STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF INDIANAPOLIS POWER & LIGHT COMPANY ("IPL") FOR AUTHORITY TO INCREASE RATES AND CHARGES FOR ELECTRIC UTILITY SERVICE AND FOR APPROVAL OF: (1) ACCOUNTING RELIEF, INCLUDING IMPLEMENTATION OF MAJOR STORM DAMAGE RESTORATION RESERVE ACCOUNT; (2) REVISED DEPRECIATION RATES; (3) THE INCLUSION IN BASIC RATES AND CHARGES OF THE COSTS OF CERTAIN PREVIOUSLY APPROVED QUALIFIED POLLUTION CONTROL PROPERTY; (4) IMPLEMENTATION OF NEW OR MODIFIED RATE ADJUSTMENT MECHANISMS TO TIMELY RECOGNIZE FOR RATEMAKING PURPOSES LOST REVENUES FROM DEMAND-SIDE MANAGEMENT PROGRAMS AND CHANGES IN (A) CAPACITY PURCHASE COSTS; (B) REGIONAL TRANSMISSION ORGANIZATION COSTS; AND (C) OFF SYSTEM SALES MARGINS; AND (5) NEW SCHEDULES OF RATES, RULES ANDREGULATIONS FOR SERVICE.	)	**CAUSE NO. 44576**
IN THE MATTER OF THE INDIANA UTILITY REGULATORY COMMISSION'S INVESTIGATION INTO INDIANAPOLIS POWER & LIGHT COMPANY'S ONGOING INVESTMENT IN, AND OPERATION AND MAINTENANCE OF, ITS NETWORK FACILITIES	)	**CAUSE NO. 44602**

MOTION FOR LEAVE TO FILE CORRECTED DIRECT TESTIMONY

The Office of Utility Consumer Counselor (OUCC), by counsel respectfully moves for leave to file corrected testimony and in support hereof, shows the Commission that:

1. Pursuant to the pre-hearing conference order, the OUCC's direct case-in-chief testimony was due to be filed on Monday July 27, 2015.

2. Due to a clerical error, a portion of OUCC witness Anthony Alvarez's testimony was not filed on July 27, 2015.

3. Petitioner IPL was served a complete copy of Mr. Alvarez's testimony on July 27, 2015.

4. The OUCC respectfully requests that the corrected, complete testimony of Anthony Alvarez, attached hereto, be accepted as timely filed and the version filed yesterday be discarded. Please note that Mr. Alvarez's attachments were correctly filed on July

27 and will not be re-filed with his corrected testimony unless the Commission orders otherwise.

WHEREFORE, the OUCC respectfully moves for leave to file corrected direct testimony and all other appropriate relief.

Respectfully submitted,

Randall C. Helmen, Atty. No. 8275-49
Chief Deputy Consumer Counselor

CERTIFICATE OF SERVICE

This is to certify that a copy of the ***OUCC Motion for Leave to File Corrected Testimony*** has been served upon the following counsel of record in the captioned proceeding by electronic service on July 28, 2015.

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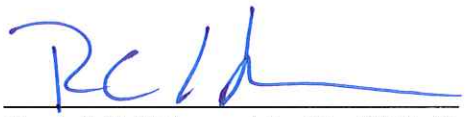

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TESTIMONY OF OUCC WITNESS ANTHONY A. ALVAREZ
CAUSE NOS. 44576/44602
INDIANAPOLIS POWER & LIGHT COMPANY

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is Anthony A. Alvarez, and my business address is 115 West Washington Street, Suite 1500 South, Indianapolis, Indiana 46204.

Q: By whom are you employed and in what capacity?

A: I am employed by the Indiana Office of Utility Consumer Counselor ("OUCC") as a Utility Analyst for the Resource Planning and Communications Division ("RPC"). A summary of my educational and professional background as well as work experience and preparation for this case is attached to my testimony as "Appendix A."

Q: What is the purpose of your testimony?

A: Through the testimony of Wes Blakley, the OUCC opposes the special accounting treatment Petitioner seeks to establish for its Level 3 and Level 4 major storms. I make recommendations that would apply if the Commission approves IPL's requested special accounting treatment for major storm expenses. More specifically, for purposes of implementing any Major Storm Damage Restoration Reserve, I recommend the Commission require IPL to rely on the Institute of Electrical and Electronics Engineers ("IEEE") Standard 1366-2012™ ("IEEE Standard 1366") to establish what constitutes "Major Event Days" ("MEDs") and

"major storms." In addition, I recommend IPL provide status reports to the Commission and the OUCC with respect to its major storm expenses. Further, I recommend the Commission require IPL to more closely adhere to the data and information requirements prescribed in 170 IAC 4-1-23(b) in its Outage Reports.

With respect to the investigation, I identified two root cause risks of explosive underground events[1] that remain within the IPL underground distribution system (both network and non-network) in IPL's Central Business District ("CBD") and Mile Square underground secondary network systems.[2] I recommend the Commission require IPL to create detailed implementation plans within the next 12 months to mitigate or eliminate these risks.[3]

II. MAJOR STORM RESTORATION RESERVE AND STORM EXPENSE

Q: What is IPL's proposal with respect to recovering its major storm costs?

A: IPL seeks authority to establish a Major Storm Damage Restoration Reserve ("Major Storm Reserve") account "to address major storm costs in the future." IPL Witness Mr. James Cutshaw testifies it is similar to that approved by the Commission for Indiana Michigan Power Company ("I&M") in Cause No.

[1] The two (2) root cause risks of explosive underground events are (1) the risk of arc flashing from primary termination degradation in its underground system; and (2) the risks of combustible gases being generated from the thermal degradation of fiber conduits in IPL's underground distribution systems (including its secondary networks).

[2] Attachment AAA-1. The geographic area of IPL's downtown "Mile Square" is bounded by North St., West St., South St., and East St., in Indianapolis, IN. (IPL responses to OUCC 63-1 Attachment 1, 61-4, and 61-4 Attachment 1).

[3] An Implementation Plan is a detailed listing of activities, costs, expected difficulties, and schedules that are required to achieve the objectives of the strategic plans.
See website: http://www.businessdictionary.com/definition/implementation-plan.html#ixzz3fQEqZDlS

44075.[4] However, there are differences that would affect its implementation including how IPL proposes to define a "major event" for these purposes.

Q: What is a "major event" and what is its relevance to major storms.

A: The Commission's "Investor-Owned Utilities Reliability Report Data for 2003 to 2013" defines "Major Events" as "storms or weather events that are more destructive than normal storm patterns."[5] The Commission's Rules require an electric Investor-Owned Utilities ("IOU") to provide the utility's definition of a major event used for reporting purposes.[6] According to a Lawrence Berkeley National Laboratory Study, "[u]tilities define major events as a means for distinguishing between utility performance in planning for, and responding to, routine interruptions versus that of non-routine or extraordinary interruptions."[7] The IEEE Standards Dictionary: Glossary of Terms and Definitions define "Major Event" as a designation of an "event that exceeds reasonable design and operational limits of the electric power system."[8] The IEEE further states, "[a] Major Event includes at least one Major Event Day."[9]

170 IAC 4-1-23(e) requires an IOU to report its electric reliability measures to the Commission for the twelve months ending December 31 of the reporting year. In its report, the utility is to define and identify those major events

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[4] IPL witness Mr. James L. Cutshaw, Direct at 15, lines 16 – 18.
[5] *See* IPL Witness JAS Attachment 1 – IURC, *Investor-Owned Utilities Reliability Report Data 2003-2013.* Page 1.
[6] 170 IAC 4-1-23(e)(2).
[7] Joseph H. Eto and Kristina Hamachi LaCommare, "Tracking the Reliability of the U.S. Electric Power System: An Assessment of the Publicly Available Information Reported to State Public Utility Commissions," Ernest Orlando Lawrence Berkeley National Laboratory, October 2008.
[8] *See* IEEE Guide for Electric Power Distribution Reliability Indices, IEEE Std. 1366-2012. *Also*, IEEE Standards Dictionary: Glossary of Terms and Definitions is available at http://shop.ieee.org.
[9] Eto, "Tracking Reliability." Major Event Day ("MED"): A day in which the daily System Average Interruption Duration Index ("SAIDI") exceeds a Major Event Day threshold value. T_{MED}.

used for reporting purposes and provide information related to the reliability metrics, such as the number of customers used for the calculations and the utility's definition of customer.[10] Further, the utility is to describe its program(s) with respect to improving the worst performing circuits or areas. Utilities calculate and report their reliability indices in two sets: (1) "with major events" and (2) "without major events."[11] By including major events in one set of reliability indices, electric utilities give some indication of how severely storms or weather events affected a particular service area. This means that the impact of the event on the system is beyond what is normally expected.[12] Excluding major events in another set of reliability indices helps utilities focus their assessment of their system over a period of time under normal conditions. This means the event's impact on the system's reliability only requires the utility to respond with its normal, day-to-day mode of operation.

Q: How does IEEE Standard 1366 define a major event?

A: IEEE Standard 1366 provides guidelines for identifying major events using the concept of Major Event Days ("MEDs"). This standard introduces a "2.5 beta method" that defines an MED as a day in which the daily system "SAIDI"

[10] *See* 170 IAC 4-1-23(e) (1-3).
[11] *See* 170 IAC 4-1-23(e) (1). *See* also IURC "Glossary of Electrical Industry Terms, Regional Transmission Organization (RTO) Terms and Related Gas Terms." http://intranet.oucc.in.gov/electric/Working%20Documents/Electric%20and%20Gas%20Glossary%206-15-15.pdf. Accessed 07/06/15.
[12] Definition of "Major Event Days," IURC "Glossary of Electrical Industry Terms, Regional Transmission Organization (RTO) Terms and Related Gas Terms." http://intranet.oucc.in.gov/electric/Working%20Documents/Electric%20and%20Gas%20Glossary%206-15-15.pdf. Accessed 07/06/15.

(System Average Interruption Duration Index) exceeds a threshold value, T_{MED}.[13] The IEEE created the 2.5 beta method because it is a "sound basis for measuring performance." It provides "a clearer view of performance, both on a daily basis and during Major Events;" it "can form a solid basis for review of operational effectiveness, decision making and policy making;" and it provides "more consistent benchmarking."[14]

The 2.5 beta method uses five (5) sequential years of historical SAIDI data in calculating the utility's threshold value, T_{MED}. The IEEE chose the SAIDI reliability performance index because it is size independent, and it provides the "best indicator of system stresses beyond those that utility's staff, build and design."[15] An MED may require the utility to respond in a crisis mode of operation (e.g., disaster, emergency or urgent).

Q: How do the other IOUs in Indiana define major event?

A: The five large electric IOUs in the state: Duke Energy Indiana ("DEI"), Northern Indiana Power Service Company ("NIPSCO"), Indiana Michigan Power Company ("I&M"), Vectren South Electric ("Vectren South"), and Indianapolis Power & Light Company ("IPL") all adopted the IEEE Standard 1366 to define a

[13] Cheryl A. Warren, "IEEE 1366 & Regulatory Implications," *See* Conference, Orlando, FL, June 29, 2006, Institute of Electric and Electronics Engineers, Inc. http://grouper.ieee.org/groups/td/dist/sd/doc/2006-07-IEEE1366-Regulatory-Implications.pdf. Accessed 07/06/2015.

[14] John McDaniel, "Uses of IEEE 1366 and Catastrophic Days," IEEE PES (Power & Energy Society), April 2012. http://eei.org/meetings/Meeting_Documents/2012Apr-TDM-McDaniel.pdf. Accessed 03/11/2015.
See also Cheryl A. Warren, "IEEE 1366 & Regulatory Implications," Conference, Orlando, FL, June 29, 2006, Institute of Electric and Electronics Engineers, Inc. http://grouper.ieee.org/groups/td/dist/sd/doc/2006-07-IEEE1366-Regulatory-Implications.pdf. Accessed 03/11/2015.

[15] McDaniel, "Uses of IEEE 1366 and Catastrophic Days."

major event.[16] However, this is not the definition of "major event" IPL proposes to use to determine whether storm restoration costs will qualify for special accounting treatment.

Q: How does IPL define a major event for purposes of the special accounting treatment?

A: In its 2014 Electric Reliability Report to the Commission, IPL stated it defined major events using the "IEEE 1366, 2.5 beta methodology and terminology," and adopted the IEEE Standard 1366 since 2012.[17] However, IPL intends to use its definition of storms by "their severity, number of customers affected, and the estimated restoration time."[18] IPL describes the storm events "as Level 1 through 4, with a Level 4 storm being the most severe." IPL's definition does not directly follow the IEEE Standard 1366 definition of "Major Events," or the IEEE Standard 1366, 2.5 beta methodology in determining the Major Event Day threshold ("T_{MED}").

Q: Mr. Cutshaw testified that IPL's request for special accounting treatment is similar to the special accounting treatment I&M sought in Cause No. 44075. Is it identical to the special accounting treatment I&M sought?

A: No. In response to OUCC DR 44-16, IPL noted that I&M relies on the IEEE 1366 standard for the major storm definition used for its authorized Cause No. 44075 accounting treatment:[19]

> According to lines 13-16 of page 3 of the direct prefiled testimony of J. Edward Ehler in Cause No. 44075, I&M defines or

[16] 170 IAC 4-1-23 (e) (2) requires a utility to provide its definition of major event (whether "internal" or adopted industry standard) in its reliability reports for the purpose of providing a clear delineation between what is a "major" and what is a "normal" event. Vectren does not include planned interruptions in reporting its reliability performance indices to the Commission.
[17] Attachment AAA-2. (IPL 2014 Electric Reliability Report to the IURC, February, 27, 2015).
[18] Mr. Holtsclaw, Direct at 8, lines 7 – 8.
[19] Attachment AAA-3. ((IPL response to OUCC 44-16).

> determines major storms based on the methodology outlined in IEEE Standard 1366-2003, IEEE Guide for Electric Power Distribution Reliability Indices.[20]

However, IPL did not use the IEEE Standard 1366 to define major storms for purposes of the Major Storm Restoration Reserve Account; rather, it uses its own internal definition of storm level (Level 1 through 4, with a Level 4 storm being the most severe).[21]

Q: Did IPL formally define major storms in its case-in-chief?

A: No. However, IPL witnesses seem to use the phrase "major storms" to refer to "Level 3&4" storms.[22] Mr. Cutshaw identified IPL's storm expenses associated with major storms and storm Levels 3&4, but referred to Mr. Holtsclaw for the descriptions of the storm levels.[23] Mr. Holtsclaw did not define or describe major storm, but identified the January 5, 2014, Level 3 storm as the "one major storm [that occurred] during the test year…"[24]

Q: Does IPL's lack of a major storm definition for purposes of the reserve present a problem?

A: Yes. IPL's lack of a formal definition for "major storm" is problematic because it creates uncertainty of what should count as a major storm for purposes of its proposed Major Storm Reserve. Through the IEEE Standard 1366, the industry has a well-established and well-understood definition of what constitutes a "major event" and, by extension, a "major storm." Relying on the IEEE Standard 1366

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[20] *See* Footnote 8.
[21] Mr. Holtsclaw, Direct at 8, lines 9 – 10.
[22] Mr. Cutshaw, Direct at 15, line 19. *Also, see* Cutshaw, p. 15, footnote 1.
[23] Mr. Cutshaw, Direct at 16, lines 1 – 2.
[24] Mr. Holtsclaw, Direct at 9 lines 14 – 16, testified, "There was one major storm during the test year ending June 30, 2014 and that was the Level 3 storm in January 2014."

would promote certainty and avoid controversy in the future. Moreover, having IPL use the same standard definition as I&M for major storm events will promote even comparisons for benchmarking and other evaluative processes.

Q: Did IPL set forth fully developed and detailed guidelines, procedures or policies related to its proposed Major Storm Reserve?

A: No. In IPL's response to OUCC DR 17-22, IPL disclosed it has not yet developed any guidelines, procedures, and/or policies related to its proposed Major Storm Reserve.[25] It is not clear that IPL has considered its own geography, system design and operation, load density, and local weather characteristics, all of which could differ from the characteristics of I&M's service territory.

Q: Please summarize the OUCC's recommendations regarding IPL's request for a Major Storm Reserve?

A: OUCC witness Wes Blakley provides reasons why the Commission should reject IPL's request for special accounting treatment. I do not address those reasons in this testimony. However, I provide two additional reasons why IPL's major storm damage reserve should not be approved.

First, IPL has not established guidelines that adequately articulate how operating costs will be classified by either Levels 3 and 4, which IPL proposes be qualified for Major Storm Reserve relief, or for Levels 1 and 2, which would not qualify. Second, IPL does not propose to rely on the IEEE Standard's definition of a Major Event and a Major Storm for purposes of the Major Storm Reserve.

[25] Exhibit AAA – 4. (IPL response to OUCC 17-22).

Q: If the Commission authorizes IPL to establish a Major Storm Damage Restoration Reserve, do you recommend any changes?

A: Yes. If the Commission authorized such a reserve, the OUCC recommends the Commission require IPL to do the following:

1. Rely on the IEEE Standard 1366 definition of "major events" and "major storm"; and

2. Submit annual reports to the Commission and the OUCC along with IPL's Electric Reliability Report to the IURC (as prescribed by 170 IAC 4-1-23(e)).

IPL's annual report should include, at the minimum, the following:

1. IPL's IEEE 1366, 2.5 Beta methodology TMED and calculation as of December 31 of the year prior to its electric reliability-reporting year to the IURC;

2. The SAIDI of each day IPL included in its Major Storm Damage Restoration Reserve calculation of the reporting year;

3. The complete set of outage reports related to each day IPL included in its Major Storm Damage Restoration Reserve calculation of the reporting year; and

4. IPL's IEEE 1366, 2.5 Beta methodology TMED and calculation as of December 31st of its electric reliability-reporting year to the IURC.

III. ACCURACY AND CONSISTENCY OF IPL OUTAGE REPORTS

Q: What is an outage report?

A: Pursuant to 170 IAC 4-1-23(b), the Commission requires electric utilities to submit outage reports describing sustained service interruptions within their service area. This report includes, among other things, the estimated number of customers initially affected; the number of customers currently affected; the interruption start date and time; and the duration of the outage.[26] An outage report includes an initial report, follow-up reports provided in regular intervals, and a final report.[27] Outage reports allow the Commission to assess the time it takes the utility to restore power to its customers.[28]

Q: Why is the accuracy and dependability of IPL's outage reports an issue?

A: These reports could play an important role in determining which events qualify for IPL's proposed Major Storm Reserve. While comparing each outage report for 2009- 2014, I discovered multiple inconsistencies between reports originally provided electronically via email to the OUCC during the storm and the same reports provided by IPL in discovery. It appears IPL modified several reports after they were first provided without clearly identifying the changes.

Therefore, I recommend that when IPL issues its outage reports, it clearly designate at that time that the report is an initial report or a final report as the case may be. Further, IPL should maintain its reports so that once a report is issued,

[26] *See* 170 IAC 4-1-23(b).
[27] *Id.*
[28] *See* IURC Report of Outage, State Form 54646 (3-11). https://forms.in.gov/Download.aspx?id=9574.

no changes are made to the report. Any explanation required after the report has been issued must be made on a separate sheet.

IV. IPL'S UNDERGROUND DISTRIBUTION SYSTEM

Q: Please provide an overview of IPL's underground distribution system.

A: IPL's underground distribution system includes both network and non-network distribution facilities,[29] which serve the area covered by IPL's Central Business District.[30] Within the heart of the CBD is IPL's downtown "Mile Square."[31] IPL's downtown underground network system consists of four independent (not electrically interconnected) and distinct underground secondary networks.[32] The four distinct secondary networks have been designated Edison East, Edison West, Gardner Lane North, and Gardner Lane South.[33] In 2014, IPL incorporated an additional fifth separate downtown underground secondary network, the former Substation 3 ("Sub 3") secondary network, into the Edison East Underground Secondary Network.[34] However, the former Sub 3's secondary network remains intact, is not electrically interconnected, and is distinct from the Edison East secondary network, except that its primary feeders now come from the Edison

[29] Attachment AAA-5. (IPL response to OUCC 65-02). *See* Also, O'Neill Management Consulting, LLC. "2.2 System Overview - Update." *Investigation of IPL's Network - Report of Independent Contractor.* Indianapolis: Indiana Utility Regulatory Commission, 2010. 10. Print.
[30] Attachment AAA-6. (IPL response to OUCC 61-07). The geographic area of IPL's Central Business District ("CBD") is bounded by 16th St. to the North, White River to the West, I-70 to the South, and I-70/I-65 and College Ave. to the East.
[31] Attachment AAA-1. The geographic area of IPL's downtown Mile Square is bounded by North St., West St., South St., and East St., in Indianapolis, IN.
[32] Attachment AAA-7. (IPL response to OUCC 65-08 (c)).
[33] 2015 O'Neill Investigation Report to the IURC, page 9.
[34] Id.

East Substation.[35]

IPL's non-network underground distribution system covers the CBD area including the downtown "Mile Square."[36] IPL's general distribution system includes overhead, underground, and non-network electrical distribution facilities. I confine my testimony to the underground component of IPL's general distribution system and downtown network.[37]

Q: Please discuss distinctive features of IPL's underground distribution facilities.

A: IPL built and expanded its network and non-network underground infrastructure, such as duct lines, manholes, transformer vaults, and other underground facilities, over a period of time. Depending on the vintage of the infrastructure, IPL's network and non-network underground facilities have certain distinct features influenced by the standards, designs, and materials used in the construction of such infrastructure.[38] As electrical underground standards evolve, the electrical industry evaluates, assesses, and adopts newer materials, components, equipment, designs, and techniques for new construction, replacement, or repair of underground facilities.[39] For example, older underground facilities, such as duct lines and conductors, may have "coal tar paper conduits" (also known as "fiber conduits" or "fiber ducts") and paper insulated conductors (Paper Insulated

[35] Attachment AAA-8. (IPL response to OUCC 68-14). *See* also, 2015 O'Neill Investigation Report to the IURC, page 8.
[36] Attachment AAA-1.
[37] Attachment AAA-5.
[38] Attachment AAA-9. (IPL response to OUCC 64-5 Attachment 3, pp. 1 & 8). In-service dates of IPL's distribution substations serving IPL's underground secondary networks. *See* also, IPL's response to IURC Staff DR 6-4 Confidential Attachment 1 – AES, Downtown Underground Network Asset Life Cycle Plan, March 23, 2015.
[39] *See* 2015 O'Neill Investigation, Sections 2.3 System Design and Equipment Specification – Update, and 2.4 System Condition – Update, pages 11 and 13, respectively.

Laminated Conductors or "PILCs").[40] Newer underground facilities typically have Polyvinyl Chloride ("PVC") conduits and newer types of electrical conductors, such as Ethylene Propylene Rubber ("EPR") insulated conductors.[41] In addition, newer underground equipment and components, such as transformers and primary connections, are compact, higher capacity, and typically designed with elbow connectors instead of primary terminations.[42]

V. OUCC CONCERNS

Q: Please state the OUCC concerns regarding IPL's transformer primary terminations and underground distribution fiber ducts.

A: IPL lacks specific implementation plans to address and eliminate the risks of arc flashing and combustible gases generated from underground fiber conduits. Without specific implementation plans, IPL's underground distribution and secondary network systems will continue to experience the network events that gave rise to this investigation. It is IPL's responsibility to initiate and carry out the necessary assessments, engineering studies, and implementation plans with established objectives and goals of eliminating and mitigating these risks.[43]

VI. ARC FLASHING AT PRIMARY TERMINATIONS AND STRESS CONES

Q: Please describe arc flashing and the risks it poses.

A: Arc flashes (or flashovers) occur when electricity flows irregularly along an

[40] Attachment AAA-10.(IPL response to OUCC 64-5 Attachment 3, pp. 1 & 15).
[41] *Id. See* also 2015 O'Neill Investigation, Sections 2.3 (p.11) and 2.4 (p.13).
[42] *See* 2015 O'Neill Investigation, Sections 2.3 System Design and Equipment Specification – Update, page 12.
[43] Attachment AAA-11. (IPL's response to OUCC 61-03). Duties and responsibilities of IPL's Major Underground Project Engineering Team.

undesired path. Because arc flashes can reach temperatures of 35,000°F, they are extremely dangerous.[44] I will address concerns regarding arc flashing at IPL's underground transformers where feeders interconnect with the transformer, also known as the primary termination.

Stress cones are a common method to prevent arc flashes on primary terminations. The cone reduces stress at the connection point, reduces electrical field distortions, and most importantly has insulating properties.

Q: What happens when stress cones degrade?

A: Degradation or deterioration of primary terminations or stress cones (due to age, overload conditions, electrical spikes, or incipient faults) reduces the insulating effectiveness, and can cause arc flashes that may generate energy in the form of thermal heat, toxic fumes, pressure waves, and explosions.[45] For example, IPL experienced this type of explosive network event inside one of its Massachusetts Avenue transformer vaults on March 16, 2015.

Q: What is IPL's plan to address the arc flashing generated from degraded stress cones?

A: The 2011 O'Neill Report recommended IPL begin a primary termination / elbow connector retrofit program. In its January 19, 2012 response, IPL committed to adjust its standard transformer specification to include this requirement and to have retrofitted units available by the 4th quarter of 2012. IPL also committed to retro-fill termination chambers with FR3 (Envirotemp) ™ fire retardant dielectric

[44] Attachment AAA-12. "Arc-flash Safety Solutions," Eaton Corporation, 2013, page 1.
[45] Attachment AAA-12.

fluid, which has a higher flash point.[46]

Q: Please discuss IPL's plan to retrofit primary terminations with elbow connectors.

A: Elbow connectors can reduce the risk of arc flashing. IPL's plan to eliminate the use of stress cones by retro-fitting or replacing transformer primary terminations with elbow connectors is sound engineering.

One year after its initial commitment, IPL's January 25, 2013 Response noted only one new transformer with elbow connectors was installed in 2012, and "[g]oing forward this will be the standard for any transformer installed in a vault whether it's a new installation or a replacement of an existing unit."[47] However, only two of the eight transformers IPL replaced in 2013 had elbow connectors; the other six used primary terminations and stress cones.[48]

On June 17, 2015, IPL informed the OUCC that IPL's primary termination replacement plan is dependent on its network transformer replacement plan.[49] While the completed retrofits are a positive step,[50] IPL lacks a specific implementation plan that addresses the remaining primary terminations. The longer they remain uncorrected, the greater the risk of another explosive network event. IPL needs a detailed plan for primary termination replacements, prioritized

[46] IPL's "Response To: Independent Assessment of Indianapolis Power & Light's Downtown Underground Network," January 19, 2012, pages 8, 24.
[47] Attachment AAA-13, IPL's "Report in Response to O'Neill Consulting Independent Assessment of Indianapolis Power and Light Company's Downtown Underground Network for the Year Ended 2012," January 25, 2013, page 18, section 3.3.2.
[48] Attachment AAA-14. (IPL's response to OUCC DR 84-08) shows only two "dead-front" (elbow connector) transformers were installed in 2013. *See* also The 2015 O'Neill Report, page 37, Table 7, shows IPL replaced eight transformers in 2013.
[49] Attachment AAA-15. (IPL response to OUCC 84-11).
[50] The 2015 O'Neill Report's Table 7 also shows IPL installed 13 transformers between January 1, 2014 and June 22, 2015, all with elbow connectors. *See* also Attachment AAA-14.

according to risk and consequence of failure. This plan should include an analysis of possible interim improvements that can address arc flashing for transformers not scheduled for immediate replacement.

Q: Will IPL's current primary termination replacement plan eliminate the risk of arc flash from degraded primary termination and stress cone?

A: No. By making its termination replacement plan dependent on its condition-based transformer replacement plan, IPL allows the risk of explosive network events due to arc flashes to remain.

Q: Please discuss the benefits of IPL's plan to retro-fill the primary termination chambers with FR3 fire retardant dielectric fluid.

A: Envirotemp™ FR3™ increases the flash point of the insulating fluid, raises operating temperatures of transformers and termination chambers, and improves safety.[51] Once subjected to certain extreme electrical conditions, i.e. high voltage or high current conditions, the insulating properties of electrical components, such as the primary termination stress cone, can breakdown and an arch flash or flashover can occur.[52] The FR3 may extinguish the arc flash at the earliest possible cycle (alternating current of AC cycle), but neither IPL nor Cargill (FR3's manufacturer) claims the fluid can prevent arc flash from occurring.[53]

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[51] Petitioner's witness Mr. Michael L. Holtsclaw, Supplemental at 25, lines 20 – 21.
[52] Snodgrass, Robert E., and W. Z. Black, Fellow. IEEE. "Design of Safety Devices to Mitigate Explosions in Underground Vaults and Manholes." *IEEE Transactions on Power Delivery*, vol. 23, no. 4, Oct. 2008. Print.
[53] Petitioner's witness Mr. Michael L. Holtsclaw, Supplemental at 25, lines 21. *See* also Cargill Envirotemp™ FR3™ Sell Sheet. Website: http://www.cargill.com/wcm/groups/public/@ccom/documents/document/na3076869.pdf. Accessed 07/06/15.

VII. COAL TAR PAPER OR FIBER CONDUITS

Q: Please discuss IPL's use of fiber conduits and the risks of combustible gases generated from thermal degradation.

A: IPL's underground ductworks contain fiber conduits, composed of cellulose or paper fiber impregnated with a "petroleum based product like coal tar."[54] According to the Department of Labor, Occupational Safety & Health Administration, Safety and Health Topics, Coal Tar Pitch Volatiles (CTPVs) are composed of various chemical vapors that become airborne during the heating of coal tar pitch.[55] The National Institute for Occupational Safety and Health considers coal tar, coal tar pitch, and creosote to be coal tar products.[56]

Heat sources, such as steam lines near IPL's underground fiber duct lines and overloaded conductors with compromised insulation inside the duct lines, can cause the thermal degradation of fiber conduits.[57] Coal tar materials and products, such as fiber conduits, are known to burn when ignited. Combustion generates hazardous decomposition products, such as carbon monoxide, carbon dioxide, nitrogen oxides, sulfur oxides (or SOx), and polynuclear aromatic hydrocarbons.[58] IPL has acknowledged that the thermal degradation of fiber conduits could generate combustible gases in confined spaces, such as primary, feeder, or

[54] Attachment AAA-16. (IPL's response to OUCC DR 86-01 (a)).
[55] Department of Labor, OSHA website: https://www.osha.gov/SLTC/coaltarpitchvolatiles/index.html. Accessed 07/14/15.
[56] *Id.*
[57] IPL RCA for the March 19, 2015 Network Event, pages 32, 34 and 35.
[58] ALCOA, Coal Tar Pitch Material Safety Data Sheet.
http://www.alcoa.com/global/en/environment/msds_view.asp?loadmsds=203838. Accessed 07/14/15.

secondary duct lines, vaults, and manholes.[59] This degradation can contribute to a build-up of pressure and energy.[60] Once ignited, this can result in an explosive network event.[61]

IPL found that "remaining high level of Carbon Monoxide (CO) and other combustible gases" caused the explosion that dislodged and catapulted manhole covers during the network event at North St. and Capitol Ave. on March 19, 2015.[62] In the aftermath of the event, damages to the underground facilities included thermally degraded or burned-out network and non-network primary feeders and secondary cables, and burned and collapsed fiber ducts. In one part of the duct line, the burned fiber ducts fused with the cables inside preventing retrieval of the cables and rendering the duct damaged and unusable.[63]

Q: IPL stated that there are more than 500 steam line and underground electrical duct line crossings in the Central Business District and Mile Square downtown network. Does IPL know the type of duct material in each of these crossings?

A: Not for all, but IPL believes "the duct material at the vast majority of the crossing points will be fiber ducts."[64]

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[59] IPL RCA for the March 19, 2015 Network Event, pages 32, 34 and 35 (also pages 4, 9, 13, 30 and 31). IPL attributed the majority of the combustible gases generated to the thermal degradation of conductor insulation.

[60] B. P. Walsh and W. Z. Black, *Fellow, IEEE*, "Thermodynamic and Mechanical Analysis of Gas Explosions in Underground Vaults," *IEEE Transactions on Power Del.*, vol. 17, no. 1, pp. 8-12, Jan. 2002.

[61] IPL RCA for the March 19, 2015 Network Event, page 9.

[62] IPL RCA for the March 19, 2015 Network Event, page 5.

[63] *Id.* at 29, "During the restoration efforts [the following] two secondary cable sections could not be removed from their duct lines due to cable and or duct line damage."

[64] Attachment AAA-17.(IPL's response to OUCC DR 84-07).

Q: Is there an IPL plan to address the combustible gases generated from the fiber conduit thermal degradation?

A: No. The OUCC asked for, but did not receive, data and information regarding ignition temperature, melting point, and flash point of IPL's fiber conduit.[65] IPL stated that it could not locate a copy of the Material Safety Data Sheet from its fiber conduit manufacturer.[66] In addition, IPL did not identify any decomposition products, chemical, or physical properties of substances that occur as a result of fiber conduit thermal decomposition.[67]

IPL's Root Cause Analysis of the March 19 explosive network event, found evidence of melted fiber conduit fused with a conductor, and combustible gases generated by burned out fiber duct wall.[68] However, IPL did not initiate any engineering analysis or assessment on the role of combustible gases from the thermal degradation of the fiber ducts during the event.[69]

Q: Is IPL taking other steps to address combustible gases?

A: Yes. IPL is installing some Swiveloc manhole covers, which may limit the on-rush of fresh air that sustains the combustion of gases, and can mechanically prevent the explosive ejection of typical manhole covers. The Swiveloc manhole covers cannot prevent the *ignition* and combustion of gases *within* the manhole and duct line.[70]

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[65] Attachment AAA-18.(IPL's response to OUCC DR 86-13).
[66] Attachment AAA-16. (IPL's response to OUCC DR 86-01 (b)).
[67] Attachment AAA-19.(IPL's responses to OUCC DRs 86-15 and 86-16).
[68] IPL RCA for the March 19, 2015 Network Event, page 31.
[69] *Id.* IPL RCA for the March 19, 2015 Network Event, page 31.
[70] Snodgrass and Black, Design of Safety Devices to Mitigate Explosions. Conclusion.

VIII. SUMMARY OF RECOMMENDATIONS AND CONCLUSION

Q: Please state your recommendations.

A: The OUCC recommends the following:

1. The Commission reject IPL's requested special accounting treatment for major storm expenses;

2. If the Commission authorizes the special accounting treatment, it should require IPL to rely on the IEEE Std. 1366 for the purposes of establishing what constitutes "Major Event Days" ("MEDs") and "major storms;"

3. The Commission require IPL to provide annual Major Storm Reserve reports including the information set forth in my testimony above. IPL should submit such reports to the Commission and the OUCC at the time IPL submits its Electric Reliability Report to the IURC as prescribed by 170 I.A.C. 4-1-23(e); and

4. The Commission require IPL to maintain the integrity of its reports so that once a report is issued, no changes are made to the report.

The OUCC also recommends that the Commission require IPL to do the following within 12 months after issuance of the Final Order in this Cause:

5. Conduct assessments, analyses, and engineering studies necessary to identify, address, mitigate, and eliminate the risk of arc flash from primary termination degradation.

6. Create a detailed plan for primary termination replacements, prioritized according to risk and consequence of failure. This plan should include an analysis of possible interim improvements that can address arc flashing for transformers not scheduled for immediate replacement.

7. Conduct assessments, analyses, and engineering studies necessary to identify, address, mitigate, and eliminate the risk of combustible gases generated from the thermal degradation of fiber conduits. These should include, at least, data and information regarding ignition temperature, melting point, and flash point of IPL's fiber conduit; and identify any decomposition products, chemical, or physical properties of substances from fiber conduit thermal decomposition.

8. Create a detailed plan to address, mitigate, and eliminate risks of the generation of combustible gases from the thermal degradation of the fiber conduits.

9. Prepare detailed implementation plans with deadlines and specific objectives designed to mitigate and ultimately eliminate these risks.

10. Formally submit such analyses and implementation plans with supporting documentation to the Commission and the OUCC.

Q: Does this conclude your testimony?

A: Yes.

APPENDIX A

Q: Please describe your educational background and experience.

A: I hold an MBA from the University of the Philippines ("UP"), Diliman, Quezon City, Philippines. I also hold a Bachelor's Degree in Electrical Engineering from the University of Santo Tomas ("UST"), Manila, Philippines.

Hired by the OUCC in July 2009, I completed the regulatory studies program at Michigan State University sponsored by the National Association of Regulatory Utility Commissioners ("NARUC"), as well as other utility and renewable energy resources-related seminars, forums and conferences.

Prior to joining the OUCC, I worked for the Manila Electric Company ("MERALCO") in the Philippines as a Senior Project Engineer responsible for overall project and account management of large and medium industrial and commercial customers. I evaluated electrical plans, designed overhead and underground primary and secondary distribution lines and facilities, primary and secondary line revamps, extensions and upgrades with voltages up to 34.5 KV. I successfully completed the MERALCO Power Engineering Program, a two-year program designed for engineers in the power and electrical utility industry.

Q: What did you do to prepare for your testimony?

A: I reviewed Indianapolis Power & Light's ("IPL") petition and relevant portions of its case-in-chief including exhibits and attachments. I drafted data requests and reviewed IPL's responses. I reviewed the Indiana Utility Regulatory Commission ("IURC" or "Commission") Investor-Owned Utilities Reliability Report Data

2002-2013,[71] IPL's Electric Reliability Report from 2003 through 2014,[72] and IPL's test year and specific 2006 to 2014 outage reports[73] to the Commission. I also reviewed the IURC Staff data requests, the 2011 and 2015 O'Neill Reports, IPL's Root Cause Analysis ("RCA") reports on network events, and IPL's respective responses, pertaining to the IURC Investigation. I previously toured IPL's Petersburg and Harding Street Generating Stations. I also participated in meetings and technical conferences with OUCC staff and IPL personnel.

Q: Have you previously testified before the Indiana Utility Regulatory Commission?

A: Yes. I have testified in a number of causes before the Commission, including electric utility base rate cases; environmental tracker cases; applications for Transmission, Distribution, and Storage System Improvement Charges; applications for Certificates of Public Convenience and Necessity; and Duke Energy Indiana's application for recovery of Integrated Gasification Combined Cycle costs.

[71] "IURC Investor-Owned Utilities Reliability Report Data 2002-2013," Indiana Utility Regulatory Commission. http://www.in.gov/iurc/files/2013_Reliability_Summary_Report(1).pdf. Accessed 03/09/2015.

[72] Indiana electric utilities submit an annual "Electric Reliability Report to the IURC" in accordance with the Commission's Rules and Regulations 170 I.A.C. 4-1-23 (e).

[73] Indiana electric utilities provide the Commission outage reports in accordance with 170 I.A.C. 4-1-23 (b).