United States Nuclear Regulatory Commission Official Hearing Exhibit
In the Matter of: Entergy Nuclear Operations, Inc.
(Indian Point Nuclear Generating Units 2 and 3)
ASLBP #: 07-858-03-LR-BD01
Docket #: 05000247 | 05000286
Exhibit #: ENT000096-00-BD01 Identified: 10/15/2012
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Other:

ENT000096
Submitted: March 28, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

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In re:

License Renewal Application Submitted by

Entergy Nuclear Indian Point 2, LLC,
Entergy Nuclear Indian Point 3, LLC, and
Entergy Nuclear Operations, Inc.

Docket Nos. 50-247-LR and 50-286-LR

ASLBP No. 07-858-03-LR-BD01

DPR-26, DPR-64

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DECLARATION OF PAUL BLANCH

Paul Blanch, hereby declares under penalty of perjury that the following is true and correct:

1. I have been retained by the New York State Office of the Attorney General to provide expert services in connection with the application by Entergy Nuclear Operations, Inc. and its affiliates (collectively Entergy) for a renewal of the two separate operating licenses for the nuclear power generating facilities located at Indian Point on the east bank of the Hudson River in the Village of Buchanan, Westchester County, New York.

2. I submit this declaration in opposition to Entergy's August 14, 2009 motion for summary disposition that seeks the dismissal of New York State Contention Number 8 concerning transformers.

Experience

3. Beginning in 1964, I served in the U.S. Navy as a nuclear reactor and electric plant operator on *Polaris* class submarines for seven years. These submarines typically were at sea for extended tours of duty. During my Navy service, I and my fellow crew members were in close proximity to the submarines' nuclear reactors that powered the vessels whether they were under the sea or on the surface.

4. As a qualified Electric Plant Operator, I was responsible for the operation of motors, power supplies, inverters, breakers, switchgear, battery chargers, motor and steam-powered electric generators (AC and DC), and transformers.

5. I graduated from the U.S. Navy Electronics Technician School in 1964; the U.S. Navy Nuclear Power School, in 1966; and the U.S. Navy Submarine School, in 1968.

6. As part of my Navy duties, I was certified as an operator/instructor at the Navy prototype reactor (S1C) in Windsor Locks, Connecticut. I instructed Navy officers and enlisted personnel on reactor operations and maintenance including the subjects of electrical theory related to power generation, motors, generators, battery chargers, transformers, transistors, instrumentation and control systems, and magnetic amplifiers.

7. During my Navy service, we employed various test equipment that

included active variable winding ratio transformers commonly referred to as "Variac" transformers.

8. I received an honorable discharge from the Navy in 1971. In 1972, I received a Bachelor of Science in Electrical Engineering from the University of Hartford.

9. I have more than 35 years of engineering, design, operations, maintenance, engineering management, and project coordination experience for the construction and operation of nuclear power plants. This includes positions at Northeast Utilities that involved in the design, construction, operation, and maintenance of Millstone Units 1, 2, and 3 and Connecticut Yankee (Haddam Neck). During this period, I was under the direction of the Electrical Engineering division within Northeast Utilities. I have also been employed by Consolidated Edison and Entergy at Indian Point Unit 2 as an advisor to the Chief Nuclear Officer (CNO) at that facility. I served in a similar position at Maine Yankee reporting to the CNO of Maine Yankee Atomic Power Company.

10. I am a registered professional engineer in the State of California (currently with an inactive status)

11. I have actively participated in industry standards writing activities with the American Nuclear Society (ANS), Instrumentation Society of America (ISA), and the Institute of Electrical and Electronics Engineers, Inc. (IEEE) for use by the nuclear industry.

12. I have been employed as a contractor for the Electric Power Research Institute (EPRI) for the development of computerized monitoring systems for nuclear power plants including monitoring the conditions of active devices including pressure and level monitoring systems.

13. I have been engaged as a contractor to Nuclear Energy Institute (NEI, previously NUMARC) to educate Chief Nuclear Officers on the attributes of a Safety Conscious Work Environment (SCWE).

14. In 1993, I was named "Engineer of the Year" by Westinghouse Electric and Control magazine for my efforts in identifying the subtle failures of active electrical devices such as pressure, level, and flow transmitters and indicators. All of these devices contain active components such as transistors and integrated and digital circuits that require an external energy source. These components, by design, undergo a "change in state" and vary their conductive, resistive, and other properties without moving parts. These devices may also include passive components such as resistors, capacitors, inductors/transformers, and printed circuit boards that do not change state to perform their intended function.

15. I have reviewed the April 30, 2007 License Renewal Application submitted by Entergy to renew the operating licenses for Indian Point Unit 2 and Unit 3. I have also reviewed pertinent sections of the recent August 12, 2009 Safety Evaluation Report prepared by NRC Staff, the August 14, 2009 Motion for Summary Disposition filed by Entergy, and the September 14, 2009 filing by NRC

Staff in support of Entergy's motion. As set out in my November 2007 declaration and as developed in the relevant Contentions contained in the State of New York's Petition to Intervene, it is my opinion that the proposed aging management programs fail to provide reasonable assurance that IP2 and IP3 will operate safely through their proposed license renewal periods.

Transformers

16. A transformer is an electrical device that can convert alternating currents and voltages to different voltages and currents or provide isolation of circuits. Transformers typically contain two insulated wires that are wrapped or coiled around form called a "core" that is frequently made of iron or metal alloys. Transformers contain a primary winding and one or more secondary windings. In its most basic form, a transformer need not even contain a physical core: two coils of wire adjacent to one another can act as a transformer. Two parallel wires or cables may also act as a transformer in that varying current in one wire or conductor may induce voltages and currents in the adjacent wire or conductor.

17. Transformers do not contain any moving parts for their basic functions.[1] During their normal operation, there is no change in the configuration of

[1]While there is a subcategory of transformers that could be viewed as containing active components, those devices are not included within Contention 8. Thus, this description would not apply to "Variac" transformers, which are manually or motor operated variable transformers (manufactured by Staco Energy Products and Variac - Trade Mark of Power Designs, Inc.). Additionally, some transformers may

transformers or their constituent parts, nor are there intended changes in the properties of transformers. Transformers have design properties such as turns ratios, current, voltage, and power. Transformers have the capability to function through a phenomenon known as electromagnetism: when an electrical current input passes through a coil of wire, a magnetic field is generated; in turn, the electrical current is induced from one coil to another through the changing magnetic field. When an electrical current flows into a transformer, that electrical input will create an electromagnetic field within the transformer. Conversely, when there is no current flow into the transformer, there is no magnetic field; the coils and the core do not produce a magnetic field on their own when there is no incoming electrical current. None of these properties and capabilities is designed to change during normal operation of a transformer.

18. The Handbook of Transformer Design & Application states that "Transformers are passive devices for transforming voltage and current." Flanagan, The Handbook of Transformer Design & Application (2nd Edition), page 1.1, McGraw-Hill, 1993, ISBN 0-07-021291-0. Another text book states that a transformer is "a static electrical device, involving no continuously moving parts, used in electrical power systems to transfer power between circuits through use of electromagnetic induction." Harlow, Electric Power Transformer Engineering, page 2-1, CRC Press (2004) ISBN 0-8493-1704-5 (referencing ANSI / IEEE) ; Harlow,

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have cooling systems, but these cooling systems are not necessary for the basic functional capability of the transformer.

Electric Power Transformer Engineering, page 2-1 (2d Edition) CRC Press (2007) ISBN 0-8493-9186-5. The sixth edition of the IEEE Standard Dictionary of Electrical and Electronic Terms includes the following definition of transformer: "A static electrical device consisting of a winding, or two or more coupled windings, with or without a magnetic core, for introducing mutual coupling between electrical circuits." IEEE Standard Dictionary of Electrical and Electronic Terms, IEEE Std 100-1996 (6th Edition), page 1131, ISBN 1-55937-833-6 (1996).

19. Transformers play important roles in the operation of a nuclear power plant. Transformers can come in a variety of sizes. By way of example, some large transformers used at power reactors likely would include Station Auxiliary Transformers, Station Service Transformers, Station Black Out (SBO) transformer, 15 KVA GRD Transformer for the gas turbines, instrumentation transformers, and lighting transformers. Some smaller transformers in use at power reactors would include those used in control circuits. A review of various publicly available electrical one-line diagrams for IP2 and IP3 reflects that there are numerous electrical transformers ranging from 345 KV to 120 volts located throughout the Indian Point facilities that perform a function described in §§ 54.4(a)(1)/(2) and (3). The role of some of the transformers in providing for safety functions is described in Chapter 8 (Electrical Systems) of the UFSAR for each Unit on pp. 1167-68, 1333-43 of the UFSAR for IP3 and on pp. 1039-50 of the UFSAR for IP2. The UFSAR for IP2 includes a one-line diagram for the electrical plan for IP2; that diagram

identifies some of the transformers at IP2 and the central role that they play in the electrical system of the plant. IP2 UFSAR, figure 8.2-1, 8.2-2; Indian Point No.3 Nuclear Power Plant, Electrical Distribution & Transmission System, DWG NO 9321-F-33853, REV 17.

NRC Regulations

20. In preparing this declaration, I reviewed 10 C.F.R. § 54.21. Specifically, § 54.21(a)(1) provides:

> Structures and components subject to an aging management review shall encompass those structures and components—
>
> (i) That perform an intended function, as described in § 54.4, without moving parts or without a change in configuration or properties. These structures and components include, but are not limited to, the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and mechanical penetrations, equipment hatches, seismic Category I structures, electrical cables and connections, cable trays, and electrical cabinets, excluding, but not limited to, pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies; and

(ii) That are not subject to replacement based on a qualified life or specified time period.

10 C.F.R. § 54.21(a)(1)(i), (ii).

21. Based on my review of 10 C.F.R. § 54.21(a)(1), it is my understanding that NRC regulations provide that structures or components without moving parts or without a change in configuration or properties are included within the scope of the rule. The regulation contains a non-exhaustive list of such structures and components. My understanding of the regulation is that those structures and components are to be included in an aging management review. The regulation then also provides another non-exhaustive list of structures and components that are not within the scope of the rule. The NRC has elected to exclude this second category of structures and components from aging management review. 10 C.F.R. § 54.21(a)(1)(i).

22. The text of § 54.21(a)(1)(i) expressly includes the following components as within the first category and therefore within the scope of the regulation: the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and mechanical penetrations, equipment hatches, seismic Category I structures, electrical cables and connections, cable trays, and electrical cabinets. Because these components are expressly included in the first category, they are subject to aging management review. 10

C.F.R. § 54.21(a)(1)(i).

23. On the other hand, pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies are included in the second category and therefore are not subject to aging management review. 10 C.F.R. § 54.21(a)(1)(i).

Comparison of Transformers to Included and Excluded Components

24. In preparing this declaration, I also reviewed the Atomic Safety and Licensing Board's July 31, 2008 decision concerning the admission of various contentions including the admission of New York State Contention No. 8, which concerns transformers. The Board further stated: "In addressing this contention, the Board will require, *inter alia*, representations from the parties to help us determine whether transformers are more similar to the included, or to the excluded, component examples." July 31, 2008 ASLB Memorandum and Order at 45.

25. I have prepared a table that compares the included and excluded structures and components expressly listed in 10 C.F.R. § 54.21(a)(1) to transformers. This table entitled, "Comparison of Various Structures and

Components," accompanies this declaration, and it demonstrates that transformers are similar to the category of structures and components that are expressly listed as included in 10 C.F.R. § 54.21(a)(1) in that transformers, like the included structures and components, contain no moving parts, do not change properties or configuration, and do not undergo any change of state. The table summarizes whether a structure or component contains moving parts, experiences a change in configuration or properties, experiences a change in state, is active or passive, and is specifically listed in § 54.21(a)(1).[2]

26. To be sure, many of these "included" structures and components do change the "properties" of the fluids, voltages, currents, or fuel that travel through or is contained within those structures and components; however, the "properties" of the included structures and components themselves do not change during their intended use. Likewise, a transformer may increase or decrease the voltage of the electrical current that passes through transformer; however, the properties of the transformer itself do not change during its intended use.

27. Electric Cables. Electric cables do not have moving parts. When AC current passes through a cable, a varying magnetic field is generated around the cable. The properties of the currents and voltages in and out of an electric cable

[2] In my review of 10 C.F.R. § 54.21(a)(1)(i), I observed that the provision does not contain the terms "active," "passive," or a "change in state." I am also aware that the Commissioners have stated "Further the Commission has concluded that 'a change in configuration or properties' should be interpreted to include 'a change in state,' which is a term sometimes found in the literature relating to 'passive.'" 60 Fed. Reg. at 22,477

may change, but the properties of the cable (*e.g.*, resistance, capacitance) are not designed to change. Cables are included as within the scope of §54.21(a)(1).

28. Pipes. The properties of fluids contained within piping may change. These properties of such fluids include pressure, velocity, flow rates, and temperature. The phase of the fluid in a pipe may even change. Yet, a pipe is a component which is included within the scope of § 54.21(a)(1). A pipe's diameter may narrow at a particular location or the pipe may contain a restriction (*e.g.*, "elbow," or "tee") that may change the velocity or pressure of the fluid contained in the pipe; however, the properties of the pipe itself have not changed. Stated differently, the properties of the contents (fluid) may change, but not the conduit (pipe). The pipe itself is not designed to change its own properties.

29. Heat Exchanger. The temperature properties of the fluids contained within a heat exchanger may change, as can a fluid's flow rates. The properties of the fluid in a heat exchanger change in a manner similar to the change in voltage and current that takes place in a transformer. A heat exchanger (another component which is included within the scope of § 54.21(a)(1)) is not designed to change its own properties.

30. Steam Generator. The properties and the state of the fluids in a steam generator may both change. The fluid's temperature may increase and the fluid's state may change from liquid to steam. However, the steam generator itself (another component which is included within the scope of § 54.21(a)(1)) is not

designed to change its own properties during its normal use.

31. Reactor Vessel & Containment. Further, various nuclear processes do occur within the reactor vessel, the containment liner, or the containment, but those components are included in § 54.21(a)(1). Those processes cause some wear on those components, and that wear is the subject of aging management.

32. Turning to transformers, transformers do not have moving parts. The properties of the currents and voltages in and out of a transformer may change, but the properties and configuration of the transformer and its capabilities (ability to transform electricity from one voltage to another) are not designed to change during normal operation. Furthermore, transformers themselves do not experience a "change of state" as that term is commonly used.

Entergy's Argument

33. Dr. Dobbs, in his declaration dated August 12, 2009 presents a position that transformers change "properties" in that:

> *20. The table above (paragraph 19) demonstrates that the voltage and current properties of a transformer change depending on the load condition of the transformer.*

While I agree with the recognition that the "properties" of the current and voltage *inputs* and *outputs* are changed when they pass through a transformer, I disagree with Dr. Dobbs' implication that those are "properties" of the transformer or that the transformer component itself changes. The transformer does not change its

configuration or properties during its intended use; the wire coils do not change state, nor does the internal metal core. Input and output voltages are not "properties" of the transformer itself.

34. Dr. Dobbs also contends that a transformer is similar to a transistor in that the properties of the transformer and transistor change with the operation of the device.

35. As noted above, transformers have properties such as turns ratios, resistance, and capacitance and also have the capability to transform electricity from one voltage to another through a magnetic field generated by the input electrical current. None of these properties or capabilities is designed to change during normal operation of a transformer.

36. In contrast, the properties of a transistor itself do change during its normal intended use. Transistors are commonly three wire solid state devices initially made from germanium (Ge) and silicon (Si) semiconductor material. A semiconductor is a material whose resistivity can be changed by applying an electric current to the material; a semiconductor's electrical resistance can vary between that of a conductor (full flow) and that of an insulator (no flow). An external electrical field or voltage changes a semiconductor's resistivity -- which is a property of the component itself. A transistor clearly undergoes a change in its properties and, in some cases, a change in state (from conductor to insulator).

37. This change in resistivity that occurs in the semiconductor can be

thought of as a valve whose position may be changed through an external electric stimulus. A small change in the voltage input to a basic transistor changes the properties (resistance and/or conductance) of the semiconductor. As a result of this applied voltage, the semiconductor changes its properties and may act as an insulator, conductor, or variable resistor controlling relatively large currents. These characteristics are the direct result of a change in properties of the semiconductor. Many transistors such as silicon controlled rectifiers undergo a "change of state" from a conductor to an insulator depending on the applied voltage and the polarity of the applied voltage.

38. A transistor, one of the listed components that are expressly excluded in 10 C.F.R. § 54.21(a)(1)(i), is a device that relies on external power to operate and requires an external source of energy to control its operations.[3] Because of this intended ability to vary its resistivity, it is possible to continuously control the operation of a transistor and its valve-like function by changing its state (its resistivity). Accordingly, a transistor and most other solid state devices are considered active devices whose properties continuously change.

39. Transistors, tubes, magnetic amplifiers, and other active electronic devices have the capability to control and switch large currents and change/amplify

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[3] I understand that when the Commissioners modified the license renewal regulations they said "'a change in configuration or properties' should be interpreted to include 'a change in state,' which is a term sometimes found in the literature relating to passive. For example a transistor can 'change its state' and therefore would not be screened in under this description." Final Rule, Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. 22,461, 22,477 (May 8, 1995).

the power input. Active devices including transistors and other solid state devices normally require an external source of energy (power supply) to perform its function of power amplification and/or switching. Passive electrical devices, such as resistors, cables, connectors, capacitors, inductors, and transformers are not designed or capable of power amplification, changing conductance, or otherwise changing the output power based upon an external control signal.

40. An analogy may be helpful to understand the active nature of a transistor. One might imagine a simple garden hose that has properties such as internal and external diameters, length, stiffness, and materials of construction. It may also have design capacities such as maximum flow rate and temperature limitations. I would suggest that a hose is a passive device similar to a pipe. When water flows through a hose, the properties of the hose do not change. Increasing or decreasing the flow does not change the properties of the hose. However, if some external force is applied to the hose such as squeezing or crimping the hose with one's hand or foot, the properties of the hose are changed as a result of changing the effective internal diameter of the hose. Turning back to electrical components, a resistor is an electrical component that restricts the flow of electrical current, but it does so at a fixed rate much like a section of hose or pipe. In much the same way that a person might squeeze a hose, the invention of the transistor made it possible for a small voltage from an external source to change the properties of a fixed resistance previously provided by a resistor. Thus, the name "transistor." The

semiconductor in the transistor changes state in much the same way that the diameter of the hose is decreased when someone squeezes the hose. The resistivity properties of a transistor can be changed on an ongoing manner through the application of an external electrical stimulus.

Consequences of Inadequate Management of Transformers

41. As noted in my initial November 2007 declaration and the State of New York's petition, the failure to properly manage aging of Electrical Transformers at Indian Point may compromise:

a. The integrity of the reactor coolant pressure boundary;

b. The capability to shut down the reactor and maintain it in safe shutdown condition; or

c. 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. 10 C.F.R. §§ 54.4(a)(1)(2) and (3).

42. The consequence of failures of Electrical Transformers may result in accidents beyond the Design Basis Accidents resulting in exposures to the public exceeding 10 C.F.R. § 100 limits.

43. Failure to properly manage aging of electrical transformers could

result in loss of emergency power to the 480 volt safety equipment and 6.9kV busses including station blackout loads.

44. Recently, there have been a number of transformer failures at power reactors, which although NRC staff believes generally do not involve safety related transformers, provide evidence that since the time of the 1997 Grimes memorandum and 1995 NEI paper, there is a growing realization of the importance of the need for the proper maintenance and aging management of transformers. For example, as discussed in NRC Information Notice 2009-10[4]:

- Indian Point, Unit 3—On April 6, 2007, while operating at 92-percent power, a fault occurred on the No. 31 main transformer resulting in an automatic reactor trip and transformer explosion and fire.
- Limerick Generating Station, Unit 2—On February 1, 2008, a low voltage bushing connection failed on the 2A main transformer resulting in a turbine trip and reactor scram.
- Diablo Canyon, Unit 2—On August 16, 2008, an automatic reactor trip occurred resulting from the failure of the main electrical transformer C phase. Plant operators subsequently declared a Notification of Unusual Event due to an observed fire at the C phase transformer.
- North Anna, Unit 2—On October 29, 2008, while attempting to place the unit on line, the turbine tripped on a generator lockout relay

[4] NRC Information Notice 2009-10, Transformer Failures - Recent Operating Experience, July 7, 2009, ADAMS ML090540218.

actuation. The C main transformer was discovered to be spraying oil.

- Oyster Creek—On November 28, 2008, an electrical fault internal to the M1A main transformer led to an automatic reactor scram due to load reject. That transformer was replaced with the spare, and on February 1, 2009, this replacement transformer failed due to a bushing failure, resulting in a reactor scram, fire, and declaration of a Notification of Unusual Event.

45. In 2003, EPRI published a report that identified a growing problem with failures in large transformers and a wide range of maintenance programs that it recommended be implemented by nuclear utilities to address these problems including the problem of aging degradation of transformers. EPRI Life Cycle Management Planning Sourcebooks, Volume 4, Large Power Transformers, [1007422], March 2003, at 4-1 to 4-6, 4-17 and 6-2 to 6-13

46. In 2006, EPRI published another report that also identified problems with failures in large transformers and a wide range of diagnostic programs that it recommended be implemented by nuclear plant operators to address these problems including the problem of aging degradation of transformers and develop contingency planning to preclude end-of-life failures. EPRI, Large Transformer End-of-Expected-Life Considerations and the Need for Planning [1013566], December 2006

47. In 2006, IEEE published a report listing failure modes of transformers and methods for detecting these failures before they occur. IEEE Guide for the

Evaluation and Reconditioning of Liquid Immersed Power Transformers (IEEE Std C57.140-2006) at 11-15.

48. In 1994, Sandia National Laboratories published a report identifying aging degradation mechanisms for transformers. Sandia, Aging Management Guideline for Commercial Nuclear Power Plants Power and Distribution Transformers, SAND93-7068 · UC-523 Unlimited Release, May 1994, at 4-1 to 4-23.

49. These reports make clear that while some modes of transformer failure can be detected by performance monitoring there are significant transformer failure modes that involve aging degradation of transformer components that do not affect transformer operating performance until the transformer fails and for which aging management programs that go beyond performance monitoring are required.

50. Over time transformers age and can experience failure. For example, over time, the insulation can deteriorate, internal shorts could develop, moisture can collect in the components, or connections can become loose; also, there could be a loss of coolant, an accumulation of oil, dirt, or salt spray, or corrosion.

51. The aging degradation of some constituent parts of transformers is not detected by performance monitoring. Nevertheless, aging management programs could be implemented to address transformer component aging and help to ensure that the transformers will be capable of performing their designated function. Not only should transformers in active operating electrical systems be age managed, but so should transformers that are part of electrical systems that are used less

frequently such as the IP3 transformers for Appendix R (6.9KV/480V), 15 KVA GRD transformers for the gas turbines, Station Service Transformers and transformers for Station Black Out (SBO). Some of these transformers may not normally be energized and/or operating under full load conditions.

52. The 2009 Information Notice, EPRI's 2003 report entitled Large Transformer End-of-Expected-Life Considerations and the Need for Planning [1013566], and IEEE's 2007 report entitled IEEE Guide for the Evaluation and Reconditioning of Liquid Immersed Power Transformers[C57.140TM-2006], indicate that current monitoring procedures for detecting the performance of transformers, such as those in use at Indian Point, are not adequate to detect, in advance of failure, all of the aging defects and degradation phenomena in transformers. The declaration of Mr. Rucker makes general reference (at paragraphs 19-21) to monitoring programs that seem to be focused on the performance of the transformers, but not on the condition of the transformer components themselves. Mr. Rucker's declaration contains only generalities about performance monitoring. It also contains many qualifiers that make it difficult to understand the depth or the extent of such monitoring. While it makes reference to "transformers" or "certain" transformers, it does not demonstrate that the licensee will monitor the performance of *all* transformers that would be within the scope of Part 54, nor does it explain how the licensee monitors transformers that may not normally be energized and/or operating under full load conditions.

53. Moreover, simply monitoring the performance of transformers may not ensure that critical transformer components are not degrading to the point of component failure -- now or during the period of license extension. As discussed in the 1994 Sandia Report, the 2003 EPRI report, the 2006 EPRI report, and the 2006 IEEE report, monitoring procedures such as component performance monitoring, personnel training, and quality assurance audits are not adequate. Such monitoring procedures do not provide the level of aging management sufficient to demonstrate that the various transformers will perform their intended functions during the period of extended operation including a potential design basis accident or incident. Additional aging management programs could be implemented to detect aging degradation of transformers and their component parts in advance of failure. *See, e.g.*, EPRI 2003 Report, at 7-2 & sec. 7.1.2. Aging management programs for age related degradation of transformers may include physical inspections, power factor testing, analysis of insulation resistance, oil leakage, gas-in-oil, comparison with original factory test reports, and vibration (humming). By way of example, the 2003 EPRI Report identifies additional testing, surveillance, and inspection techniques that could support a meaningful aging management program. *See, e.g.*, EPRI 2003 Report, at 6-1 to 6-16

54. Attached to this declaration is a true and correct copy of NRC Information Notice 2009-10, Transformer Failures - Recent Operating Experience, July 7, 2009, ADAMS ML090540218 as well as excerpts of: IEEE Standard

Dictionary of Electrical and Electronic Terms, IEEE Std 100-1996 (6th Edition), page 1131, ISBN 1-55937-833-6 (1996); EPRI Life Cycle Management Planning Sourcebooks, Volume 4, Large Power Transformers, [1007422], March 2003; EPRI, Large Transformer End-of-Expected-Life Considerations and the Need for Planning [1013566], December 2006 ; IEEE Guide for the Evaluation and Reconditioning of Liquid Immersed Power Transformers [IEEE Std C57.140-2006] 2006; Sandia National Laboratories, Aging Management Guideline for Commercial Nuclear Power Plants Power and Distribution Transformers, SAND93-7068• UC-523 Unlimited Release, May 1994.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Dated: September 22, 2009
Seattle, Washington

Paul Blanch

Paul Blanch

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IEEE Standard Dictionary of Electrical and Electronic Terms, IEEE Std 100-1996 (6th Edition), page 1131, ISBN 1-55937-833-6 (1996)

UFSAR, Indian Point Unit 2, Chapter 8 (2007)

UFSAR, Indian Point Unit 2, figure 8.2-1, 8.2-2 (electrical drawing)

UFSAR, Indian Point Unit 3, Chapter 8 (2007)

Indian Point No.3 Nuclear Power Plant, Electrical Distribution & Transmission System, DWG NO 9321-F-33853, REV 17 (electrical drawing)

NRC Information Notice 2009-10, Transformer Failures - Recent Operating Experience, July 7, 2009, ADAMS ML090540218

EPRI report, EPRI Life Cycle Management Planning Sourcebooks, Volume 4, Large Power Transformers, [1007422], March 2003

EPRI report, Plant Support Engineering: Large Transformer End-of-Expected-Life Considerations and the Need for Planning [1013566], December 2006

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Sandia National Laboratories report, Aging Management Guideline for Commercial Nuclear Power Plants Power and Distribution Transformers, SAND93-7068• UC-523, Unlimited Release, May 1994

COMPARISON OF VARIOUS STRUCTURES AND COMPONENTS

Component	Moving Parts	Change In Configuration/ Properties[1]	Change In State[2]	Active or Passive	Included, Excluded In 10 CFR 54.21
Reactor vessel	No	No	No	Passive	Included
Reactor coolant system pressure boundary	No	No	No	Passive	Included
Steam generators	No	No	No	Passive	Included
Pressurizer	No	No	No	Passive	Included
Piping	No	No	No	Passive	Included
Pump Casings	No	No	No	Passive	Included
Valve Bodies	No	No	No	Passive	Included
Core Shroud	No	No	No	Passive	Included
Component Supports	No	No	No	Passive	Included
Pressure Retaining Boundaries	No	No	No	Passive	Included
Heat Exchangers	No	No	No	Passive	Included
Ventilation Ducts	No	No	No	Passive	Included
Containment and Liner	No	No	No	Passive	Included
Penetrations	No	No	No	Passive	Included
Equipment Hatches	No	No	No	Passive	Included
Seismic Structures	No	No	No	Passive	Included
Cable Trays	No	No	No	Passive	Included
Cables and Connectors	No	No	No	Passive	Included
Electrical Cabinets	No	No	No	Passive	Included
Pumps (except casings)	Yes	Yes	Yes	Active	Excluded
Valves (except bodies)	Yes	Yes	Yes	Active	Excluded
Motors	Yes	Yes	Yes	Active	Excluded
Diesel Generators	Yes	Yes	Yes	Active	Excluded
Air Compressors	Yes	Yes	Yes	Active	Excluded
Snubbers	Yes	No	Yes	Active	Excluded
Control Rod Drive	Yes	Yes	Yes	Active	Excluded
Ventilation Dampers	Yes	Yes	Yes	Active	Excluded
Pressure Transmitters[3]	Yes	N.A.	Yes	Active[4]	Excluded
Pressure Indicators	Yes	N.A.	Yes	Active	Excluded
Water Level Indicators	Yes	N.A.	Yes	Active	Excluded
Switchgears	Yes	Yes	Yes	Active	Excluded
Cooling Fans	Yes	Yes	Yes	Active	Excluded
Transistors	No	Yes	Yes	Active	Excluded
Batteries	No	N.A.	Yes	Active	Excluded
Breakers	Yes	Yes	Yes	Active	Excluded
Relays	Yes[5]	Yes	Yes	Active	Excluded
Switches	Yes	Yes	Yes	Active	Excluded
Power Inverters	No	Yes	Yes	Active[6]	Excluded
Circuit Boards	No	Yes	Yes	Active[7]	Excluded
Battery Chargers	No	Yes	Yes	Active[8]	Excluded
Power Supplies	No	No	Yes	Active[9]	Excluded

Table - Comparison of Various Structures and Components

Component	Moving Parts	Change In Configuration/ Properties[1]	Change In State[2]	Active or Passive	Included, Excluded In 10 CFR 54.21
Transformers	No	No	No	Passive	Neither Included nor Excluded
Heaters	No	No	No	Passive	Neither Included nor Excluded
Lamps (incandescent)	No	No	No	Passive	Neither Included nor Excluded
Lamps (LED)	No	Yes	Yes	Active[10]	Neither Included nor Excluded
Lamps (CFL)	No	Yes	Yes	Active[11]	Neither Included nor Excluded
Fuses	No	No	Yes[12]	Active	Neither Included nor Excluded
Resistors Capacitors Inductors	No	No	No	Passive	Neither Included nor Excluded

Endnotes appear on p. T-3

Table Endnotes:

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[1] Change in configuration occurs only with an external energy source applied.

[2] Final Rule, Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. 22,461, 22,477 (May 8, 1995): "Further, the Commission has concluded that 'a change in configuration or properties,' should be interpreted to include 'a change in state,' which is a term sometimes found in the literature relating to 'passive.'"

[3] Pressure and level transmitters may or may not contain moving parts. Solid state indicators (LEDs or plasma) contain no moving parts; however, they do contain solid state devices such as transistors.

[4] Most process transmitters and indicators (level, flow, pressure) contain either moving parts or transistors (solid state devices) and are considered "active."

[5] Solid state relays and switches do not contain moving parts; however, they are considered active based upon the Commission's SOC related to transistors.

[6] Power inverters employ solid state and other active devices to convert DC power to AC power. Power output may be controlled by external inputs.

[7] Circuit boards are assumed for the purpose of this discussion to contain active components such as transistors and other solid state devices.

[8] Battery chargers convert AC voltages and currents to DC using solid state active devices such as transistors and rectifiers. Power output may be controlled by external inputs.

[9] Power supplies convert AC voltages and currents to DC regulated voltages using solid state active devices such as transistors and rectifiers.

[10] Light Emitting Diodes (LEDs) change state (conductance) when a voltage is applied. State is determined by the polarity of the applied voltage.

[11] Compact Fluorescent Lights (CFL) lamps contain active devices such as diodes and transistors and may also contain passive devices including transformers.

[12] In order to perform their intended function, fuses undergo a change of state (conductance).