuclear engineering from the University of Oklahoma and an M.B.A. from the University of Arkansas. Mr. Cox was licensed by the NRC in 1981 as a reactor operator and in 1984 as a senior reactor operator at another Entergy plant, ANO, and since 2001, he has worked full time on license renewal for Entergy. As

technical manager, Mr. Cox was involved in developing or reviewing Aging Management Programs for IP2 and IP3, including the Non-environmentally-Qualified Inaccessible Medium-voltage Cable Program and the Insulated Cables and Connections Program. Entergy Pre-filed Test. at 1-3.

67. Roger B. Rucker is a self-employed engineering consultant and president of Rucker Nuclear Consultants, Inc. in Russellville, Arkansas. He received a B.S. degree in electrical engineering from the University of Arkansas, and he has been a member of the Nuclear Energy Institute ("NEI"), the Electric Power Research Institute ("EPRI") and the IEEE Standards Association and participated in the development of an EPRI report, "Plant Support Engineering: Aging Management Program Guidance for Medium-Voltage Cable Systems for Nuclear Power Plants." Entergy Pre-filed Test. at 3-4.

68. Thomas S. McCaffrey is employed by Entergy as the Design Engineering Manager at Indian Point since 2007 and is responsible for the design engineering staff that maintains the IP2 and IP3 design bases and performs plant modifications. Mr. McCaffrey received a B.S. in electrical engineering from the State University of New York. Although Mr. McCaffrey was not directly involved in the preparation of the LRA, he is familiar with Indian Point's electric power cable systems. Entergy Pre-filed Test. at 4-6.

69. Howard G. Sedding is employed by Kinetrics, Inc., an engineering firm in Toronto, Canada, that provides technology services to electric utilities, power equipment manufacturers, and large end users of electrical energy. Mr. Sedding received a B.S in electric and electronic engineering from the University of Strathclyde in Glasgow, Scotland. an M.S. in Crystallography from the University of London and a Ph.D. in electrical engineering and applied physics from Brighton Polytechnic. He has over 28 years of experience related to testing,

condition monitoring and assessment of insulation materials, including dielectric power cables used by the electric generating, transmission, and distribution industries. Entergy Pre-filed Test. at 6-8.

### 3. NRC Staff Witnesses

70. NRC Staff presented two witnesses on Contention NYS 6/7; (1) Cliff Doutt and (2) Duc Nguyen. These witnesses submitted pre-filed testimony and testified in person at the Indian Point evidentiary hearing in Tarrytown, New York on December 12, 2012. NRC000077 Pre-filed Testimony of NRC Staff Experts Cliff Doutt and Duc Nguyen on NYS 6/7("Staff Pre-filed Test.") (Mar. 30, 2012).

71. Clifford K. Doutt received a B.S. in electrical engineering technology from Lake Superior State University and has been employed by the NRC since 1989. He is currently an electrical engineer in the Division of License Renewal in the Office of Nuclear Reactor Regulation ("NRR"), and he was previously a reliability and risk analyst in the NRR Division of Risk Assessment and an electrical engineer in the NRR Division of Engineering instrumentation and controls branch. Since 2009, Mr. Doutt has been an electrical reviewer for license renewal amendments and has participated in the aging management program. NRC000078 Clifford K. Doutt, Statement of Professional Qualifications.

72. Duc Nguyen received a B.S. in electrical engineering from George Washington University and he has been employed by the NRC since 2006 as an electrical engineer in the Division of License Renewal ("DLR") in NRR and was previously an electrical engineer in the NRR Division of Engineering from 1993 to 2006. NRC000079 Duc T. Nguyen, Statement of Professional Qualifications.

### B. Background Concerning Electric Cable Construction

73. The two basic components of an electric cable are (1) the conductor that carries the current and (2) the cable insulation that prevents the electricity in the conductor from discharging into the surroundings. If the cable insulation is no longer capable of preventing the electricity from discharging into the surroundings, the voltage of the electricity drops, the electricity faults to ground, the cable circuit fails, and the circuit is then unable to perform its task. In an electric cable, the voltage between the conductor and the outer cable is called "line to ground voltage." It represents the electrical potential on the conductor to drive the movement of the electrons. NYS000136 Bascom Initial Test. at 7:12 -8:03; ENT000233 Entergy Pre-filed Test. at 20-2, A. 34 (Sedding, Rucker, McCaffrey).

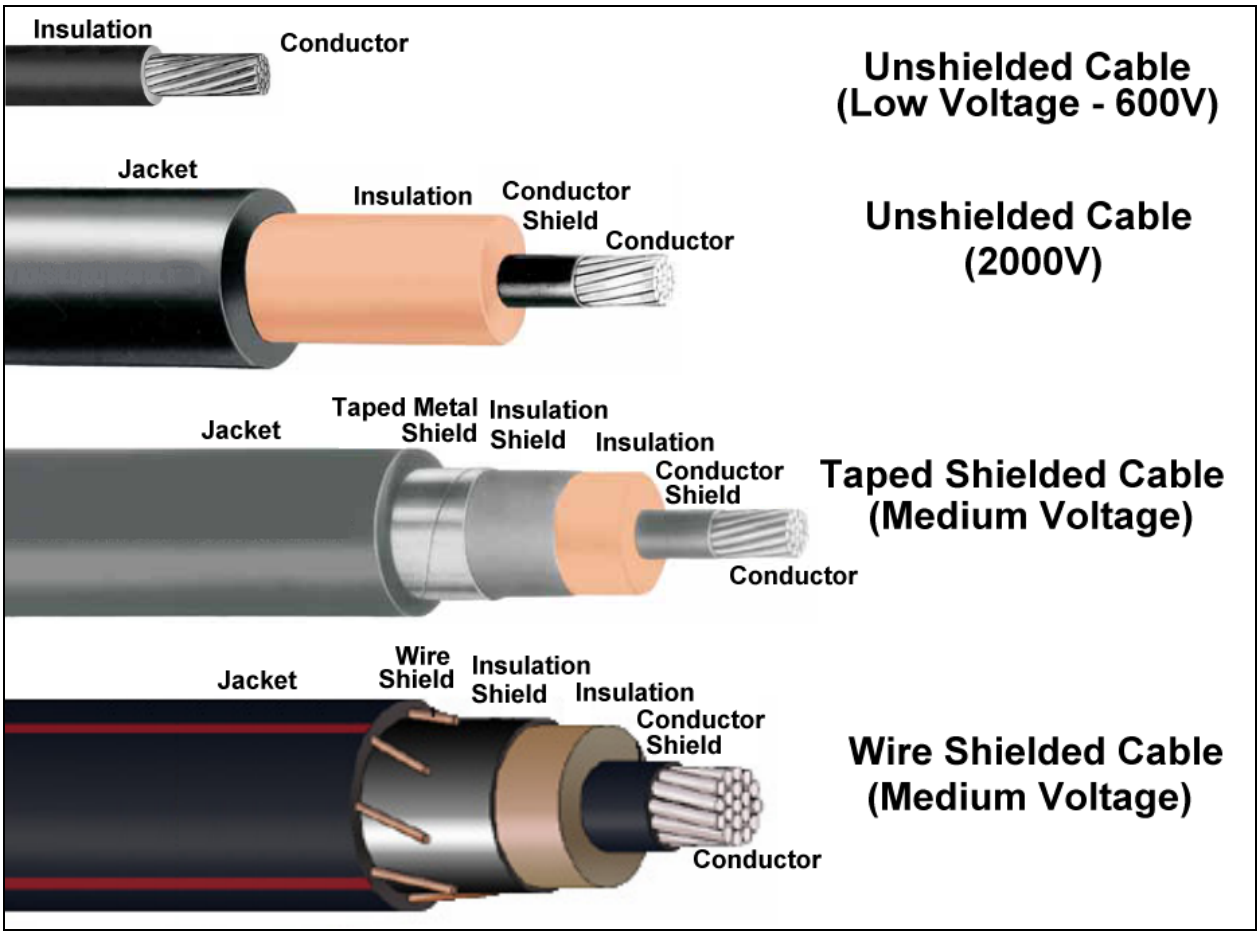
74. Low-voltage cables typically do not contain a metallic shield. Medium-voltage cables typically contain a metallic shield. NYS000136 Bascom Initial Test. at 8:04-11.

75. In the context of Entergy's Aging Management Program, low-voltage power cables are classified for operation at 400V to 2Kv and medium-voltage cables are classified for operation from 2kv to 35kv. NYS00154, Attachment 1 at 1.

76. Figure 1 below is a composite of pictures showing various cable types, to illustrate the parts of an insulated power cable. Descriptions of the various components are provided below the figure. NYS000136 Bascom Initial Test. at 9:01-06; ENT000233 Entergy Pre-filed Test. at 23, A.35.

**FIGURE**

**Low-Voltage and Medium-Voltage Underground Cable Components**




Source: NYS000138 Bascom Report at 8, Figure 2.

77. A cable contains a conductor that carries the electrical current. The conductor is made either of copper or aluminum. Because the conductor has imperfections and non-uniformity that can cause electrical stress in the overlying insulation layer, a thin semi-conducting layer of material, known as the conductor shield, is applied over the conductor to provide a smooth interface between the conductor and the surrounding insulation. NYS000136 Bascom Initial Test. at 9:10 -10:07.

78. The insulation layer on a cable prevents the electricity from leaving the cable circuit, flowing into the surrounding environment and causing a voltage drop in the cable that breaks the circuit. NYS000136 Bascom Initial Test. at 10:08-12.

79. The insulation on cables constructed in the 1960s and 1970s was generally made of cross-linked polyethylene ("XLPE"), or ethylene-propylene-rubber ("EPR"). NYS000136 Bascom Initial Test. at 10:205-211; ENT000233 Entergy Pre-filed Test. at 24, A.38.

80. An insulation shield, similar to the conductor shield, is often applied to the insulation of medium-voltage cables to provide a smooth interface between the insulation and the outer cable layers. NYS Bascom Initial Test. at 10:13-16.

81. The insulation of an unshielded cable, typically low-voltage, has no shield separating the insulation from the outer jacket of the cable. NYS000136 Bascom Initial Test. at 22:01-02.

82. Some medium-voltage cables also contain a metallic shield over the insulation shield. The metallic shield can consist of helical copper or aluminum wire strands, helical copper or aluminum tapes or longitudinal copper or aluminum foil wrap. NYS000136 Bascom Initial Test. at 10:23-11:08.

83. An insulating jacket made of polyvinyl chloride or polyethylene is then placed over the insulation, insulation shield and metallic shield, if there is one. NYS000136 Bascom Initial Test. at 11: 09-16.

**C. Causes of Underground Cable Failure**

84. The major causes of failures of underground cables are mechanical damage during dig-ins, workmanship errors in the field during the installation of cables to accessories, or

slow degradation of the cable insulation due to moisture intrusion or exposure to heat above the cable's rating. NYS000136 Bascom Initial Test. at 13:04-15.

85. If the insulation becomes sufficiently degraded, the cable may no longer support the line-to-ground voltage. Electricity from the conductor will then discharge into the surrounding environment, causing a drop in voltage and the inability of the current to complete the circuit. NYS000136 Bascom Initial Test. at 13:10-15.

86. The major cause of insulation degradation in cables constructed in the 1960s and 1970s with XLPE or EPR that are exposed to significant moisture is a type of electrochemical degradation, known as "water treeing." Water treeing can lead to a phenomenon known as "electrical trees." NYS000136 Bascom Initial Test, at 13:16-14: 06;ENT000233 Entergy Pre-filed Test. at 25-26, A.41.

87. Water treeing occurs in energized cables that are not constructed to resist water intrusion but are nevertheless wetted or submerged in water for periods of time. Water permeates the cable over time and forms channels that resemble trees. NYS000136 Bascom Initial Test. at 13:21-14:06; ENT000233 Entergy Pre-filed Test. at 26, A.42.

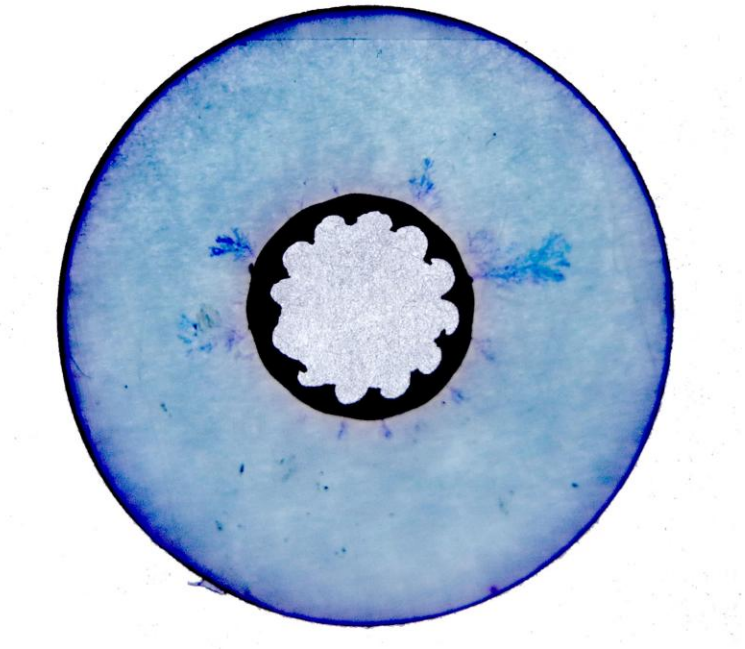
88. Water trees themselves do not significantly break down the electrical strength of the insulation but a degree of partial discharge of the electricity may occur at their location. This partial discharge will carbonize the channels, or burn them, and they then form electrical trees. If enough electrical trees form throughout the insulation, the insulation will break down, the cable will not be able to support voltage and will be unable to carry current. NYS000136 Bascom Initial Test. at 15:05-19; ENT000233 Entergy Pre-filed Testimony at 26-27, A.43.

89. Examples of water trees are shown in following Figure, a photograph taken by the State's witness Mr. Bascom, of a cross-section of cable insulation in which the conductor has

been removed. The insulation has been dyed so that the channels of the water trees are revealed. NYS000136 Bascom Initial Test. at 13:03-09; ENT000233 Entergy Pre-filed Test. at 28, A.43.

**FIGURE**

**Example of Water Trees In Cable Insulation**



Source: NYS000138 Bascom Report at 13, Figure 3.

### D. Entergy's Proposed Aging Management Program for Non-Environmentally-Qualified Inaccessible Low- and Medium-Voltage Power Cables Exposed to Wetting or Submergence

90. Entergy's program description in its proposed amended AMP for Inaccessible Low and Medium-voltage Power Cables exposed to wetting or submergence is contained in its August 9, 2011 response to the NRC's July 27, 2011 Request for Additional Information. NYS000154, Attachment 1 at p. 2. This program description replaces the program description of the initial proposed AMP that was contained in the 2007 License Renewal Application.

91. Set forth below is the program description in Entergy's 2011 proposed amended AMP.

> 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) and low-voltage power cables (400 V to 2 kV) exposed to significant moisture will be tested at least once every six years to provide an indication of the condition of the conductor insulation. Test frequencies will be adjusted based on test results and operating experience. The program includes inspections for water accumulation in manholes at least once every year (annually). In addition to the periodic manhole inspections, manhole inspection for water after events, such as heavy rain or flooding will be performed. Inspection frequency will be increased as necessary based on evaluation of inspection results.
>
> This program will be implemented prior to the period of extended operation.

NYS000152 at B.1.2.3 (strike-out and underlining omitted).

92. Unrevised sections of the AMP are contained in the original 2007 License Renewal Application. ENT00015B (App. B) at B-81 - B-82. In the AMP that it initially proposed in the 2007 License Renewal Application, Entergy states in the initial AMP in the LRA that the AMP will be consistent with the program attributes of the GALL Report, Section XI.E3, and will contain no exceptions to that section of GALL.

93. Entergy's currently proposed aging management program for cables is a little over one page in length. ENT00015B, App. B at B-81 – B-82.

94. The GALL Rev. 2 guidance for Inaccessible Cables contains the following list of tests that the applicant can use with reasonable confidence to "assess the condition of the cable insulation: Dielectric Loss (Dissipation Factor/Power Factor), AC Voltage Withstand, Partial Discharge, Step Voltage, Time Domain Reflectometry, Insulation Resistance and Polarization Index, Line Resonance Analysis, or other testing that is state-of-the-art at the time the tests are performed." NYS000147D GALL Rev. 2 at XI E3-2.

95. The selection of an appropriate testing technique depends on cable characteristics such as voltage rating, cable insulation or jacket material, cable shielding, and cable location. Bascom Initial Test. at 26:17-27:07, citing NYS000148 (NUREG/CR-7000, Essential Elements of an Electric Cable Condition Monitoring Program, Brookhaven National Laboratory (January 2010)) at 3-20. For example, the condition of cables without an intact metallic shield around the insulation cannot be effectively tested with partial discharge or time domain reflectometry because the minute signals evidencing localized breakdowns in the insulation are much more likely to be lost or attenuated in unshielded than in shielded cables. NYS000136 Bascom Initial Test. at 21:15-22:07.

96. Similarly, certain tests, such as DC Step Voltage or Insulation Dissipation Factor are generally inappropriate for cables of extruded construction, such as XLPE or EPR cables. These same tests would be effective for paper-lead cables, another cable type that utilities frequently used in the 1960s and 1970s. NYS000136 Bascom Initial Test. at 27:08-13.

97. Entergy's proposed amended AMP contains no information about the characteristics of the cables that will be tested. Nor does it select one of the testing methods listed in GALL Rev. 2 that the NRC Staff has determined can be used with "reasonable confidence to assess the condition of the cable insulation." Nor does it select another test that is "state-of the-art." NYS000154, Attachment 1 at p. 2.

98. Each of the tests listed in GALL Rev. 2 has acceptance criteria to determine whether the cable insulation has "passed" the test. GALL Rev. 2 states that the acceptance criteria for each test are "defined by the specific type of test performed and the specific cable tested." NYS000147D at XI.E3-3. Because Entergy's proposed AMP has not selected any

particular testing methods, it does not include acceptance criteria for determining whether a cable has passed the test. NYS000136 Bascom Initial Test. at 28:19.

99. The GALL Rev. 2 section on Inaccessible Power Cables states that "trending actions are included as part of this AMP, although the ability to trend results is dependent on the specific types of test(s) or inspection chosen." NYS00147D at XI.E3-3.

100. The results of cable condition monitoring tests are "trendable" if the performance of the cable on a later test can be compared with the performance of the same cable on an earlier test so that its relative performance over time can be assessed. Trendable results are important because they provide information about the rate of cable insulation degradation and that information can be used preventively to repair or replace cables before they fail. NYS000136 Bascom Initial Test. at 29:01-09.

101. Not all the tests listed in GALL Rev. 2 provide trendable results. Certain tests that are destructive or pass/fail, such as AC Voltage Withstand, can only determine whether the tested cable withstood the voltage on a particular occasion but reveal nothing specific about the relative condition of the cable insulation on that occasion. The results of diagnostic or non-destructive tests, such as partial discharge or tan delta, can be trended over time because the test on a later occasion may reveal partial discharge in a section of the cable where none had occurred previously, which could indicate increased cable insulation degradation. NYS000136 Bascom Initial Test. at 20:11-21:14.

102. Because Entergy's currently-proposed amended AMP does not identify which cable condition monitoring tests will be used, it does not reveal whether trendable tests will be chosen whenever possible.

### E. No Aging Management Program for Non-Environmentally-Qualified Inaccessible Low-Voltage and Medium-Voltage Power Cables Exposed to Thermal Stress

103. GALL Rev. 2 contains guidance on managing the aging effects of thermal stress, radiation and moisture on accessible aboveground low-voltage and medium-voltage power cables exposed to adverse local environments, including moisture, heat, and radiation. NYS000147D GALL Rev. 2 at XI E1-1 – XI E1-3.

104. The focus of GALL Rev. 2, § XI.E1, at XI E1-1 – XI E1-3 is on accessible aboveground cables:

> Parameters Monitored/Inspected: *Accessible* electrical cables and connections installed in adverse localized environments are visually inspected for cable jacket and connection insulation surface anomalies indicating signs of reduced insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation, and moisture intrusion as indicated by signs of embrittlement, discoloration, cracking, melting, swelling or surface contamination.
>
> Acceptance Criteria: The *accessible* cables and connections are to be free from unacceptable visual indications of surface anomalies that suggest that cable jacket or connection insulation degradation exists. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function.

NYS000147D at XI E1-1 – XI E1-3 (emphasis added).

105. GALL Rev. 2 at XI E1-1 – XI E1-3 does not appear to contain specific guidance for inaccessible aboveground low-voltage and medium-voltage non-environmentally-qualified cables. NYS000147D at XI E1-1 – XI E1-3.

106. Another section of GALL Rev. 2 (§ XI.E3) concerns "inaccessible or underground" cables that "may be exposed to wetting or submergence, and are, such as cables in conduits, cable trenches, cable troughs, duct banks, underground vaults, or directly buried in soil installations." GALL Rev. 2 at XI E3-1.

107. GALL Rev. 2 at XI E3-1 XI E3-5, however, does not address age related thermal degradation.

108. During the evidentiary hearing, witnesses confirmed that GALL Rev. 2 does not contain guidance for managing the effects of thermal stress on low-voltage and medium-voltage power cables that are inaccessible because they are buried underground. Tr. 4101:09-4104:03 (Bascom/ Rucker).

109. Cable insulation can be degraded by thermal stress in essentially three circumstances:

> (1) a power cable is operated above its rated temperature, and the insulation melts or burns, causing the insulation's dielectric strength to degrade and cause an electrical breakdown
>
> (2) the thermal resistance of the soil through which the underground cable passes is too high for the heat generated by the current to pass out of the cable into the surrounding soil
>
> (3) the ambient temperature around the cable is greater than the cable was designed to withstand, because of an external heat source, such as a steam line or hot water pipe

NYS000136 Bascom Initial Test. at 30:06-21.

110. Degradation can also occur if cables are in close proximity to each other, particularly in underground conduits. The heat from the other cables can cause the temperature to rise in the vicinity of the subject cable and cause a mutual heating effect. NYS000136 Bascom Initial Test. at 30:618-21.

111. Entergy witness Thomas McCaffrey testified that he reviewed all the site drawings for Indian Point and did not identify any external source of heat that might affect the insulation of the underground cables. Accordingly, he asserted, the only potential source of heat would be the cables themselves. Tr. 4105:02-06, 18-20 (McCaffrey).

112. According to Mr. McCaffrey, the Indian Point facilities were each designed to take into account the soil's thermal resistance, the number of cables running in a conduit, and the load on each cable. He testified that the Indian Point facilities' electrical system is thus designed to avoid the ohmic heating that can occur when heat from the current cannot dissipate in the surrounding environment or the mutual heating effect when cables are in too close proximity to one another. Mr. McCaffrey's testimony was based on his review of calculations that were prepared for the design of the Indian Point facilities. Tr. 4104:6-15; 4108:04-15 (McCaffrey).

113. If modifications were made to the Indian Point facilities and electrical systems and components, Entergy witnesses stated that Entergy would redo the calculations to verify that the modifications would not invalidate the temperature requirements for the cable. Tr. 4136:01-12 (McCaffrey). If a change were made, for example, to a pump that needed more amperage and the change did not meet the original design requirements, Entergy witness McCaffrey testified that Entergy would then change the cable size or reroute the cable or take other steps to meet the original design requirements. Tr. 4146:02-22 (McCaffrey).

114. Testing of the cable insulation for moisture damage would also detect degradation of the cable due to thermal stress. Tr. 4104:22 - 41051:01 (McCaffrey); 4112:04-06 (Bascom). However, the thermal stress has to progress for an extended period of time before the insulation would degrade to a point where it would be detected by one of the tests, in contrast to damage from water treeing which can be detected earlier in the degradation process. Tr. 4112:17 - 4113:08 (Bascom).

**F. Entergy's Fleet-Wide Cable Reliability Program -- EN-DC-346**

115. On June 14, 2011, Entergy issued a fleet-wide procedure entitled Cable Reliability Program, Rev. 2, EN-DC-346. ENT000237.

116. On April 30, 2012, Entergy issued Revision 3 to its Cable Reliability Program. ENT000583 EN-DC-346 Rev. 3.[3]

117. According to Entergy, the purpose of the Cable Reliability Program is to provide the means to effectively manage underground medium and low-voltage power cables that are safety related, that are non-safety related but whose failure could affect safety related equipment, and cables serving equipment that is in the scope of the maintenance rule. ENT000237 at 3.

118. According to Entergy, the purpose of this procedure is to provide guidance to "monitor the insulation condition of underground medium-voltage and low-voltage power cables using appropriate testing and evaluation of test results and to provide guidance on manhole inspection and dewatering." ENT000237 at 3.

119. The Cable Reliability Program contains as attachments the Tan Delta Test Acceptance Criteria, the Insulation Resistance (IR) Test Acceptance Criteria, the Medium-Voltage In-scope Cable List, the Low-Voltage In-scope Cable List, the In-scope Manhole List and the Cable Risk Ranking Guidelines. ENT000254; ENT000242; ENT000243; ENT000248.

120. Entergy witness Cox described the Cable Reliability Program as "the implementing procedure" for the proposed amended cable AMP described in Entergy's August 9, 2011 Response to NRC Staff's Request for Additional Information. Tr. 3313:23 - 3314: 09; 4074:10-14 (Cox).

121. Unlike Entergy's one-page amended AMP or its one-page AMP description in the UFSAR, the Cable Reliability Program is 34 pages long and contains almost all of the details about how exactly Entergy will manage the aging of underground cables exposed to wetting or

[3] During the hearing when Entergy witnesses and counsel and the Board referred to EN-DC-346, reference was made to exhibit ENT000237, which is EN-DC-346 Rev. 2.

submergence. None of these details are included in Entergy's amended AMP or the UFSAR for Indian Point Unit 2 and Indian Point Unit 3.

122. The Cable Reliability Program (and its attachments) identifies and describes the in-scope inaccessible underground low-voltage and medium-voltage cables, selects appropriate cable condition monitoring tests for shielded and unshielded low- and medium-voltage cables, provides instructions for performing the tests, identifies test acceptance criteria for the selected cable condition monitoring tests, and describes corrective actions for cables that do not meet the test acceptance criteria. The Cable Reliability Program also directs Entergy's employees at each of Entergy nuclear facilities to create a cable risk factor associated with each cable based on criticality, adverse environment, service life, ampacity, splices, and the results of testing and inspection, in order to set priorities for testing and replacement. ENT000237 at 3. The Entergy document specifically states: "Existing information regarding cables and raceways will be used to create a cable risk factor ("CRF") for each cable." *Id.* at 32. This will require the development of a risk ranking matrix specifically for the inaccessible underground cables at Indian Point Unit 2, Indian Point Unit 3 and the Indian Point site.

123. The Cable Reliability Program (and its attachments) identifies all manholes containing medium- and low-voltage power cables as within the scope of license renewal, requires the installation of sump pumps wherever practical in manholes, vaults, and duct systems containing cables that have the potential for submergence, and requires the adjustment of the intervals of manual inspection and pumping sufficient to keep the cables dry. ENT000237 at 16.

### G. The Amended Cable AMP Is Not Sufficient to Support License Renewal Because the Cable Reliability Program's Implementing Procedures in EN-DC-346 Are Not Incorporated in the AMP

124. Entergy's expert Dr. Howard Sedding testified that his overall impression of Entergy's cable AMP, "*as detailed in the program-implementing procedure, EN-DC-346* (Cable Reliability Program)" is that it contains "the required elements of a credible and robust methodology for cable aging management" for the extended 20 year renewal period. ENT000233 Entergy Pre-Filed Test. at 45, A.72 (Sedding) (emphasis added).

125. Dr. Sedding further testified that "Entergy's AMP [for Inaccessible Low and Medium-Voltage Cables] *if implemented in accordance"* with EN-DC-346 "provides the reasonable assurance required by the NRC." ENT000233 Entergy Pre-filed Test. at 45-46, A.72 (Sedding) (emphasis added).

126. New York State's expert witness, Earle Bascom, testified that the Cable Reliability Program, if followed, would likely adequately manage the effects of aging caused by the exposure of these cables to significant moisture. NYS000411 Bascom Rebuttal Test. at 2.

127. Mr. Cox of Entergy testified that the implementing procedure is the vehicle that demonstrates that an AMP will comply with GALL. Tr.3318:18 - 25 (Cox).

128. In questioning Entergy witness Roger Rucker, Judge McDade stated:

> JUDGE McDADE: Let me interject something here, Mr. Rucker, to clarify in my own mind. You made a very strong distinction between program and procedure. Aren't the procedures part of the program, how the program is going to be implemented?
>
> MR. RUCKER: This is Roger Rucker for Entergy. The procedure that you referenced, EN-DC-346, that is implementing the requirements, the commitments of the program. That is correct.

Tr. 4035:20 - 4036:03 (Rucker).

129. The implementing procedures are not included in the LRA or the UFSAR. Tr. 3315:20-3316:05 (Cox).

**H. No NRC Review of EN-DC-346 Implementing Procedures**

130. Instead, before license renewal NRC Staff does an Aging Management Program Audit at the site and reviews all of the procedures that will implement the Aging Management Program. Tr. 3324:06-19 (Holston). In these AMP audits, Staff may have to review 200 to 300 pages of procedures and reports. Tr. 3325:22-25 (Holston).

131. NRC Staff conducted the audit of procedures to implement the Aging Management Programs at Indian Point Unit 2 and Indian Point Unit 3 during site visits in 2007 and 2008. ENT000041 Audit Report for Plant Aging Management Programs and Reviews Indian Point Nuclear Generating Units Nos. 2 and 3 (dated Jan. 13, 2009) ("AMP Audit Report") at 1 (referring to NRC Staff site visits of August 27 - 31, 2007, October 22 - 26, 2007, November 27 - 29, 2007, and February 19 - 21, 2008); NRC000077 Staff Pre-filed Test. at 13-15, A.14 (Doutt/Nguyen) .

132. At the time of the Indian Point AMP audit, Entergy had not yet developed any implementing procedures for the inaccessible low and medium-voltage cable program. Accordingly, Staff could not review these procedures at the audit. The audit addressed only Entergy's program elements and the corresponding program in the GALL Report as they existed at that time. Audit Report for Plant Aging Management Programs and Reviews, Indian Point Nuclear Generating Units Nos. 2 and 3. ENT000041 AMP Audit Report at 23 (Jan. 13, 2009).

133. NRC Staff reviewed only two on-site documents in its audit of Entergy's Aging Management Program for Inaccessible Medium-Voltage Cables -- the GALL Report and an Entergy internal document entitled Aging Management Evaluation Report, Electrical,

Inaccessible Medium-Voltage Cable Program, IP-RPT-06-LRD09, Sec. 3.2. ENT000041 AMP Audit Report at 24. The GALL Report then in circulation was GALL Revision 1 (which has been released in September 2005). NYS00146A-NYS00146C.

134. There is no evidence in the record that NRC Staff reviewed Entergy's implementing procedures after the 2007-2008 AMP audit to determine whether they effectively implement the AMP or are in compliance with GALL Rev 2.

135. Nor did NRC Staff re-audit the proposed aging management program after Entergy's 2011 decision to include low-voltage cables within the program's scope. NRC000077 Staff Pre-filed Test. at 15, A.14 (Doutt/Nguyen).

**I. Enforceability of EN-DC-346 Implementing Procedures**

136. In response to a question whether Entergy could change implementing procedures at any time without prior approval or review by the NRC, Staff witness Holston testified that: "We take the most critical aspects of the [aging management] program" and ensure that they are in the UFSAR which is a document that requires the applicant "to take licensing action" before it can be changed. Tr. 3329:08-11 (Holston). He added that the applicant can revise other features of the implementing details of the program without an evaluation under 10 C.F.R.§ 50.59. NRC Staff witness Kimberly Green testified that Staff "would like to see" key aspects of an AMP incorporated in the UFSAR so that Entergy would be required to perform an evaluation under 10 C.F.R. § 50.59 before changing a key aspect. Tr. 3649:08-20 (Green).

137. As an example, Mr. Holston characterized the number of inspections of buried pipes, 14 over each ten year period of extended operation, as a "critical aspect" of the AMP for buried pipes and that number of inspections was incorporated in the UFSAR. Tr. 3641:21-3642:03 (Holston). As another example, Mr. Holston testified that Entergy could change a soil

resistivity rating in the implementing procedures for buried pipes from a 10 to an 8 without doing a 50.59 evaluation. Tr.3399:04-07; 3403:15-21 (Holston). By contrast, the fact that risk ranking for the buried pipes is based on corrosion risk could not be changed without a § 50.59 evaluation.[4]

138. In another example involving inaccessible underground cables, Alan Cox of Entergy testified that because the program description of Entergy's cable AMP in the UFSAR for Indian Point Unit 2 and Unit 3 explicitly includes the AMP's requirement that underground cables be tested at least every six years, Entergy would have to evaluate changing the testing interval to seven years under the § 50.59 criteria because it would be changing a detail in the UFSAR. If the change met any of the eight criteria, Entergy would be required to notify the NRC and submit a license amendment request before making the change. Tr. 4076:24 - 4077:13 (Cox). If Entergy determined that the § 50.59 criteria were not triggered, then Entergy could reduce the testing frequency immediately without informing the NRC or obtaining a license amendment.

139. The description of the proposed aging management program for inaccessible cables that is contained in Entergy's UFSAR includes none of the details contained in Entergy's implementing procedure EN-DC-346, such as the physical characteristics of the relevant cables, the cable insulation tests to be used, the acceptance criteria for those tests, or the corrective actions to be taken if the acceptance criteria are not met. Nor are the implementing procedures of EN-DC-346 incorporated in any other legally enforceable document.

[4] Mr. Holston's testimony about the relation between 10 C.F.R. § 50.59 and the buried cable program is cited here because it is equally relevant to New York contention NYS-6/7 about inaccessible underground cables, and no Staff witness at the hearing on NYS-6/7 gave such detailed testimony.

140. Pursuant to 10 C.F.R. § 50.59, even if the UFSAR contains a critical or key aspect of an AMP, Entergy can change that critical aspect without first informing the NRC under certain circumstances. 10 C.F.R. § 50.59(c)(1)(2) permits Entergy to make changes in the FSAR without prior notice to the NRC and without obtaining a license amendment provided there is no change in the Technical Specifications in the license and Entergy determines that the change does not meet any of the eight criteria set forth above at paragraph 17, *supra*.

141. If Entergy determines, after a § 50.59 evaluation, that no prior NRC approval or license amendment is required for a change, it must maintain a record that includes the bases for the determination that no license amendment is needed. A report of the changes must be submitted to the NRC at least every two years. 10 C.F.R. § 50.59 (d)(1) and (2).

142. The testimony by Entergy and NRC Staff witnesses differentiated between a "50.59 screen" and a "50.59 evaluation."

143. Entergy witness Alan Cox testified that Entergy screens every change in an AMP's implementing procedures "to see if it meets the criteria that would require reporting under 50.59." He stated:

> There may be a change in procedure that may not affect the description of the program in the SAR but we still have to go through that screening process to make sure that is the case. Every procedure gets a screening to see if further evaluation under 50.59 is necessary.

Tr.3399:13-21 (Cox).

144. After further testimony by Mr. Cox about the "50.59 screening" of implementing procedures, Judge McDade asked Mr. Holston "Didn't you indicate that those procedures were not subject to the 50.59 review?" Tr. 3403:07-09 (J. McDade).

> MR. HOLSTON: The question that I believe I was asked was whether the 50.59 be done. And what Mr. Cox was explaining is that every administrative procedure goes through a screen, a 50.59 screen to determine whether you have to do a 50.59

> evaluation. And so I believe that if the example I gave, which is if you had a rating factor of ten for soil resistivity of X and you change that rating factor to eight, that level of detail is not in the UFSAR and in all likelihood a 50.59 would not be done. A 50.59 screen is a process to ensure you don't change something that should have been addressed by a 50.59.
>
> JUDGE McDADE: Okay. If they were to change the methodology to determine the priority of inspection, is that something that would be, first of all, subject to review but review on what standards?
>
> MR. HOLSTON: If they change the methodology but they were still addressing corrosion risk and they were still addressing consequence of corrosion damage, then in all likelihood at least what I would believe is that would be screened and they would say no, this is a level of detail beyond what is our UFSAR so we can make this change. But they would have to screen that to ensure it wasn't stepping into UFSAR territory.

Tr. 3403:10-3404:09 (Holston/J. McDade).

145. Judge McDade and NRC witness Mr. Holston had a colloquy on this issue. Judge McDade summarized his understanding of the process:

> [W]hether there's a link to the SAR supplement or not, as I understood Mr. Cox, they would have to do the screening, and depending on the nature of the screening, if it fit within 50.59, then you would have to submit that to the agency before making the procedure change. Did I understand your testimony correct[ly]?
>
> MR. HOLSTON: Partially. All the procedures would need to be screened, to whether a 50.59 evaluation would have to be conducted. If a 50.59 evaluation has to be conducted, it could (?) be conducted, and if there's no unreviewed safety question, that's the conclusion the 50.59 comes to, the applicant can then make the change, or the licensee in this case, can make the change absent informing or getting permission from the NRC ahead of time.
>
> JUDGE McDADE: Wait, without getting permission from the NRC?
>
> MR. HOLSTON: Correct. If there's no unreviewed safety question. That's what you do a safety evaluation for, to determine if there's an unreviewed safety question.
>
> JUDGE McDADE: Okay. Now how is it different if there are links to the SER?
>
> MR. HOLSTON: If there are links if it's a level of detail in the UFSAR, it's almost a foregone conclusion that you'll have to perform a 50.59 evaluation. The screening

> really tells us whether you're going to get into the space of having to conduct a 50.59 evaluation.
>
> So it's part of the 50.59 process, but it's a part that tells you where you have to do the much more detailed analysis. If it screens out, and in this case, if that level of detail's not in the UFSAR, typically it would screen out. Then no 50.59 safety evaluation is done. The change can go ahead and be executed by the station.

Tr.3472:09-3473:20 (J. McDade/Holston).

146. As described by Mr. Cox, the "50.59 screening" appears limited to determining whether the proposed change involves an activity explicitly described in the UFSAR. Tr. 4075:04-10 (Cox).

147. Neither Mr. Holston nor Ms. Green nor Mr. Cox cited to any regulation or other legal authority requiring Entergy to do a "50.59 screening" for changes in implementing procedures that are not specifically mentioned in the description of an AMP in the UFSAR.

148. In discussing the "50.59 screening" process, NRC Staff witness Kimberly Green testified that she thought there were three questions that a licensee will answer to determine if a 50.59 evaluation is needed for a change in an implementing procedure that is not specifically included in the UFSAR. Judge Wardwell then asked "where are those three initial questions documented . . . I didn't know they existed." Ms Green responded:

> I don't think they are in the regulation. I think it's questions that an applicant develops and puts in their site procedure to help them determine if they actually need to do a 50.59 evaluation. But my lawyers can correct me if they look at the regulation and tell me.

Tr. 3650:10-3651:02.

149. The NRC lawyers at the hearing did not correct Ms. Green's understanding that the screening questions used by an applicant are not contained in the regulations.

150. There is no evidence in the record of whether Entergy is legally required to do "screenings" of changes in implementing procedures that are not included in the UFSAR.

### J. Entergy's Aboveground Cable and Connection Inspection Procedure – EN-DC-348

151. During the evidentiary hearing, there was testimony about aboveground cables. *See, e.g.,* Tr. 4101-4104 (Bascom/Rucker/J. Kennedy); *see also* ENT000233 (Entergy Pre-Filed Test. at 16, A.30; *id.* at Table 1; *id.* at 19, A.32 (Cox, Rucker, McCaffrey, Sedding).

152. New York's witness, Mr. Bascom, focused on inaccessible underground cables. NYS000136 Bascom Initial Test. at 6:15-18; NYS NYS000138 Bascom Report; Tr. 4101-4103 (Bascom/Rucker/J. Kennedy); *see also* NYS000135 NYS Initial Statement of Position at 26-27. Mr. Bascom did note the possibility of inaccessible aboveground cables. NYS000138 Bascom Report at 7 ("'Inaccessible' cables are directly buried or in buried or above ground conduits where direct visual inspection is not possible, or potentially in area that people cannot access because of safety or environmental hazards.").

153. As part of its pre-filed evidence, Entergy introduced and discussed a document that pertained to aboveground cable inspections. ENT000241 EN-DC-348 Rev. 2 Non-EQ Insulated Cables and Connection. Entergy issued EN-DC-248 on July 5, 2011, and it is a fleet-wide Non-EQ Insulated Cables and Connection Inspection procedure document. ENT000233 Entergy Pre-filed Test. at 48, A. 77-79 (Cox, Rucker).

154. EN-DC-348 Rev. 2 defines "accessible" and "inaccessible" cables as follows:

> Accessible – Cables and connections that can be readily approached and easily viewed [Reference EPRI 1013475] (i.e. those that can be accessed without installing ladders or scaffolding). Cables and connections in enclosures such as cabinets, junction boxes, terminal boxes, condulets, etc., are considered inaccessible and are not included in this inspection.

ENT000241, at 7, § 3.1[1].

155. EN-DC-348 Rev. 2 provides for visual inspection of accessible aboveground electrical cables.

> 5.1 SCOPE OF PROCEDURE
>
> [1] Consistent with the guidance of NUREG-1801, Section XI.E1, the Non-EQ Insulated Cables and Connections Program will do the following.
>
> > (a) The procedure identifies all areas with ALEEs, which is based on the spaces approach.
> >
> > (b) All accessible electrical cables and connections in close proximity to any ALEE[5] will be visually inspected for insulation or jacket surface anomalies, which is consistent with the bounding approach. A focus of this inspection is to distinguish cables exhibiting significant aging effects (i.e. deterioration) from those exhibiting little or no deterioration.
> >
> > (c) The procedure identifies all insulated cables and connections (by conduit, cable tray, and/or cabinet number) exposed to an ALEE regardless of whether they are readily accessible and easily approached and viewed.

ENT000241, at 12, § 5.1[1].

156. Although EN-DC-348 Rev. 2 makes reference to inaccessible aboveground cables it provides no specific inspection requirement or corrective action directives.

> ALEEs shall be reviewed to determine the potential effects on accessible and inaccessible cable and to determine the extent of the effect. Note that the NUREG-1801, XI.E1 program is a visual inspection of readily accessible cables. However, all cables affected by an ALEE, even those cables that may not be accessible for visual inspection, must be considered in the evaluation by the Program Coordinator.

ENT000241, at 21 § 5.8[2] (corrective action); *see also* ENT000233 Entergy Pre-filed Test. at 48, A. 79 (Cox, Rucker).

[5] The term "ALEE" refers to Adverse Localized Equipment Environment. ENT000241, at 7, § 3.1[2]. An Adverse Localized Equipment Environment includes "A condition in a limited plant area that is significantly more severe than the specified service condition for the area. The service conditions of interest include normal, abnormal, and error-induced conditions, prior to the start of a design-basis accident or earthquake. For example, areas with high temperature process fluid piping and vessels, areas with equipment that operates at high temperature, and areas with limited ventilation are prone to high temperatures . . ." *Id.*

157. Thus, it appears that inaccessible aboveground cables are not included within the inspections described in EN-DC-348, which concerns aboveground accessible cables, or in EN-DC-346, which concerns underground cables.

## V. CONCLUSIONS OF LAW

158. For the following reasons, Entergy's proposed AMP for inaccessible underground low-voltage and medium-voltage cables that are wetted or submerged in water does not provide reasonable assurance that the effects of aging on these cables will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. 10 C.F.R. § 54.21(a)(3).

(A) Entergy's witnesses testified that implementing procedures for its Aging Management Program for inaccessible low-voltage and medium-voltage cables that are wetted or submerged are needed in order for Entergy to meet its license renewal commitments and be in compliance with the GALL Report Revision 2. NRC Staff could not review these implementing procedures during its 2007-2008 audit of Entergy's AMPs because Entergy had not yet created them, and there is no evidence in the record that NRC Staff reviewed the implementation procedures at any later date. As such, it appears that NRC Staff has not yet made a determination whether the implementing procedures contained in the current version of Entergy's EN-DC-346 Revision 3 provide reasonable assurance that the Indian Point facilities' current licensing basis will be maintained throughout the period of extended operation with respect to inaccessible and underground, low-voltage and medium-voltage, non-environmentally-qualified electrical cables as required by 10 C.F.R. § 54.29.

(B) Entergy witnesses testified that implementing procedures are needed for its proposed Aging Management Plan for inaccessible low-voltage and medium-voltage cables in

order for Entergy to meet its license renewal commitments and be in compliance with the GALL Report Revision 2, but the implementing procedures are not incorporated in the LRA or the UFSAR and are not binding on the applicant or enforceable by Staff. On these grounds, Entergy's AMP does not provide reasonable assurance that the Indian Point facilities' current licensing basis will be maintained throughout the period of extended operation with respect to inaccessible and underground, low- and medium-voltage, non-environmentally-qualified electrical cables as required by 10 C.F.R. § 54.29.

159. With respect to the potential for thermal degradation or ohmic heating of underground inaccessible electrical cables at the Indian Point facilities, Entergy presented evidence that: (1) there is no external source of heat that could affect the insulation of underground electrical cables; (2) the only potential source of heat that could affect the insulation of underground electrical cables would be other adjacent cables; (3) the design of the Indian Point facilities took into account the soil's thermal resistance, the number of cables running in underground conduits, and the electrical load on each cable; (4) if any changes were to take place to the Indian Point facilities' electrical systems, Entergy would re-examine the electrical system's design calculations and ensure that the modifications would not exceed the temperature requirements for the electrical cables; and (5) Entergy's testing of cables for moisture damage would also detect thermal degradation of the electrical cables. Entergy has not incorporated these representations into an enforceable and detailed proposed AMP for inaccessible cables. On these grounds, Entergy's AMP does not provide reasonable assurance that the Indian Point facilities' current licensing basis will be maintained throughout the period of extended operation with respect to inaccessible and underground, low-voltage and medium-voltage, non-environmentally-qualified electrical cables as required by 10 C.F.R. § 54.29.

## VI. PROPOSED ORDER

160. For the foregoing reasons, the State of New York's Contention NYS-6/7 is resolved in favor of the State of New York. Accordingly, the Director of Nuclear Reactor Regulation is not authorized to issue, and may not issue, renewed operating licenses for the Indian Point nuclear power plants Units 2 and 3.

161. In accordance with 10 C.F.R. § 2.341(b)(1), any party to this proceeding may file a petition for review of this Initial Decision with the Commission within twenty-five (25) days after service of this initial decision. In accordance with 10 C.F.R. § 2.340(g) and § 2.1210, this Initial Decision shall constitute the final decision of the Commission forty (40) days after its issuance, unless there is a petition for Commission review filed, or the Commission decides to review this Initial Decision under 10 C.F.R. §2.1210(a)(2) or (3).

Respectfully submitted,

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