INDEPENDENT STUDIES

1.0 INDEPENDENT REVIEW OF RETUBE AND FEEDER REPLACEMENT CONTRACT

Concentric Energy Advisors, Inc. ("Concentric") was retained to review the contract for the Retube and Feeder Replacement ("RFR") work package for the Program and delivered a report in July 2016. In particular, Concentric was asked to build upon conclusions from its previous work regarding OPG's commercial strategies for the RFR contract filed in EB-2013-0321 (re-filed as Attachment 4 of Ex. D2-2-8) and to provide an opinion on whether the final contract for the RFR is reasonable and prudent, appropriately establishes a target price and appropriately allocates risk between OPG and the Contractor.

Concentric has concluded that, based on OPG's activities with regard to amending and finalizing the RFR contract, the terms of the RFR contract, including the target price and the allocation of risk, are both reasonable and meet the regulatory standard of prudence. Concentric's report is included as Attachment 1.

2.0 INDEPENDENT REVIEW OF PLAN AND APPROACH TO PROGRAM EXECUTION

In April 2016, Pegasus Global Holdings, Inc. ("Pegasus-Global") was retained to provide an independent and objective assessment of the degree to which OPG's plan and approach to execution of the Program, including the processes in place for management of costs and schedule, program controls and its application of any contingency, are consistent with the way other projects of comparable magnitude, scale and complexity have been carried out. Pegasus-Global delivered its testimony in July 2016.

Pegasus-Global concluded OPG has reasonably and prudently prepared for its execution of the DRP, and that OPG's approach for executing the Program is consistent with the approach typically used on other megaprograms, and in several areas, is exemplary relative to other megaprograms of similar magnitude, scale, and complexity. Pegasus-Global also observed that the extensive pre-execution planning that was undertaken by OPG places it in a favorable position to have successful execution of the Program. Pegasus-Global's testimony is included in Attachment 3.

ATTACHMENTS

Attachment 1:	Concentric Energy Advisors – Updated Assessment of Commercial Strategies Developed for the Darlington Refurbishment Program Retube & Feeder Replacement Work Package
Attachment 2:	Concentric Energy Advisors Engagement Letter
Attachment 3:	Pegasus Global Holdings, Inc. – Testimony of Dr. Patricia D. Galloway
Attachment 4:	Pegasus Global Holdings, Inc. Engagement Letter

UPDATED ASSESSMENT OF COMMERCIAL STRATEGIES DEVELOPED FOR THE DARLINGTON REFURBISHMENT PROGRAM RETUBE & FEEDER REPLACEMENT WORK PACKAGE

PREPARED FOR ONTARIO POWER GENERATION

JULY 2016

CONCENTRIC ENERGY ADVISORS

TABLE OF CONTENTS

I. INTRODUCTION

On April 11, 2016, Torys LLP retained Concentric Energy Advisors, Inc. ("Concentric") to:

- Assist legal counsel to OPG, for purposes of providing legal advice, by providing an opinion on the contract for the Retube & Feeder Replacement work package for the Darlington Refurbishment Program (the "Program"). In particular, building on conclusions from Concentric's previous work regarding Ontario Power Generation Inc.'s ("Ontario Power Generation's" or the "Company's") commercial and contracting strategies for the Program, provide an opinion as to whether the final contract for the Retube & Feeder Replacement work package is reasonable and prudent, and appropriately establishes a target price and allocates risk between OPG and the joint venture formed by SNC Lavalin Nuclear, Inc. and Aecon Industrial, a division of Aecon Construction Group Incorporated ("SLN-Aecon" or the "Joint Venture").

This report includes a summary of our findings with regard to the final contract for the Retube & Feeder Replacement work package, as amended, with the Joint Venture. This report contains: (1) Concentric's assessment of the process the Company used to arrive at an Execution Phase amendment to the contract for the work package; (2) a review of the reasonableness and prudence of the commercial terms in the final amended contract; and (3) our evaluation of the allocation of risk between Ontario Power Generation and the Joint Venture that is articulated in the contract.

Concentric was initially engaged by Torys LLP in August 2011 to review the commercial strategies and contracts developed and implemented for the refurbishment of four CANDU heavy water reactors at Ontario Power Generation's Darlington Nuclear Generating Station ("Darlington" or the "Plant"). We provided a written report summarizing our review in September 2013. That report was submitted into evidence in Ontario Power Generation's last rate case (EB-2013-0321), and Concentric's Chairman and Chief Executive Officer, John J. Reed, appeared as an expert witness in that proceeding. That report has also been re-filed in Ontario Power Generation's current rate case (EB-2016-0152, *see*, Exhibit D2-2-2, Attachment 1).

The Program will include removal and replacement of the reactor calandria tubes and pressure tubes from each reactor,[1] replacement of all feeders (referred to together with the calandria and pressure tube replacement as the "Retube & Feeder Replacement work package"), refurbishment of the existing fuel handling equipment, refurbishment of the existing turbine generators, refurbishment of the existing steam generators, and a set of supporting refurbishment projects aligned with existing station systems. The plant modifications are currently planned to be made during outages for each of the four Darlington units between October 2016 and 2026.[2]

The Retube & Feeder Replacement work package, which is the focus of Concentric's analysis for this report, is the largest single component of work under the Program. Assuming that all four units are ultimately

[1] The amended contract envisions refurbishment of all four units at Darlington, but contains off-ramp opportunities that allow the Company to choose to complete fewer than four refurbishments at its discretion.

[2] Ontario Power Generation's contract with SLN-Aecon (executed in March 2012) for the Retube & Feeder Replacement scope of work was applicable to the Definition Phase of the work package. In order to transition to the Execution Phase of work the Company and SLN-Aecon agreed to a contract amendment on January 11, 2016 that included key terms and conditions for the Execution Phase.

refurbished, the Retube & Feeder Replacement work package is currently expected to cost approximately $3.6 billion, or 65% of the total Program cost for work bundles.[3]

II. SUMMARY OF CONCLUSIONS

As discussed below, Concentric has concluded that, based on Ontario Power Generation's activities with regard to amending and finalizing the Retube & Feeder Replacement contract since our last report (*i.e.*, September 2013), the terms of the Retube & Feeder Replacement contract, including the target price and the allocation of risk, are both reasonable and meet the regulatory standard of prudence as we defined that concept in our September 2013 report and repeat herein for convenience.

Concentric's opinion is not without certain caveats and limitations, which are discussed in the sections that follow. Similarly, the basis for our opinions are described throughout the remainder of this document.

III. STANDARD OF REVIEW

Torys LLP asked Concentric to evaluate whether the final, amended Retube & Feeder Replacement contract is reasonable and prudent, including the risk allocation terms of the contract. To perform our evaluation, Concentric used the same definition for the regulatory standard of prudence that we used in our September 2013 report.

The definition of regulatory prudence that we applied for our review was based on Concentric's work before state, provincial and federal energy regulators in both Canada and the United States. The definition of regulatory prudence that Concentric has applied is consistent with the Supreme Court of Canada's 2015 overview of the prudent investment test provided in *Ontario (Energy Board) v. Ontario Power Generation Inc.*[4] In addition, the definition used by Concentric is consistent with decisions rendered by the Ontario Superior Court of Justice,[5] the Court of Appeal for Ontario,[6] the Ontario Energy Board[7] and the U.S. Supreme Court,[8] among other jurisdictions. Specifically, Concentric defined the prudence standard as examining the range of actions that a reasonable manager would take given the facts or circumstances that were known or knowable at the time of the decision or action. This definition rejects the use of hindsight as a basis for determining the prudence of a decision or action. In addition, the definition relies on an evaluation of decisions or actions. Project costs are neither prudent nor imprudent. Instead, costs are prudently or imprudently incurred as a consequence of the decisions and actions of management.

IV. GENERAL LIMITATIONS OF OUR OPINION

---

3 Excludes campus plan, Ontario Power Generation functions cost, contingency, interest and escalation. Of the total $12.8 billion Program cost estimate, the Retube & Feeder Replacement work package is approximately 28% of the cost.

4 Supreme Court of Canada Decision, *Ontario (Energy Board) v. Ontario Power Generation*, Docket 35506, September 25, 2015.

5 2005 CanLII 4941 (Ont. Div. Ct.).

6 Court of Appeal for Ontario Decision, Docket: C55602, C55641 and C55633, June 4, 2013.

7 Decision with Reasons, RP-2001-0032, December 13, 2002. This Decision deals with Enbridge Gas Distribution Inc.'s (formerly Enbridge Consumers Gas or ECG) application for a Board Order approving rates for the 2002 Test Year.

8 Separate, concurring opinion of Justice Louis Brandeis, Missouri ex. Rel. Southwestern Bell Telephone Co. v. Public Service Commission, 262 U.S. 276 (1923).

The following are general limitations regarding the scope of our review:

- First, our review is limited to Ontario Power Generation's actions and documents prepared through April 5, 2016. This opinion builds on the report Concentric provided in September 2013, and reflects our evaluation of Ontario Power Generation's actions beginning in late 2009. Concentric did not complete a thorough review of Ontario Power Generation's actions related to the Program prior to or after that time period.
- Next, Concentric did not independently verify the appropriateness, sufficiency, or correctness of the Program schedules, cost estimates, or scope. Concentric was informed of the processes used to develop and to define further these planning assumptions. As such, we have considered these processes in the context of our review, but not the technical specifications that are the result of these processes.
- Concentric assumes Ontario Power Generation will continue to retain adequately qualified personnel to complete the Program generally and the Retube & Feeder Replacement work package specifically. Those resources are critical to the success of the Program, and may be sourced internally, hired directly, or engaged through contracts with third parties.
- Concentric did not perform a compliance audit to determine whether Ontario Power Generation and the Program complied with Ontario Power Generation's internal policies, procedures, instructions and guidelines, or applicable Provincial and Federal regulations. Similarly, Concentric did not conduct a legal review of Ontario Power Generation's agreements or proposed agreements with any contractors. Notwithstanding that limitation, Concentric did review relevant Ontario Power Generation internal policies and procedures, and relevant provincial and federal laws and regulations when developing our opinion. Concentric also notes that Ontario Power Generation has separately retained outside counsel to advise it on the legal terms of the agreement with the Joint Venture performing the Retube & Feeder Replacement work package.
- Finally, Concentric's review is not an assessment of the Program's likelihood of success. Successful execution of the Program generally, and the Retube & Feeder Replacement work package specifically, will require the efforts of many entities and individuals over many years. The development and implementation of the Program's contracting strategies is only one contributor to project success.

V. RETUBE & FEEDER REPLACEMENT CONTRACT AMENDMENTS

Since Concentric's September 2013 report, Ontario Power Generation has continued with the planning activities necessary to prepare for the Execution Phase of the Program. Since Concentric concluded our review in September 2013, Ontario Power Generation entered into four more amendments to the RFR contract:

1. Amendment 2 on February 28, 2014;
2. Amendment 3 on November 2, 2015;
3. Amendment 4 on January 11, 2016; and
4. Amendment 5 on February 1, 2016.

Amendment 2 modified the scope and milestone schedule for the work performed by the Joint Venture related to Darlington reactor mock-up. Amendment 3 incorporated certain Project Change Directives and the milestone schedule, pricing, and tooling milestone payment schedule. Amendment 4 is the most significant in terms of progress on the Retube & Feeder Replacement work package. With that amendment, which incorporated the milestone schedule, target schedule, target price, and submittal schedule, Ontario Power Generation made the decision to move forward with the Execution Phase of the Program. Amendment 4, and its incorporation into the Retube & Feeder Replacement contract, was a primary emphasis of our review. Amendment 5 addressed contractual terms related to the retube waste processing building.

Throughout 2015, Ontario Power Generation undertook an iterative process that involved further defining the scope of work and allocation of risk under the contract, and that would ultimately result in the schedule and cost parameters of the Execution Phase of the Retube & Feeder Replacement work package. Risk registers, which identified the risks that each party would bear during the execution of the work package, were key components of that iterative process and led to the allocation of risk that is embodied in the contract.

Once the initial risk allocation was negotiated, the parties focused on establishing the budget and schedule parameters of the contract. The Retube & Feeder Replacement contract's target cost and schedule were the subject of lengthy negotiations between Ontario Power Generation and the Joint Venture during the summer 2015. In order to make the significant progress that was required and to remain on schedule, Ontario Power Generation assembled a team of skilled nuclear cost estimators and engineers in late spring to validate and develop a comprehensive understanding of the elements within the target price deliverables that the Joint Venture had provided through May of 2015. The Ontario Power Generation team worked closely with the Joint Venture's experts and construction project managers to investigate all cost elements. Through this close collaboration and a detailed challenge and review process that addressed over 50,000 distinct line items with cost, schedule, and risk implications, Ontario Power Generation was able to identify and eliminate risk-related costs that did not belong in the Joint Venture's estimates. Ontario Power Generation was able to reduce the Joint Venture's cost by approximately $550 million through this process. At the conclusion of this validation process the parties agreed on the risk sharing arrangement incorporated in the Retube & Feeder Replacement contract, as well as the target price and schedule. Specifically, Ontario Power Generation and the Joint Venture agreed upon a target price and schedule for the Retube & Feeder Replacement work package based on a probabilistic analysis of the work package's costs and schedule estimates.

To put itself in a position to succeed during the Darlington refurbishment, Ontario Power Generation has undertaken numerous planning and front-end engineering and design activities. Those activities included testing the tooling provided by the Joint Venture to ensure that the tooling met performance requirements. During the negotiations, Ontario Power Generation also undertook several measures to keep competitive pressure on the Joint Venture and to put the Company in a position to fulfill its commercial goals in the Program. Those measures included benchmarking the Program against other CANDU refurbishments such as those at the Wolsong nuclear plant in South Korea, the Bruce nuclear plant in Ontario, and the Point LePreau nuclear plant in New Brunswick. Ontario Power Generation and the Joint Venture also engaged an expert panel (made up of two individuals selected by Ontario Power Generation and two selected by the Joint Venture; the panel's report was filed in EB-2016-0152 at Ex. D2-2-8, Attachment 4) to insert additional third-party independence and objectivity into the process of developing the final pricing. Ontario Power

Generation was also working on a "Plan B" to serve as a back-up plan in the event that Ontario Power Generation and the Joint Venture could not come to agreement on the cost and schedule of the Execution Phase. This Plan B was a self-perform option, under which Ontario Power Generation would have performed the Execution Phase itself. In the end, Ontario Power Generation was able to successfully reach agreement with the Joint Venture both on contractual terms and risk allocation.

The following are, in Concentric's view, the key risk sharing terms in the amended contract for the Retube & Feeder Replacement work package:

- Tooling performance guarantee: The Retube & Feeder Replacement contract requires that the tooling meet established minimum performance thresholds. If the tooling had not met those requirements (which it did), there would have been a reduction of up to 10% of the tooling fixed price.
- The parties agreed to productivity gains under the contract.
- Up to 80% of the Joint Venture's fixed fee under the contract is at risk, and Ontario Power Generation has an obligation to pay financial incentives of up to 40% of the fixed fee.
- Cost incentives: The Execution Phase has a +/- $75mm neutral band above and below the Execution Phase target cost. Cost incentives are based on an aggregate basis across all four units.
- Limitation on change orders: The contract restricts the ability of the Joint Venture to initiate project change directives or make claims for excusable delays or force majeure. This provision in the contract pertains to all changes that have would cause a delay of less than three days.
- Schedule incentives: the guaranteed schedule duration is 10% greater than the target schedule duration. For any full day that is 10% above the target schedule duration, the Joint Venture will pay Ontario Power Generation $250,000 per day. Ontario Power Generation is obligated to pay the Joint Venture $125,000 per day for every day by which the schedule is shorter than the target schedule.
- Performance incentives: The Joint Venture will bear the costs of any defective or warranty work.

The apportionment of risk between Ontario Power Generation and the Joint Venture is a key element of the Retube & Feeder Replacement contract. In general, Ontario Power Generation's goal has been to assign the risks embodied in the contract to the party that has the greatest ability to mitigate or control each risk. Based on this principle, the Joint Venture bears the majority of risks except in areas where Ontario Power Generation has significant control. For instance, a key risk that Ontario Power Generation has retained is management of the Radiation Protection function across the Darlington site over the full term of the Program. The resources required for Radiation Protection are small in comparison to any specific work package, but radiological exposure risk applies to many activities that are on the Program's critical path. Radiation Protection programs could, therefore, have a material effect on the Program. In addition, the Program will address units in sequence: units that are not in an active phase of refurbishment execution will continue to operate, creating a coordination challenge for the Radiation Protection teams tasked with managing dosage and exposure risks for personnel across shifts, contractors, and units. Staff that will be affected by Radiation Protection processes will be working not just on the Retube & Feeder Replacement work package, but on other components of the Program and on ongoing operations and maintenance activities at the site. Ontario Power Generation has also retained risks related to oversight of contracts, and must manage conflicts between the Company's processes and its contractors. While the Joint Venture will

manage the work of its subcontractors, Ontario Power Generation will manage interfaces between the Joint Venture, contractors completing other work packages, and the Plant's ongoing operations. The Company is, therefore, likely to be better able to manage the Radiation Protection and exposure risks that apply across the Program.[9]

Other key risks related to the Retube & Feeder Replacement work package were allocated among the parties, with the Joint Venture bearing the majority of the risks under the contract. Ontario Power Generation retained those risks that either it is in the best position to mitigate or that neither party can reasonably influence (*e.g.*, cost impact of inflation above and beyond expectations).

Ontario Power Generation has developed and continues to monitor risk mitigation plans for each risk that it retains under the Retube & Feeder Replacement Execution Phase contract. These plans should describe the Company's plans to reduce its risk exposure to the degree possible by minimizing the cost and schedule impact of the risk materializing. Maintenance of risk mitigation plans and ongoing risk monitoring will be key objectives for the Company throughout the Program's Execution Phase.

VI. CONCLUSIONS

Concentric's review of the process by which Ontario Power Generation reached agreement on the terms and conditions of the Execution Phase Plan confirmed the reasonableness and prudence of the Company's contract for the Execution Phase of the Retube & Feeder Replacement work package as well as the target price and risk allocation within the contract.

Specifically, Concentric has the following findings:

- The terms of the final Retube & Feeder Replacement contract are consistent with what Concentric would expect for a project of this scale and nature.
- The parties have agreed on a reasonable allocation and apportionment of risks that holds each party responsible for those risks over which it has the most control.
- The review and validation process Ontario Power Generation followed to arrive at a target price estimate was both comprehensive and prudent.
- The contract provides a reasonable structure by which the Joint Venture has incentives to meet and outperform the cost and schedule budgets (and is penalized for exceeding those budgets).

We emphasize that while the terms of the Retube & Feeder Replacement work package are both reasonable and prudent, the existence of a strong contract will not ensure success alone. Ontario Power Generation must continue to recognize that it still faces significant risks in the execution of a project of this scale and duration.

[9] Furthermore, the Joint Venture perceived a significant cost exposure for managing Radiation Protection. Ontario Power Generation felt it could manage the risk effectively and that it would not be able to transfer the risk affordably.

As Concentric noted in its September 2013 report, no Canadian CANDU refurbishment or return to service project to date represents a model of a successful commercial strategy. While Ontario Power Generation has taken reasonable and prudent steps to allocate and apportion risks and provide incentives and disincentives to the Joint Venture to perform the work on time and on budget, there are many challenges that will need to be overcome in the execution of the construction and refurbishment. It is critical that, among many other important objectives, Ontario Power Generation maintains rigorous and extensive project controls and oversight processes to enable successful implementation of the Program. The Company must continue to demand the highest standards of safety, quality and workmanship by the Joint Venture in all of its work within the scope of the Program.

April 11, 2016

Mr. Charles Keizer
Torys LLP
Suite 3000
79 Wellington St. W.
Box 270, TD Centre
Toronto, Ontario
M5K 1N2 Canada

Dear Mr. Keizer:

On behalf of Concentric Energy Advisors, Inc. ("Concentric"), I would like to thank you for the opportunity to assist Torys LLP ("Torys"), effective as of March 11, 2016, respecting its advice to Ontario Power Generation, Inc. ("OPG") in the review of the Darlington Nuclear Generating Station refurbishment ("DRP"). Specifically, Concentric will provide an independent expert review of the DRP procurement strategies and execution as outlined in our separate scope of work (Attachment A). This letter provides an overview of Concentric, proposed commercial terms and the proposed project team. Additionally, I have included our billing rates, terms and conditions, résumés for the proposed project team, and a Concentric contact list as Attachments B – E, respectively.

INTRODUCTION TO CONCENTRIC

Concentric is a regulatory, financial and economic advisory firm focused on the North American energy industry. Concentric specializes in a full range of regulatory and utility ratemaking advisory services; expert testimony and litigation support; market assessment and strategic consulting services; and financial and transaction-related advisory services. The firm's principals and affiliates have held executive positions with a number of prominent utility management consulting firms, utility companies, regulatory agencies, competitive energy suppliers and investment banks.

Concentric has unique experience and expertise in the nuclear power industry, providing advisory services to owners and operators of, and investors in, nuclear power plants in North America. Concentric's staff has been involved in these activities for more than 25 years, and therefore has a strong understanding of the unique financial, economic, managerial and regulatory issues that nuclear power plant development, construction, ownership and operation present.

PROPOSED SCOPE

The scope of Concentric's services is specified in Attachment A.

PROPOSED COMMERCIAL TERMS

Concentric will perform the services specified in Attachment A on a time and materials basis, at a [redacted] discount from our standard rates, which are updated annually and included as Attachment B. Our direct expenses will be billed at cost and in accordance with OPG's Standard Form Business Expense

Schedule (last updated December 10, 2014). A copy of the agreed upon terms and conditions can be found in Attachment C. Please note that all payments are to be made in U.S. dollars.

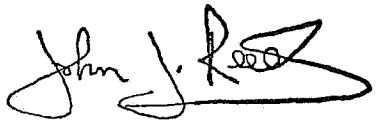
PROPOSED PROJECT TEAM

Concentric will provide a highly experienced team to perform the services required by Torys. John Reed, Chairman and Chief Executive Officer, will serve as the Responsible Officer for the project. He will be assisted by Dan Dane, Assistant Vice President; Mark Cattrell, Senior Project Manager; and Ben Davis, Senior Project Manager. Résumés for these team members are included as Attachment D and a contact list is provided as Attachment E. Additional advisory, research and administrative resources may be utilized as necessary.

If the above terms are acceptable to you, please kindly execute and return to me, the signature pages of this letter and the agreed upon terms & conditions (Attachment C).

Concentric is looking forward to the opportunity to assist Torys and OPG.

Best regards,
CONCENTRIC ENERGY ADVISORS, INC.



John J. Reed
Chairman and Chief Executive Officer

Enclosures:
Attachment A – Scope of Services
Attachment B – Concentric's Standard Rates
Attachment C – Standard Terms and Conditions
Attachment D – Résumés of Project Team Members
Attachment E – Concentric Contact List

AGREED AND ACCEPTED:

Torys LLP

CLIENT SIGNATURE

TITLE: Partner

COMPANY: Torys LLP

DATE: April 11/16

Scope of Work
Scope of Services of Expert Reviewing
Darlington Refurbishment Contracts and Strategy

The scope of services provided by Expert is expected to include:

- Assist legal counsel to OPG, for purposes of providing legal advice, by providing an opinion on the contract for the Retube and Feeder Replacement ("RFR") work package for the Darlington Refurbishment Program. In particular, building on conclusions from its previous work regarding OPG's commercial and contracting strategies for the Darlington Refurbishment Program, provide an opinion as to whether the final contract for RFR is reasonable and prudent, and appropriately establishes a target price and allocates risk between OPG and the contractor.

- The Expert may also be asked to testify at future OEB rate hearings, prepare interrogatory and undertaking responses, assist with preparation of argument, and participate in other facets of the hearing.

Concentric Energy Advisors, Inc.
Hourly Rate Schedule

(EFFECTIVE JANUARY 1, 2016)

TITLE	HOURLY RATE
CHAIRMAN AND CHIEF EXECUTIVE OFFICER	[redacted]
SENIOR VICE PRESIDENT	
VICE PRESIDENT	
ASSISTANT VICE PRESIDENT	
SENIOR PROJECT MANAGER	
PROJECT MANAGER	
SENIOR CONSULTANT	
CONSULTANT	
ASSISTANT CONSULTANT	
ANALYST	
ASSOCIATE	
PROJECT ASSISTANT	

CONCENTRIC ENERGY ADVISORS, INC.
TERMS AND CONDITIONS

1. *Scope* – Concentric Energy Advisors, Inc. ("Concentric") will perform the services set forth in the Letter or Proposal of which these Terms and Conditions (Terms) are a part. The provisions of these Terms shall control in the case of conflict with any provisions of the Letter or Proposal.

2. *Fees and Expenses* – Unless otherwise stated, fees for services by Concentric shall be based upon the rates, at the time the work is performed, of the personnel actually involved in the assignment, on the basis of the rates most recently communicated to, and accepted by, Torys. Report production and printing, reproduction, and telephone charges will be billed to you at Concentric's standard charges for such materials for services. Expenses of consultants while on assignment or any other charge incurred or expenditure made on your behalf will be charged at our cost.

3. *Payment* – Concentric will submit monthly invoices reflecting actual work performed and expenses incurred. Payment shall be due in U.S. funds 30 days after the date of an invoice. Amounts past due more than 30 days shall bear interest at an annual rate of [redacted] from the due date until payment is received.

4. *Sales Tax* – You are responsible for paying any local, state, or federal sales, use, or ad valorem tax that might be assessed on our services.

5. *Independent Contractor* – It is understood and agreed that Concentric shall for all purposes be an independent contractor, shall not hold itself out as representing or acting in any manner for you, and shall have no authority to bind you to any contract or in any other manner.

6. *Termination* – These terms shall be subject to the right of either party to terminate at any time upon not less than ten (10) days prior written notice to the other party. Upon termination, you shall pay the full amount due for services rendered and costs and expenses incurred and not paid for up to that time, and the costs of returning consultant personnel to home base and other reasonable costs and expenses incurred in effecting termination and returning documents.

7. *Responsibility Statement* – Concentric agrees that the services provided for herein will be performed in accordance with recognized professional consulting standards for similar services and that adequate personnel will be assigned for that purpose. If, during the performance of these services or within six months following completion of the assignment, such services shall prove to be faulty or defective by reason of a failure to meet such standards, Concentric agrees that upon prompt written notification from you prior to the expiration of the six month period following the completion of the assignment containing any such fault or defect, such faulty portion of the services shall be redone at no cost to you up to a maximum amount equivalent to the cost of the services rendered under this assignment.

The foregoing shall constitute Concentric's sole liability with respect to the accuracy or completeness of the work and the activities involved in its preparation. In no event shall Concentric, its agents, employees, or others providing materials or performing services in connection with work on this assignment be liable for any direct, consequential or special loss or damage, whether attributable to breach of contract, tort, including negligence, or otherwise; and except as herein provided, you release, indemnify, and hold Concentric, its agents, employees, or others providing materials or performing services in connection with work on this assignment harmless from any and all liability including costs of defense, settlement and reasonable attorney's fees.

8. *Work Product* – Any report or other document prepared pursuant to these Terms shall be for your use only. Concentric's prior written consent is required for the use of (or reference to) its report or any other document prepared pursuant to these Terms in connection with a public offering of securities or in connection with any other financing. Concentric hereby agrees, however, to the Client's reference to the work product in connection with any proxy relating to a combination between two parties. It is understood and agreed that Concentric's use of its proprietary computer software, methodology, procedures, or other proprietary information in connection with an assignment shall not give you any rights with respect to such proprietary computer software, methodology, procedures or other proprietary information. Concentric may retain and further use the technical content of its work hereunder.

9. *Excused Performance* – Concentric shall not be deemed in default of any provision hereof or be liable for any delay, failure in performance, or interruption of service resulting directly or indirectly from acts of God, civil or military authority, civil disturbance, war, strikes or other labor disputes, fires, other catastrophes, or other forces beyond its reasonable control, whether or not such event may be deemed foreseeable.

10. *Related Litigation* – In the event that Concentric employees (current or former), subcontractors or agents are compelled to provide testimony, produce documents, or otherwise incur costs or expend time in any legal proceeding related to Concentric's work for you, you agree to reimburse Concentric at its regular billing rate per hour for its time expended, and for any expenses incurred (at Concentric's direct cost).

11. *Notices* – All notices given under or pursuant to the Terms shall be sent by Certified or Registered Mail, Return Receipt Requested, and shall be deemed to have been delivered when physically delivered if to Concentric Energy Advisors, Inc., 293 Boston Post Road West, Suite 500, Marlborough, MA 01752, Attention Mr. John J. Reed, Chairman and Chief Executive Officer, and if to you at the address shown on the Letter or Proposal of which these Terms are a part or such other address as you may designate by written notice to us.

12. *Complete Agreement* – It is understood and agreed that these Terms and the Letter or Proposal of which they are a part embody the complete understanding of the parties and that any and all provisions, negotiations and representations not included herein are hereby abrogated and that these terms cannot be changed, modified or varied except by written instrument signed by both parties. In the event you issue a purchase order or memorandum or other instrument covering the services herein provided, it is hereby specifically agreed and understood that such purchase order, memorandum, or instrument is

for your internal purposes only, and any and all terms and conditions contained therein, whether printed or written, shall be of no force or effect unless agreed to in writing by Concentric. No waiver by either parties of a breach hereof or default hereunder shall be deemed a waiver by such party of a subsequent breach or default of like or similar nature.

13. *Conflicts of Interest* – Concentric confirms it is free of any actual or potential conflicts of interest, respecting this assignment relating to OPG.

14. *Staffing of Assignments* - Concentric shall staff this assignment as described in the attached Contact List for OPG Nuclear EPC (Attachment E). Concentric will be permitted to assign up to three other consulting staff members without Torys' prior approval. Concentric will obtain the prior approval from Torys before assigning any material work to any person beyond those permitted by this paragraph.

    Concentric will strive to avoid duplication of effort in handling the assignment.

15. *Strategy and Budgeting* - At the onset of handling this assignment, Concentric will work with Torys to develop an overall strategy for the assignment. This strategy should be revised periodically as circumstances warrant.

    Concentric acknowledges that it may be asked to prepare a cost estimate or budget to implement the strategy, which has been agreed to for the conduct of an assignment. This budget will be used to assist in evaluating the strategy proposed for the assignment and to assist Torys in monitoring expenses.

16. *Privilege and Confidential Information* - Concentric confirms that correspondence and other communications, memorandums, documents, opinion letters and records exchanged between Torys, OPG business personnel or other OPG representatives and any OPG Counsel are not to be released to other persons without the prior written approval of Torys. It is recognised, however, that the rules of privilege governing the release of such correspondence and other communications, memorandums, documents, opinion letters and records vary from jurisdiction to jurisdiction. Concentric and Torys will agree on a protocol in an effort to minimise the risk of required disclosure and shall agree as to when Concentric must make any required disclosure. In addition to any requirements imposed on Concentric by law or regulation, Concentric will maintain all information provided to Concentric by Torys and OPG in strict confidence.

17. *Public Disclosure* - Concentric will not publicly disclose or reference work activities performed for Torys and OPG in any manner, including promotional brochures, advertisements, websites or similar representations, without the prior written approval of Torys and OPG.

18. *Accounts* - Notwithstanding the provisions of section 2 above respecting Fees and Expenses, Concentric agrees to the following provisions respecting this assignment.

    Due to the confidential nature of this assignment, Concentric agrees to submit:

    (1) a summary sheet only of each account, showing: (a) the fee, (b) expenses, (c) Canadian goods and services tax or any other applicable taxes, (d) a subtotal, excluding taxes, and (e) the grand total;

(2) a detailed account which will include at least the following information:

(a) identification of the billing period to which the account relates;

(b) an itemised summary of the work that has been undertaken, including a brief description of each service, the date on which each service was rendered, the time spent on each service, the individual who performed the service and the billing rate of such individual;

(c) an itemisation and brief description of all expenses incurred during the billing period, with copies of supporting invoices for any expenses in excess of [redacted], unless Torys indicates that such invoices are not required;

19. *Other Rules on Fees and Expenses*

(a) Concentric will bill for travel expenses only in accordance with OPG's Standard Form Business Expense Schedule (a copy of which is attached as Schedule 1 hereto) as the same may be amended, supplemented or replaced from time to time. Concentric may not bill for any time away from the office which is not spent on this assignment.

(b) Concentric will bill for photocopying and printing at a rate of no more than [redacted] per page for all pages on the assignment. If it is anticipated that the photocopying expenses for a particular matter will exceed [redacted] in any month, Concentric will advise Torys accordingly so that it may be considered whether the copying services should be performed by a third party service provider.

(c) Concentric will not bill for telephone expenses or the transmission or receipt of faxes. Whenever possible, e-mail is preferred.

(d) Concentric will not bill for routine (non project specific) secretarial work or office administration, and will not bill for charges for "opening a file", software licenses, system application charges, legal research search fees or office supplies.

(e) Concentric will not bill for overtime of administrative staff, unless Torys has consented to such billings in advance.

(f) Concentric will not bill for time spent preparing or reviewing proposals, accounts or budgets.

20. *Expert Testimony* - Concentric acknowledges and agrees that it has received a copy of Rule 13A of the OEB's *Rules of Practice and Procedure* concerning expert evidence, a copy of which is attached as Schedule 2 hereto, and agrees to accept the responsibilities that are or may be imposed on Concentric by that rule with respect to testimony before the OEB, should Torys requests that Concentric testify before the OEB.

21. *General* - These Terms are governed by, and are to be construed and interpreted in accordance with, the laws of Ontario and the laws of Canada applicable in Ontario. These Terms will not be amended by any invoice or other document, even where such document purports to be paramount to any term of these Terms, unless such document is signed by Concentric and Torys.

AGREED AND ACCEPTED:

Torys LLP

CLIENT SIGNATURE

TITLE: Partner

COMPANY: Torys LLP

DATE: April 11/16

SCHEDULE 1

OPG's Standard Form Business Expense Schedule
(updated December 10, 2014)

STANDARD FORM BUSINESS EXPENSE SCHEDULE FOR CONTRACTORS

Effective June 17, 2009

ONTARIO POWER GENERATION INC.

Updated December 10, 2014

Table of Contents

BUSINESS EXPENSE SCHEDULE

RECITALS

A. Ontario Power Generation Inc., (**"OPG"**) entered into an Agreement (the **"Agreement"**) with the other party to the Agreement (the **"Contractor"**). This schedule (this **"Schedule"**) forms part of the Agreement. Under the Agreement, OPG agreed to reimburse the Contractor for certain business expenses incurred by employees of the Contractor (**"Eligible Employees"**) in performing work for OPG under the Agreement.

B. This Schedule sets out the terms on which OPG will reimburse the Contractor for business expenses incurred by Eligible Employees in performing work for OPG.

SECTION 1 – INTERPRETATION

1.1 Three Types of Reimbursement

OPG will reimburse the Contractor for expenses that are eligible for reimbursement in accordance with the Schedule. OPG will make the reimbursements in 1 of 3 ways respecting each Eligible Employee in respect of whom reimbursements are payable. The 3 ways of reimbursements are:

(a) reimbursement of individually incurred Allowable Expenses as set out in section 2 through section 5;

(b) payment on a flat rate daily basis as set out in section 6; or

(c) payment on a flat rate monthly basis as set out in section 7.

Except as expressly set out in section 6 or section 7, if OPG pays the Contractor the daily or monthly rate in respect of an Eligible Employee, OPG will reimburse the Contractor no Allowable Expenses in respect of that Eligible Employee.

1.2 Definitions

In this Schedule, the following terms have the respective meanings set out below.

(a) **Agreement** is defined in Recital A.

(b) **Allowable Expenses** is defined in Section 2.1.

(c) **Business Day** means any day other than a Saturday, Sunday, New Year's Day, Family Day, Good Friday, Easter Monday, Victoria Day, Canada Day, Civic Holiday, Labour Day, Remembrance Day, Thanksgiving Day, Christmas Day and Boxing Day.

(d) **Contractor** is defined in Recital A.

(e) **Eligible Employees** is defined in Recital A.

(f) **Home Base** means the permanent place of residence (home) of Eligible Employee.

(g) **Reporting Location** means the normal work location or base office for Eligible Employee. For all work at Darlington Nuclear (DN) and Pickering Nuclear (PN) sites, this is further defined as an area consisting of a 100km radius around the midpoint between DN and PN site. Bruce Nuclear (BN) is also considered a reporting location.

(h) **OPG Representative** is defined in Section 2.1 (d).

(i) **Schedule** is defined in Recital A.

(j) **Work Site** means a location at which the Eligible Employee may be required to provide service that is different from the Eligible Employee's normal reporting location.

1.3 Headings

The division of the Schedule into sections, the insertion of headings and the provision of a table of contents are for convenience of reference only and are not to affect the construction or interpretation of this Schedule.

1.4 Expanded Definitions

Unless otherwise specified, words importing the singular include the plural and vice versa and words importing gender include all genders. The term **"including"** means "including without limitations", and the terms **"include"**, **"includes"** and **"included"** have similar meanings. The term **"will"** means "shall".

1.5 Business Day

If under this Schedule any payment or calculation is to be made on or as of a day which is not a Business Day that payment or calculation is to be made on or as of the next day that is a Business Day

1.6 Payment Currency

Except as expressly set out in the Agreement, amounts to be paid or calculated under this Schedule will be paid or calculated in Canadian dollars. Any amounts to be paid or calculated which are denominated in a foreign currency will be converted into Canadian dollars, within three Business Days of the invoice date, using the Bank of Canada nominal noon exchange rate, as posted on the Bank of Canada website (currently located at www.bankofcanada.ca).

1.7 Conflict

If there is conflict between any term of this Schedule and any term in another part of the Agreement, the relevant term in the other part of the Agreement will prevail.

1.8 Notice

Any notices to be given under this Schedule will be given in accordance with the notice terms set out elsewhere in the Agreement.

SECTION 2 – REIMBURSEMENT OF ALLOWABLE EXPENSES

2.1 Allowable Expenses

OPG will only reimburse the Contractor for the following eligible expenses (**"Allowable Expenses"**) to the extent they otherwise meet the requirements of this Schedule and the rest of the Agreement:

(a) air, rail and bus travel expenses permitted under section 3;

(b) vehicle expenses permitted under section 4;

(c) lodging expenses permitted under section 5; and

(d) any other expenses which have been approved in writing by the OPG individual managing the Agreement (the **"OPG Representative"**).

2.2 Expenses Minimised

Notwithstanding any term in this Schedule, the Contractor will use all reasonable efforts to ensure that Eligible Employees minimise Allowable Expenses and the Contractor will ensure that all Allowable Expenses are reasonable and properly incurred in a manner consistent with effective and efficient business practice. OPG is not obliged to reimburse any expenses which are not so incurred. Eligible Employees who normally live together are expected to share accommodations and vehicle expenses, where reasonable.

2.3 Excluded Items

Notwithstanding any term in this Schedule, OPG will not reimburse any amounts to the Contractor or any Eligible Employee for any hospitality, food or incidental expenses, including, but not limited to, in respect of the following:

(a) meals, snacks, alcoholic and non-alcoholic beverages;

(b) any expense whatsoever if the one way distance between the Eligible Employee's Home Base or Reporting Location and the Work Site is less than 100 kilometers;

(c) gratuities;

(d) airline or railway club dues, fees or other charges;

(e) personal service expenses, including hair care, shoe shine, toiletry and spa treatment expenses;

(f) laundry, dry cleaning or valet expenses;

(g) hotel telephone charges or internet access;

(h) personal telephone calls;

(i) cellular telephones, data devices (for example, Blackberries) or other communication devices;

(j) entertainment or recreation expenses, including pay-per-view, video, compact disk or DVD rental, in-room entertainment, games, gaming, reading, sports or exercise expenses;

(k) headsets or other in-flight expenses;

(l) dependent care expenses;

(m) pet care expenses;

(n) mini bar charges or sundry items (including gum and snacks);

(o) credit card interest or other credit card expenses;

(p) automobile washes;

(q) fines or other expenses assessed or otherwise incurred in respect of traffic or parking violations; or

(r) fees or other expenses for toll highways or vehicle rental agency administration charges for use of toll highways.

2.4 Method of Reimbursement

OPG will reimburse the Contractor for Allowable Expenses which otherwise meet the requirements of this Schedule and the rest of the Agreement in accordance with the following terms.

(a) **Monthly Invoice.** The Contractor will deliver to OPG, to the address indicated in the purchase order or Agreement, on a monthly basis, an invoice for Allowable Expenses in a form and manner acceptable to the OPG Representative, acting reasonably. The Contractor will deliver to the OPG Representative, a copy of the invoice and will ensure that the invoice legibly itemises and, if necessary, briefly describes all allowable expenses. The Contractor will not invoice or otherwise charge OPG for any expenses other than allowable expenses. The Contractor will ensure that all expenses claimed on each such invoice meet the requirements of this Schedule and the rest of the Agreement and are first approved by the Contractor. If the Contractor fails to deliver an invoice

to OPG for an expense within six months of the expenses being incurred, OPG will not be obliged to reimburse the Contractor for such expense.

(b) **Receipts.** The Contractor will deliver to the OPG Representative, together with a copy of the invoice, original official itemised receipts for each allowable expense claimed (including airline, railway or bus ticket passenger coupons or electronic ticket, boarding passes, vehicle rental contracts, itemised hotel bills and travel itineraries). The Contractor will separate expenses for each Eligible Employee. Debit card and credit card receipts are not acceptable without the itemised receipt. OPG will accept electronic, photocopied or fax copies of receipts.

(c) **GST/HST Deducted.** The Contractor will deduct all Canadian goods and services tax/harmonized sales tax levied under the *Excise Tax Act* (Canada) recovered or recoverable by the Contractor on the payment of expenses before submitting any invoice to OPG covering any allowable expenses. The Goods and Services Tax/Harmonized Sales Tax levied under the *Excise Tax Act* (Canada) and reimbursable by OPG under this Schedule.

(d) **Reimbursement.** OPG will reimburse the Contractor for Allowable Expenses which meet all of the requirements of this Schedule, received and approved by OPG before the 25th of each month on the 25th of the following month. The Contractor will ensure that all Eligible Employees initially pay for expenses using their own payment methods. OPG will not provide any advances respecting allowable expenses. The Contractor is exclusively responsible for the reimbursement of expenses to all Eligible Employees. Failure by the Contractor to comply with the requirements of this Schedule and the rest of the Agreement may result in delay of reimbursement of expenses or rejection of any invoice in whole or in part.

2.5 Travel Agency

OPG has and may in the future negotiate rates with a travel service to reduce travel and lodging expenses. Unless OPG provides the Contractor with written notice stating otherwise, or the Contractor can demonstrate it can obtain lower rates from providers other than American Express Business Travel, the Contractor will ensure that all Eligible Employees process travel requirements through American Express Business Travel. OPG also encourages the Contractor to have all vehicle rental and hotel arrangements made through American Express Business Travel. American Express Business Travel may be reached in Canada and the United States at 1-866-868-4441. The Contractor will ensure that all Eligible Employees travelling for the purpose of providing services under the Agreement identify themselves to American Express Business Travel as such.

2.6 Confirming Rates

The Contractor will ensure that the rates booked by it or an Eligible Employee are the same or lower than that listed on the travel itinerary.

2.7 Home Base and Work Site

Where applicable, the Contractor will specify in each invoice the Home Base, Reporting Location and the Work Site for each Eligible Employee. At OPG's request, the Contractor will provide written confirmation from each Eligible Employees as to the employee's permanent residence and street address. A post office box is not acceptable street address.

2.8 Non EPSCA Eligible Employees and Extended Staff

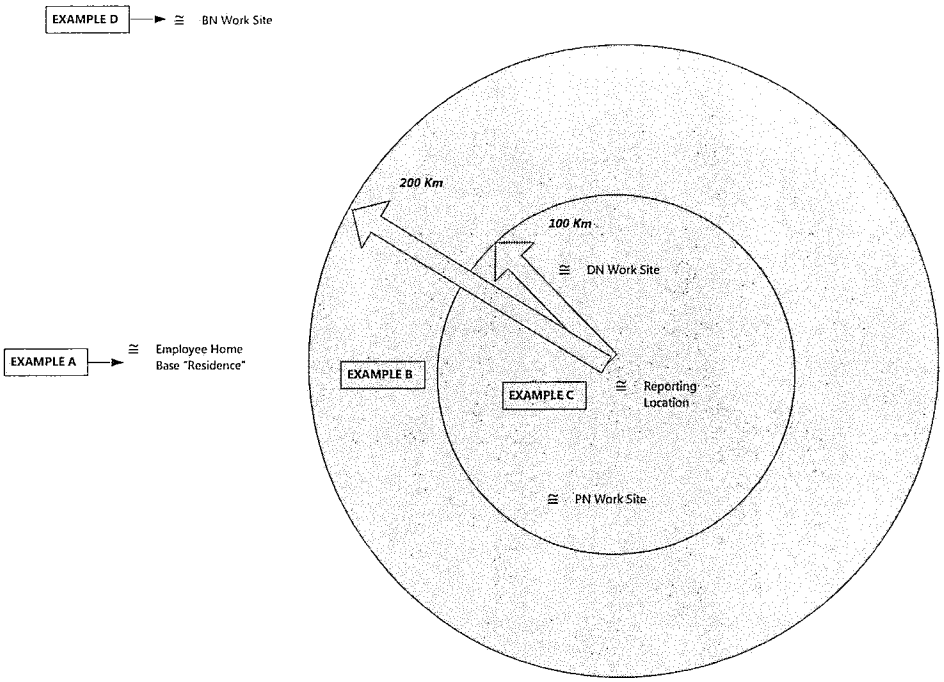
OPG will only reimburse the Contractor's Eligible Employees and extended staff, not subscribed to an EPSCA Agreement, expenses incurred from their Home Base to the designated reporting location as per the illustration below and detailed examples provided:

Example A: Home Base is outside the 200 kilometers ring from the reporting location. Prior approval from an OPG Representative is required and depending on the duration of the assignment, either section 6 or section 7 applies. If the duration is greater than one month, section 7 applies and the Eligible Employee will be paid an "all inclusive" monthly rate (or prorated portion of the month). If the assignment is less than one month, section 6 applies and the Eligible Employee will be paid an "all inclusive" daily rate.

Example B: Home Base is outside the 100 km ring but inside the 200 kilometers ring from the reporting location. Prior approval from an OPG Representative is required and OPG will pay the less of a daily "all inclusive" rate per section 6 or rates in accordance with sections 2 through 5. If sections 2 through 5 apply, the Eligible Employee will only be entitled to one round trip per week, from Home Base to the reporting location.

Example C: Home Base is within a 100 kilometers radius of the reporting location. In this scenario, the Eligible Employee is not entitled to any expenses whatsoever. This would include any and all trips to the Work Site within the 100 kilometers radius.

Example D: In this example, the reporting location and Work Site is one and the same. Prior approval from an OPG Representative is required and the preceding examples A, B and C apply.


EXAMPLE D
≅ BN Work Site
200 Km
100 Km
≅ DN Work Site
EXAMPLE A
≅ Employee Home Base "Residence"
EXAMPLE B
EXAMPLE C
≅ Reporting Location
≅ PN Work Site

SECTION 3 – AIR, RAIL OR BUS TRAVEL

3.1 Air, Rail or Bus Travel

The expense of air, rail and bus travel is an allowable expense to the extent the actual amount of airfare or, rail or bus fare was incurred by an Eligible Employee in providing services to OPG under the Agreement and to the extent of compliance with the other requirements of this Schedule and the rest of the Agreement. Pre approval by an OPG Representative is required for all air, rail or bus travel. The Contractor will cause Eligible Employees, to the extent possible, to take advantage of hotel and airport shuttles where available. OPG will reimburse the Contractor for the expenses actually incurred by an Eligible Employee for travel between the Eligible Employee's Home Base, reporting location or Work Site and the airport, rail way station or bus terminal where the Eligible Employee arrives or departs. In addition, the amount of any such reimbursement may not exceed the lesser of:

(a) the expense of the taxi fare or other similar out of pocket charge to travel to or from the airport, railway station or bus terminal; and

(b) if applicable, parking charges at the airport, railway station or bus terminal.

3.2 Economy Class

Air expenses are not Allowable Expenses unless the Eligible Employee travels on economy class or equivalent. Rail expenses will be permitted for travel by VIA 1 or equivalent.

3.3 Vehicle Instead of Air, Rail or Bus Travel

OPG will only reimburse the Contractor for use of a personal vehicle or rental car (the lesser of) for trips which would customarily be travelled by air, rail or bus, for the amount which is equal to the lesser of:

(a) the expense of the airfare, rail fare or bus fare that would have been reimbursed by OPG to the Contractor under section 3; and

(b) the amount that would otherwise be reimbursable by OPG to the Contractor for vehicle travel pursuant to section 4. OPG will not reimburse the Contractor for any lodging that would not have been incurred had the trip been made by air, rail or bus.

3.4 Visits Home

OPG will reimburse air, rail or bus travel expenses for a maximum of one round trip home per month for each Eligible Employee on assignment at a Work Site where the duration is more than 45 days and the Home Base of that employee is greater than 400 kilometers from the Work Site.

3.5 Minimising Expenses

The Contractor will, to the extent possible, cause all air travel, to be by "lowest logical airfare", to take advantage of weekend specials and other discount fares and to reduce overall expenses and plan ahead (booking at least 2 weeks before the departure date is expected).

SECTION 4 – VEHICLES

4.1 Reimbursable Vehicle Expenses

The expense of rental vehicles or personal vehicles (the lesser of) used by Eligible Employees will be and allowable expense to the extent that:

(a) the use of the vehicle was for official OPG business;

(b) the one way distance between the Eligible Employee's reporting location and the Work Site is greater than 100 kilometers;

(c) the use of the rental vehicle was pre-approved in writing by the OPG Representative; and

(d) the expense otherwise meets the requirements of this Schedule and the rest of the Agreement.

4.2 Personal Vehicle

If the Eligible Employee is required to provide services at a location other than the Eligible Employee's reporting location, OPG will reimburse the Contractor as an allowable expense for all personal vehicle travel by an Eligible Employee in excess of 200 kilometers (round trip), at the published rates per kilometre on the date of invoice, for vehicle expenses for Ontario set on the Canada Revenue Agency website (www.cra-arc.gc.ca/tx/llrts/menu-eng.html). This Canada Revenue Agency amount covers all vehicle related expenses, except parking.

4.3 Reducing Expenses

The Contractor will use all reasonable attempts to reduce the expenses of vehicle travel by:

(a) arranging for employees to share vehicles to minimise travel expense;

(b) requiring Eligible Employees to use rental vehicle and refuel it before returning it;

(c) considering a long-term lease for lengthy work assignments (that is, more than 30 consecutive days) when the Eligible Employee requires a rental vehicle; and

(d) requiring Eligible Employees to use public transit when travelling to locations within or around urban centres.

4.4 Multiple Users

OPG will only reimburse the Eligible Employee whose vehicle is used when two or more Eligible Employees travel in one vehicle. If two or more Eligible Employees share a rental vehicle, OPG will only reimburse the Eligible Employee who incurred the expense.

SECTION 5 – LODGING

5.1 Overnight Accommodation

The expense of overnight accommodation for Eligible Employees will be an allowable expense to the extent that the overnight stay was pre-approved in writing by OPG Representative and to the extent that the expense otherwise meets the requirements of this Schedule and the rest of the Agreement. The OPG Representative will not approve any overnight accommodation unless:

(a) the presence of the Eligible Employee is required at a Work Site which is more that 200 km (one way) from that Eligible Employee's reporting locations or;

(b) poor weather creates hazardous driving conditions and the Eligible Employee cannot safely return to the Eligible Employee's Home Base;

(c) the Contractor will include a written explanation for all overnight accommodation with the invoice.

SECTION 6 – DAILY RATES

6.1 Daily Rates Instead of Allowable Expenses

To the extent this section 6 applies to any Eligible Employee, none of the terms of section 2 to section 5 apply, except for any Allowable Expenses for air, rail or bus travel between an Eligible Employee's reporting location and a Work Site that is reimbursable in accordance with section 3. Notwithstanding the previous sentence, the temporary residence (where the Eligible Employee resides while working on the OPG project), or in some instances the Home Base will be

considered the reporting location for the purpose of calculating Allowable Expenses in the event the Eligible Employee is required to travel to a location other than the reporting location.

6.2 Daily Rates

Before the commencement of, or at any time during, a work assignment for any Eligible Employee, OPG may elect based on the remaining duration of the work assignment, the distance between the Eligible Employee's reporting location and the work site or for other reasons to pay the Contractor a daily rate in respect of that Eligible Employee rather than to reimburse the Contractor for allowable expenses.

6.3 All Inclusive

Except as expressly set out in this section 6, the daily rate set out in section 6.4 is inclusive of all expenses whatsoever that will be reimbursed by OPG, including expenses respecting accommodation, local transportation, work permits and fees, utilities, communication charges, furnishings, insurance and any Allowable Expenses that would otherwise be reimbursable to the Contractor under section 2 to section 5.

6.4 Rates

Subject to adjustment under section 6.5, the following are the daily rates that OPG will pay the Contractor in respect of Work Sites:

(a) City of Toronto, $150 and;

(b) all other locations, $120 (including Mississauga, Pickering, Whitby and Darlington).

6.5 Application of Rate

Where OPG has elected to pay the daily rate for an Eligible Employee, OPG will pay the daily rate to the Contractor on a monthly basis for that Eligible Employee for each full day that the Eligible Employee provided services under the Agreement and for each weekend day unless the Eligible Employee surrendered his or her accommodations. The daily rate will not be paid for any period of an unexcused absence or when the Eligible Employee has surrendered the Eligible Employee's accommodations during a home visit or absence (includes unavailability to work on weekends if trip home was taken on the weekend). The daily rate will be reduced by $35 for each day of approved trips home and on the last day of providing services under the Agreement. Where OPG has elected to pay the daily rate for Eligible Employees who normally live together, the Eligible Employees are expected to share accommodations. Adjustments may be made to the daily rate set out in section 6.4 if Eligible Employees share accommodations and other expenses.

6.6 Method of Reimbursement

OPG will pay the Contractor the applicable daily rate in accordance with the following terms:

(a) **Monthly Invoice.** The Contractor will provide OPG, on a monthly basis, with an invoice listing the number of Eligible Employees from whom the Contractor is claiming the daily rate and the number of days being claimed for each Eligible Employee. The Contractor will ensure that the invoice includes a description of the work package or project name and project number (and work breakdown structure element if applicable).

(b) Evidence of Expenses. The Contractor will provide OPG with original or electronic photocopies itemised receipts and time sheets evidencing that the Eligible Employee attended the Work Site and made use of temporary accommodation on each day for which the daily rate is being requested. Debit card and credit card receipts are not acceptable without the itemised receipt. Failure by the Contractor to comply with the requirements of this Schedule and the rest of the Agreement may result in delay of reimbursement of expenses or rejection of any invoice whole or in part.

6.7 Absences

Unless authorised in writing by the OPG Representative, OPG will not be required to pay daily rates for an Eligible Employee where that Eligible Employee was absent from the Work Site without having been excused by the OPG Representative or where that Eligible Employee did not make use of the Eligible Employee's accommodations during an absence for the Work Site (other than an absence required to perform services to OPG under the Agreement). The OPG Representative may consider authorising payment of the daily rate for absences such as an infrequent sick day or medical appointments requiring exams or tests.

Section 7 – MONTHLTY RATES

To the extent this section 7 applies to any Eligible Employee, none of the terms of section 2 to section 6 apply, except for any Allowable Expenses for air, rail or bus travel between and Eligible Employee's reporting location and a Work Site that is reimbursable in accordance with section 3. Where OPG elects to pay on a monthly basis in respect of any Eligible Employee, OPG will pay the Contractor $1800 per month (on pro-rated portion of a month). All the terms of section 6 apply to the calculation of this monthly rate, with such modifications as the circumstances require.

SCHEDULE 2

Rule 13A of the OEB's *Rules of Practice and Procedure*

13A. Expert Evidence

13A.01 A party may engage, and two or more parties may jointly engage, one or more experts to give evidence in a proceeding on issues that are relevant to the expert's area of expertise.

13A.02 An expert shall assist the Board impartially by giving evidence that is fair and objective.

13A.03 An expert's evidence shall, at a minimum, include the following:

(a) the expert's name, business name and address, and general area of expertise;

(b) the expert's qualifications, including the expert's relevant educational and professional experience in respect of each issue in the proceeding to which the expert's evidence relates;

(c) the instructions provided to the expert in relation to the proceeding and, where applicable, to each issue in the proceeding to which the expert's evidence relates;

(d) the specific information upon which the expert's evidence is based, including a description of any factual assumptions made and research conducted, and a list of the documents relied on by the expert in preparing the evidence; and

(e) in the case of evidence that is provided in response to another expert's evidence, a summary of the points of agreement and disagreement with the other expert's evidence.

(f) an acknowledgement of the expert's duty to the Board in **Form A** to these Rules, signed by the expert.

13A.04 In a proceeding where two or more parties have engaged experts, the Board may require two or more of the experts to:

(a) in advance of the hearing, confer with each other for the purposes of, among others, narrowing issues, identifying the points on which their views differ and are in agreement, and preparing a joint written statement to be admissible as evidence at the hearing; and

(b) at the hearing, appear together as a concurrent expert panel for the purposes of, among others, answering questions from the Board and others as permitted by the Board, and providing comments on the views of another expert on the same panel.

13A.05 The activities referred to in **Rule 13A.04** shall be conducted in accordance with such directions as may be given by the Board, including as to:

(a) scope and timing;

(b) the involvement of any expert engaged by the Board;

(c) the costs associated with the conduct of the activities;

(d) the attendance or non-attendance of counsel for the parties, or of other persons, in respect of the activities referred to in paragraph (a) of **Rule 13A.04**; and

(e) any issues in relation to confidentiality.

13A.06 A party that engages an expert shall ensure that the expert is made aware of, and has agreed to accept, the responsibilities that are or may be imposed on the expert as set out in this **Rule 13A** and **Form A**.

John J. Reed
Chairman and Chief Executive Officer

John J. Reed is a financial and economic consultant with more than 35 years of experience in the energy industry. Mr. Reed has also been the CEO of an NASD member securities firm, and Co-CEO of the nation's largest publicly traded management consulting firm (NYSE: NCI). He has provided advisory services in the areas of mergers and acquisitions, asset divestitures and purchases, strategic planning, project finance, corporate valuation, energy market analysis, rate and regulatory matters and energy contract negotiations to clients across North and Central America. Mr. Reed's comprehensive experience includes the development and implementation of nuclear, fossil, and hydroelectric generation divestiture programs with an aggregate valuation in excess of $20 billion. Mr. Reed has also provided expert testimony on financial and economic matters on more than 150 occasions before the FERC, Canadian regulatory agencies, state utility regulatory agencies, various state and federal courts, and before arbitration panels in the United States and Canada. After graduation from the Wharton School of the University of Pennsylvania, Mr. Reed joined Southern California Gas Company, where he worked in the regulatory and financial groups, leaving the firm as Chief Economist in 1981. He served as executive and consultant with Stone & Webster Management Consulting and R.J. Rudden Associates prior to forming REED Consulting Group (RCG) in 1988. RCG was acquired by Navigant Consulting in 1997, where Mr. Reed served as an executive until leaving Navigant to join Concentric as Chairman and Chief Executive Officer.

REPRESENTATIVE PROJECT EXPERIENCE

Executive Management

As an executive-level consultant, worked with CEOs, CFOs, other senior officers, and Boards of Directors of many of North America's top electric and gas utilities, as well as with senior political leaders of the U.S. and Canada on numerous engagements over the past 25 years. Directed merger, acquisition, divestiture, and project development engagements for utilities, pipelines and electric generation companies, repositioned several electric and gas utilities as pure distributors through a series of regulatory, financial, and legislative initiatives, and helped to develop and execute several "roll-up" or market aggregation strategies for companies seeking to achieve substantial scale in energy distribution, generation, transmission, and marketing.

Financial and Economic Advisory Services

Retained by many of the nation's leading energy companies and financial institutions for services relating to the purchase, sale or development of new enterprises. These projects included major new gas pipeline projects, gas storage projects, several non-utility generation projects, the purchase and sale of project development and gas marketing firms, and utility acquisitions. Specific services provided include the development of corporate expansion plans, review of acquisition candidates, establishment of divestiture standards, due diligence on acquisitions or financing, market entry or expansion studies, competitive assessments, project financing studies, and negotiations relating to these transactions.

Litigation Support and Expert Testimony

Provided expert testimony on more than 200 occasions in administrative and civil proceedings on a wide range of energy and economic issues. Clients in these matters have included gas distribution utilities, gas pipelines, gas producers, oil producers, electric utilities, large energy consumers, governmental and regulatory agencies,

trade associations, independent energy project developers, engineering firms, and gas and power marketers. Testimony has focused on issues ranging from broad regulatory and economic policy to virtually all elements of the utility ratemaking process. Also frequently testified regarding energy contract interpretation, accepted energy industry practices, horizontal and vertical market power, quantification of damages, and management prudence. Has been active in regulatory contract and litigation matters on virtually all interstate pipeline systems serving the U.S. Northeast, Mid-Atlantic, Midwest, and Pacific regions.

Also served on FERC Commissioner Terzic's Task Force on Competition, which conducted an industry-wide investigation into the levels of and means of encouraging competition in U.S. natural gas markets and served on a "Blue Ribbon" panel established by the Province of New Brunswick regarding the future of natural gas distribution service in that province.

Resource Procurement, Contracting and Analysis

On behalf of gas distributors, gas pipelines, gas producers, electric utilities, and independent energy project developers, personally managed or participated in the negotiation, drafting, and regulatory support of hundreds of energy contracts, including the largest gas contracts in North America, electric contracts representing billions of dollars, pipeline and storage contracts, and facility leases.

These efforts have resulted in bringing large new energy projects to market across North America, the creation of hundreds of millions of dollars in savings through contract renegotiation, and the regulatory approval of a number of highly contested energy contracts.

Strategic Planning and Utility Restructuring

Acted as a leading participant in the restructuring of the natural gas and electric utility industries over the past fifteen years, as an adviser to local distribution companies, pipelines, electric utilities, and independent energy project developers. In the recent past, provided services to most of the top 50 utilities and energy marketers across North America. Managed projects that frequently included the redevelopment of strategic plans, corporate reorganizations, the development of multi-year regulatory and legislative agendas, merger, acquisition and divestiture strategies, and the development of market entry strategies. Developed and supported merchant function exit strategies, marketing affiliate strategies, and detailed plans for the functional business units of many of North America's leading utilities.

PROFESSIONAL HISTORY

Concentric Energy Advisors, Inc. (2002 – Present)
Chairman and Chief Executive Officer

CE Capital Advisors (2004 – Present)
Chairman, President, and Chief Executive Officer

Navigant Consulting, Inc. (1997 – 2002)
President, Navigant Energy Capital (2000 – 2002)
Executive Director (2000 – 2002)
Co-Chief Executive Officer, Vice Chairman (1999 – 2000)
Executive Managing Director (1998 – 1999)
President, REED Consulting Group, Inc. (1997 – 1998)

REED Consulting Group (1988 – 1997)
Chairman, President and Chief Executive Officer

R.J. Rudden Associates, Inc. (1983 – 1988)
Vice President

Stone & Webster Management Consultants, Inc. (1981 – 1983)
Senior Consultant
Consultant

Southern California Gas Company (1976 – 1981)
Corporate Economist
Financial Analyst
Treasury Analyst

EDUCATION AND CERTIFICATION

B.S., Economics and Finance, Wharton School, University of Pennsylvania, 1976
Licensed Securities Professional: NASD Series 7, 63, 24, 79 and 99 Licenses

---

BOARDS OF DIRECTORS (PAST AND PRESENT)

Concentric Energy Advisors, Inc.
Navigant Consulting, Inc.
Navigant Energy Capital
Nukem, Inc.
New England Gas Association
R. J. Rudden Associates
REED Consulting Group

AFFILIATIONS

American Gas Association
Energy Bar Association
Guild of Gas Managers
International Association of Energy Economists
National Association of Business Economists
New England Gas Association
Society of Gas Lighters

ARTICLES AND PUBLICATIONS

"Maximizing U.S. federal loan guarantees for new nuclear energy," *Bulletin of the Atomic Scientists* (with John C. Slocum), July 29, 2009

"Smart Decoupling – Dealing with unfunded mandates in performance-based ratemaking," *Public Utilities Fortnightly*, May 2012

Daniel S. Dane, CPA
Assistant Vice President

Daniel S. Dane has extensive experience in the energy and financial services industries providing advisory services to power companies, natural gas pipelines, and local gas distribution companies in the areas of regulation and ratemaking, litigation support, generating asset divestitures, valuation, financial statement audits and analysis, and the examination of financial reporting systems and controls. Mr. Dane has also provided expert testimony on regulated ratemaking matters for investor-owned utilities. Mr. Dane has an MBA from Boston College in Chestnut Hill, Massachusetts and a BA in Economics from Colgate University in Hamilton, New York. Mr. Dane is a certified public accountant, and is a licensed securities professional (Series 7, 28, 63, 79, and 99). Mr. Dane also serves as the Financial and Operations Principal of CE Capital Advisors, a FINRA-Member firm and a subsidiary of Concentric.

REPRESENTATIVE PROJECT EXPERIENCE

Ratemaking and Utility Regulation Assignments

Expert Testimony

- Submitted expert direct testimony on behalf of Northern States Power, a wholly-owned subsidiary of Xcel Energy Inc., to present evidence and provide an opinion regarding the company's proposed ROE in South Dakota Public Utilities Commission Docket No. EL11-019.
- Submitted expert direct and rebuttal testimony on behalf of Ameren's Illinois utilities regarding ratemaking policy issues specifically related to regulated rate base (Illinois Commerce Commission Docket No. 09-0306 through 09-0311 (Cons.)).

Regulatory Support

- Provided financial modeling, development of expert reports, and preparation of multiple rounds of testimony on behalf of U.S. and Canadian investor-owned electric and natural gas utilities related to multiple aspects of the ratemaking process, including: cost of capital; ring fencing; revenue requirements; decoupling; prudence and cost recovery; capital tracker tariff mechanisms; cost allocation and shared services; merger approval; and ratemaking policy.
- Developed marketing materials, regulatory filings, and cost of service/rate design financial models for natural gas pipeline facilities for U.S. and state regulatory filings and open seasons.
- For natural gas pipeline filings, advised applicants on Federal Energy Regulatory Commission (FERC) policies and precedent regarding tariff rates and other filing requirements.
- Developed market power studies, along with supporting testimony, for developers and owners of U.S. natural gas storage facilities.
- Assignments include utilities in Ontario, Alaska, Arizona, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Illinois, Iowa, Kansas, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, North Dakota, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, North Dakota, Texas, Wisconsin, Vermont, and the District of Columbia.

Financial Advisory Assignments

Competitive Solicitations & Asset Divestitures

- Sell-side support provide for approximately $2 billion in generating asset transactions, including nuclear, natural gas, and coal generating facilities.

- Buy-side due diligence support for U.S. and international investors in wind generation and natural gas pipeline facilities.

Valuation Services

- Developed Fairness Opinions issued by CE Capital Advisors, Inc. to Boards of Directors of companies entering into asset purchases and sales. Led valuation modeling on multiple energy-related valuation assignments using the Income Approach, Cost Approach, and Sales Comparison Approach.

Litigation Advisory Assignments

Prepared economic and financial analyses and expert reports in proceedings related to contract disputes, takings claims, and bankruptcy proceedings. Clients include international diversified energy companies, regulated utilities, and bondholders.

Management and Operations Consulting Assignments

Prudence reviews, including contracting strategy reviews and assessments of project controls and oversight for developers of nuclear generating capacity uprates and new nuclear facilities.

PRESENTATIONS

"A Comparative Analysis of Return on Equity of Natural Gas Utilities" (with Jim Coyne and Julie Lieberman), presented to the Ontario Energy Association, June, 2007.

PROFESSIONAL HISTORY

Concentric Energy Advisors, Inc. (2004 – Present)
CE Capital Advisors, Inc.
Assistant Vice President (Concentric)
Financial and Operations Principal (CE Capital)

Ernst & Young (2000 – 2001, 2003 – 2004)
Staff Auditor and Database Management Associate

ZIA Information Analysis Group (1997 – 2000)

EDUCATION AND CERTIFICATIONS

M.B.A., Boston College, 2003
B.A., Economics, Colgate University, 1996
Licensed Securities Professional: NASD Series 7, 28, 63, 79 and 99 Licenses

---

DESIGNATIONS AND PROFESSIONAL AFFILIATIONS

Certified Public Accountant, 2004
Massachusetts Society of Certified Public Accountants, 2004
American Institute of Certified Public Accountants, 2011

Mark C. Cattrell
Senior Project Manager

Mr. Cattrell has provided financial analysis, regulatory advisory services, and public policy analysis on a variety of engagements with Concentric. His projects have included strategic assessments of the U.S. nuclear energy industry, asset valuations, state regulatory and federal litigation cases, nuclear regulatory matters, expert testimony preparation, and client initiated studies on a wide range of energy-related issues.

REPRESENTATIVE PROJECT EXPERIENCE

Financial and Economic Advisory Services

Performed asset valuations and financial modeling associated with spent nuclear fuel litigation. Assessed value of a hydroelectric generating facility for a major US utility by developing a discounted cash flow model. Verified economic assumptions used in appraisal of a proposed desalination facility for a multinational industrial developer. Provided research on comparable transactions, previous mergers and acquisitions, and potential transaction opportunities.

Regulatory Analysis and Ratemaking

Conducted regulatory analysis and economic research for electric and natural gas utilities to support expert testimony in ratemaking proceedings before state regulatory agencies. Conducted research to support testimony associated with the natural gas revenue decoupling. Evaluated economic potential of baseload energy alternatives for leading US renewable energy supplier to support regulatory filings for multi-billion dollar nuclear expansion. Performed a competitive analysis of nuclear performance as part of a benchmarking study. Customized a model to design support rate design recommendations based on cost of service studies.

Energy Market Assessment

Conducted an assessment of the United States nuclear power industry for a European client, including assessment of proposed expansions to present fleet of nuclear generating plants. Created demographic and economic projections to support valuation studies. Evaluated process by which a major western utility conducted long-range resource planning.

Business Strategy and Operations

Performed strategic and competitive analysis of proposed nuclear construction projects. Composed and compiled sections of a major financing application to the Department of Energy. Conducted a study of local statutes, tax policies, and incentives for infrastructure projects.

PROFESSIONAL

Concentric Energy Advisors, Inc. (2008 – present)
Project Manager
Senior Consultant
Consultant

Harvard University (2003 - 2006)
Associate

Janus Associates, Inc. (2001 – 2002)
Jr. Consultant

EDUCATION

M.P.P., Georgetown University, 2008
B.A., Colby College, 2001

DESIGNATIONS AND PROFESSIONAL AFFILIATIONS

Energy Bar Association
National Association of Business Economics
U.S. Association of Energy Economics

AVAILABLE UPON REQUEST

Extensive client and project listings, and specific references.

Benjamin O. Davis
Senior Project Manager

Mr. Davis has over 7 years of experience working on a wide range of electric power and regulatory issues at the Massachusetts Department of Public Utilities. Mr. Davis' experience at the Department includes matters pertaining to clean energy policies, competitive electric market, electric system reliability, sustainable electricity policies and proposals such as energy efficiency, grid modernization, long-term contracts for renewable generation, electric vehicles, net metering, utility mergers, dynamic pricing, service quality, and retail electric market issues. Mr. Davis has a Master's degree in Public Policy from the Kennedy School of Government at Harvard University, a B.A. cum laude from Harvard University, and a Master of Divinity from Andover Newton Theological School.

REPRESENTATIVE EXPERIENCE

Representative experience from the Massachusetts Department of Public Utilities includes:

- Supervise staff of 15 in regulating electric sector in Massachusetts, with focus on clean energy policies, competitive electric market, and electric system reliability
- Execute management functions, including: conducting and overseeing performance evaluation reviews for staff; interviewing, evaluating, and hiring staff; assigning and training staff; and case management
- Communicate and coordinate with Commission, other division directors, other state agencies, utility regulatory staff, and non-government organizations
- Interact with utility personnel and industry stakeholders in formal and informal settings, ranging from hearings and technical sessions to conferences and site visits
- Supervise staff analysis, investigation, and execution of cases, including cross examination, writing of discovery, orders, and memoranda, and making presentations on sustainable electricity policies and proposals such as energy efficiency, grid modernization, long term contracts for renewable generation, electric vehicles, net metering, utility mergers, dynamic pricing, service quality, and retail electric market issues
- Serve on several interagency efforts, including compliance with Global Warming Solutions Act (an aggressive greenhouse gas emissions mitigation law), energy storage, and a clean energy standard
- Served as DPU Steering Committee representative for DPU's intensive Grid Modernization Working Group process, comprised of utilities and other stakeholders, to investigate and develop framework for grid modernization efforts
- Make presentations at industry meetings and conferences on topics including grid modernization, energy efficiency, and utility ratemaking

- Completed training and received certificate in Massachusetts' Commonwealth Management Certificate Program

---

PROFESSIONAL HISTORY

Concentric Energy Advisors, Inc. (2015 – present)
Senior Project Manager

Massachusetts Department of Public Utilities (2008 – 2015)
Electric Power Division – Director, Assistant Director, Economist

City of Boston Mayor's Office (2007 – 2008)
Policy Analysis Intern

United Way of Massachusetts Bay and Merrimack Valley (Summer 2007)
Community Impact Intern

Wellesley Congregational Church (2002 – 2006)
Associate Pastor

Massachusetts Institute of Technology (1996 – 1998)
Administrative Assistant

EDUCATION

M.P.P., Kennedy School of Government, Harvard University (2008)

M.Div., Andover Newton Theological School (2002)

B.A. *cum laude*, Harvard University (1994)

CONCENTRIC ENERGY ADVISORS

Attachment E
Concentric Contact List
Confidential

CONCENTRIC ENERGY ADVISORS	293 BOSTON POST ROAD, SUITE 500 MARLBOROUGH, MA 01752 1300 19TH STREET NW, SUITE 620 WASHINGTON, DC 20036

Name/Title	Phone/Fax	Email
John J. Reed Chairman, CEO (Responsible Officer)	Phone: 508-263-6262 202-587-4477 Cell: 617-699-8136 Fax: 508-303-3290	jreed@ceadvisors.com
Dan Dane Assistant Vice President	Phone: 508-263-6208 Cell: 617-515-3739 Fax: 508-303-3290	ddane@ceadvisors.com
Mark Cattrell Senior Project Manager	Phone: 202-587-4783 Cell: 617-283-7976 Fax: 202-587-4479	mcattrell@ceadvisors.com
Ben Davis Senior Project Manager	Phone: 508-263-6231 Cell: 617-797-9787 Fax: 508-303-3290	bdavis@ceadvisors.com
Joanna Bickford Executive Assistant (Project Assistant)	Phone: 508-263-6227 Cell: 508-320-6572 Fax: 508-303-3290	jbickford@ceadvisors.com

TESTIMONY OF
DR. PATRICIA D. GALLOWAY
PRESIDENT AND CHIEF EXECUTIVE OFFICER,
PEGASUS GLOBAL HOLDINGS, INC.
ON BEHALF OF
ONTARIO POWER GENERATION INC.
RE: EB-2016-0152 – 2017-2021 PAYMENT AMOUNTS APPLICATION
BEFORE THE
ONTARIO ENERGY BOARD

JULY 2016

TABLE OF CONTENTS

LIST OF ACRONYMS & ABBREVIATIONS

AACE International ..... AACE

Actual Cost ..... AC

Board of Directors..... Board

Budget Variance ..... BV

Change Control Board ..... CCB

Coordination & Control Schedule Level 2 ..... CCL2

Cost Breakdown Structure ..... CBS

Cost Performance Index..... CPI

Cost Variance..... CV

Critical Path Method..... CPM

Curriculum Vita ..... C.V.

Darlington Refurbishment Program..... DRP, or "Program"

Earned Value..... EV

Earned Value Management..... EVM

Engineering, Procurement, and Construction ..... EPC

Facilities and Infrastructure Projects..... F&IP

First in a While ..... FIAW

First of a Kind..... FOAK

Integrated Reporting Plan ..... IRP

National Association of Corporate Directors..... NACD

Ontario Power Generation Inc. ..... OPG

Operating Experience..... OPEX

Project Planning and Controls ..... PP&C

Pegasus Global Holdings, Inc. ..... Pegasus-Global

Planned Value ..... PV

Program Change Control Board..... PCCB

Program Evaluation and Review Technique..... PERT

Program Integrated Master Schedule..... PIMS

Program Management Office..... PMO

Project Management Institute ..... PMI

Project Management Professional..... PMP

Readiness to Execute ..... RTE

Release Quality Estimate ..... RQE

Resource Breakdown Structure..... RBS

Retube and Feeder Replacement..... RFR

Risk Management and Oversight..... RMO

Royal Institute of Chartered Surveyors..... RICS

Safety Improvement Opportunities..... SIO

Schedule Performance Index ..... SPI

Schedule Variance ..... SV

U.S. Government Accountability Office..... GAO

Work Breakdown Structure ..... WBS

EXECUTIVE SUMMARY

Sections I-III of my testimony begins with an introduction of my background, qualifications and experience relevant to the engagement, followed by the purpose and summary of my testimony that identifies the scope of the assessment and overall conclusions, and lastly provides educational information on megaprojects and megaprograms, including organization of such projects, the policies and procedures commonly used, project controls, pre-execution planning, and cost treatment of megaprograms in a regulatory environment.

Section IV provides the detailed findings and conclusions of my assessment of the Darlington Refurbishment Program (DRP or Program). These findings and conclusions are specifically identified by the following corresponding subsections as they appear in my testimony:

A. DESCRIPTION OF THE DARLINGTON REFURBISHMENT PROGRAM

- The DRP is considered a megaprogram by every measure generally used within the industry.
- OPG is treating the DRP as a First-of-a-Kind (FOAK) program, which is appropriate in my opinion.
- Specific FOAK and First-in-a-While (FIAW) work has been elevated as a key risk and factored into the probabilistic modeling for the $12.8B estimate.[1]
- OPG is utilizing a multi-prime contractor model, with OPG serving as the integrator between the prime contractors and having responsibility for the entire Program.
- OPG anticipates each unit outage to have a duration of 37 to 40 months, with an overall duration of 112 months for the complete refurbishment of all four reactors.

B. ORGANIZATION AND PEOPLE

[1] The $12.8B estimate includes $2.4B in interest and escalation.

- OPG is using a strong matrix organization comprised of full-time project managers with considerable authority and full-time functional support staff, which I consider appropriate.
- The content and scope of OPG's program and project management plans is consistent with industry best practices and other megaprojects and megaprograms I have reviewed.
- OPG sought to find the most qualified individuals in the industry to manage the Program and I found that the individuals assigned to the Program are qualified and competent.
- OPG has efficient oversight in place, including senior and executive management and a Board of Directors (Board) with a focus on important process/progress issues; participation in strategic decisions; and, active in issue resolution.
- The Program Management Organization and Staff decisions were reasonable and in accordance with good utility practice.

C. POLICIES AND PROCEDURES

- OPG's policies and procedures are exemplary in their thoroughness and alignment with other individual policies and procedures and industry best practices.

D. PROJECT CONTROLS

- Project controls are managed from both a program and project-level, with appropriate project controls systems in place.

1. ESTIMATING AND COST MANAGEMENT

- OPG's estimating process and basis of estimate align with industry best practices, with appropriate adaptations to account for the uniqueness of the Program.

- Due to the FOAK nature of the DRP, benchmarking was largely tied to OPG's operating experience and subject matter expertise, but also included available cost data from other refurbishment projects.
- The $1.7B of contingency included in the estimate is reasonable, and based on a thorough risk assessment and Monte Carlo analysis, utilizing a P90 confidence level.
- There is no specific confidence level considered as a best practice, but using a P90 confidence level provides OPG with a high probability of completing the Program within the $12.8B estimate.
- OPG's cost management procedures align with industry standards for program financial monitoring and control.
- OPG established appropriate processes and oversight for the management of contingency.
- OPG has procedures and processes in place to effectively monitor and capture actual costs and evaluate performance against the physical work completed, similar to or beyond what I have observed on other megaprograms.

2. SCHEDULE MANAGEMENT

- OPG ensures that contractors prepare schedules in accordance with OPG's policies, which are reviewed and aligned to the Program Integrated Master Schedule (PIMS).
- Schedule development activities and the level of detail developed at this time is consistent with what I have observed on other megaprograms.
- OPG's selection of a P90 confidence level for the Unit 2 schedule is reasonable and in accordance with the robust risk analyses that were performed.

- It is typical for megaprograms, such as the DRP, to be managed on a planned duration that is less time than reflected in the high-confidence schedule.
- OPG has the plans and processes in place to effectively develop, manage, and control the schedule in full alignment with industry standards and best practices.

3. RISK MANAGEMENT

- OPG undertook a number of activities in its identification of key risks to the Program and development of processes in order to manage those key risk factors.
- OPG's risk management processes is typical of what I would expect to find in a megaprogram such as the DRP and utilizes the fundamental steps of: planning; identification; assessment; treatment; and, monitoring and control.
- OPG identified key risk areas from major themes of risk and incorporated these into the risk registers, with risk mitigation plans developed for the identified risks.
- OPG appropriately took into account lessons learned from other refurbishment projects, other nuclear projects, and other megaprojects and megaprograms.
- OPG's cost and schedule contingency development aligns with industry standards through identifying risks, estimating the probability of occurrence and impact, considering risk responses, addressing cost and schedule dependency, assessing overall outcomes through Monte Carlo simulations, and estimating and evaluating contingency.
- OPG has identified those risks that could potentially impact the Program and instituted practices in accordance with industry standards that allow OPG early identification of emerging risks to quickly implement mitigation plans.

4. REPORTING MANAGEMENT

- OPG has established a repository for metrics and reporting data, including a comprehensive and tiered metrics infrastructure.
- OPG has developed an Integrated Reporting Plan (IRP) to communicate how information and data is distributed on the Program.
- Performance and progress will be measured through Earned Value Management (EVM) techniques, which is typical within the construction industry.
- The types of reports that OPG is and will be using are what I would expect to see on a megaprogram such as the DRP.

E. PROGRAM EXECUTION

- The Facilities and Infrastructure Projects (F&IP) and Safety Improvement Opportunities (SIO) were not necessarily completed per the initial planned schedule and estimate, however, I did not find any fundamental issues that would impact the Program execution and there is no impact to the Breaker Opening milestone.
- Many of the F&IP and SIO were executed under the pre-existing Projects and Modifications organization before the DRP organization was in place and did not use the “gated process” that will be used for the DRP execution.
- OPG’s decision to substantially complete Unit 2 before starting Unit 3 will allow for effective implementation of lessons learned from Unit 2.
- The DRP development is at a point in its execution where I would expect an owner to be in a megaprogram at this stage of execution.

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Dr. Patricia D. Galloway. My business address is 1750 Emerick Road, Cle Elum, Washington 98922.

Q. What is your occupation?

A. I am the President and Chief Executive Officer of Pegasus Global Holdings, Inc. (Pegasus-Global), a management consulting firm that provides services to the energy and infrastructure industries globally, specifically focusing on megaprojects and megaprograms. I am the Director of this engagement for Pegasus-Global.

Q. Please summarize your educational background and professional experience.

A. My qualifications and experience are contained in my curriculum vita (C.V.) attached as **Exhibit No. PG-1**. In summary, I received a doctorate in Infrastructure Systems (Civil) Engineering from Kochi University of Technology in Kochi, Japan in 2005, a Master's in Business Administration from the New York Institute of Technology in 1984, and a Bachelor's of Civil Engineering from Purdue University in 1978. I have over 38 years of experience in the construction and utility industries. I have performed extensive work on behalf of both public and private sector clients, on a wide-range of complex, global engagements involving the construction, engineering, and procurement of megaprojects and megaprograms. I have an extensive background in engineering, construction, and project management, including project controls and scheduling. I have been involved with pre-design, engineering, procurement, construction, and commissioning work for large complex projects like the Darlington Refurbishment Program (DRP, or Program). This work includes significant experience in management decision making, governance evaluations, estimate review and evaluation, contract risk reviews, contract strategy, bidding and bid solicitation for such projects, procurement, design change review, constructability reviews,

project controls, schedule resource loading and activity evaluation, cost control, progress reporting, quality assurance and control, startup and operations, commissioning, testing and maintenance. I have worked on engineering and construction projects in over 60 countries. I am a licensed Professional Engineer currently in 15 U.S. States, Manitoba, Canada, and Australia. I am a certified Project Management Professional (PMP) by the Project Management Institute (PMI) and a Certified Quantity Surveyor in the fields of Project Management and Risk Management by the Royal Institute of Chartered Surveyors (RICS). I hold a Certificate in Dispute Resolution from Pepperdine Law School (Straus Institute), a Diploma in International Arbitration from Oxford (CIARb), and a Certificate in Director Education from the National Association of Corporate Directors (NACD) and have also served on several corporate boards for both for-profit corporations and non-profit corporations. I also served on the National Science Board, appointed by President Bush and Senate confirmed, from 2006-2012, having served as its Vice Chair from 2008-2010.

Q. What types of power plants have you worked on over your career?

A. My power plant experience includes work on over sixty power plants, the majority being nuclear units, also including coal, natural gas, IGCC, hydro, waste-to-energy, geothermal, solar, and wind power. My full work experience is described in my C.V., which I have attached as **Exhibit No. PG-1** to my testimony.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q. What is the purpose of your testimony?

A. Pegasus-Global was engaged by Torys LLP to provide an independent and objective assessment of the degree to which Ontario Power Generation Inc.'s (OPG) plan and approach to the execution of the DRP, including the processes in place for management of costs and schedule, program controls and its application of any contingency, are consistent with the way other megaprojects and megaprograms of similar magnitude, scale, and complexity have been carried out.

Q. Can you summarize how you conducted your review?

A. Yes. Pegasus-Global began its evaluation with a review of the organization established to manage and oversee the design and construction of the Program. We then reviewed the policies, procedures, and other relevant documents used in the planning and execution of the Program. In general, this included evaluating the governance, organizational structure, project controls, estimate, contingency, and schedule, and pre-execution planning of the Program. Once familiar with the processes, policies, and procedures in place and the current status of the Program, I led our team through interviews with key personnel at OPG who have responsibility for the execution and oversight of the Program to gain additional understanding of how key personnel plan to implement the processes, policies, and procedures in place to execute the Program.

Q. Can you summarize the findings of your assessment?

A. Yes. Based on the review of OPG's governance, policies and procedures, and project controls developed and in use for the Program, and interviews conducted with OPG personnel, I found that OPG has reasonably and prudently prepared for its execution of the DRP. My summary findings include:

- OPG's approach for executing the Program is consistent with the approach typically used on other megaprograms and in several areas exceed what I have seen on other megaprograms of similar magnitude, scale, and complexity.
- It is my opinion that the extensive pre-execution planning that was undertaken places OPG in a favorable position to have successful execution of the Program. This pre-execution planning includes: the incorporation of lessons learned from Darlington and other nuclear projects including Point Lepreau Nuclear Generating Station, Bruce Nuclear Generating Station, Pickering Nuclear Generating Station, Vogtle Electric Generating Plant, Watts Bar Nuclear Generating Station, as well as non-nuclear megaprojects such as the London Olympics and Heathrow International Airport; the use of industry best practices for development of the Release Quality Estimate (RQE); and, the policies, procedures, and project control tools that were developed and in use for Program execution.
- By performing a detailed cost estimate and schedule based on a thorough and robust probabilistic risk assessment of the Program, OPG has established a P90 confidence level of the cost to complete the Program and established an appropriate level of contingency, which in my opinion, is a reasonable cost estimate.

III. BACKGROUND INFORMATION

A. MEGAPROJECTS AND MEGAPROGRAMS

Q. Can you define what is meant by a construction megaproject?

A. Yes. Megaprojects are generally defined within the industry as very large-capital investment projects (costing more than $1B USD) that attract a high level of public attention or political interest because of substantial direct and indirect impacts on the community, environment, and companies that undertake such projects.[1] Other attributes of a megaproject include:

- execution of an engineered facility or structure which is complex or unusual;
- an extended execution schedule (greater than four years measured from initial concept development to final completion);
- multiple equipment and material suppliers;
- multiple specialty trade contractors;
- multiple project stakeholders/investors; and,
- multi-national party stakeholder involvement.

Q. Why is the distinction between a construction megaproject and a typical construction project important when assessing the management organization and tools to manage the megaproject?

A. Challenges that one faces on a typical construction project are orders of magnitude less challenging than one faces on a megaproject. Lack of a sound contextual basis against which to examine and judge the decisions made and actions taken by management during the execution of a construction project can lead to findings, conclusions and opinions which are inaccurate measures of the reasonableness or prudence of those management decisions and actions. Thus, one needs to understand the context of executing a megaproject when evaluating decisions and actions.

Q. Are all megaprojects the same?

A. No. The technological complexities of megaprojects, in and of themselves, mean that each megaproject presents unique challenges, any of which may have a direct bearing on the context within which the management of a project should be examined and judged. Because of the size, duration, and complexity of any megaproject, establishing the context within which the management and execution of that project should be examined for reasonableness or prudency must be individually set to reflect the unique factors which existed during the execution of that project. This often includes a lack of suitable projects from which to benchmark against, as each megaproject features its own complexities and environment in which it is executed.

Q. Are megaprojects more "complex" than a typical construction project?

A. Yes. Actual management of a megaproject is in itself more complex than the management of a typical construction project. For example, in a megaproject there is simply not a "one-size-fits-all" or "best" methodology for allocating or contracting for the numerous different sub-scopes of work required in a megaproject. The sheer size and complexity of most megaprojects generally results in an execution methodology that involves multiple delivery methodologies and contracting approaches. For example, the specialty trade elements of a process or power generation megaproject may in themselves cost more and take longer than the average construction project, requiring the use of multiple specialty trade contractors, each working on an element of the whole and each under a different tailored contractual agreement. A typical construction project may hire one specialty trade contractor to execute the entire scope of that specialty work; on a megaproject, management will have to work with multiple contractors in order to gain sufficient resources to execute that trade specialty scope of work.

Q. What is the difference between a megaproject and a megaprogram?

A. A megaproject is one large and complex project with all the attributes I have previously discussed. A megaprogram still possesses all the same attributes as a megaproject, but is comprised of multiple individual projects, many of which may constitute a megaproject on its own.

Q. Given the unique circumstances of a megaprogram and recognizing the stresses that accompany those circumstances, how does the management of a megaprogram differ from that of typical construction projects?

A. The greatest difference in managing a megaprogram from a typical construction project lies in management's willingness to understand and accept that conditions will change. On megaprojects, and particularly megaprograms, it is important for the owner to acknowledge that even with the best forecast in place, it is still a forecast, and over the extended duration of execution, factors can and will change that may challenge the original forecast. Management and control approaches, processes, procedures and systems must be flexible and adaptable to these changing conditions. Ultimately, megaprogram management relies on the ability to adjust repeatedly to a myriad of competing forces to maintain the greatest possible control over the project environment as it evolves.

B. ORGANIZATION OF MEGAPROGRAMS

Q. What type of organizational or management structures do megaprograms utilize?

A. Typically, megaprograms utilize a matrix type of organization, which provides "checks and balances" to ensure adherence to risk, cost, schedule, and quality. When properly implemented, matrix organizations facilitate flexibility and adaptability needed to adapt and respond to changing conditions. A matrix organization can be quite effective in adjusting repeatedly to a myriad of competing forces to maintain the greatest possible control over the program environment as it evolves.

Q. What is a "matrix organization"?

A. Generally, a "matrix organization" is an organizational structure in which project managers share responsibility with functional managers for assigning priorities and directing the work of persons assigned to the program. For example, a project controls lead may be assigned to a project manager for execution of a given project. Under a matrixed arrangement, the project controls lead will bring specific knowledge to perform given tasks on a project under a particular project manager (e.g. cost estimating and forecasting), while still maintaining a reporting relationship with the project controls manager.

C. POLICIES AND PROCEDURES

Q. What is the importance of having a good set of policies and procedures in place before executing a megaprogram?

A. Policies and procedures serve as the foundational documents from which a megaprogram is managed and controlled. They provide guidance for implementing effective project controls, which in turn provide senior management with the information necessary to make informed decisions on the program.

Q. How do the policies and procedures provide guidance for effectively executing a project?

A. It begins with a project charter, which creates a formal record of the existence of the program, defines the overall scope of work, and provides senior management a mechanism to formally accept and commit to the program.[2] From there, program management plans and project management plans support the framework of project controls during execution by describing the functional support to the program (program management plan) and how the specific aspects of a project within the program will be planned, executed, monitored, controlled, and closed (project management plan). Depending on the needs of the program or project, further topic-specific plans may be developed and implemented to provide additional guidance during execution (e.g. schedule management plan, cost management plan, risk management plan, etc.).

Q. How can it be determined if a policy and procedure is adequate?

A. There are a variety of project management and construction industry organizations and government bodies that have written extensively as to recommended practices, suggested guidelines, and other advice as to what constitutes best practices in project and program management. Aspects of these practices and guidelines detail the expected requirements of planning, executing, and controlling a project or program and can be compared to the policies and procedures in place by an organization to determine if the requirements are being addressed.

During execution, senior management, in its oversight role, will have first-hand insight into if the intent of the policies and procedures is being met through the reporting information it regularly receives. In addition, as a regular practice, organizations typically implement audits of specific aspects of a project or program to ensure the requirements are being met. These audits can be conducted by the internal audit group of the organization and/or by a third-party group.

Q. Do policies and procedures evolve during the execution phase?

A. Yes, when there is an identified need to expand, refine, or otherwise revise an aspect of project controls, the related policies and procedures will be updated to reflect these changes. Construction projects, especially megaprojects, are inherently dynamic with a variety of influences both inside and outside the project that may adjust the project controls needs. Progressive elaboration of the policies and procedures allows for a continually improved process to manage and oversee the execution based on the actual conditions of the project or program.

D. PROJECT CONTROLS

Q. What are "project controls"?

A. "Project controls" is a general term of art within the construction industry denoting the systems used by management to enable it to measure progress and performance, assess remaining work, and report the current status of specific aspects of a project, an entire project, or a program of projects. The most common aspects of project controls include: cost management; schedule management; risk management; and, reporting management. These primary project controls are most intertwined with project performance as to the physical execution of the project.

1. ESTIMATING AND COST MANAGEMENT OF MEGAPROJECTS/MEGAPROGRAMS

Q. Why are cost estimates important for the Owner and other stakeholders?

A. Cost estimates allow the owner and other stakeholders to obtain a summation of the individual cost elements of a project or program to estimate the future (or completed) costs, based on the information available at the time of the estimate. During execution, the cost estimate serves as a baseline against which program management can measure performance and identify possible trends that management uses for decision-making relative to program execution.

Q. Would you please explain the applicable industry standards for cost estimating?

A. Many government bodies and project management or construction industry groups have written at great length about how to properly prepare and develop a cost estimate. Common themes reappear across these groups constituting best practices in estimating. For example, the U.S. Government Accountability Office (GAO) has a twelve-step guide to estimating:[3]

1. Define estimate's purpose;
2. Develop estimating plan;
3. Define program characteristics;
4. Determine estimating structure;
5. Identify ground rules and assumptions;
6. Obtain data;
7. Develop point estimate and compare it to an independent cost estimate;
8. Conduct sensitivity analysis;
9. Conduct risk and uncertainty analysis;
10. Document the estimate;
11. Present estimate to management for approval; and,
12. Update the estimate to reflect actual costs and changes.

Similarly, AACE International (AACE, formerly known as the Association for the Advancement of Cost Engineering) summarizes the cost estimating process as including: *"…planning for the estimate, quantifying scope, applying cost to the scope, pricing of the project, reviewing, validating, and documenting the estimate."*[4]

Each aspect of developing an estimate has recommendation and guidelines from the various industry-recognized sources that further provide guidance to proper estimate development.

Q. What is a 'basis of estimate'?

A. Essentially, a basis of estimate documents an understanding of what the estimate means, from its scope, the way it was developed, its assumptions, its expected accuracy and confidence levels, as well as inclusions and exclusions to the estimate.[5]

Q. Are there different levels of cost estimates as defined in the industry which provide for an expected accuracy range?

A. Yes. AACE has defined five classes of estimates based on the various estimate characteristics (maturity level of project definition deliverables, end usage, estimating methodology, expected accuracy range, and effort to prepare estimate). The maturity level of project definition deliverables (e.g. scope definition, plans and schedules, drawings, calculations, etc.) is the primary characteristic in determining the class of estimate, as it relates to the quality and completeness of the information available to the estimators.[6]

Q. Are the AACE estimate classification recommended practices in general use within the power industry?

A. Yes. It would be unusual to find a large, complex power project that did not utilize the AACE estimate classification recommended practices, and other AACE estimating guidelines, during development of the project estimate. AACE supports the usage of its recommended practices within the power industry with its development of industry-specific estimate classification recommended practices, such as for Engineering, Procurement, and Construction (EPC) work in the process industries (Recommended Practice No. 18R-97) and the hydropower industry (Recommended Practice No. 69R-12). However, even with its common usage and acceptance within the power industry, AACE noted, *"It is understood that each enterprise may have its own project and estimating process and terminology, and may classify estimates in particular ways."*

AACE added that its cost estimate classification system, *"provides a generic and generally-acceptable classification system that can be used as a basis to compare against."*[7]

Q. How is estimating a megaprogram different than estimating a typical linear project?

A. With most linear projects, the scope is confined to an individual project, typically the type of project that has been executed in the past by an organization (e.g. new transmission lines, pipelines, etc.) and is generally executed in a "point a" to "point b" trajectory, with little outside influence. On a megaprogram, the estimate is comprised of multiple projects that have varying degrees of interdependency with one another, often involving a multitude of disciplines. As a result, understanding the interfaces between the projects within a megaprogram is paramount to developing a sound estimate.

Q. What is meant by a 'confidence level'?

A. A confidence level reflects the probability that the actual result of an estimate or schedule will be more favorable than the estimated amount or duration. Confidence levels are typically generated through probabilistic risk modeling, often using Monte Carlo analysis and simulations that represent probabilities, not certainty.

Q. What is a Monte Carlo analysis?

A. A Monte Carlo analysis is a risk quantification technique that uses a mathematical simulation to forecast the probability of completing the project on time or within budget. The analysis takes a range estimate for each project task and then generates a random number within that range for each task. The computer software performs this thousands of times during a simulation run. The modeling requires an identification of a probability for each critical item relative to the probability of occurrence and probability of impact if it occurs, along with the monetary and time impact. This modeling results in many iterations being run to generate a cumulative probability

distribution curve for a complete estimate. The probability factors that are in the Monte Carlo simulations are commonly 30%, 50%, and 90%, meaning that there is a corresponding likelihood of an underrun on the estimate, and expressed as "P30", "P50", and "P90". For example, with a P50 confidence level, there is an equal chance (50%/50%) of an underrun or overrun. The Monte Carlo analyses take the uncertainty of cost or duration estimates into account. By utilizing a higher confidence number (e.g. P90), the owner and stakeholders reduce a significant amount of risk due to cost overruns. This is accomplished by utilizing a contingency amount that corresponds to the high confidence number selected in order to account for those identified risks, should they emerge.

Q. How do confidence levels differ from a point estimate?

A. A point estimate provides the value most likely to be realized on a project, given the information available at the time it was developed. A confidence level, on the other hand, provides additional information in identifying the underlying uncertainty of the estimate by providing a range of possible costs based on a specified probability level. For example, a project with a point estimate of $100 million could produce a range of $80 million to $120 million at a P90 confidence level.

Q. What are the reasons for selecting a higher or lower confidence level?

A. Selection of a confidence level is primarily reflective of the risk appetite of the owner. If the owner wishes to reduce the risk of overrunning the estimate, using a higher confidence level reduces the likelihood of a budget overrun and provides provisions for risks unknown at the time of the estimate, but likely to appear as the project progresses. On a megaprogram, given the extended duration for execution and increased complexities compared to a typical project, it is common for a high confidence level to be selected as it provides more assurance that the estimate will be adequate for the duration of the program.

Q. What are the general objectives of cost management?

A. In general, cost management involves planning, managing, and controlling costs to help facilitate a project being completed within its approved budget.

Q. Are there industry standards relative to how owners apply cost management on megaprojects and megaprograms?

A. Yes. As PMI notes, cost management begins with development of the policies, procedures, and processes to be used during execution.[8] Cost estimating allows the owner to identify the expected costs of the individual components of the project, based on the information known at the time of the estimate, and facilitates the establishment of a control or baseline budget.[9] During execution, cost management focuses on monitoring the status of the project relative to the budget. This is typically accomplished by comparing actuals to the estimate or plan, evaluating metrics (i.e. earned value), and trending and forecasting to predict future values based on current performance.[10] These tools provide management with necessary information as to the status of the project, allowing management to make informed decisions.

Q. What is the purpose of contingency?

A. Owners establish contingency levels based on an acceptable risk level, degree of uncertainty, and the desired confidence levels for meeting baseline requirements. When used to absorb the impacts of uncertainty, the contingency is a form of risk mitigation.[11] AACE provides that contingency is *"An amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs."*[12] AACE also identifies that contingency typically covers such uncertain "items, conditions, or events" as: planning and estimating errors and omissions; minor price fluctuations; design developments and changes within the scope; and, variations in market and environmental conditions. In summary, contingency typically falls into one of three categories: 1) cost

estimating uncertainty; 2) schedule estimating uncertainty; and/or, 3) discrete risks. Contingency typically excludes: major scope changes; extraordinary events (e.g. major strikes, natural disasters); management reserves; and, escalation or currency effects. Generally, contingency is expected to be expended during the execution of a project or program as the uncertainties manifest.[13]

Q. What is the purpose of management reserves?

A. Unlike contingency, which covers identified, but not yet realized risks, management reserves are intended to address unforeseeable emergencies that cannot be effectively managed using contingency as they are such magnitude and rarity that they go beyond project-specific risks (e.g. terrorist attacks, changes in the political environment that impact the program, etc.). Also, unlike contingency, management reserves are not part of the overall cost baseline from which performance of a project or program is measured.[14] An owner may choose to add a management reserve as a mechanism to have funding available to the project or program in the event of truly unforeseen events, but would not include such reserves in the project or program's cost estimate. Management reserve is thus not included in the budget since it is not expected or intended to be expended.[15]

Q. Are there industry standards that establish what an appropriate amount of contingency is?

A. While there is not a lone standard method in which contingency is calculated, there are general methods that are commonly used within the industry based on the experience and preference of the estimating organization. Such methods include:[16]

- Expert judgement – based on experience and competency in risk management.
- Predetermined guidelines – using standardized percentages for a simple calculation, or more complex scoring mechanisms using elements of parametric modeling.

- Simulation analysis – combining expert judgment with an analytical model in a simulation to provide a probabilistic output.
- Parametric modeling – generally an algorithm based on multi-variable analysis of quantified risk drivers versus cost growth outcomes for historical projects.

Contingency development typically combines more than one of the above methods.[17]

Q. How would contingency typically be developed for a megaprogram?

A. Using the practices discussed in my testimony above, contingency development for a megaprogram would be based on consideration of the work plan and an identification of those risks that could happen and the associated potential cost and schedule impact. These risks are then typically modeled through a probabilistic simulation, which in turn, provides various outcomes for management consideration relative to appropriate amounts of contingency based on those modeled risks and respective impacts.

Q. How is contingency typically identified in the budget estimate?

A. From a budget perspective, contingency is a separate project cost element or line item in the budget estimate. As a discrete line item contingency is subject to the same processes as any other cost element, with one exception; unlike most cost elements, the contingency amount may increase or decrease from month-to-month (as funds are used to address realized risks, or funds are returned to the program contingency when risks expire or projects are completed).

Q. How is contingency typically managed and controlled on a megaprogram?

A. It is common practice for contingency to be both distributed to individual projects within a megaprogram and to an overall program contingency. This is a reflection of acknowledging the identification of both project-specific risks and overall program risks. Use of contingency typically is approved by the project manager, senior management, or possibly the president/board

of directors, depending on the amount needed and the thresholds for its use established by the company (e.g. the project manager may have approval to use up to $1 million, cumulatively, in contingency, amounts needed beyond that would need approval from a more senior person or group in the organization).

Q. What happens to unused contingency when a project within the megaprogram is completed?

A. Given the level of risk on a megaprogram, it is expected that unused contingency for an individual project within a program is reallocated to the program, which reflects the nature of managing a program versus an individual project. This is similarly true for multi-unit programs. If one unit is completed under its budget estimate, the unused contingency is allocated back to the overall program, which may be used by any remaining units should their respective budgets be exhausted. The way a program estimate is developed and supported is based on this interconnectivity of the various projects that comprise the program, and not a collection of isolated projects for which there is no interdependence. Thus, remaining contingency will only truly be unused when the overall program reaches its completion.

2. SCHEDULE MANAGEMENT

Q. Are there industry standards for schedule development applicable to megaprograms?

A. Yes. PMI and AACE, along with other entities such as the GAO, have developed best practices for schedule development, similar to what these organizations prescribed for other aspects of project controls. PMI prescribes that key steps of schedule development include: defining milestones; designing the project's activities; sequencing activities; determining resources and durations for each activity; analyzing the schedule output; and, approving the baseline schedule.[18]

Q. What are the general objectives of schedule management?

A. The general objectives of schedule management are to identify what activities are of a critical nature (and the relationship those activities have to one another), how the various vendors' or contractors' activities relate to the critical path, and to provide the means to recognize deviation from the plan and take corrective and preventive actions that minimize risk.[19] Schedule management and control typically involves usage of different "levels" of a common integrated master schedule to address the specific needs of the various audiences.

Q. What is meant by a schedule "level"?

A. Levels of a schedule, from Level 0 to Level 5 typically, are commonly used within the construction industry to designate the level of depth a given schedule depicts, with a higher level of schedule providing an increased level of detail. These different levels of schedule are summarized as follows:[20]

- Level 0: Depicts the total project from start to finish, effectively a single bar demonstrating the project timeline and often includes major milestones.
- Level 1: A high-level schedule showing key milestones and summary activities by major phase, stage, or project being executed to provide information to assist in the decision

making process. A Level 1 schedule may or may not be the summary roll-up of a more detailed critical path schedule.

- Level 2: Generally used to communicate the integration of work throughout the lifecycle of a project, including interfaces between key deliverables and participants (contractors). Level 2 schedules assist in identifying project areas and deliverables that require actions and/or course correction.
- Level 3: Prepared to communicate the execution of the deliverables for each of the contracting parties. Development of a Level 3 schedule is generally the output of a critical path scheduling software (e.g. Primavera P6) and provides enough detail to identify critical activities.
- Level 4: Used to communicate the production of work packages at the deliverable level, providing project managers, superintendents, and general foremen with enough detail to plan and coordinate contractor or multi-discipline/craft activities.
- Level 5: Usually considered to be "working schedule" that reflect highly detailed task requirements for specific activities. This detailed level of schedule is typically used by superintendents and general foremen directing and overseeing actual work in the field.

3. RISK MANAGEMENT

Q. You previously discussed in your testimony that as part of the cost estimating industry standards that it was important to conduct a risk and uncertainty analysis to identify the areas within the estimate with a significant risk or opportunity. What is a risk?

A. Risk is an uncertain event or condition that, should it occur, would affect at least one program or project objective. Risk is unpredictable and involves uncertainty, whether that be in the form of a threat or an opportunity. Risk is always in the future. However, based on experience, those involved in the program execution and the program risk assessment can predict what items or events may happen. Based on an individual's prior experience an expected prediction of risks can be made based on items or events that have happened before, but may not manifest on the particular project being assessed. It is those risks that can be predicted that are commonly called "known unknowns," a term widely used in the industry, including by major U.S. government agencies.[21] The risk portion of risk management consists of addressing each high priority risk and developing a risk response (mitigation plan) or countermeasure (for threats) or an enhancement plan (for opportunities).

Q. What is the difference between "risks" and "issues"?

A. Risks, as I stated, are in the future. An issue, on the other hand, is a problem that occurs in the present that the Program Team has to deal with. Risk management is proactive, whereas issue management is reactive. The purpose of risk management is to be proactive rather than reactive regarding things that might go wrong on the program and, just as important, those things that would enhance program success.

Q. Are there specific steps that typically can be undertaken in applying risk management to a program such as the DRP?

A. Yes. There are typically five steps one would undertake in development of a risk management program: 1) planning how risk will be approached for the program; 2) identifying the risks that would potentially emerge in the program; 3) assessing, quantifying, and prioritizing those risks; 4) developing a response to those risks; and, 5) monitoring and managing risk, both those identified and new emerging risks, during program execution.

Q. What is a risk register?

A. A risk register takes the identified risks and categorizes them into various types or "themes" of risk that are entered into a spreadsheet or risk database, which typically features such information as the risk and its ranking, along with the risk owner, and mitigation actions. The risk register is essentially a tracking system. Similar to other project control tools, it tracks risks throughout the program's execution through regular occurring updates and reviews. The primary purpose of the risk register is to support the owner's management decisions and actions and to avoid and/or minimize cost overruns and delays. The likelihood of occurrence and the nature and magnitude of the risks are used for prioritizing risk mitigation actions. The risk register is a tool for allocating managerial responsibility for specific tasks and for reporting and monitoring the status of the risks. The effective use of this project control tool includes regular and frequent reporting on each risk until the risk or the program passes a point where the risk is no longer an issue and is retired.

4. REPORTING MANAGEMENT

Q. What are the general objectives of progress reporting?

A. The main objective of reporting is to consolidate performance data to provide the necessary information to program management in a reasonable time and in an understandable format that allows program management to make the necessary decisions based on the Program's reported status.[22]

Q. What types of information is typically provided in performance or progress reporting?

A. Performance and progress reporting typically is as elaborate as the project or program being reported. For instance, on a small or routine project, a simple status report will provide information such as overall percent complete and a status dashboard for individual elements (e.g. schedule, cost, risk, etc.). PMI notes that more elaborate reports may include:[23]

- *"Analysis of past performance,*
- *Analysis of project forecasts (including time and cost),*
- *Current status or risks and issues,*
- *Work completed during the period,*
- *Work to be completed in the next period,*
- *Summary of changes approved in the period, and*
- *Other relevant information, which is reviewed and discussed."*

On large and complex projects, such as megaprojects or megaprograms, it is common for there to be multiple types of reports used that each serve a specific intent as far as the information gathered or the intended audience of the report.

G. PRE-EXECUTION PLANNING

Q. Describe the pre-execution planning for megaprograms.

A. Pre-execution planning occurs at different levels. At a strategic level, governance framework, functions and processes must be developed. This process would include, for example:

- Determining governance requirements for the megaprogram and how those functions and processes will be integrated into existing governance frameworks;
- Developing a schedule and roadmap for implementing the governance requirements, including prioritizing those requirements, identifying the resources required, and determining whether it may be possible to leverage existing resources or streamline existing governance frameworks;
- Establishing governance roles, responsibilities and authorities; and,
- Establishing the governance functions and processes, which then also must be tested.

Q. What other pre-execution planning occurs?

A. Although it may be called different names, a Planning Process Group will establish the total scope of the effort, define and refine the objectives, and develop the course of action that will be required to attain those objectives. The output of the Planning Process Group is a program management plan (which again may be called different names) and related program documents, which address all aspects of the scope, time, costs, quality, communications, human resources, risks, procurement, and stakeholder management. This process, of course, requires a significant amount of time and funds relative to the size and complexity of the program or project being planned.

Q. Please provide some more detailed examples of the pre-execution planning that would occur in the development of the program management plan and related program documents.

A. For example, schedule management would include the identification of the planned work scope, activity definition and sequence, activity resource and durations estimates, and the development of a schedule. Under cost management, the scope of planned work would be identified, costs would be estimated, and a budget would be determined. Under risk management, the planned work would be identified, risks would be identified, qualitative and quantitative risk analyses would be performed, and risk mitigation responses would be developed. These program documents, and the activities, costs, resources, durations, etc., contained therein, are all interdependent, and must be aligned so that they are consistent with the scope, and enable the objectives of the program management plan, and at a higher level, the program charter. This alignment can be a complex process that takes a significant effort to achieve.

Q. Is it typical in a megaprogram for the pre-execution phase to include execution of smaller projects in accordance with the proposed procedures and project control tools so that those procedures and project control tools can be tested and lessons learned incorporated?

A. Yes. In a megaprogram, program management will often identify a few projects on which the project control tools can be "tested". This allows for lessons learned to be incorporated into the program management plan as well as then being able to adjust and/or enhance those project control tools in order to avoid and/or minimize any issues during execution of the program that may have been encountered in the pre-execution phase. By undertaking these initial projects prior to the execution phase of the overall program, opportunity exists to anticipate the types of problems that may potentially occur in the future and adjust its planning accordingly to mitigate such risks.

Q. Is it possible to rigidly follow an execution plan set early in a megaprogram for the megaprogram's entire duration?

A. Typically, no. Construction projects inherently are executed within a dynamic environment and can be influenced by a myriad of factors, events and issues arising during the execution. Progressive elaboration of the execution plan allows the program management team to continuously improve the process in place as more detailed and specific information is obtained.

H. COST TREATMENT OF MEGAPROGRAMS FOR REGULATORY PURPOSES

Q. Is it typical for a utility to allocate all of its planning costs in a multi-unit megaprogram to the first unit, instead of allocating those costs across all units?

A. Yes. With a multi-unit megaprogram, while there are many common costs that benefit all units, those costs must be expended to allow even the first unit to be operable. For example, a program, or any of its individual projects or units, cannot proceed until all of the policies, procedures, and project control tools and systems are established in addition to the actual development of the schedule, cost estimate, and risk management plan. As another example, common facilities needed for all units often have to be completed prior to execution of the first unit, meaning the costs of such facilities are absorbed upfront, even though the later units will have the benefit of the facilities being in place. Therefore, given the net benefit to the program, it is both appropriate and reasonable to allocate all of the planning costs to the first unit, because that is the most cost-efficient way for the program to proceed.

Q. Is it unusual for a megaprogram, such as the Darlington Refurbishment Program, to have its entire cost estimate approved by the regulatory body prior to the program's execution?

A. No. I am aware of a number of regulated utility projects where the commissions approved the cost estimate before the program was executed. For example, the Georgia Public Utility Commission approved the cost estimate for the construction of the multi-billion dollar Vogtle Nuclear Units 3 and 4, as did both the Mississippi Public Utility Commission regarding the construction of the Kemper IGCC Generating Power Project, and the Indiana Utility Regulatory Commission regarding the Edwardsport IGCC Power Plant. The Georgia PUC found that, *"as a matter of fact that Georgia Power's projection for the total costs* [Georgia Power share $6.4B] *for Vogtle 3 and 4 is reasonable."*[24] The Oregon Public Utility Commission in its Order regarding the $514 million estimate for the Carty combined cycle natural gas fired plant found that the plant's cost estimate was reasonable and prudent.[25] The State Corporation Commission of the

Commonwealth of Virginia approved the cost estimate of the Greensville County Power Station, a 1588 MW natural gas combined cycle plant, noting in its order, *"We find that the estimated cost of the Project-$1.33 Billion (excluding financing costs) –is reasonable. …Dominion has established in this proceeding that the estimated capital costs of the Project, along with the protections negotiated by Contract, are reasonable and prudent."*[26] I also understand that the South Carolina Public Utility Commission also approved the $4.5B 2007 ($6.3B with escalation) cost estimate for the two 1117 MW units SCANA nuclear project prior to its execution.[27]

Q. In the United States, do the regulatory commissions regularly allow costs to go into rate base before a project is completed?

A. Yes. Due to regulatory uncertainty that occurred in the late 1980s and 1990s regarding inclusion of costs into rate base and that decision not being made until the project was completed, in order to provide incentives to utilities to construct new projects, upgrade existing projects and address concerns regarding regulator uncertainty, a number of states passed statutes and implemented accompanying regulation to mitigate risks. Regulations generally include some or all of the following elements: approval to construct the project, approval of the cost estimate, and allowing recovery of pre-construction costs, etc.

IV. PROGRAM-SPECIFIC

A. DESCRIPTION OF THE DARLINGTON REFURBISHMENT PROGRAM

Q. Do you consider the Darlington Refurbishment Program a megaprogram as defined within the industry?

A. Yes. My review of the DRP has identified that it has the following attributes of a megaprogram:

- The refurbishment is complex from both an engineering and construction perspective;
- Total execution duration from the Breaker Opening until its estimated completion is approximately 9 1/2 years;
- Engineering for later units will overlap with construction of the first unit;
- There are multiple specialty equipment and material suppliers;
- There are multiple specialty trade contractors;
- There are multiple project stakeholders at both the ownership and the consumer levels; and,
- There is much public and political interest.

By every measure generally used in the industry, the DRP is classified as a megaprogram.

Q. What is your understanding of the overall purpose and scope of the Darlington Refurbishment Program?

A. I understand the purpose of the Program is to extend the operating life of the Darlington Station by approximately 30 to 35 years. The refurbishment involves an outage for replacement of life-limiting components, as well as an inspection and maintenance or replacement of other components that are most effectively done during the refurbishment outage.

Q. Would you consider this a First-of-a-Kind (FOAK) program?

A. Yes. My understanding of OPG's planning is that OPG is treating this as a FOAK program, and in my opinion, it makes sense to do so. While there are other Canadian nuclear units that have gone through refurbishments, including Point Lepreau Generating Station, Bruce Nuclear Generating Station, and the Pickering Nuclear Generating Station, the difference between those refurbishments and the DRP is the fact that the refurbishment of each DRP unit will be performed while immediate adjacent units remain in operation. In addition, each unit refurbishment will begin from a hot unit versus other refurbishments that involved units that were laid up for an extended period of time prior to the refurbishment. There is simply not a good model for a brownfield nuclear project, other than general megaprogram models, in terms of scope, schedule, and cost. I am not aware of another project in which one nuclear reactor has been shut down and refurbished from a hot state while the other immediate adjacent reactors continue to operate. This further makes it difficult to compare or benchmark this Program with any other. Further, the DRP will involve other FOAK aspects involving design, equipment, and execution methods.

Q. Did you assess OPG's planned execution for dealing with the FOAK aspects of the Program?

A. Yes. From my assessment, I determined that OPG is utilizing its Project Oversight Standard, which provides the oversight principles and requirements to be applied to the DRP and specifies that increased levels of oversight from multiple groups will apply to Program areas that include new processes or technology. For example, the FOAK work goes before the Options Review Board to vet readiness. The Options Review Board is chaired by the Vice President, Refurbishment Execution and consists of senior representatives from Operations and Maintenance, Engineering, Planning and Controls, Execution, Supply Chain, Finance and External Oversight. My assessment further found that the execution of FOAK and First-in-a-While (FIAW) work has been elevated as a key risk and has been factored into the probabilistic

modeling for the $12.8B cost estimate for the Program.[2] This will require a cross-cutting comprehensive mitigation strategy.

Q. What is OPG doing to mitigate the FOAK/FIAW risks?

A. In review of DRP documentation and interviews with OPG personnel, I have identified that engineering, project teams, and various execution and functional groups are identifying work that is FOAK or FIAW using a rating tool containing 40-plus prompts and 0-3 scoring in the following six areas:

- New design/innovation/software unique to project;
- New line of equipment, devices, materials;
- New installation method/tools or first time in 5/10/20 years;
- Work that is new to performing group and oversight or both;
- Equipment/assets that have not been maintained/accessed for 5/10/20 years; and,
- Unprecedented scale of activity (>10x, >20x, >50x).

Specific mitigation actions are then defined for FOAK/FIAW risks, and tracking of the mitigation actions is in progress. All of this work is being integrated into the work program at a strategic and tactical level.

Q. Did you determine what contracting strategy OPG is using for the Program?

A. Yes. My assessment found that OPG is approaching the contracting strategy for the Program using a multi-prime contractor model in which there is more than one prime contractor working on the Program. OPG has a separate contract with each prime contractor, and each prime contractor is responsible for the completion of the work under its particular contract, but not for the entire Program. OPG is the integrator between the prime contractors and is responsible for the

[2] The $12.8B estimate includes $2.4B in interest and escalation.

entire Program including deliverables, cost and schedule. This is, in my opinion, important given the scale, technical complexity and integrated nature of the Program. As noted earlier in my testimony, this contracting model is typical of what would be expected on a megaproject or megaprogram.

Q. What is the overall schedule for the Darlington Refurbishment Program?

A. Based on the information I have reviewed, OPG anticipates a high confidence duration for each unit outage of 37 to 40 months. The schedule begins with the Darlington Unit 2 outage in October 2016. It will take up to 112 months (to February 2026) to complete refurbishment of all four reactors.

B. ORGANIZATION AND PEOPLE

Q. Before discussing the capabilities of the OPG Program Management Team, what do you understand to be the division of responsibility on the Program?

A. Based on my review of the Program record and interviews with OPG personnel, I identified that a separate Nuclear Refurbishment Organization has been established within OPG. Its charge, as established by the DRP Charter, is to plan and execute the refurbishment, as well as returning the units to operations and manage the refurbishment closeout.[28] The Nuclear Refurbishment Organization receives support from many functions, both nuclear and non-nuclear, within the Company.[29] I also determined that OPG is using a matrix organizational structure which, as discussed earlier in my testimony, is common in megaprograms. I found that OPG is using a strong matrix organization comprised of full-time project managers with considerable authority and full-time functional support staff,[30] which I consider appropriate for the DRP.

Q. Did OPG develop program and project management plans and are they consistent with industry best practices?

A. Yes. I determined that OPG initially developed a Program Charter that generally defined the scope to be undertaken and from that Charter, developed program and project management plans. I found the content and scope of OPG's program and project management plans consistent with industry best practices and what I have seen in megaprojects and megaprograms at this stage of their life cycle.

Q. Did you assess OPG's oversight of the Program?

A. Yes. I found that oversight of the Program occurs both externally and internally. The Program oversight occurs from the following groups: The Board of Directors (Board); independent experts; the Darlington Refurbishment Committee (a Board subcommittee); Internal OPG Audit; the Nuclear Safety Review Board; the Refurbishment Construction Review Board; the CEO and

Enterprise Leadership Team; Management Systems Oversight (MSO); the Program Assurance Group; and, steering committees for each major vendor. MSO acts as the Program Owner for oversight, which entails monitoring compliance with project and program standards to ensure Program objectives are achieved and facilitating and coordinating internal and external audit and oversight functions.[31]

Q. In your opinion does OPG possess the required experience and expertise to design and construct a megaprogram the size and complexity of the Darlington Refurbishment Program?

A. Yes. I found that OPG has a long history of managing nuclear construction projects and was intimately involved with the engineering and management of those projects. We interviewed 15 individuals involved in the DRP at different levels and functions. The group represented a vast amount and a breadth of nuclear experience. For example, some individuals had actually been involved in the original construction of Darlington. Others had come to the DRP after years of experience in multiple nuclear programs. My conclusion was that OPG sought to find the most qualified individuals in the industry to manage the Program and the individuals that were assigned to manage the Program are qualified and competent.

Q. What were your findings and conclusions pertaining to the OPG oversight of the Darlington Refurbishment Program?

A. I conclude that OPG senior management, executive management, and the Board of Directors: (i) have efficient oversight processes in place; (ii) are focused on important process/progress issues; (iii) are participating fully in strategic decisions; and, (iv) are active in issue resolution and are informed and engaged in the planning and pre-execution phases. I also conclude that OPG's oversight process is thorough, complete and consistent with what I would expect from a reasonable and prudent utility company embarking on this type of megaprogram.

Q. Was OPG's approach to its Program Oversight Organization and Staffing for the Darlington Refurbishment Program reasonable for a megaprogram?

A. Yes. The evolution of the program structure, organization, and staffing that I observed is evidence of management attention and action. I found that the Program Management Organization and Staffing decisions were reasonable and in accordance with good utility practice.

C. POLICIES AND PROCEDURES

Q. Did you conduct an examination of OPG procedures and processes as part of your review?

A. Yes, our assessment included a review of OPG's corporate and program-specific policies and procedures.

Q. Can you provide an overview of the types of policies and procedures OPG has in place to facilitate execution of the Darlington Refurbishment Program?

A. Effectively, I found that OPG has structured its policies and procedures into three tiers of supporting documents. At the highest level, "OPG Governance" provides general oversight to OPG's planning and controls through documents such as OPG's Project Management Standard and Project Oversight Standard. In the next tier, OPG has a set of documents that provide additional detail for its nuclear projects portfolio. These cover planning and controls elements such as the gating process, scoping, estimating, risk management, cost control, and scheduling (among others). These same planning and controls elements are further defined for the specific of the DRP in the program-specific tier of OPG's policies and procedures.

Q. How do the Darlington Refurbishment Program-specific policies and procedures differentiate from the organizational policies and procedures?

A. The DRP Charter explains how the Program's policies and procedures align with the overall requirements and expectations of OPG.[32] This is effectively the difference between the different tiers of policies and procedures. At an organizational and portfolio level, they communicate the general requirements and expectations; whereas at the program level, they expand on those requirements and expectations to define how the work will actually be performed, monitored, and controlled during execution of the Program.

Q. What types of program-specific policies and procedures has OPG implemented?

A. My assessment found that OPG has established and implemented program-specific policies and procedures to support the scoping, estimating, risk management, scheduling, project control, and records and document management processes. In addition, a set of 23 program management plans were implemented to address the function-specific requirements and processes for DRP execution (e.g. planning and controls, environmental, contract management, operations, quality, etc.).

Q. What were your overall findings of your review of OPG's policies and procedures?

A. In reviewing OPG's policies and procedures, both from an organizational and program-specific standpoint, I found they are exemplary in their thoroughness and alignment with other individual policies and procedures providing OPG with a comprehensive tool from which it can properly execute the Program. In addition to reflecting corporate standards and expectations, the policies and procedures support OPG's adherence to its regulatory requirements. Each policy and procedure was written in a way that aligns with industry best practices, as applicable, as prescribed by leading project management organizations such as PMI and AACE.

D. PROJECT CONTROLS

Q. What did you find relative to how project controls are implemented and managed on the Program?

A. My assessment found that project controls are managed from both a program and project-level with the Project Planning and Controls (PP&C) group being accountable for the overall program-level scope, cost and schedule management, estimating, forecasting, risk management, and major milestone management. As such, PP&C has responsibility for establishing the project controls standards and tools that are used on the Program.[33] I found that OPG has a dedicated program management plan for its intended use during planning and execution of the Program.[34] This document provides an overview of the project controls functions as well as the roles and accountability of key personnel in the Program as it pertains to project controls. My review of the Program record and interviews with OPG personnel determined that the project controls systems in place on the Program include: Primavera P6 (schedule management); Ecosys (cost management); RMO (risk management and oversight); and an integrated database (used for reporting program/project metrics).

1. ESTIMATING AND COST MANAGEMENT

Q. Did you assess OPG's role in developing the Program Release Quality Estimate?

A. Yes. I found that OPG had two primary functions in the RQE development: 1) provide oversight to and approval of EPC vendor estimates; and, 2) facilitate and perform estimate vetting, reviews, and validations of estimate submissions with confirmation of the recommended class of estimate achieved.[35]

Q. What is the intent of the Release Quality Estimate?

A. It is my understanding that the intent of the RQE is to have a 4-unit cost and schedule estimate for the purposes of obtaining execution phase approval of the DRP. The RQE incorporates: scope; engineering design; contracting strategy; cost estimates; schedule; owner's costs; contingency; and, interest and escalation.[36]

Q. Did the RQE development align with GAO's best practices and twelve step estimating process you mentioned earlier in your testimony?

A. Yes, it did. My assessment of how the OPG estimating process aligned with the twelve-step process developed by the GAO[37] is summarized as follows:

1. Define estimate's purpose. *"The Darlington Refurbishment Project Release Quality Estimate has been developed as a culmination of the Refurbishment Project planning effort to establish a high confidence, four-unit total program life cycle cost estimate."*[38]
2. Develop estimating plan. *"The Nuclear Refurbishment RQE Cost Estimate Plan, NK-38-PLAN-09701-10235, provides the outline of the activities required to generate a total program cost estimate as a progression from the previous program funding approved, Release 4D November 2014. This plan defines the estimating activities executed to developed the total program cost."*[39]

3. Define program characteristics. *"The DRP is a four-unit 30 year life extension project conducted through unit outages and comprised of replacement of life-limiting components, as well as, maintenance or replacement of other components most effectively conducted during a refurbishment outage period. Key scopes of work comprise re-tube & feeder replacement, turbine generator refurbishment & controls modifications, steam generator cleaning & inspections, fuel handling modifications & replacements, and balance of plant modifications & replacements."*[40]
4. Determine estimating structure. *"The DRP scope is organized into groupings of categories and project groups identified as bundles."* The DRP scope was also developed into a work breakdown structure (WBS).[41]
5. Identify ground rules and assumptions. *"Assumptions made within previous estimates have been validated and transformed into plans with the assumptions closed out accordingly…Estimate basis and remaining assumptions recorded within the RMO Assumptions & Basis Log."*[42]
6. Obtain data. *"The development of the RQE comprises bottoms up estimates generated from EPC Vendors for each project bundle, OPG functional and owner costs generated from OPG estimate owners, and the consolidation of all costs (historical, actual and estimate) by the RQE team and coordinated by the RQE Project Manager."*[43]
7. Develop point estimate and compare it to an independent estimate. In addition to the internal review process, areas of RQE underwent independent review and assessment.[44]
8. Conduct sensitivity analysis. 3-point estimates (optimistic, realistic, and pessimistic) were developed, challenged, and reviewed for all possible variables associated with discrete risks and cost and schedule uncertainties.[45]
9. Conduct risk and uncertainty analysis. *"The determination of DRP contingencies has been made through a robust bottoms up risk review and analysis process, building up from vendors, OPG Projects and, finally OPG Program risk and contingency analysis."*[46]

10. Document the estimate. The Basis of Estimate report, as I discuss later in my testimony, provides the overview of the methodology and process used in development of the RQE.[47]
11. Present estimate to management for approval. The RQE was presented to the OPG Board and approved in a November 2015 meeting.[48]
12. Update the estimate to reflect actual costs and changes. The RQE represents a progression from the previous program funding approved.[49]

Q. Did you review the basis of estimate that OPG developed for the RQE?

A. Yes. I found that OPG prepared a comprehensive basis of estimate document that explicitly aligns with the guidelines established by AACE in its Recommended Practice 34R-05, "Basis of Estimate." OPG detailed its adherence to AACE Recommended Practice 34R-05 as an appendix to the basis of estimate, which summarized the topics outlined by AACE Recommended Practice 34R-05 with the RQE package elements to detail the completeness of the basis of estimate.[50]

Q. Did OPG take into consideration the experience of other refurbishment projects in its development of the RQE?

A. Based on my review and the interviews conducted, it is my understanding that OPG benchmarked against the available cost data from other refurbishment projects at Point Lepreau, Pickering, and Bruce Units 1 and 2, incorporating lessons learned from these projects into the DRP estimate. Due to the limited available data as a result of the uniqueness and FOAK nature of the Program, I understand that benchmarking was largely tied to OPG's operating experience and subject matter expertise.

Q. What Class of estimate is the RQE considered?

A. I understand that the RQE was determined by OPG to be a Class 3 estimate, based on 93% of the EPC execution work estimates comprising of detailed cost line items, which were developed from:

- Bottoms up work flow steps and operations;
- Construction work packages and work tasks;
- Assembly level cost line items by trade discipline; and,
- Site and work face conditions.

The remaining 7% of the execution work was estimated at a summary or semi-detailed level.[51] The largest two bundles, from a cost standpoint, are the Retube and Feeder Replacement (RFR) and Turbine Generator scopes, which collectively comprise 41% of the overall RQE. I understand that these two bundles were developed at a Class 2 estimate level, which provides a higher level of detail than a Class 3 estimate.

Q. What is the expected accuracy range of a Class 3 estimate per AACE?

A. Per AACE recommended practice 18R-97,[52] a Class 3 estimate provides an expected accuracy range of -10% to -20% on the low end and +10% to +30% on the high end. AACE notes that the expected accuracy range provides a general framework for likely outcomes of actual costs, but is affected by the state of technology, availability of applicable reference cost data, and other such risks.

Q. What were your conclusions regarding OPG's estimating process?

A. I found that OPG, in its basis of estimate, noted that AACE's recommended practices 17R-97 and 18R-97 cover "new construction" projects and do not fit a nuclear refurbishment project without adaptations to accomplish the intent of measuring and aligning the maturity of the project

definition with the expected cost accuracy of execution to funding, corporate risk governance, and gating process. I further found that OPG appropriately made the necessary adaptations from that note in AACE's recommended practices and with the completion of detailed engineering and work planning on the DRP, provided management with high confidence as to the Program's scope, cost, and schedule estimates.[53] I also understand that OPG determined the RQE to have a -10% to +25% expected accuracy range based on its detailed EPC estimate vetting and review.[54] I find the estimating process OPG used to be reasonable and aligned with industry standards and what I have seen in other megaprograms.

Q. Based on the expected accuracy range, what do you consider to be the appropriate amount of contingency?

A. Ultimately, it is management's decision to determine the appropriate amount of contingency based on the level of confidence it chooses to fund a program. As I discussed earlier in my testimony, there are various accepted practices for determining the amount of contingency on a project or program. Conducting risk analyses provides management with a mechanism for reaching a determination on what is an appropriate contingency amount.

Q. Did you assess whether the amount of contingency included in the RQE by OPG was reasonable given the nature of the DRP?

A. Yes. In review of the DRP documentation and through interviews with OPG personnel, I have determined that OPG's $1.7B of contingency for the DRP is reasonable. I base this finding on my understanding of the robust method in which OPG determined its contingency amount, which included a comprehensive risk assessment, Monte Carlo simulations, vetting by internal and external parties, and the decision to use a P90 confidence level.

Q. Is it appropriate to use the P90 confidence level to determine the amount of contingency?

A. Yes. Although no specific confidence level is considered a best practice, using a P90 confidence level provides OPG with a high probability that the Program will be completed within the budget. Using a lower confidence level, such as a P50 confidence level, may not adequately address the complexities and risks inherent with the execution of a megaprogram (particularly the extended duration of execution as compared to a typical project), thus increasing the risk of a cost overrun.

Q. Does the estimate account for risks sufficiently?

A. Yes. My assessment found that risks were accounted for as part of the robust contingency development exercises implemented by OPG. Key risks that were considered for contingency on the Program include:[55]

- Schedule extension – contingency is provided to cover the risk of delay up to the high confidence schedule duration, totaling $503 million. This was derived from a detailed analysis of risks and uncertainties associated with critical path activities.
- Estimating uncertainty – because an estimate is truly an 'estimate', contingency is provided to account for the possibility that the actual cost to complete the project may be greater than the estimated cost (exclusive of discrete risk impacts).
- Resource management/bridging between units – contingency is provided to retain critical trades and leadership resources between periods of specific resource demand, totaling $50 million. This is to account for the fact that between periods, such as between completion of Unit 2 and beginning Unit 3, key resources may leave to take on other work. Losing such resources would result in the need to re-train staff and reduce opportunities for gaining efficiencies.

- Vendor performance – contingency is provided to hire replacement contractors, re-train the resources, and self-perform work for short periods, if necessary, in the event that vendor performance becomes irrecoverable.

Q. Did you reach a conclusion as to whether or not OPG met accepted industry standards for estimating on the Program?

A. Yes. I found that OPG's estimating process is well-defined in its policies and procedures and the results of the estimating process are fully explained within the basis of estimate document as well as summarized in material presented to OPG's Board. OPG had a clear intent to ensure its process aligned with industry standards as prescribed by organizations such as AACE, and followed through on that intent by holding itself to the industry standards and documenting its results.

Q. Did you reach any overall opinions concerning the RQE $12.8B estimate for the DRP?

A. Yes. From my review and evaluation of the contemporaneous documentation and the interviews of OPG management, at the time the RQE cost estimate was completed, OPG had ample reason to feel confident in the accuracy of RQE estimate. I found the methodologies employed by OPG to develop the RQE estimate to be *world-class*. A review of all the relevant documentation and interviews with OPG project personnel confirmed the fact that the methodologies employed met all accepted industry standards and guidelines as promulgated by AACE. As I discussed earlier in my testimony, the use of a P90 confidence level, along with the detailed estimate development process, provides OPG with appropriate assurances that the DRP can be completed within the $12.8B estimate.

Q. Does OPG have in place the necessary cost management procedures to monitor expenditures against the RQE?

A. Yes. Through my review of the Program project controls and OPG's management of costs, I identified aspects of OPG's cost controls to include:[56]

- Using standard project reporting to monitor cost performance;
- Reporting and communicating cost trends, performance, and any corrective actions;
- Developing sufficient cost detail to allow for effective cost monitoring, including alignment of the WBS and the cost accounts;
- Ensuring proper project cost or control accounts are set up in OPG's cost management systems;
- Ensuring planned value (or budget) is accurately allocated, and that actual cost is collected in the cost or control accounts to support measuring cost performance;
- Ensuring accrual is captured in actual costs;
- Identifying incorrect, inappropriate, or unauthorized charges and implementing corrective actions to rectify;
- Performing cost trend analyses and forecasting the Estimate at Completion and cash flows; and,
- Evaluating cost impacts of changing conditions and issues on the project budget and cash flow.

These activities align with the program financial monitoring and control activities prescribed by PMI in its *The Standard for Program Management*.[57]

Q. How will costs be tracked and forecasted on the Program?

A. My understanding is that OPG has developed a Cost Breakdown Structure (CBS) that mirrors the WBS and also contains cost-only elements such as contingency and interest that are not included

in the WBS. The CBS identifies all the Control Accounts used by the Program, each of which contains one or more Work Packages. Budgets for all work are established at the Work Package level, with actual costs being captured at this level to support cost performance monitoring.[58] I also determined that cost forecasting is accomplished by analyzing work performed against the work planned, identifying potential trends, verifying the remaining work, and determining the impact of performance to date on the estimated cost and schedule going forward. The Project Managers are accountable for having the forecast updated, as necessary, to reflect the current status and expected performance of the individual projects.

Q. Does OPG have reasonable processes in place for managing contingency during the execution of the Program?

A. Yes. It is my opinion that OPG has established appropriate processes and controls for management of contingency during the Program's execution. All program or project contingency changes will be documented and reflected in the Program risk register, which I discuss later in my testimony, and reviewed and dispositioned by the Change Control Board (CCB) and the Program Change Control Board (PCCB). OPG's policies dictate that drawdown of contingency will be avoided whenever possible through the effective management and mitigation or risks and trends.[59] When a risk or trend cannot be fully mitigated, a drawdown of contingency will occur.

Q. Are the OPG cost management processes in accordance with industry best practices and typical of what you have found on other power plant megaprograms?

A. Yes. As noted by PMI, *"Much of the effort of cost control involves analyzing the relationship between the consumption of project funds to the physical work being accomplished for such expenditures."*[60] As discussed above, OPG has the procedures and processes in place to effectively monitor and capture the actual costs and evaluate performance against the physical

work completed, and in my opinion, in many aspects exceeds what I have found on other megaprograms similar to the size and complexity of the DRP.

2. SCHEDULE MANAGEMENT

Q. Did you assess how the schedule for the Program developed?

A. Yes. Based on my review of the DRP information, and as discussed in interviews with OPG personnel, the schedule development process for the Program involved multiple steps, with each step generating a schedule subcomponent that can stand alone to inform the Project Team of that aspect of the final schedule. From my assessment, I understand the schedule development process to include:[61]

- Creation of a Level 1 schedule (Program Integrated Master Schedule, or "PIMS") based on the outage segments;
- Creation of a WBS and execution structure;
- Creation of a resource breakdown structure;
- Creation of a responsibility assignment matrix;
- Creation of a Level 3 schedule with the ability to roll-up to a Level 2 schedule (Nuclear Program Coordination & Control Schedule, or "CCL2");
- Integration and alignment of the Level 2 schedule with the Level 1 outage schedule;
- Integration of the Level 3 schedules with the interface milestones; and,
- Baselining the integrated schedule.

I found that OPG ensures that contractors prepare schedules in accordance with OPG's "Nuclear Projects Scheduling Requirements from EPC Contractors." The contractors' Level 3 schedules are reviewed and then integrated and aligned to the CCL2 and PIMS, using a common WBS and coding guideline.[62]

Q. How are the interfaces between the various projects and vendors managed in the schedule?

A. I determined that OPG created a separate interface/integration project schedule that provides overall control on all work window interfaces. All vendor and OPG schedules are required to

communicate their schedule interdependencies to this project, which allows for communication of vendor schedule progress to other dependent schedules.[63]

Q. How are costs integrated with the schedule?

A. I determined that costs and schedule are integrated at the work package. This allows for monitoring and measuring earned value. As noted in the Planning and Controls Program Management Plan, *"Once the schedule updates are progressed and statused by work package, the physical percent complete, actual start, actual finish, forecast start and forecast finish is prepared and integrated into the cost system used for earned value calculation…"*[64]

Q. Did you determine whether the Program Integrated Master Schedule was fully developed at the time of your testimony?

A. At the time of this testimony, the PIMS is still being vetted and reviewed. A Rev. C version of the schedule is considered by OPG to be approximately 60-70% complete. It is expected that the final PIMS will be fully complete by mid-September 2016, which will then set a control baseline for cost and schedule.

Q. Is this level of schedule development at this time reasonable and what you would expect to see at this stage of the Program?

A. Yes. Breaker Opening is not scheduled to occur until October 2016. The schedule development activities and the level of detail developed at this time is consistent with other megaprograms similar to the size and complexity of the DRP that I have seen at this stage of development.

Q. Has the Unit 2 schedule been fully integrated with the RQE estimate and the Program risk assessment?

A. Essentially yes. There is approximately 4% of the Unit 2 project that has not been fully integrated from a cost, schedule, and risk perspective. This 4% accounts for smaller bundles of scope, typically balance of plant type work, that is non-critical path and will not materially impact the schedule. These remaining bundles currently lack a complete detailed design. Typically, this level of completeness would be expected at this point in the megaprogram. As such, these bundles lack fully refined quantities and, as a result, will carry a higher contingency. As the schedule is vetted and refined through September 2016, OPG's processes will provide for a check to ensure that the baseline schedule and baseline costs are in sync.

Q. Do you believe it is reasonable to use the high-confidence P90 schedule for execution of Unit 2?

A. While there is no prescribed standard for use of a particular confidence schedule over another, OPG, by selecting the P90 schedule for Unit 2, has demonstrated its risk tolerance preference for a high-confidence schedule (aligning with its use of a P90 estimate) to limit the likelihood of schedule overruns. I find OPG's selection of a P90 confidence level for the Unit 2 schedule to be reasonable and in accordance with the robust risk analyses that were performed.

Q. How will OPG manage the schedule?

A. Based on my review, it is my understanding that OPG will manage the Program towards a planned outage duration based on the Level 3 schedules provided by each vendor as integrated into the PIMS. The planned outage duration completes the Program in a shorter duration than the high-confidence schedule. In order to maximize success of the Program, planned non-critical path work (e.g. Balance of Plant work) will not exceed 60% of the critical path (i.e. the RFR bundle).

Vendors will maintain and update their schedules with oversight from the OPG master scheduler.[65]

Q. Is it reasonable to manage the Program based on a planned outage duration?

A. Yes. It is typical on megaprojects and megaprograms, such as the DRP, which are planned to be executed over an extended time to manage the execution based on a planned outage duration. This provides additional assurances that the project or program will be completed within the high-confidence schedule.

Q. Does OPG's schedule processes align with industry standards?

A. Yes. GAO provides ten best practices associated with high-quality and reliable schedules.[66] These practices also align with what is prescribed by AACE and PMI. My assessment of how the OPG scheduling process aligned with the ten best practices provided by GAO is summarized as follows:

- Capturing all activities: *"The schedule should reflect all activities as defined in the project's work breakdown structure (WBS)…"*
    - DRP Schedule Management: *"In order to successfully implement the Multi Level Scheduling Model we will utilize the WBS functionality in P6 to allow progress on lower activities to roll up through the WBS to Work Packages and Control Accounts."*[67]
- Sequencing all activities: *"The schedule should be planned so that critical dates can be met. To do this, activities need to be logically sequenced—that is, listed in the order in which they are to be carried out."*
    - DRP Schedule Management: *"Tasks are linked together and sequenced to identify the relationships between deliverables, sub-deliverables, activities, tasks, and subtasks."*[68]

- Assigning resources to all activities: *"The schedule should reflect the resources (labor, materials, overhead) needed to do the work…"*
    - DRP Schedule Management: *"Crew codes will be used to estimate resources and provide resource demand curves. All level 3 activities will be resource loaded. Labour will be identified in hours. Commodities such as Pressure Tubes or Control Valve can also be included in the RBS* [Resource Breakdown Structure]. *Common critical equipment such as the Turbine Hall Crane will also be included in the RBS in order to identify conflicts in requirements."*[69]
- Establishing the duration of all activities: *"The schedule should realistically reflect how long each activity will take."*
    - DRP Schedule Management: *"To identify the time- risk associated with a critical or near critical activity or task, the Darlington Refurbishment and/or contractor staff should apply the Program Evaluation and Review Technique (PERT)."*[70]
- Verifying that the schedule can be traced horizontally and vertically: *"The detailed schedule should be horizontally traceable, meaning that it should link products and outcomes associated with other sequenced activities."*
    - DRP Schedule Management:[71]
        - *"A horizontal schedule review of the sequence of scheduled activities and logic ties is performed to ensure prerequisites or constraints are satisfied…"*
        - *"A vertical slide of activities scheduled to be executed concurrently is reviewed…"*
- Confirming that the critical path is valid: *"The schedule should identify the program critical path—the path of longest duration through the sequence of activities."*
    - DRP Schedule Management:

- *"The JV developed the Logic Flow Diagrams with OPG operations and project management and represents the combination of JV and OPG activities that make up the overall project critical path. The duration is based on the as performed Tool Performance Guarantee times and was agreed to between OPG and the JV."*[72]
- *"Input from all project bundles have been incorporated in the critical path and window durations. Each bundle and project was assessed at the level of schedule."*[73]

- Ensuring reasonable total float: *"The schedule should identify reasonable float (or slack)—the amount of time by which a predecessor activity can slip before the delay affects the program's estimated finish date—so that the schedule's flexibility can be determined."*
  - DRP Schedule Management: *"Based on daily status updates in Level 3 schedules, the Master Schedulers will analyze the schedule accuracy, float, extra time and overruns with respect to impact on interfaces across work group or execution windows within segments."*[74]
- Conducting a schedule risk analysis: *"A schedule risk analysis uses a good critical path method (CPM) schedule and data about project schedule risks and opportunities as well as statistical simulation to predict the level of confidence in meeting a program's completion date, determine the time contingency needed for a level of confidence, and identify high-priority risks and opportunities."*
  - DRP Schedule Management: *"P50 and P90 durations have been calculated through detailed schedule risk PERT analysis and adjusted based on management experience."*[75]
- Updating the schedule using actual progress and logic: *"Maintaining the integrity of the schedule logic at regular intervals is necessary to reflect the true status of the program."*

- DRP Schedule Management: *"Level 3 schedules will be updated daily or weekly during the execution phase based on the Outage Segment requirement…Daily updates will include actualizing activities and entering percent complete."*[76]

- Maintaining a baseline schedule: *"The schedule should be continually monitored so as to reveal when forecasted completion dates differ from planned dates and whether schedule variances will affect downstream work."*
  - DRP Schedule Management: *"The progress data is verified and reviewed by OPG. Once reviewed, a variance analysis is produced to provide reasons for any schedule slippages and to determine necessary corrective action/recovery plans when needed. A critical path analysis is also produced using level 3 schedule details."*[77]

Based on my assessment and as summarized above, I found that OPG has the plans and processes in place to effectively develop, manage, and control the schedule in full alignment with industry standards and best practices.

3. RISK MANAGEMENT

Q. Did you assess whether OPG undertook any risk management activities to prepare OPG for execution of the Program?

A. Yes. My assessment found that OPG undertook a number of activities in its identification of key risks to the Program and development of processes in order to manage those key risk factors in addition to others that may emerge throughout the Program execution. I determined that the activities performed by OPG in preparation of the Program included: identification of risk management process;[78] a detailed review of program and project risk and contingencies, development of risk registers based on the detailed review of program and project risks;[79] development of mitigation plans should identified risks emerge;[80] and, development of a Risk Management and Oversight (RMO) Tool that provides project managers with a platform to perform risk management activities for the projects that comprise the Program.[81]

Q. Did you assess whether the risk management process provides OPG with the necessary guidance and direction to ensure risks are closely monitored and managed so as to minimize threats to the $12.8B RQE?

A. Yes. I found that OPG's risk management process provides the authority that ties together all the activities that I described earlier in my testimony – i.e., risk identification, analysis, and mitigation – with a functional complete perspective. The process is an integral part of the overall Program planning that informs all members of the DRP of the risks to the Program, how they will be managed, and who will manage them through the DRP execution. I further found that OPG's risk management process is supported through the incorporation of risk management plans into the individual project management plans. I found that OPG's risk management process is typical of what I would expect to find in a megaprogram such as the DRP, and, like all of the planning documents, the risk management process is a dynamic document that is being used to guide day-to-day decisions by the Program and Project Teams.

Q. How did OPG undertake its identification of risks that may arise on the Program?

A. Through my review of the Program record and my interviews with OPG personnel, I found that risks were identified through a number of sources, including operating experience and external lessons learned, project manager direction, and through the Program Management Office (PMO) risk department proactively seeking input and providing oversight support. Specific activities that facilitated the identification of risks include: facilitated risk workshops; Basis of Estimate and contingency development reviews; and, project schedule reviews.[82] For example, I determined that during the contingency development, the risk register items were input into a RQE template where additional discrete risk and cost uncertainty information, such as three-point estimates, was populated. These RQE templates were subjected to a rigorous screening and challenge process, which included a review panel of subject matter experts.[83]

Q. Did you determine whether OPG developed risk registers?

A. Yes. I found that OPG identified key risk areas from major themes of risk and incorporated these key risks areas into the risk registers. I found that the key risk areas were assigned to executive owners and included a cross-cutting, comprehensive mitigation strategy. Examples of the key risk areas that were identified include: availability/retention of project leadership; availability of skilled craft resources/supervision; and, vendor performance. [84]

Q. Did OPG develop risk mitigation plans for these risks?

A. Yes. As part of my review, I examined a sample of the mitigation plans that were developed for these key risk areas. For example, the mitigation plan for vendor performance included:

> *"A Readiness to Execute oversight plan has been issued. This will support the detailed readiness assessment challenge process leading to the readiness milestone in June 2016. Plans to improve collaborative activities with the vendors for Engineering, Procurement and Construction have been developed. It includes active management and assisting*

vendors in removing barriers to work. A Nuclear Construction Supervisor Academy is operational, and is integral in improving vendor supervisory performance. The integrated field readiness walk downs at T-6 months and T-3 months with refurbishment and vendor teams will also promote better vendor performance overall in the field portion of work." [85]

Q. Did OPG, in its risk planning, take lessons learned from past experience or other nuclear projects into account?

A. Yes. Through my review and in interviews with OPG personnel, I found that OPG captured operating experience and lessons learned from Darlington projects, past nuclear refurbishments on other units, and other large projects involving CANDU reactors. OPG identified lessons learned from previous refurbishments and megaprojects at other nuclear stations such as Pickering Nuclear Station, Point Lepreau Nuclear Generating Station, Bruce Nuclear Station, Vogtle Electric Generating Plant, and Watts Bar Nuclear Generating Station and have taken specific actions in the DRP to incorporate those lessons learned. OPG also identified lessons learned from non-nuclear megaprograms including the London Olympics and the Heathrow International Airport. Some of those lessons learned include lack of management and contractor oversight, lack of intrusive performance assessments, and performance assurance independent assessment. There have also been lessons learned from the Darlington SIO and F&IP, which included the Darlington Energy Complex, Darlington Water and Sewer, Heavy Water Storage and Drum Handling Facility, Darlington Operations Support Building Refurbishment, Refurbishment Project Office, Electrical Power Distribution System, RFR Island Support Annex, Vehicle Screening Facility and the Re-tube Waste Processing Building. Through interviews with OPG personnel, I found that OPG appropriately identified lessons learned and took appropriate actions to apply these lessons learned to OPG's operating environment and implement into the contractors' plans. In addition, I found that OPG continues to work in a collaborative manner

with Bruce Power to share lessons learned identified during both companies' overlapping refurbishments.[86]

Q. How has risk been integrated with cost and schedule?

A. OPG evaluated risks and uncertainties for each segment of the Program, leading to the development of schedule and estimate contingency and the basis for the high-confidence (P90) schedule and estimate.[87]

Q. Did OPG's cost and schedule risk contingency development align with industry standards?

A. Yes. OPG's cost and schedule contingency development aligns with industry standards, such as those prescribed by AACE. AACE explained that, *"The probability and impact of risks/uncertainties are specified and the risks/uncertainties are linked to the activities and costs that they affect. Using Monte Carlo techniques one can simulate both time and cost, permitting the impacts of schedule risk on cost risk to be calculated."*[88] I found that OPG has completed this effort by identifying risks, estimating the probability of occurrence, estimating the risk impact, considering risk responses, addressing cost and schedule dependency, assessing overall outcomes through Monte Carlo simulations, and estimating and evaluating contingency.

Q. Did you assess whether OPG has risk management processes in place to use during execution?

A. Yes. I understand that risk management on the Program is guided by the "Nuclear Projects Risk Management" manual, which provides direction as to both the day-to-day risk management activities and the risk management preparations for authorization packages presented at funding gates/committees.[89] In addition, as I previously discussed in my testimony, the Program utilizes an RMO tool that provides project managers with a platform to perform risk management activities for the projects. The RMO tool was developed by OPG to consolidate various risk-

related logs into one source in order to streamline work flows. It includes issues log, OPEX [Operating Experience], Lessons Learned, Oversight Findings and Plan, and new daily SharePoint logs to establish a comprehensive resource for risk management.[90] The RMO is owned and administered by the PMO, which also provides training, support, and guidance for the use of the RMO tool.[91] As part of the monitoring and reporting of risks, I found that OPG can incorporate known risks into the forecasts through calculating a project's current estimate at completion or estimate to completion. The cost forecast is then justified through a pending contract change or by managing the specific risk through mitigation plans.[92]

Q. How is the risk register maintained during execution?

A. I determined that the risk register is maintained both at the Program-level and at the individual project level. The Program risk register is managed by the risk management group of PP&C and contains risks that apply to the entire DRP and risks that are related to DRP functions (e.g. supply chain, planning and control, etc.). The Project risk registers are managed by each individual bundle and contains risks that apply to project work within the given bundle (e.g. balance of plant, fuel handling, etc.).[93]

Q. How are risks reported?

A. I determined through my review of the Program record and interviews with OPG personnel that risks are reported as part of the monthly reporting cycle, including top risks from each bundle and function and key DRP program risks. The type of information included in the risk reporting includes a description of the risk, response strategy and status, current risk score, post-risk response risk score, and target date for reaching post-risk response score.[94] The risk scores measure the probability of occurrence, schedule impact, and financial impact of a given risk and assists those inside and outside the project in quickly identifying the biggest risks to the project at a given point in time.

Q. Do OPG's risk management processes align with industry standards and are they in accordance with prudent utility practices?

A. Yes. I found that OPG's risk management processes utilize the fundamental steps of: planning; identification; assessment; treatment; and, monitoring and control,[95] which align with industry standard practices such as those prescribed by PMI[96] and AACE.[97]

Q. In your opinion, will OPG's risk management process assist OPG and the DRP stakeholders in maintaining confidence that the Program can be executed within the $12.8B estimate?

A. Yes. It is my opinion that OPG has, through a reasonable and prudent process, identified those risks that could potentially impact the Program's cost and schedule and has instituted practices in accordance with industry standards that will allow OPG early identification should any of those risks emerge, allowing OPG to quickly implement the mitigation plans, thereby either avoiding or minimizing the impact of that risk. Further, I found that OPG developed through its Monte Carlo risk simulation modeling, the necessary risk contingency to address such risks, thereby providing a high confidence that the Program can be executed within the $12.8B RQE.

4. REPORTING MANAGEMENT

Q. Did you determine what types of reports will be generated by OPG during execution of the Program?

A. Yes. I found that OPG has established a repository within the DRP Data Warehouse for metrics and reporting data. A comprehensive, tiered metrics infrastructure has been established and will be maintained at the program, project, and functional levels to measure progress in areas of: environment, health, and safety; scope; schedule; cost; and, quality.[98] In addition, a variety of standard reports will be generated during the Program's execution. I also identified that straw-models for all key reports are being developed to ensure adequate information is available to support decision making and actions. OPG has indicated that all key reports will be in place by the fourth quarter of 2016.[99]

Q. How are decisions communicated across the Program?

A. Through my review of the Program record and interviews with OPG personnel, I found that OPG developed an Integrated Reporting Plan (IRP) to communicate how information and data is grouped, presented, and distributed to accommodate the management of the Program, Bundles, and projects.[100] The IRP identifies all stakeholders, frequency, and elements to be reported on.

Q. How can OPG gain assurance that the information it receives from contractors is accurate and adequate for reporting requirements?

A. During the pre-execution phase, I found that OPG observed that contractors were not adequately reporting low-level events, which made identification and response to adverse trends difficult. To correct this, I found that OPG has embedded staff at the contractors' premises to assist with enhancing low-level reporting and trending capability, which facilitates identifying corrective actions at an early stage.

Q. How will progress be measured and reported during execution?

A. I understand that OPG utilizes Earned Value Management (EVM) as the fundamental mechanism in evaluating the Program's overall cost and schedule status.[101] Elements of EVM include:

- Planned Value (PV) – the current Control Budget assigned to the work;
- Earned Value (EV) – the dollar value of work performed in terms of the approved budget assigned to the work;
- Actual Cost (AC) – the dollar amount of actual cost incurred as recorded in the OPG financial source system;
- Schedule Performance Index (SPI) – ratio of EV to PV;
- Cost Performance Index (CPI) – ratio of EV to AC;
- Cost Variance (CV) – difference between EV and AC;
- Budget Variance (BV) – difference between PV and AC; and,
- Schedule Variance (SV) – difference between EV and PV.

The above EVM elements are facilitated through the PP&C group. Based on my review, it is my opinion that OPG has a thorough system in place to capture, analyze, report, and respond to progress on the Program.

Q. Does the measurement of progress align with industry standards?

A. Yes, earned value is a widely accepted tool for measuring progress on a program or project and should provide for reliable progress reporting and process control.[102]

Q. Will the reports as developed or envisioned provide the necessary information upon which OPG management can make reasoned and informed decisions regarding the execution of the Program?

A. Yes. The types of reports that OPG is and will be using are what I would expect to see on a program the size and complexity of the DRP and should provide the necessary information in a timely manner to management for incorporation into its decision-making process.

E. PROGRAM EXECUTION

Q. In your opinion, does the fact that the Facilities and Infrastructure Projects and Safety Improvement Opportunities were not executed per the cost and schedule plan foreshadow similar issues in the execution of the DRP?

A. No. Many of these projects were executed under the pre-existing Projects and Modifications organization and did not use a "gated process" that will be used for the DRP execution. While the F&IP and SIO were not completed per the initial planned schedule and estimate when the RQE was submitted, I did not find any fundamental issues that would impact the Program execution. Recovery plans were designed and initiated. Further, I did not find that there were any impacts on the Breaker Opening milestone for the Program's execution. As is typical in any pre-execution period, there are certain projects or activities that must be completed to allow for execution. In addition, as discussed earlier in my testimony, one benefit of having initial projects completed pre-execution is to be able utilize proposed project procedures and project control tools in order to adjust and/or enhance those procedures and project controls to effectively monitor and manage issues as they arise. The lessons learned from these F&IP and SIO occurred in areas such as collaborative planning, scope clarity and control, estimating, scheduling, material tracking, contractor/construction oversight, sub-surface risks, and contract and claims management and have been incorporated into the execution planning for the overall Program. As discussed next in my testimony, OPG has also internalized the process of incorporating lessons learned into its execution planning with its Readiness to Execute (RTE) Plan. Finally, I found that OPG's decision to substantially complete Unit 2 before starting Unit 3 was made to allow the effective implementation of lessons learned.

Q. What do you understand OPG's Readiness To Execute (RTE) Plan to entail?

A. I understand that the RTE Plan includes four plan periods:

- In the lead-up period, the test plans for the test period are developed, and table top exercises are defined to test those plans, processes and activities that cannot be directly tested during the implementation of the test modifications.
- In the pre-test period, work programs and proxies for the test period are refined, challenge meetings are conducted, the Execution Team is indoctrinated on the RTE Plan, and preparation for RTE field work occurs.
- In the test period, field work activities and table top exercises are executed, and the basis of information is developed for conducting extensive lessons learned reviews, focused improvements and corrections to training, work processes, team dynamics and worker and team behaviors.
- Finally, in the implementation of lessons learned period, identified changes are made based on vetted results from the test period, and change management is conducted to ensure that all parts of the integrated execution are practicing the changes in their work.

My assessment determined that the first three plan periods have been completed, and as of the date of my testimony, the final plan period is underway.

Q. Is the planned execution status of the DRP at a stage that you would expect to find at this point in time on a megaprogram?

A. Yes. The policies and procedures, project control tools and systems, as well as the risk management processes are comprehensive, thorough and align with industry best practices. As stated in more detail previously in my testimony, the methodologies employed by OPG to develop the RQE are world class, well-defined, and fully explained. Those methodologies certainly meet all accepted industry standards. The development of the PIMS is typical of what I have seen on megaprograms of this size and complexity. In terms of integration with the RQE estimate and the Program's risk assessment, only four percent remains to be detailed and

integrated, and that is to be expected at this point in the process. Although the F&IP and SIO have not been completed per the initial planned schedule and estimate, the Breaker Opening milestone date for program execution has not been affected, and lessons learned have been incorporated. The RTE work will continue until Breaker Opening as OPG makes identified changes based on vetted results from the Test Period and conducts change management to ensure that all parts of the integrated execution are practicing the changes in its work. Finally, the PIMS will be finalized and issued and the Unit 2 Execution Estimate will be finalized and approved by the Board. Again, the current stage of the DRP development is where I would expect an owner to be in a megaprogram, such as the DRP, as of the date of this testimony.

ENDNOTES

[1] "Managing Gigaprojects: Advice from Those Who've Been There, Done That", Edited by Patricia D. Galloway, Kris R. Nielsen, Jack L. Dignum, Part 1 Megaprojects to Gigaprojects, page 1, ASCE Press, 2013
[2] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, page 66, 2013
[3] GAO Cost Estimating and Assessment Guide, GAO-09-3SP, pages 9-11, March 2009
[4] AACE, Recommended Practice No. 46R-11: Required Skills and Knowledge of Project Cost Estimating, page 2, January 16, 2013
[5] AACE International, Recommended Practice 34R-05, "Basis of Estimate", April 4, 2013
[6] AACE International, Recommended Practice 17R-97, "Cost Estimate Classification System", November 29, 2011
[7] AACE International, Recommended Practice 17R-97, "Cost Estimate Classification System", November 29, 2011
[8] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide),* Fifth Edition, page 195, 2013
[9] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide),* Fifth Edition, page 201, 2013
[10] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide),* Fifth Edition, page 216, 2013
[11] The Owner's Role in Project Risk Management, Chapter 6, Contingency, National Academic Press, Committee for Oversight and Assessment of U.S. Department of Energy Project Management, 2005
[12] AACE Recommended Practice No. 10-90, "Cost Engineering Terminology", page 21, April 25, 2013
[13] AACE Recommended Practice No. 10-90, "Cost Engineering Terminology", page 21, April 25, 2013
[14] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide),* Fifth Edition, page 206, 2013
[15] The Owner's Role in Project Risk Management, Chapter 6, Contingency, National Academic Press, Committee for Oversight and Assessment of U.S. Department of Energy Project Management, 2005
[16] AACE Recommended Practice No. 40R-08, "Contingency Estimating – General Principles", pages 3-4, June 25, 2008
[17] AACE Recommended Practice No. 40R-08, "Contingency Estimating – General Principles", pages 1-2, June 25, 2008
[18] Project Management Institute, *Practice Standard for Scheduling – Second Edition*, pages 27-32, 2011
[19] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, page 185, 2013
[20] AACE Recommended Practice No. 37R-06, "Schedule Levels of Detail – As Applied in Engineering, Procurement and Construction", pages 3-4, 2010
[21] Risk Management Guide for Large Facilities, National Science Foundation, page 6, March 3, 2011; The Owner's Role in Project Risk Management, Chapter 6, Contingency, National Academic Press, Committee for Oversight and Assessment of U.S. Department of Energy Project Management, 2005; Metro Westside Subway Extension, Chapter 6 – Cost and Financial Analysis, Draft Environmental Impact Statement/Environmental Impact Report, September 2010, page 6-2; Overview, Risk Management Requirements Floating Bridge and Landings (FB&L) RFP, SR520 ITP/RFP Risk Management Provisions and Strategies, page 1, January 10, 2011
[22] Project Management Institute, *The Standard for Program Management – Third Edition*, page 77, 2013
[23] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, page 301, 2013
[24] Georgia Public Utility Commission, March 30, 2009 Amended Order, 27849, 2010 Order on Remand, Docket 29800.
[25] November 11, 2015, Oregon PUC Order 15356, Docket UE 294, [CPCN Order June 29, 2012]
[26] March 29, 2016, Commonwealth of Virginia, State Corporation Commission, Case No. PUE-2015-00075
[27] March 2, 2009 South Carolina Public Utility Commission, Order 2009-104 (A)
[28] Darlington Refurbishment Charter, Doc. No. D-PCH-09701-10000, Rev. 003, January 26, 2016
[29] Darlington Refurbishment Charter, Doc. No. D-PCH-09701-10000, Rev. 003, January 26, 2013
[30] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, page 23, 2013
[31] DR Management Systems Oversight Program Management Plan, Doc. No. NK38-NR-PLAN-09701-10001-0010, Rev. 002, October 9, 2015

[32] Darlington Refurbishment Charter, Doc. No. D-PCH-09701-10000, Rev. 003, January 26, 2016
[33] Darlington Nuclear Refurbishment Project Controls Overview (presentation), April 28, 2016
[34] Darlington Nuclear Refurbishment Planning and Controls Program Management Plan, Doc No. NK38-NR-PLAN-09701-10001-002, Rev. 001, March 3, 2015
[35] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[36] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[37] GAO Cost Estimating and Assessment Guide, GAO-09-3SP, pages 9-11, March 2009
[38] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[39] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[40] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[41] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[42] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[43] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[44] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[45] RQE Contingency Development Report, Doc. No. NK38-REP-09701-10304, Rev. 00, October 28, 2015
[46] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[47] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[48] Darlington Refurbishment Program Final Cost and Schedule Estimate – Funding to October 2016, November 13, 2015
[49] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[50] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 0, November 5, 2015
[51] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 00, November 3, 2015
[52] AACE International, Recommended Practice 18R-97, "Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries", November 29, 2011
[53] Appendix 2 – Darlington Refurbishment Program 4-Unit Cost and Schedule Estimate and Economic Update, November 13, 2015
[54] Release Quality Estimate (RQE) – Basis of Estimate Report, Doc. No. NK38-REP-09701-0548257, Rev. 00, November 3, 2015
[55] Darlington Refurbishment Execution Phase Business Case Summary, Doc. No. N-REP-00120.3-10001, Rev. 000, page 31, November 12, 2015
[56] Project Controls, Doc. No. N-MAN-00120-10001-PC, Rev. 000, January 1, 2013
[57] Project Management Institute, *The Standard for Program Management – Third Edition*, page 81, 2013
[58] Darlington Refurbishment Planning and Controls Program Management Plan, Doc. No. NK38-NR-PLAN-09701-10001-0002, Rev. 001, March 13, 2015
[59] Nuclear Refurbishment, Program Change Management, Doc. No. N-MAN-00120-10001-PC-12, Rev. 001, April 22, 2016
[60] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, page 216, 2013
[61] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[62] Nuclear Projects Schedule Management, Doc. No. N-MAN-00120-10001, Rev. 001, May 14, 2013

[63] Planning Assumptions Regarding 4-Unit Refurbishment Schedule, Doc. No. NK38-REP-09701-0568619, Rev. 000, October 27, 2015
[64] Darlington Nuclear Refurbishment Planning and Controls Program Management Plan, Doc No. NK38-NR-PLAN-09701-10001-002, Rev. 001, March 3, 2015
[65] Darlington Nuclear Refurbishment Planning and Controls Program Management Plan, Doc No. NK38-NR-PLAN-09701-10001-002, Rev. 001, March 3, 2015
[66] GAO Schedule Assessment Guide, Doc. No. GAO-12-120G, pages 3-6, May 2012
[67] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[68] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[69] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[70] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[71] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[72] Planning Assumptions Regarding 4-Unit Refurbishment Schedule, Doc No. NK38-REP-09701-0568619, Rev. 000, October 27, 2015
[73] Planning Assumptions Regarding 4-Unit Refurbishment Schedule, Doc No. NK38-REP-09701-0568619, Rev. 000, October 27, 2015
[74] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[75] Planning Assumptions Regarding 4-Unit Refurbishment Schedule, Doc No. NK38-REP-09701-0568619, Rev. 000, October 27, 2015
[76] Darlington Refurbishment: Schedule Management Plan for Integrated Level 3 Execution, Doc. No. N-MAN-00120-10001, Rev. 000, April 4, 2014
[77] Darlington Nuclear Refurbishment Planning and Controls Program Management Plan, Doc No. NK38-NR-PLAN-09701-10001-002, Rev. 001, March 3, 2015
[78] Nuclear Projects Risk Management, Doc. No. N-MAN-00120-10001-RISK, Rev. 002, May 29, 2015
[79] RQE Contingency Development Report, Doc. No. NK-38-REP-09701-10304, Rev. 000, October 28, 2015
[80] Nuclear Projects Risk Management, Doc. No. N-MAN-00120-10001-RISK, Rev. 002, May 29, 2015
[81] Nuclear Projects Risk Management and Oversight (RMO) Tool, Doc. No. N-GUID-09701-10123, Rev. 000, August 7, 2015
[82] Nuclear Projects Risk Management, Doc. No. N-MAN-00120-10001-RISK, Rev. 002, May 29, 2015
[83] RQE Contingency Development Report, Doc. No. NK-38-REP-09701-10304, Rev. 000, October 28, 2015
[84] Darlington Nuclear Refurbishment Project Controls Overview (presentation), April 28, 2016
[85] Darlington Nuclear Refurbishment Project Controls Overview (presentation), April 28, 2016
[86] Memorandum of Understanding on Collaboration during Ontario's Refurbishment Period Between Bruce Power LP (Bruce Power) and Ontario Power Generation Inc. (OPG), November 12, 2015
[87] RQE Contingency Development Report, Doc. No. NK38-REP-09701-10304, Rev. 00, October 28, 2015
[88] AACE International, Recommended Practice No. 57R-09 "Integrated Cost and Schedule Risk Analysis and Contingency Determination Using Monte Carlo Simulation of a CPM Model", June 18, 2011
[89] Nuclear Projects Risk Management, Doc. No. N-MAN-00120-10001, Rev. 002, May 29, 2015
[90] Nuclear Projects Risk Management and Oversight (RMO) Tool, Doc. No. N-GUID-09701-10123, August 7, 2015
[91] Nuclear Projects Risk Management, Doc. No. N-MAN-00120-10001, Rev. 002, May 29, 2015
[92] Darlington Nuclear Refurbishment Project Controls Overview (presentation), April 28, 2016
[93] Darlington Refurbishment Planning and Controls Program Management Plan, Doc. No. NK38-NR-PLAN-09701-10001, Rev. 001, March 13, 2015
[94] Darlington Refurbishment Planning and Controls Program Management Plan, Doc. No. NK38-NR-PLAN-09701-10001, Rev. 001, March 13, 2015
[95] Nuclear Projects Risk Management, Doc. No. N-MAN-00120-10001, Rev. 002, May 29, 2015
[96] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, page 309, 2013

[97] AACE International, Recommended Practice No. 62R-11, "Risk Assessment: Identification and Qualitative Analysis", May 11, 2012; AACE International, Recommended Practice No. 63R-11, "Risk Treatment", August 23, 2012
[98] Darlington Refurbishment Planning and Controls Program Management Plan, Doc. No. NK38-NR-PLAN-09701-10001, Rev. 001, March 13, 2015
[99] Darlington Nuclear Refurbishment Project Controls Overview (presentation), April 28, 2016
[100] Darlington Nuclear Refurbishment Project Controls Overview (presentation), April 28, 2016
[101] Nuclear Refurbishment – Cost Management and Reporting, Doc. No. N-MAN-00120-10001, Rev. 000, October 14, 2013
[102] "Project Performance Reporting and Prediction: Extension of Earned Value Management", A. Czaringowska, P. Jaskowski, S. Biruk, International Journal of Business and Management Studies, Vol. 3, No. 1, 2011

Exhibit PG-1

DR. PATRICIA D. GALLOWAY

President and Chief Executive Officer

PROFESSIONAL EXPERIENCE

Pegasus Global Holdings, Inc. – 2008-Present

As President and Chief Executive Officer of Pegasus Global Holdings, Inc.® (Pegasus-Global), Dr. Galloway oversees all aspects of the firm's management consulting services. Her experience and expertise centers on megaprojects. She has consulted on matters covering the entire project delivery process in the energy and infrastructure industries, working on behalf of private and public sector clients globally. She is an international arbitrator and mediator and serves on several arbitral institutional panels. Dr. Galloway also served as a member of the U.S. National Science Board, appointed by U.S. President Bush with Senate confirmation in 2006 for a six-year term, serving on its executive committee and as its Vice Chair from 2008 to 2010. She received an honorary Doctor of Science from the South Dakota School of Mines in 2011.

With over 38 years of experience, Dr. Galloway's experience includes: strategic advice to boards and senior management concerning governance, management structures and performance, contracting strategies, contract development and risk reviews, project controls, and contract administration; risk management including evaluating corporate-wide enterprise risk management programs, project risk identification, assessment and analysis, trend evaluations and risk reduction plans; Auditing including performance, prudence, and management audits; Integrity Generally Accepted Processes & Practices (G.A.P.P.) Analysis™ of corporate and project specific policies and procedures and benchmarking; and Alternative Dispute Resolution (ADR) services including claims avoidance, non-testifying expert consulting including Testing Expert Evidence,® litigation strategy, assistance in legal counsel and arbitrator selection, and serving as an arbitrator and mediator.

Dr. Galloway has extensive global experience having worked on some of the world's largest projects including: over 30 nuclear power plant projects; Duke Energy's Coal Ash Basin Closure Program; Kemper County IGCC coal plant; Edwardsport IGCC coal plant; Vogtle Nuclear Units 1,2,3,4; Sakhalin Island, Russia, Oil and Natural Gas Pipeline Project; Cadereyta Refinery Project, Mexico; HBJ Pipeline Project, India; Murrin Murrin nickel-cobalt mine, Western Australia; the Tsing Ma Bridge, Hong Kong; Panama Canal; Seattle Sound Transit Light Rail Program; London's Crossrail Project; Citylink Project, Melbourne, Australia; Venice Lagoon Floodgate Project, Italy; Xiaolangdi Dam, China; and, City of Winnipeg, Canada, Capital Improvement Program.

She serves as an advisor to multiple owner and contractor clients including board audit and compliance committees and has served as a member of various risk management assessment and independent review panels (IRP), including advisor to the New York Thruway Authority for the approximately $4 billion New Tappan Zee Bridge, her appointment by both the Governors of Washington and Oregon to the IRP for the Columbia River Crossing Project, and by the Washington Legislature and Governor as Chair of the Expert Review Panel (ERP) for the $3.5 billion Alaskan Way Viaduct Replacement Program.

Dr. Galloway is often retained as a keynote speaker regarding arbitration, mediation, leadership, women in engineering, and risk management. Dr. Galloway has served as a guest lecturer at multiple universities including: Manhattanville College, the University of Melbourne; UCLA; New York Institute of Technology; Central Washington University; University of Wisconsin; Harbin University of Technology in Harbin, China; the University of Bologna, Italy; the Old Master's Program at Purdue University; University of British Columbia and the West Virginia's University Center for Women's Studies Programs.

Filed: 2016-07-29
EB-2016-0152
Exhibit D2-2-11
Attachment 3
Page 85 of 122

The Nielsen-Wurster Group. – 1981-2008

Prior to joining Pegasus-Global, Dr. Galloway was the Chief Executive Officer and Principal of The Nielsen-Wurster Group Inc. (Nielsen-Wurster), an international management consulting firm which specialized in management consulting, risk management and dispute resolution. She served as both a consulting and testifying witness in numerous arbitration forums regarding projects throughout the world: refineries, offshore platforms, oil depots, LNG facilities, petrochemical plants, gas pipelines and compression modules, power plants (wind, nuclear, fossil fuel, gas-fired, combined-cycle, hydroelectric, waste-to-energy, transmission), hotels, casinos, stadiums, commercial offices, hospitals, universities, civic and convention centers, parking garages, process plants, wastewater treatment plants, landfills, airports, highways, bridges, tunnels, mass transit, railroads, port facilities, dams, bulk pharmaceutical plants, manufacturing and other projects.

She was also the Chief Executive of Nielsen-Wurster Asia-Pacific, a Nielsen-Wurster subsidiary corporation, which was located in Melbourne, Australia. In addition, Dr. Galloway served as President of another Nielsen-Wurster subsidiary Nielsen-Wurster ESB, a joint venture with the Electricity Supply Board of Ireland that specialized in power plant maintenance software.

CH2M Hill – 1978-1981

Before joining Nielsen-Wurster, Dr. Galloway was employed by CH2M Hill assigned to the $1.6B Milwaukee Water Pollution Abatement Program (MWPAP). Her responsibilities at CH2M Hill on the MWPAP included preparation of project management training courses, project controls including estimating and critical path scheduling and tunnel inspection, being the first woman tunnel inspector in Wisconsin. In her last role at the MWPAP as the Master Program Scheduler her responsibilities included the preparation and updating of the Program Master Schedule, coordination of all project schedules, involvement with cost engineering functions, preparation of all program / project schedule progress reports for public and client presentations and monitoring compliance with court orders imposed on the Program. Other activities at the MWPAP included authoring a scheduling manual; preparation of bid documents, on-site tunnel inspection, and coordination of a project manager's training series.

Industry Activity – 1978-Present

Dr. Galloway is an internationally recognized leader in the engineering and construction arena. In 2004, she served as the first woman President of the American Society of Civil Engineers (ASCE). Dr. Galloway has been recognized by her peers and is an elected member to the College of Commercial Arbitrators, the National Academy of Construction, the Pan American Academy of Engineering, and the position of Fellow in several professional organizations.

Dr. Galloway is regularly consulted by private and public organizations and government entities on trends in the industry, the media regarding current topics and events, universities seeking input on university curricula, mentor programs, engineering education, research and diversity issues, and professional societies relative to topics of interest to its membership. Her achievements have been highlighted by TED with her TEDx talk on "Are Engineers Human", on Sky News Australia TV, ADR Perspectives, PM Network, *Time* magazine, CNN Lou Dobbs, Discovery Channel, *Engineering News Record*, and Federal Technology Watch. Dr. Galloway was also a blog writer for *Engineering News Record* discussing current trends, challenges, and hot topics in the construction industry.

REGISTRATIONS / CERTIFICATIONS

- Certificate in Dispute Resolution, Pepperdine Law School (Straus Institute)
- Diploma in International Commercial Arbitration, Oxford, Jesus College (CIArb)
- Certificate of Director Education, National Association of Corporate Directors (NACD)
- Professional Engineer in the following U.S. locations:

  - Arizona #16978
  - Colorado #28566
  - Florida #44498
  - Georgia #031939
  - Kansas #19495
  - Kentucky #17690
  - Mississippi #25328
  - New Hampshire #12184
  - Ohio #72520
  - New Jersey #GE-29321
  - New York #060684-1
  - Pennsylvania #PE-046146-R
  - Washington #28262
  - Wisconsin #21786-006
  - Wyoming #PE-4974

- Professional Engineer in the following global locations:
  - Australia, Institution of Engineers Australia, CPEng #1194740
  - Canada, Province of Manitoba #15061
- International Registry of Professional Engineers in the discipline of Civil Engineering, Construction Management by the United States Council for International Engineering Practice (USCIEP) #131
- Certified Examiner, National Council of Examiners for Engineering and Surveying (NCEES) #12046
- Certified Project Management Professional (PMP) #0012-84
- Professional Member of the Royal Institution of Chartered Surveyors, Faculties of Project Management and Risk Management (MRICS)
- Certified Forensic Claims Consultant (CFCC), AACE

ARBITRATION EXPERIENCE

Dr. Galloway is a Fellow of the Charted Institute of Arbitrators (CIArb) and of the College of Commercial Arbitrators (CCA) where she co-chairs its Construction Committee. Dr. Galloway is a member of the American Arbitration Association's (AAA) Board of Directors and its Executive Committee and Past Chair of the AAA's National Construction Dispute Resolution Committee (NCDRC). Her arbitral panel memberships include:

- AAA: Master Mediation, Megaproject, Energy, Commercial, Construction, and, Large Complex Case.
- The International Center for Dispute Resolution (ICDR) Panel, including its International Energy Arbitration List;
- International Center for Conflict Prevention & Resolution (CPR): Energy, Construction, and Cross-Border
- The United States Council for International Business (USCIB) International Chamber of Commerce (ICC) Panel.

She has served as a sole arbitrator, Chair and member of three-member panels arbitrating a large number of disputes involving commercial, construction and energy issues of private and governmental facilities in the energy, process, and building industries. Dr. Galloway has experience with numerous arbitration forums including: ICC, UNCITRAL, Singapore International Arbitration Center (SIAC), and the London Court of International Arbitration (LCIA), with disputes ranging from US$1 million to US$6 billion.

BOARDS AND DIRECTORSHIPS

For-Profit Boards

- Pegasus Global Holdings, Inc., 2000-Present
- Bergmann and Associates, 2012-2016
  - Governance Committee, 2015-2016
  - Future Leader Development Committee, 2013-2016
- Unionville Vineyards (Partner), 1986-2008
- The Nielsen-Wurster Group, Inc., 1984-2008

- Nielsen-Wurster Asia-Pacific Pty. Ltd., 2001-2008
- Unionville Aviation, 1987-2005
- Nielsen-Wurster ESB 1986-1989

Non-Profit Boards

- Central Washington University Foundation Board of Trustees, 2012-Present
  - Treasurer, 2013-2015
- Pacific Science Center, 2012-Present
  - CEO Search Committee, 2014-2015
  - Development Committee, 2013-Present
  - Co-chair of the Festival of Fountains 2014
  - Chair of the Foundations of Science Breakfast 2015
  - Co-chair of the Foundations of Science Breakfast 2014
  - Finance and Audit Committee, 2012
  - Science & Education Advisory Committee, 2012-Present
- Life Support, Board of Trustees (Philanthropic Organization) 2010-Present
- The Patricia Galloway and Kris Nielsen Foundation, 2009-Present
- American Arbitration Association, 2009-Present
  - Executive Committee, 2014-Present
- National Science Board, (Presidential Appointment and Senate Confirmation) 2006-2012
  - Vice Chair, 2008-2010
  - Executive Committee, 2010-2011
  - Chair, 60th Anniversary Committee, 2008-2010
  - Sustainable Energy Task Force Committee, 2007-2009
  - Audit & Oversight Committee, 2006-2012
  - Polar Research Committee, 2006-2012
  - Committee on Strategy & Budget, 2006-2012
  - International Task Force Committee, 2006-2008
- Pan American Academy of Engineering, 2006-2011
- Order of the Engineer, National Board of Governors, 2004-2008
- Project Management Institute, College of Scheduling, 2003-2006
- American Society of Civil Engineers, 1992-1995, 2002-2005
- American Society of Civil Engineers Foundation, 2002-2005
- Construction Institute, 2004-2005
- Civil Engineering Research Foundation (CERF), 2002-2004
- Purdue University Engineering Alumni Board, 1991-2001
- Hoover Medal Award Board, 1996-1999

Advisory Boards / Committees

- Chair, Duke Energy's Coal Ash Basin Closure Program Management Oversight Board, 2015-Present
- University of North Carolina Charlotte (UNCC) National Ash Management Advisory Board, 2015-Present
- Co-Chair, College of Commercial Arbitrators (CCA) Construction Committee, 2015-Present
- Central Washington University President's Advisory Board, 2013-Present
- AAA National Construction Dispute Resolution Committee, Past Chair, Member since 2005
- Seattle Chamber of Commerce Community Development Roundtable, 2013-2014
- Roebling Global Technical School, 2012-2015
- Independent Expert Review Panel for Alaskan Way Viaduct Replacement Project, Chair, 2011-2015

- SR520 Strategic & Technical Advisory Panel (STAT), 2011-2014
- New York Institute of Technology (NYIT) Engineering Dean's Advisory Council, 2011-2016
- Eastern Washington Governor's Business Advisory Council, 2007-2012
- Initiative for Sustainable Infrastructure, 2007-2016
- Major Science Initiatives International Advisory Committee, Canadian Foundation for Innovation, 2011-2012
- Discovery Channel, Science Channel Board of Advisors, 2009-2012
- Independent Review Panel for Columbia River Crossing Bridge Project, 2010
- Construction Industry Institute Advisory Board, 2006-2010, Co-Chair, RT-260, Reimbursable Contracts
- Construction Superconference Advisory Board, 2007-2010
- American Society of Civil Engineers Industry Leadership Council, 2008-2010
- University of Nebraska Charles W. Durham School of Architectural Engineering and Construction Academic Review Team, 2009
- Purdue University Engineering Dean's Advisory Council, 2004-2007
- Engineers for a Sustainable World, Member of Advisory Board, 2003-2007
- National Science Foundation Engineering Directorate Advisory Committee, 2004-2006
- National Science Foundation International Directorate Advisory Committee, 2006
- Civil Engineering Research Foundation (CERF), Member of Corporate Advisory Board, 2001-2005
- Project Management Institute, Publications Advisory Board, 1991-1993
- Extraordinary Women in Engineering Project, 2004-2009

Editorial Boards

- ASCE Journal of Legal Affairs and Dispute Resolution in Engineering and Practice Board, 2009-Present

AWARDS AND HONORS

- Fellow, Chartered Institute of Arbitrators (CiArb), 2015
- Fellow, College of Commercial Arbitrators (CCA), 2014
- Outstanding Director, American Arbitration Association (AAA), May 2014
- The Center for Computer-Assisted Legal Instruction CALI Excellence for the Future Award for Excellence in Arbitration and Advocacy, Pepperdine Law School, March, 2013
- Profiles in Leadership, New York Institute of Technology (NYIT), 2013
- Honorary Doctor of Science, South Dakota School of Mines, December 2011
- Women's Enews.org, 21 Leaders for 21st Century Honoree for, "Architect of Spaces for Women in Engineering and Science," May, 2011
- ASCE 2010 *Journal of Legal Affairs and Dispute Resolution in Engineering and Practice* Best Scholarly, Feature, Case Study Paper Award for "Design Build/EPC Contractor's Heightened Risk – Changes in a Changing World," July, 2010
- National Association of Professional Executive Women (NAPEW) "Woman of the Year" in Prudence Audit Consultation, 2008
- G. Brooks Ernest Award, Cleveland (Ohio) Chapter of ASCE, 2007
- Engineering Excellence and Leadership Award, George Mason University, 2007
- CSI Michelangelo Award Panel of Judges, 2006 - 2007
- Pan American Academy of Engineering, 2006
- Sigma Kappa Colby Award, 2006
- "Who's Who in America," Edition 68, 2005-Present
- Key Women in Energy-Global Awards, Energy Leaders Council, 2005

- National Academy of Construction, 2005
- "Who's Who of American Women," 2004 – Present (listed since 1983)
- "Who's Who in the World," 2004- Present
- "Who's Who in Science and Engineering," 2002-Present (listed since 2002)
- YWCA Tribute to Women Honoree, 2004
- Society of Women Engineers' Upward Mobility Award, 2003
- Kentucky Governor's Award-Kentucky Colonel, 2004
- Lafayette High School Hall of Fame, Inducted 2001
- National Academy of Engineering: Celebration of Women, 2000
- White House Commission: 2000 Design Award, 1999
- Professional Leadership Award, National Professional Women in Construction, 1995
- Purdue University Distinguished Engineering Alumni Award, 1991
- Mercer County Engineer of the Year Award, 1990
- White House Fellowship Regional Finalist, 1990
- Glamour Magazine's Ten Outstanding Young Working Women for 1988
- Somerset County's Outstanding Women in Business and Industry, October 1987
- "Who's Who in America's Emerging Leaders," 1987 - Present
- Engineering News Record, "Top Women in Construction," October 1986
- "Distinguished New Engineer," Society of Women Engineers, 1980

EDUCATION AND COURSES

- Diploma in International Commercial Arbitration, Jesus College, Oxford, Chartered Institute of Arbitrators, 2015
- Certificate in Dispute Resolution, Pepperdine University School of Law, Straus Institute for Dispute Resolution, Malibu, California, 2014
- Ph.D., Infrastructure Systems (Civil) Engineering, Kochi University of Technology, Kochi, Japan, 2005
- M.B.A., New York Institute of Technology, New York, Magna cum Laude, 1984
- B.S., Civil Engineering (double major in Structures and Construction Management), Purdue University, West Lafayette, Indiana, 1978

INDUSTRY/ACADEMIC RESEARCH

- Co-Chair and member of Research Team, *CII Guide to Reimbursable Contracting, Implementation Resource 260-2,* Construction Industry Institute, The University of Texas at Austin, 2011
- Co-Chair and member of Research Team, *CII Construction Industry Institute Reimbursable Contracts, Research Summary 260-1,* Construction Industry Institute, The University of Texas at Austin, 2008-2010
- National Research Council (NRC) Committee for Advancing the Productivity and Competitiveness of the U.S. Construction Industry Workshop, 2008 – 2009
- Kochi University of Technology, Doctoral Dissertation, Engineering Education Reform, 2005

WEBINAR INSTRUCTOR

- American Arbitration Association
- Project Management Institute College of Scheduling
- Engineer Your Life

AUTHORED BOOKS/FORWARDS/CHAPTERS

- *Here Comes the Egg,* Children's book, co-authored with the late Dr. Kris R. Nielsen, Dog-ear Publishing, 2014
- "Dodd-Frank's Impact on the Utility Industry and the "Utility" of the Integrity Index in Assessing Counterparty Risk," co-authored with William Riggins and Lynn Brewer, Chapter, *Business & Corporate Integrity,* ABC-CLIO Publishing, 2014
- Galloway, Patricia D., Nielsen, Kris R., Dignum, Jack L., *Managing Gigaprojects-Advice From Those Who've Been There, Done That,* ASCE Press, Reston, VA American Society of Civil Engineers, 2013
- Galloway, Patricia D., *The 21st Century Engineer: A Proposal for Engineering Education Reform*, ASCE Press, Reston, VA American Society of Civil Engineers, 2007
- "Interview: Patricia Galloway," *Connecting Students to STEM Careers, Social Networking Strategies,* Camille Cole, International Society for Technology in Education, ISBN 978-1-56484-291-6, published 2011
- Foreword to Lunsden, Reese, *The View From Here, Optimize Your Engineering Career From the Start*, Illumina Publishing, 2011
- "Engineering in Government and Public Policy," Section 4.5.3, UNESCO Report, Engineering: Issues, Challenges and Opportunities for Development, United Nations, UNESCO Publishing, 2010 Paris, France
- Galloway's 21st Century Engineer: An Essay Review, , Volume 12 Number 14, October 8, 2009, Robert Calfee, University of California, Riverside, Stanford University, Thomas Stahovich, University of California, Riverside, http://www.edrevv.info/essays/v12n14index.html
- Foreword to Kusayanagi, S.; Niraula, R.; and Hirota, Y., *Principles and Practice of International Construction Project Management*, EIKO-SHA, Tokyo, Japan, 2009
- Foreword to Williams, F. Mary and Emerson Carolyn J. , *Becoming Leaders*, ASCE Press, Reston, VA, American Society of Civil Engineers, 2008
- Foreword to Hatch, Sybil E., *Changing our World: True Stories of Women Engineers*, ASCE Press, Reston, VA, American Society of Civil Engineers, 2006
- "Anticipating Problems: Project Risk Assessment and Project Risk Management," co-authored with K. Nielsen, Chapter 6, *Collaboration Management, New Project and Partnering Techniques*, edited by H. Shaughnessy, John Wiley & Sons 1994

MEMBERSHIPS

- American Bar Association (ABA)
  - Forum Committee on the Construction Industry, 2013-Present
  - Dispute Avoidance & Resolution Committee, 2013-Present
  - International Construction Committee, 2013-Present
  - Section of International Law, 2013-Present
- American Nuclear Society (ANS)
- American Society of Civil Engineers (ASCE) (Fellow)
  - Past President, 2004 - 2005
  - National President, 2003 - 2004
  - National President-Elect, 2002 - 2003
  - International Director of the Board, August 1992 - 1995
- Association for the Advancement of Cost Engineering International (AACEI) (Fellow)
  - Chair, National Committee-Women in Project Controls, 2004 - 2005
  - Member, National Planning and Scheduling Committee, 2003-2011

  - Member, Executive Director Search Committee, 2009-2010
- Association for International Arbitration (AIA)
- Chartered Institute of Arbitrators (CIArb) 2014-Present
- Chi Epsilon (National Civil Engineering Honor Society)
- College of Commercial Arbitrators (CCA)
  - Construction Committee, Co-Chair, 2015-Present
  - International Committee
  - Energy Committee
- Construction Institute (CI)
- Dispute Review Board Foundation (DBRF)
- Institution of Civil Engineers, United Kingdom (ICE) (Fellow)
- Institution of Engineers - Australia (Fellow)
- Inter-Pacific Bar Association (IPBA)
  - Member of Committee "T", Construction, 1999 - Present
- Japan Society of Civil Engineers (JSCE)
- National Academy of Construction (NAC)
- National Association of Corporate Directors (NACD)
- National Council of Examiners for Engineering and Surveying (NCEES)
- Order of the Engineer
- Pan American Academy of Engineers
- Project Management Institute (PMI)
  - Chair, 3rd International College of Scheduling Conference, Orlando, Florida, April 2006
  - Chair, Board of Directors, College of Scheduling, 2003 - 2006
  - Chair, 2nd International College of Scheduling Conference, Scottsdale, Arizona, May 2005
  - Chair, International College of Scheduling Conference, Montreal, Canada, April 2004
  - Member, Publications Advisory Board, 1991 - 1993
- Society for Social Management Systems
  - Honorary Chair, 2011-present
  - Chair, 2006 - 2010
- Tau Beta Pi (Honorary Member)

TECHNICAL PAPERS AND PRESENTATIONS

Dr. Galloway is a prolific writer and world renowned speaker having authored over 120 papers, 30 peer reviewed journal articles and nearly 200 public speaking (including over 45 keynote addresses) engagements regarding leadership, corporate governance, ethics and professionalism, communication, risk management, dispute resolution, contract administration, program and project management, project controls, women in engineering and other topics.

Dr. Galloway has also been featured in many international publications:

- "Why are There Still So Few Women in Construction", Seattle Daily Journal of Commerce, March 3, 2016
- "Former ASCE President Leads Expertise to High-Speed Transportation Project", *Civil Engineering News,* Published by ASCE, December, 2013
- "Petticoats and Slide Rules," *PE, The Magazine for Professional Engineers,* published by NSPE, July, 2014
- "Risk by the Numbers," *PM Network,* Project Management Institute, March 2012, Volume 26 Number 3
- "STEM to the Rescue?" *PE, The Magazine for Professional Engineers,* published by NSPE, March, 2012

- "Patricia Galloway: Changing the Face of Construction and Engineering," *ENR New York, A Supplement to Engineering News-Record,* October 10, 2011
- "Staying Smart: Engineers and Universities Advance Career-Long Learning," *ENR.com,* October 31, 2011
- "Interview with Dr. Patricia Galloway: CEO of Pegasus Global Holdings Inc. and First Woman President of the American Society of Civil Engineering," The Daily Femme, New York., April 25, 2011
- *PM Network Magazine*, Project Management Institute, March 2011 Vol. 25, No. 3 "Too Big to Handle? Megaprojects and meeting the triple constraints"
- *Public Works Magazine,* March 2011, Op-ed article: "Something Fishy with Failures?"
- ASCE Industry Leaders Council, Monthly "Insights – Perspectives from Civil Engineering Industry Leaders," podcast, January 31, 2011
- "2011 – Seven Who Blaze New Pathways," 21 Leaders for the 21st Century, Women's Enews.org, January 4, 2011
- "Engineering Future Success For Students," NYIT Magazine, Winter, 2011
- Curiosity Project, Discovery Channel, Screening in 2011
- *National Society of Professional Engineers*, Member Spotlight, Fall, 2010
- *New York Institute of Technology Magazine*, Summer 2010, Volume 8, Number 3, Cover and Feature Article, "Top of Their Game"
- *Flynn's Harp*, July 21, 2010, Feature Article, "Is Gulf Spill Oil Industry's Three Mile Island?"
- Touch Stone International Learning Management System, Online English Teaching Program, February 2010
- Interview with Patricia D. Galloway, *ADR Perspectives*, February 2010
- *Federal Technology Watch*, "Interview with National Science Board Vice Chair," January 26, 2009
- Profile of Patricia Galloway. Hatch, Sybil, *Changing Our World: True Stories of Women Engineer,* American Society of Civil Engineers, 2006
- "Building a Better Role Model," Continental Airline's *In-Flight* Magazine, November 2005 Issue
- Bad Idea. You'll Flunk Out. *Time* Magazine, Science Section, First Person: Pat Galloway, Authored by Deirdre Van Dyk, March 7, 2005 Issue
- America's Infrastructure, Live Media Radio and Television appearances in over 25 cities across the United States, October 2004
- *Engineering Marvels-Seven Modern Engineering Wonders of the World*, Co-host to ABC / Discovery Channel Television Series, April, 2004
- People "Pat Galloway: Civil Engineer, Company CEO," by Kathleen McGinn, *U.S.1 Newspaper*, New Jersey, February 3, 2003
- "First Woman President Installed to Lead Civil Engineering Society," *EWRI Currents*, Vol. 5, No. 4 Winter 2003/2004
- "Going International: Profit or Peril?", Interview with Patricia D. Galloway, Executive Vice President, The Nielsen Wurster Group, Inc., *Worldwide Projects*, Spring 1993

Arbitration / Mediation / Dispute Resolution

Publications

- "The Art of Allocating Risk in an EPC Contract to Minimize Disputes", International Bar Association Annual Conference, Washington DC, September 14, 2016
- "Streamlining the Arbitration Process Through Innovative Methods of Handling Fact Witnesses", International Bar Association, *Construction Law International*, Vol. II, Issue 2, June 2016
- "Is Construction Arbitration Ready for Online Dispute Resolution?" *International Construction Law Review,* Informa, Volume 30, Part 2, April, 2013
- "Engineering a Successful Negotiation," *Journal of Legal Affairs & Dispute Resolution in Engineering and Construction,* American Society of Civil Engineers, Volume 5, Number 1, February 2013

- "Dispute Resolution Under FIDIC – The Parties' Options," co-authored with L. Martinez and M. Marra, *Transnational Dispute Management (TDM) Journal,* TDM 7 November, 2012, www.transnational-dispute-management.com
- "Using Experts Effectively and Efficiently in Arbitration," *Dispute Resolution Journal,* American Arbitration Association, September/October 2012
- "Mapping Strategies for a Successful Mediation," co-authored with K. Nielsen, *Nepal Council of Arbitration (NEPCA) Half Yearly Bulletin,* Volume 18, February, 2012
- "Mapping Strategies for a Successful Mediation," co-authored with K. Nielsen, *Construction Law International,* International Bar Association, Volume 6, Issue 4, December 2011
- "Saving Time by Using Experts Effectively in Arbitration," Superconference, San Francisco, December 16, 2011
- "The Engineer's "Study Notes" for Understanding the Arbitration Process," *Journal of Legal Affairs and Dispute Resolution,* American Society of Civil Engineers, Volume 3, Number 2, May 2011
- "Arbitration is Voluntary and a Creature of Contract and Party-Appointed Arbitrators," American Bar Association, Mid-Winter Meeting of the Construction Forum Proceeding, New York City, January 20, 2011
- "Is Mediation a Real Option for Resolving Disputes?," Blog, *Engineering News Record*, June, 2009
- "Cumulative Impact, Current Trends in Construction Law," International Project Management and Dispute Resolution: The South Central American Project, International Arbitration Disputes Conference in conjunction with Peckar & Abramson; São Paulo, Brazil, June 5 – 6, 2006
- Delay: Use of CPM Schedules for Concurrency, Allocation, Proof, and Window Analysis, Proceedings, Hurry Up and Slow Down: Dealing with Delays in Construction, American Bar Association Forum on the Construction Industry Conference, New York, New York, January 23, 1997
- "The Contractor's Right to Finish Early," Proceedings, Hurry Up and Slow Down: Dealing with Delays in Construction, American Bar Association Forum on the Construction Industry Conference, New York, New York, January 23, 1997
- "CPM Schedule Delay: Window Analysis, Concurrency, and Proof," co-authored with K. Nielsen and M. Ramey, World Conference on Construction Risk, Paris, France, April 28 - 29, 1994
- "Disruption / Productivity Cost Claim Analyses," co-authored with K. Nielsen, Construction Disputes-Analysis and Management, Winnipeg, Canada, November 1 - 5, 1993
- "CPM Scheduling Delay: Window Analysis, Concurrency and Proof," co-authored with K. Nielsen and M. Ramey, Construction Disputes-Analysis and Management, Winnipeg, Canada, November 1 - 5, 1993
- "Using an Expert Effectively in ADR," Resolving Disputes in International Construction Contracts Through ADR Techniques, AAA & Nielsen-Wurster conference proceedings, Geneva, Switzerland, November 12 – 13, 1992
- "Overcoming Schedule Delay-Analyzing and Resolving this Project Nemesis," co-authored with K. Nielsen, IIR National Construction Conference, Sydney, Australia, August 28 - 29, 1991
- "International Construction Dispute Proofs," co-authored with K. Nielsen, Nordnet '91 Transactions: The Practice and Science of Project Management, Trondheim, Norway, June 3 - 5, 1991
- "Pricing and Proving Contractor Claims for Changes in Scope and Unforeseen Conditions," Proceedings, Construction Litigation Superconference, Andrews Conferences, Inc., April 11 - 12, 1991
- "Computerized Document Control-The Expert Witness's View," co-authored with Pamela Moon, The *International Construction Law Review Journal*, Volume 8, Part 2, April 1991
- "Pricing and Proving Contractor Claims for Changes in Scope and Unforeseen Conditions," Proceedings, Construction Litigation Superconference, Andrews Conferences, Inc., December 6 - 7, 1990
- "Contract Administration," Proceedings, Arbitration and Mediation Construction Claims Seminar, American Arbitration Association, Charleston, West Virginia, November 1, 1990
- "Resolving Claims: Selecting the Right Alternative," AAA 'Resolving Construction Disputes,' Hershey, Pennsylvania, October 5, 1990

- "Evaluating the Contractor's Right to Finish Early," co-authored with K. Nielsen, Project Management Institute Book of Proceedings, Calgary, Alberta, Canada, October 16, 1990
- "Concurrent Schedule Delay in International Contracts," co-authored with K. Nielsen, *The International Construction Law Review*, Volume 7, Part 4, pp. 386 - 401, October 1990
- "Schedule Delay Concurrency Issue Analysis & Proof," co-authored with K. Nielsen, Proceedings, International Cost Congress, Paris, France, April 1990
- "Pricing, Proving and Calculating Construction Claims," Proceedings, Construction Litigation Superconference, Andrews Conferences, Inc., April 6 - 7, 1989
- "Proof Development for Construction Litigation," co-authored with K. Nielsen, *The American Journal for Trial Advocacy*, Volume 7, No. 3, Cumberland School of Law of Samford University, Birmingham, Alabama, Summer 1984; Yearbook of Construction Articles, Volume 4, Federal Publications, 1985
- "Second Guessing the Engineer," co-authored with K. Nielsen, *Civil Engineering*, American Society of Civil Engineers, November 1985
- "Avoiding Lengthy and Costly Litigation by Negotiation Resolution Methods," co-authored with K. Nielsen, Proceedings, American Society of Civil Engineers Spring Convention, Denver, Colorado, April 1985
- "Window Analysis: An Innovative Concept to Schedule Delay Analysis," co-authored with K. Nielsen, Project Management Institute, Philadelphia, Pennsylvania, October 1984
- "Schedule Delay: A Productivity Analysis," co-authored with K. Nielsen, and J. Leverette, Project Management Institute National Convention Proceedings, Houston, Texas, October 1983

Conference Presentations / Teaching / Instruction

- Panelist, "International Construction and Infrastructure Projects; The Latest Conflict-Management Options", Rio de Janeiro, Brazil, November 18, 2015
- Panelist, "Effective Advocacy and Management in Arbitration: The Efficient Hearing," American Arbitration Association (AAA)'s Forum on the Construction Industry, April, 2015
- "Megaproject Arbitration-Why It's Different", American Arbitration Association, Construction Conference, Santa Monica, CA, March 26, 2015, Panel Member
- "Retooling Arbitration for Mega Project Construction Claims," Construction Superconference in Las Vegas, NV, December 2014, Panel Member
- "Managing Megaprojects in the Midst of Adversity," American Society of Civil Engineers (ASCE) Global Engineering Conference in Panama City, Panama, October 2014
- "Construction Mediation and the User Experience; Pathways to Settlement and Satisfaction," Associated General Contractors (AGC), Webinar presented with Harold Coleman, June 2014
- "Recent Construction Case Law Blitz," Construction Superconference in San Francisco, CA, December 2013, Panel Member
- " What Advanced Arbitration Procedures Do In House Counsel Most Favor and What Do Neutrals Say About Them", Construction Superconference, San Francisco, CA, December 2013, Panel Member
- "Contract Risk Reviews-Getting it Right Before Tender", Cutting Edge 2013: Conference on Megaprojects in Seattle, WA, November 2013
- "The Future of Dispute Boards in the Power Industry," Dispute Resolution Board Foundation, Facilitator, September 2013. Miami Beach, FL
- "The Art of Attorney Advocacy in Complex Energy and Commercial Arbitration," Energy Bar Association and International Institute for Conflict Prevention and Resolution, presented with Robert Wax, Steve Shapiro and Duncan MacKay, Washington, D.C., June 7, 2013
- "Using Experts Effectively in Arbitration by Counsel and Neutrals," American Arbitration Association Webinar, presented with Stanley P. Sklar, April 30, 2013
- "Online Dispute Resolution: The Next-Generation Construction ADR Process," North West Dispute Resolution Conference, American Arbitration Association, Seattle, March 29, 2013

- "Contractually Specified Alternative Dispute Resolution," FIDIC Americas Contract Users' Conference, New York City, October, 3, 2012
- "Optimizing Your Client's Construction Arbitration Hearing," co-presented with Mr. Albert Bates, American Arbitration Association Spring Conference, New York City, June 1, 2012
- "Building the Construction Arbitration Process to Optimize its Advantages," American Arbitration Association / International Centre for Dispute Resolution Neutrals Conference, Scottsdale, Arizona, March 9 – 10, 2012
- "Arbitration is Voluntary and a Creature of Contract and Party-Appointed Arbitrators," American Bar Association, Mid-Winter Meeting of the Construction Forum Proceeding, New York City, January 20, 2011
- "Construction Dispute Resolution in the U.S. – International Techniques That Can Be Used Domestically," American Arbitration Association Webinar, presented with Albert Bates, May 10, 2010
- Panel Member, "Controlling the Discovery Monster in Arbitration," NW Dispute Resolution Conference in Seattle, May 1, 2010
- Moderator, The Cultural and Legal Landscape to Consider – Regional Considerations for International Construction Projects, 8th Annual Miami International Arbitration Conference, March 21 - 22, 2010
- "Hot Topics in International Construction Dispute Resolution," American Arbitration Association Webinar, presented with John W. Hinchey, September 10, 2009
- "Construction Delay-How Opposing Experts Can Come to Different Conclusions From the Same Set of Facts: Honest Mistake, System Failure or Deceptive Practice," Construction Claim Advisor - Audio Conference, November 12, 2007
- Panel Member, "Intellectual Honesty in Proving Delay," Project Management Institute College of Scheduling Conference, Vancouver Canada, April 17, 2007
- "Common Disputes on Light Rail Transit Projects and How to Resolve Them," Construction Superconference, San Francisco, California, December 7 - 8, 2006
- "Cumulative Impact, Current Trends In Construction Law," International Project Management and Dispute Resolution: The South Central American Project, São Paulo, Brazil, June 5 - 6, 2006
- Panelist, "Intellectual Honesty in Proving Delay," Federal Board of Contract Appeals, Hilton Alexandria Mark Center, Alexandria, Virginia, April 3, 2001
- "Analyzing Schedule Delay, Minimizing Risks in Construction Projects and Resolving Construction Disputes," Hong Kong, September 28 - 29, 1998
- "Delay: Use of CPM Schedules for Concurrency, Allocation, Proof, and Window Analysis, Hurry Up and Slow Down: Dealing with Delays in Construction," American Bar Association Forum on the Construction Industry Conference, New York, New York, January 23, 1997
- "The Contractor's Right to Finish Early, Hurry Up and Slow Down: Dealing with Delays in Construction," American Bar Association Forum on the Construction Industry Conference, New York, New York, January 23, 1997
- "Delay: Use of CPM Schedules for Concurrency, Allocation, Proof, and Window Analysis," Taisei Corporation P.M. Conference, Tokyo, Japan, October 31, 1996
- "CPM Schedule Delay: Window Analysis, Concurrency, and Proof," World Conference on Construction Risk, Paris, France, April 28 - 29, 1994
- "Disruption / Productivity Cost Claim Analyses," Construction Disputes-Analysis and Management, Winnipeg, Canada, November 1 - 5, 1993
- Co-presenter, "Schedule Delay Analysis & Early Completion," Nielsen-Wurster Seminar on Managing Risk and Minimizing Disputes in Construction Contracts, Hilton Head Island, South Carolina, October 6 - 8, 1993
- "CPM Scheduling Delay: Window Analysis, Concurrency and Proof," Construction Disputes-Analysis and Management, Winnipeg, Canada, November 1 - 5, 1993
- Co-presenter, "Schedule Delay Analysis," WASHTO Annual Conference, Oklahoma City, Oklahoma, June 23 - 24, 1993

- Presenter, "Early Completion Claim Analysis and Expert Delay Analysis," The Nielsen-Wurster Seminar on Construction Issues Facing the Public Transportation Industry, Sacramento, California, April 28 - 30, 1993
- Co-presenter, "Utilizing an Expert Effectively in ADR," Resolving Disputes in International Construction Contracts through ADR, AAA and Nielsen-Wurster conference, Geneva, Switzerland November 12 - 13, 1992
- "International Construction Law – Opportunities and Risks in the '90's", The American Bar Association Forum on the Construction Industry, Stouffer Mayflower Hotel, Washington, D.C., November 5 – 6, 1992
- "Analyzing Scheduling Delays by Use of Window Analysis," The Nielsen Wurster Seminar on Managing and Resolving Construction Disputes, Lake Tahoe, Nevada, March 1992; San Diego, California, April 1992; Key West, Florida, October 1992
- "Overcoming Schedule Delay-Analyzing and Resolving this Project Nemesis," IIR National Construction Conference, Sydney, Australia, August 28 - 29, 1991
- "Pricing and Proving Contractor Claims for Changes in Scope and Unforeseen Conditions," Construction Litigation Superconference, Andrews Conferences, Inc., April 11 - 12, 1991
- "Pricing and Proving Contractor Claims for Changes in Scope and Unforeseen Conditions," Construction Litigation Superconference, Andrews Conferences, Inc., December 6 - 7, 1990
- "Contract Administration," Arbitration and Mediation Construction Claims Seminar, American Arbitration Association, Charleston, West Virginia, November 1, 1990
- "Resolving Claims: Selecting the Right Alternative," American Arbitration Association, Hershey, Pennsylvania, October 5, 1990
- Co-presenter, "Construction Dispute Seminar," Florida Department of Transportation, Tallahassee, Florida, August 1989
- "Pricing, Proving and Calculating Construction Claims," Construction Litigation Superconference, Andrews Conferences, Inc., April 6 - 7, 1989
- "Analyzing Schedule Delays By Use of Window Analyses," The Nielsen Wurster Group Construction Disputes Seminar, San Antonio, Texas, April 1991; New Orleans, Louisiana, April 18 - 20, 1988
- "Construction Delay Analysis," The Nielsen-Wurster Group Construction Disputes Seminar, New Orleans, Louisiana, April 18 - 20, 1988
- "Pricing Contractor's Claims," American Society of Civil Engineers Course, "Construction Claims," Anchorage, Alaska, March 1986; San Francisco, California, May 1987
- "Window Analysis: An Innovative Concept to Schedule Delay Analysis," Project Management Institute, Philadelphia, Pennsylvania, October 1984
- "The Use of Schedules in Claim Preparation," The Nielsen-Wurster Group Construction Dispute Proofs Seminar, Conference, New Orleans, Louisiana, 1988 and 1989; Seattle, Washington, 1987; Lake Buena Vista, Florida, May 18 - 20, 1983; Minneapolis, Minnesota and Denver, Colorado, April 1984; Tampa, Florida and Boston, Massachusetts, May 1984
- "Schedule Delay: A Productivity Analysis," Project Management Institute National Convention, Houston, Texas, October 1983

Management / Prudence / Performance Audits

Publications

- "Cost-Recovery for Pre-Approved Projects," co-authored with David L. Cousineau, *Public Utilities Fortnightly*, June 2013
- "Leadership and Risks during a Global Financial Crisis," co-authored with K. Nielsen and J. Dignum, *The Fifth Civil Engineering Conference in the Asian Region* (CECAR5), Sidney, Australia, August 9-11, 2010
- "New Day for Prudence," co-authored with K. Nielsen and Charles W. Whitney, *Public Utilities Fortnightly,* December 2009

- "Design-Build/EPC Contractor's Heightened Risk-Changes in a Changing World," *Journal of Legal Affairs and Dispute Resolution,* American Society of Civil Engineers, February 2009, Volume 1, Number 1."
- "The Ubiquitous Requirement of Performing to High International Standards," co-authored with K. Nielsen, published Proceedings, The Second Civil Engineering Conference in the Asian Region, Tokyo, Japan, April 16 - 18, 2001
- "Combining PURPA, Prudence and Avoided Cost Rate Design; A New Cost Engineering Environment," co-authored with K. Nielsen, Proceedings, American Association of Cost Engineers 9th Annual Mid-Winter Symposium Transactions, San Francisco, California, February 1987. Reprinted, Cost Engineering, Volume 31, No. 1, page 16, January 1989
- "The 5-Year Living Schedule," co-authored with R. Cochran, American Association of Cost Engineers Annual Convention, Atlanta, Georgia, June 1987
- "Preparing for the Utilities' Future-Managing the Prudence Issues," co-authored with K. Nielsen, *Electric Potential*, Volume 2, No. 4, July - August 1986
- "Utilities Forced Delays-Controllable or Uncontrollable," co-authored with K. Nielsen, Proceedings, American Association of Cost Engineers Annual Convention, Chicago, Illinois, June 1986
- "Preparing for Utilities Future-An 'Attack Plan' for Minimizing Disallowable Costs In Outage and Future Capital Construction," co-authored with K. Nielsen, American Association of Cost Engineers, 8th Annual Mid-Winter Symposium Transactions, New Orleans, Louisiana, February 1986; Project 2, 5th Annual Outage Symposium Proceedings, Cambridge, Massachusetts, May 1986
- "Utility Prudence Time Impact Evaluation," American Association of Cost Engineers Annual Convention Transactions, Denver, Colorado, July 1985
- "The Prudence Management Audit: A New Challenge For the Civil Engineer," co-authored with K. Nielsen, American Society of Civil Engineers Spring Convention, Denver, Colorado, April 1985
- "Performance Audits," co-authored with D. Law, Proceedings, Project Management Institute Symposium, Toronto, Ontario, Canada, October 1982

Conference Presentations / Teaching / Instruction

- "The Nuclear Industry Post-Fukushima," *Platts 8th Annual Nuclear Energy Conference*, Bethesda, Maryland, February 9, 2012
- Deutsche Bank "Road Show," London, U.K., June 8 – 12, 2010
- Deutsche Bank "Road Show," London, U.K., April 20 – 24, 2009
- Utilities Serving Our Needs: US Experience in Serving Its Communities, National Engineering Forum-Energy, Water and Telecommunications, Cooma, NSW, Australia, April 21, 1999
- Panel Moderator, "The Multi-Billion Dollar Issue Facing the Nuclear Power Industry: Decommissioning Versus Life Extension," The Future of the US and International Environmental Industry, Washington, D.C., November 10 - 12, 1997
- Co-presenter, "Electric Utility Capital Project Prudence Issues," National Association of Regulated Utility Commissioners Annual Meeting, Hartford, Connecticut, May 1985
- Co-presenter, "Prudence Concepts," American Association of Cost Engineers, Ramapo Section, April 1985
- "Performance Audits," Project Management Institute Symposium, Toronto, Ontario, Canada, October 1982

Program/Project Management

Publications

- "Engineer's Liability Considerations in Specifying Corrugated High Density Polyethylene (HDPE) Pipe," *Journal of Professional Issues in Engineering Education & Practice* American Society of Civil Engineers, January 2008

- "Managing Risks on Defense Projects Using CPM Scheduling," co-authored with Ed Blow, Scheduling The Next Generation: Third PMI College of Scheduling Conference, Orlando, Florida, April 23 - 26, 2006
- "CPM Scheduling - How Industry Views Its Use, Cost Engineering," *The AACE International Journal of Cost Estimation, Cost / Schedule Control, and Project Management*, January 2006
- "Is Our Perspective Truly Global?", American Society of Civil Engineers, *ASCE News*, April 2004
- "CPM Scheduling-Its Importance in Monitoring and Demonstrating Construction Progress," published proceedings, Japan Society of Civil Engineers, JSCE First International Symposium on Construction and Project Management-Human Resources Development under Globalization, Tokyo, Japan, October 16 - 17, 2003
- "Privatization and the Use of IVHS in the 1990s," Proceedings, ASCE Transportation Conference on IVHS, co-authored with K. Nielsen and M. Ramey, San Diego, California, October 1995
- "The Utilization of Computer Technology in the Presence of Evidence," co-authored with Pamela Moon, La Gestion de los Asuntos Mercantiles en los Juzgados de Primera Instancia, Madrid, Spain, October 26, 1994
- "CPM Schedule Delay: Window Analysis, Concurrency, and Proof," co-authored with K. Nielsen and M. Ramey, Nielsen-Wurster Seminar on Emerging Risks in Construction: How to Minimize, Manage and Avoid Disputes, New Orleans, Louisiana, May 10 - 12, 1995; Indian Wells, California, October 19 - 21, 1994
- "International Contract Administration Issues: Project Documentation, Dispute Proofs, Programmes, Productivity," co-authored with K. Nielsen, IDLI Conference, Rome, Italy, December 12, 1991
- "Delivering a Successful Project, Proceedings, Civil Engineering International Conference on Asian Infrastructure," Sustainable Development and Project Management, Manila, Philippines, February 19 - 20, 1998
- "Defining Scheduling," The Nielsen-Wurster Group Construction Dispute Proofs Seminar Handbook, Conference, New Orleans, Louisiana, 1988 and 1989; Seattle, Washington, 1987; Lake Buena Vista, Florida, May 18 - 20, 1983; Minneapolis, Minnesota and Denver, Colorado, April 1984; Tampa, Florida and Boston, Massachusetts, May 1984
- "Preparing a Project Control Specification," co-authored with K. Nielsen, Proceedings of Eleventh Annual PROJECT / 2 Utility Users Group Conference, Birmingham, Alabama, November 17 - 19, 1986
- "Failure Proof Your Projects," co-authored with K. Nielsen, *Consulting Engineer*, June 1985
- "Scheduling the Super Projects, preprint, Engineering and Construction Projects, The Emerging Management Roles," ASCE Specialty Conference, New Orleans, Louisiana, March 17 - 19, 1982
- "Schedule Control for CPM Projects," co-authored with K. Nielsen, *Journal of the Construction Division*, Proceedings of the Society of Civil Engineers, Volume 107, No. CO2, June 1981

Conference Presentations / Teaching / Instruction

- "The Unique Aspects of Managing Megaprojects in Asia", Keynote, University Lecture Series given at University of Melbourne, March, 2014
- "Hyperloop: Transforming Transportation," UCLA Ideas Lecture Series, co-presented with Marco Villa, January, 2014
- "Managing GigaProjects," Lecture, Construction Management School, Central Washington University, November, 2013
- "The Outlook for Construction in the Power Industry over the Next Decade," panelist, The Construction Superconference, San Francisco, California, December 13, 2012
- "Starting and Growing a Global Business--from Cle Elum, WA," Keynote with Dr. Kris Nielsen, Central Washington University, College of Business Innovation and Entrepreneurship Speaker Series, February, 2012

- "Managing Complex Projects: Best Practices Here & Abroad," panelist, McGraw Hill's Ground Breaking Women in Construction annual conference, The McGraw Hill Companies, New York, New York, May 9, 2011
- "Managing Your Projects to Minimize Disputes," Lecture, Construction Management School, Central Washington University, November 9, 2009
- "Trends in the Construction Industry," U.S. Law Firm Group Construction Committee, Buffalo, NY, October 23, 2009
- "Design-Build Contracting in a Changing World," CH2M Hill in-house design-build conference, Denver, CO, October 10, 2008
- "Reading Between the Pipes," IKO Concrete Pipe Association, Kentucky, June 27, 2008
- "Mega Projects - A Primer for Finance (or How Can Finance Help Improve Results)," Nexen Finance Forum Scottsdale, AZ - Co-presentation with Jack Dignum February 19, 2008
- "Managing Risks on Defense Projects Using CPM Scheduling," Scheduling The Next Generation: Third PMI College of Scheduling Conference, Orlando, Florida, April 23 - 26, 2006
- "CPM Scheduling and How the Industry Views Its Use," Association for the Advancement of Cost Engineering International's 49th Annual Meeting, New Orleans, Louisiana, June 26 - 29, 2005
- Speaker, "CPM Scheduling - How Industry Views its Use," Second Annual PMI College of Scheduling Conference, Scottsdale, Arizona, May 22 - 24, 2005
- "CPM - Current Trends in Education: A Comparative Study Between Europe, Asia and North America," On the Road to Better Scheduling-PMICOS Conference, Montreal, Canada, April 25 - 28, 2004
- PMI Scheduling Practice Standard Panel, On the Road to Better Scheduling-PMICOS Conference, Montreal, Canada, April 25 - 28, 2004
- Moderator, "The Impacts to Public Contracting in a Post 9 / 11 Environment," Luncheon Panel, Construction Super Conference, San Francisco, California, December 2003
- "CPM Scheduling," Visiting Professor, Special Lecture Series, Kochi University of Technology, Kochi, Japan, November 22, 2003
- "Mission of the Civil Engineer in the Movement of Globalization," Michigan Tech University, Houghton, Michigan, January 16, 2003
- Moderator, "Conception to Birth of a Project," Infrastructure 2000, San Francisco, California, June 7, 2000
- "Harmonizing Japanese and US Practices for Effective Project Management," Taisei Corporation M.I.T. Conference, Tokyo, Japan, November 1, 1996
- "Employing Effective Project Management to Achieve Project Success," Taisei Corporation P.M. Conference, Tokyo, Japan, October 31, 1996
- "Tricks of the Trade New Uses and Misuses of CPM Scheduling," BCQS Project Managers Chartered Quantity Surveyors, The Nielsen-Wurster Group Construction Management Consultants, Whitman Breed Abbott & Morgan Construction Attorneys' Seminar on Controlling Construction Risk and Conserving Your Cash, Radisson Hotel, Grand Cayman Islands, February 26, 1996
- "Privatization and the Use of IVHS in the 1990s," ASCE Transportation Conference on IVHS, San Diego, California, October 1995
- Co-presenter, "Construction Scheduling: Preparation, Liability, Claims and Damages," Panama Canal Commission, June 12 - 16, 1995
- "The Utilization of Computer Technology in the Presence of Evidence," co-authored with Pamela Moon, La Gestion de los Asuntos Mercantiles en los Juzgados de Primera Instancia, Madrid, Spain, October 26, 1994
- "CPM Schedule Delay: Window Analysis, Concurrency, and Proof," Nielsen-Wurster Seminar on Emerging Risks in Construction: How to Minimize, Manage and Avoid Disputes, New Orleans, Louisiana, May 10 - 12, 1995; Indian Wells, California, October 19 - 21, 1994

- "The Contractor's Right to Finish Early," Nielsen-Wurster Seminar on Emerging Risks in Construction: How to Minimize, Manage and Avoid Disputes, New Orleans, Louisiana, May 10 - 12, 1995; Indian Wells, California, October 19 - 21, 1994
- Co-presenter, "Project Manager nei settore delle construzioni," Visiting Professor, University of Bologna, SINNEA, Bologna, Italy, May 25 - 27, 1994
- Co-presenter, "Project Management for Design and Construction," Panama Canal Commission, Panama, June 28 - July 2, 1993
- Co-Presenter, "International Contract Administration Issues: Project Documentation, Dispute Proofs, Programmes and Productivity," Training Workshop on International Construction Contracts and Contractor Claims, The International Development Law Institute (IDLI), Rome, Italy for the Finnish International Development Agency (FINNIDA), Helsinki, Finland, October 13 - 16, 1992
- "Contract Administration," Master's Degree Course, SINNEA, Institulo Di Studi Per La Cooperazione E La Piccola E Media Impresa, Bologna, Italy, September 25, 1992
- "Effective Construction Contract Administration," University of Wisconsin-Madison, College of Engineering, Madison, Wisconsin, April 7 - 10, 1992
- "International Contract Administration Issues: Project Documentation, Dispute Proofs, Programmes, Productivity," IDLI Conference, Rome, Italy, December 12, 1991
- Co-presenter, "Inefficiency Seminar," Florida Department of Transportation, Deland, Florida, August 1991
- Co-presenter, "Advanced CPM Scheduling," Pennsylvania Department of Transportation, West Palm Beach, Florida, May 1991
- Co-presenter, "Contract Administration," West Virginia Division of Energy, Charleston, West Virginia, March 1991
- Co-presenter, "CPM Scheduling," Kentucky Department of Transportation, Lexington, Kentucky, December 1989
- CPM Scheduling Seminar, Reale, Fosse & Perry, P.C., Pittsburgh, Pennsylvania, November 1989
- Claims Avoidance Seminar, Loney Construction Co., Inc., Keene, New Hampshire, January 1989
- Minimization of Claims Seminar, Weyerhaeuser Paper Company, Jackson, Mississippi; Birmingham, Alabama, November 1988
- "Defining Scheduling," The Nielsen-Wurster Group Construction Disputes Seminar, New Orleans, Louisiana, April 18 - 20, 1988
- "Scheduling Super Projects," Visiting Professor, University of Wisconsin, Madison, Wisconsin, January 1987
- "Preparing a Project Control Specification," Eleventh Annual PROJECT / 2 Utility Users Group Conference, Birmingham, Alabama, November 17 - 19, 1986
- "Construction Claims Prevention and Analysis," Visiting Professor, University of Wisconsin, Madison, Wisconsin, May 1985, June 1986 and May 1987
- "Defining Scheduling," The Nielsen Wurster Group Construction Dispute Proofs Seminar, Conference, New Orleans, Louisiana, 1988 and 1989; Seattle, Washington, 1987; Lake Buena Vista, Florida, May 18 - 20, 1983; Minneapolis, Minnesota and Denver, Colorado, April 1984; Tampa, Florida and Boston, Massachusetts, May 1984
- "The Schedule, Its Use and Development," The Nielsen-Wurster Group Scheduling Seminar, Conference, Atlanta, Georgia, October 1983
- Session Moderator, "Super Projects, Case Studies," ASCE Spring Convention, Philadelphia, Pennsylvania, May 1983
- Session Moderator, "Project Management Control," ASCE Spring Convention, New York, New York, May 1981

DR. PATRICIA D. GALLOWAY

Risk Management

Invited and Keynote Presentations

- "Assessing and Remediating Systemic Counterparty Risks," Electric Utility Consultants, Inc. (EUCI), Conference, Baltimore, Maryland, November 8, 2012
- Keynote Address "Role, Responsibility and Risk Considerations of the Engineer Regarding Sustainability," Florida Engineering Society Annual Meeting, Naples, Florida, August 8, 2008
- Keynote Speaker, "Engineer, Contractor and Owner Risk in Constructed Projects," Wisconsin Transportation Builders Association WISDOT Contractor Engineer Conference, Madison, Wisconsin, January 31, 2008
- Keynote Address, "How Leaders Should be Viewing Risk Today," CII Annual Conference, Orlando, Florida, August 1, 2007
- Keynote Address, "Risks and Liabilities in Specifying HDPE Pipe," Mountain States Concrete Pipe Association 5th Annual Concrete Pipe Seminar, Illinois, February 28, 2007
- Keynote Address, "Engineer, Contractor and Owner Risk in Constructed Projects," Wisconsin Transportation Builders Association WISDOT Contractor Engineer Conference, Madison, Wisconsin, January 31, 2007
- Keynote Address, "Risks and Liabilities in Specifying HDPE Pipe," Mountain States Concrete Pipe Association 5th Annual Concrete Pipe Seminar, Salt Lake City, Utah, October 26, 2006
- Keynote Address, "Risks and Liabilities in Specifying HDPE Pipe," American Concrete Pipe Association Fall Short Course, Charlotte North Carolina, October 16, 2006

Publications

- "Risk by the Numbers," co-contributed with Jack Dignum, *PM Network,* Project Management Institute, March 2012, Volume 26 Number 3
- "Design-Build/EPC Contractor's Heightened Risk – Changes in a Changing World," *Journal of Legal Affairs and Dispute Resolution,* American Society of Civil Engineers, February 2009, Volume 1, Number 1."
- "Risk Based Processes that Assure Anti-Corruption Processes and Promote Transparency and Governance in Resource Extraction Industries," co-authored with Kris Nielsen, International Conference on Infrastructure Development and the Environment, Abuja, Nigeria, September 10 - 15, 2006
- "Risk Management-Now More Than Ever," Published Proceeding, World Engineers' Congress, Session C2. Sustainable Development of Mega-cities on Model of Transportation Structure, Model of Public Transportation First and so on, Shanghai, China, November 2 - 5, 2004
- "Basic Project Execution Risk Management," co-authored with J. Dignum, Proceedings, North American Tunneling 2002 Conference, Seattle, Washington, May 18 - 22, 2002
- "Risk Management Analysis Techniques for Projects With Significant Environmental Issues," co-authored with K. Nielsen, Proceedings, ASCE-SAS Second Regional Conference and Exhibition, Beirut, November 16 - 18, 1995
- "Project Risk Management-A Necessity for Today's Engineered Projects," Proceedings of the American Society of Civil Engineers Saudi Arabia Section First Regional Conference and Exhibition on Advanced Technology in Civil Engineering, Manama, Bahrain, September 18 - 20, 1994
- "Anticipating Problems: Project Risk Assessment and Project Risk Management," co-authored with Kris Nielsen, Chapter 6, "*Collaboration Management, New Project and Partnering Techniques*," edited by H. Shaughnessy, John Wiley and Sons 1994
- "Project Risk Management – Achieving Goals," co-authored with K. Nielsen, Proceedings, 11th INTERNET World Congress on Project Management, Florence, Italy, June 16 – 19, 1992

DR. PATRICIA D. GALLOWAY

Conference Presentations / Teaching / Instruction

- "Design-Build/EPC Contractor's Heightened Risk - Changes in a Changing World," Canadian Society of Civil Engineering Conference, May 30, 2009
- "Role, Responsibility and Risk Considerations Of the Engineer Regarding Sustainability," Florida Association of County Engineers and Road Superintendents, Doral, Florida June 26, 2008
- "The 21st Century Engineer," Seminar to the Civil Department, Civil Department Advisory Committee and to the Engineering Department, University of British Columbia (UBC) Vancouver, British Columbia, Canada, May 1, 2008
- "Viewing Risks and Liability in Light of Sustainability," The Environment and Critical Infrastructure, IBTTA Facilities Management Conference, Orlando, Florida, April 29, 2008
- "Role Responsibility and Risk Considerations for the Engineer Regarding Sustainability," Kentucky American Concrete Pipe Association Conference, Louisville, Kentucky, October 5, 2007
- "How Leaders Should be Viewing Risk Today," AES Global Engineering & Construction Conference, San Francisco, California, September 18, 2007
- "Risks and Liabilities in Specifying HDPE Pipe," American Concrete Pipe Association Fall Short Course, San Antonio, Texas, October 13, 2006
- "Risk-Based Processes that Assure Anti-Corruption Processes and Promote Transparency and Governance in Resource Extraction Industries," International Conference on Infrastructure Development and the Environment, Abuja, Nigeria, September 10 - 15, 2006
- "Basic Project Execution Risk Management," North American Tunneling 2002 Conference, Seattle, Washington, May 18 - 22, 2002
- Panelist, "Using Risk Management Techniques to Improve the Return on Investment," The Global Construction Superconference, London, United Kingdom, November 5 - 6, 2001
- Presenter, "Risk Assessment & Management," Foster Wheeler Law Department Conference, Warren, New Jersey, October 23 - 24, 2001
- The Industry Forum for Contractors, Owners and Their Attorneys, "The Nielsen-Wurster Group Examines the Risks That Must be Recognized and Managed by Owners and Contractors in a Lump Sum, EPC Project," prepared by William K. Kerivan, presented by Patricia D. Galloway and Marianne C. Ramey, The 14th Annual Construction Industry Networking Nirvana, The Millennium Construction Superconference, The Fairmont Hotel, San Francisco, California, December 9 - 10, 1999
- "Managing the Unknowns in Restarting Projects," Inter-Pacific Bar Association Ninth Annual Meeting and Conference, Shangri-La Hotel, Bangkok, Thailand, April 30 - May 4, 1999
- Panel Moderator, "Dealing with Risks on Nuclear Waste Sites," The Environmental Superconference, Washington, D.C., April 28 -29, 1999
- Panel Moderator, "Minimizing Risk in Design / Build Projects," Construction Superconference, San Francisco, California, December 10 - 11, 1998
- In-House Training Seminar, "Project Risk Management," Panama Canal Commission, Panama, March 9 - 12, 1998
- Co-presenter, "Panel of Experts-Specific Risks to Consider," World Conference on Construction Risk III, Paris, France, April 25 - 26, 1996
- "Risk Management Analysis Techniques for Projects With Significant Environmental Issues," ASCE-SAS Second Regional Conference and Exhibition, Beirut, November 16 - 18, 1995
- Co-presenter, "Panel of Experts-Specific Risks to Consider," World Conference on Construction Risk II, Singapore, October 5 - 6, 1995
- "Project Risk Management-A Necessity for Today's Engineered Projects," ASCE-India Section, Calcutta, India, January 30, 1995
- Co-presenter, "Construction Management and Administration, Construction Claims and Project Risk Management," In-House Training Seminar, Pt. Wijaya Karya, Jakarta, Indonesia, January 23 - 27, 1995

- "New Risks with CPM Scheduling-Tricks of the Trade," Nielsen-Wurster Seminar on Emerging Risks in Construction: How to Minimize, Manage and Avoid Disputes, New Orleans, Louisiana, May 10 - 12, 1995; Indian Wells, California, October 19 - 21, 1994
- "A New Game Plan for Intelligent Risk Identification / Allocation, Charting the Course to the Year 2000-Together!," DART, Hyatt-Lexington, Lexington, Kentucky, October 16 - 19, 1994
- "Project Risk Management-A Necessity for Today's Engineered Projects", Tarumanagara University, Jakarta, Indonesia, May 2, 1994
- Co-presenter, "Project Risk Management," Panama Canal Commission, Panama, April 20 - 22, 1994
- "Project Risk Management-Achieving Goals," 11th INTERNET World Congress on Project Management, Florence, Italy, June 16 - 19, 1992
- Co-chairman, Moderator, "Reducing Risks and Liability through Better Specifications and Inspection," ASCE Specialty Conference, San Diego, California, Spring 1981

Leadership / Ethics / Professionalism

Invited and Keynote Presentations

- Keynote Address, "Unlocking Your Leadership Potential: 4C's to Success", Manhattanville College, Purchase, NY, Women's Institute Inaugural Women's Leadership Symposium, June 3, 2015
- Keynote Address, "Enhancing Your Leadership Skills", American Dental Academy Annual Conference, Tucson, AZ, March 5, 2015
- Keynote Address, "The 21st Century Leader: The Path to Success in a Global Economy," 21st Century Leaders Speaker Series, New York Institute of Technology, New York City, November 3, 2010
- Keynote Address, "Using Organizations to Advance Tomorrow's Leaders," Keynote Luncheon Speaker, Annual Conference, Association for Women in Science Advance Workshop, Washington, D.C., October 29, 2009
- Keynote Address, "Leadership-How Professional Organizations Can Assist," NSF Advance Workshop, Washington, DC., October 29, 2009
- Keynote Luncheon Address, "Ethics and Professionalism-their Importance to Engineers in the 21st Century," Kentucky Society of Professional Engineers, 2008 Annual Convention, Louisville, Kentucky, April 24, 2008
- Keynote Address, "Engineer's Role in Public Policy," International Symposium on Social Management Systems, Three Gorges Dam, China, March 11, 2007
- Keynote Address, "Engineering Leadership in the 21st Century," Second Annual Luncheon at George Mason University, Fairfax, Virginia, January 30, 2007
- Keynote Address, "The Engineer's Role and Responsibility in Specifying HDPE Pipe," American Concrete Pipe Association Short Course, Nashville, Tennessee, May 5, 2006
- Keynote Address, "Leadership, Stewardship and Control," 9th Australian International Performance Management Symposium, Canberra, Australia, March 1, 2006
- Keynote Address, "What it Takes to be a Leader," Evening with Industry; California Polytechnic State University, San Luis Obispo, California, January 27, 2006
- Keynote Address, "The Engineer's Role and Responsibility in Specifying HDPE Pipe," American Concrete Pipe Association Short Course, Las Vegas, Nevada, November 9, 2005
- Keynote Address, "Leadership," *Visiting Professor, Special Lecture Series, Kochi University of Technology*, Kochi Japan, November 22, 2004
- Opening Keynote Speaker, "Leadership and Professionalism," Rebuilding Together Annual Convention, Seattle, Washington, October 2004
- Keynote Speaker, "The Engineers Role in Public Policy, Globalization and Ethics and Professionalism," ASCE Annual Leadership Conference, New Orleans, Louisiana; New York, New York; Portland, Oregon; Chicago, Illinois, January - March 2004

- Keynote Speaker, "Ethics and Professionalism," *Tau Beta Pi Annual Awards and Induction Dinner at eh University of Florida*, December 2003
- Keynote Speaker, "Ethics and Professionalism," Society of American Military Engineers Annual Conference, Seattle, Washington, May 2003
- Keynote Dinner Address, "Motivating the Engineer," Project Management Institute, Delaware Chapter Meeting, Wilmington, Delaware, October 1989

Publications

- "Educating the Master Builder of the 21st Century Strategically," *Leadership and Management in Engineering,* American Society of Civil Engineers, Volume 11, Number 2, April 2011
- "Using Professional Organizations To Advance Tomorrow's Leaders," *Leadership and Management in Engineering,* American Society of Civil Engineers, October 2010, Volume 10, Number 4, pp 141 – 143
- "Ethics, Standards of Care and Your Engineering Profession," *Kentucky Engineer*, Official Publication of the Kentucky Society of Professional Engineers, Volume 44, Fall 2007 Panel Member, "Key to Company Success in Today's Global Market," Shaping the Future: Global Talent Leadership in Engineering, Princeton, New Jersey, November 2, 2006
- "The Urgent Need for Leadership in Project Controls Management Ethic," Proceeding, 9th Australian International Performance Management Symposium, Canberra, Australia, February 2, 2006
- "Innovation-Engineering a Better Engineer for Today's Work Force," *Journal of Leadership and Management in Engineering*, American Society of Civil Engineers, Volume 4, Issue 4, pp. 127 - 132, October 2004
- "Lest We Forget-The Engineering Heroes," American Society of Civil Engineers, *ASCE News*, September 2004
- "What Do Dmitrov, Russia, and a Civil Engineer's Dream Have in Common?", American Society of Civil Engineers, *ASCE News*, August 2004
- "Engineers Laugh at Lawyers and Legal Issues, but Should They?", American Society of Civil Engineers, *ASCE News*, July 2004
- "Governance Restructuring: Leading ASCE into the Future," American Society of Civil Engineers, *ASCE News*, June 2004
- "ASCE's Institutes: Inclusive or Divisive," American Society of Civil Engineers, *ASCE News*, March 2004
- "Professionalism-Have We Forgotten?", American Society of Civil Engineers, *ASCE News*, February 2004
- "Public Policy: Friend or Foe in Advancing the Civil Engineering Profession," American Society of Civil Engineers, *ASCE News*, January 2004
- "Our Enthusiasm Can Be Persuasive," American Society of Civil Engineers, *ASCE News*, December 2003
- "Faculty Licensure-Will it Better the Profession?", American Society of Civil Engineers, *ASCE News*, November 2003
- "Innovative Benefits In a Small Consulting Firm," ASCE *Journal of Leadership and Management in Engineering, Winter* 2001, Volume 1, Number 1, pp. 45 - 47
- "Adjust Work Arrangements to Entice, Retain Professionals," *Engineering News Record*, Viewpoint Column, January 3 - 10, 2000

Conference Presentations / Teaching / Instruction

- "Ethics and Professionalism-Their Importance in the Oil and Gas Industry," Offshore Technology Conference, Houston, Texas, May 1, 2006
- "Professionalism," Visiting Professor, Harbin University of Technology, Harbin, China, November 1, 2004
- "Leadership and Professionalism," Boeing Corporation, Seattle, Washington, July 2004

- "Leaders and Leadership," Visiting Professor, Special Lecture Series, Kochi University of Technology, Kochi, Japan, November 20, 2003
- "Roles and Responsibilities of a Board Director," ASCE Board Orientation, Nashville, Tennessee, November 2003
- "Innovative Benefits in a Small Consulting Firm," 1999 ASCE Civil Engineering Conference and Exposition, Charlotte Convention Center, Charlotte, North Carolina, October 17 - 20, 1999
- Panel Moderator, "Management of Construction Risk on Infrastructure Projects in Latin America," The Latin American Market, The Fourth Annual Conference, Turnberry Isle Resort & Club, Aventura, Florida, November 17 - 19, 1998
- "Project Controls and Their Significance on International Projects," AusAID, Canberra, Australia, August 21, 1998
- "Delivering a Successful Project, Worldwide Infrastructure Partnerships," New York, New York, June 24, 1998
- "Civil Engineering with Stars and Stripes," presented at a joint ASCE / ICE Meeting, Epsom, United Kingdom, July 5, 1994

Engineering/STEM Education

Invited and Keynote Presentations

- "Are Engineers Human," TEDx Manhattan Beach, Manhattan Beach, CA, November 2014
- "Expanding Your Horizon," STEM Workshop, Central Washington University, Ellensburg, WA, March 2014
- "Successful K-12 STEM Education," Project Lead The Way, Pacific Science Center, Seattle, Washington, February 28, 2012
- Commencement Speaker, December 2011 graduating class, South Dakota School of Mines, Rapid City, South Dakota, December 17, 2011
- Keynote Address, "Why it's Cool to be an Engineer," Morgan Middle School, Annual Career day, Ellensburg, WA, February 18, 2011
- Keynote Address: "My Personal STEM Story," Open Forum to Engineering School, North Dakota State University, January 31, 2011
- Keynote Address, "Teachers – The Key to Empowering our Nation's Engineering Resources," Project Lead The Way (PLTW), Counselor Conference, Seattle University, Seattle, WA, December 13, 2010
- Keynote Address, "The Critical Need to Change the Face of Science and Engineering," Discovery Channel STEM Discovery Conference, Silver Springs, MD, August 5, 2010
- Keynote Address, "The 21st Century Engineer," The University of Texas at Arlington, Arlington, Texas, April 14, 2010
- Keynote Opening Address, Society of Social Management Systems 2010 Annual Symposium, Kochi University, Kochi, Japan, February 4, 2010
- Keynote Address, "Challenges Facing the Civil Engineer of the 21st Century," Canadian Society of Civil Engineering Conference, New Foundland, May 28, 2009
- Keynote Luncheon Address, "The 21st Century Engineer," Engineer's Week, University of Kentucky, Lexington, KY, February 20, 2009
- Keynote Dinner Speaker, "The Critical Need to Change the Face of Science and Engineering," NSF Advance Conference, Charleston, West Virginia, October 21, 2008
- Keynote address, "Mentoring for the 21st Century," annual Hoover Lecturer, Iowa State University, Ames, Iowa, October 1, 2008
- Keynote Dinner Speaker, "The 21st- Century Engineer: A Proposal for Engineering Education Reform," Cal Poly Pomona College of Engineering, Pomona CA, May 30, 2008
- Keynote Dinner Speaker, "Being A Leader In The 21st Century," ASCE Younger Member Evening Lecture, San Diego CA, May, 27, 2008

- Keynote Dinner Speaker, "The 21st Engineer," ASCE, The G. Brooks Earnest Awards Dinner, Cleveland, Ohio, October 9, 2007
- Keynote Address, "Engineering Education Reform," International Symposium on Social Management Systems, Three Gorges Dam, China, March 9, 2007
- Keynote Address, 2007 Western Regional Younger Member Council Banquet and Awards Ceremony, The Seattle ASCE Younger Member Forum, Seattle, Washington, February 24, 2007
- Keynote Address, "Innovation-Engineering A Better Engineer for Today's Workforce," Construction Innovation Forum, NOVA Awards Dinner, Dearborn, Michigan, April 2004

Publications

- "STEM to the Rescue?" *PE, The Magazine for Professional Engineers,* published by NSPE, March, 2012, includes contributions from Patricia D. Galloway
- "*Connecting Students to STEM: Social Networking Strategies*," International Society for Technology in Education (ISTE), 2011, Authored by Camille Cole, includes excerpts from Patricia D. Galloway
- Forward to "*The View From Here: Optimizing Your Engineering Career From the Start*," Reece Lumsden, Illumina Publishing, 2011
- "New Trends in Engineering Management Education," ASEE Conference, Pittsburgh PA, June 23, 2008
- Galloway, Patricia D., "*The 21st Century Engineer: A Proposal for Engineering Education Reform*", Reston: American Society of Civil Engineers, 2007
- "Bachelor's Plus, The Rationale for 'Raising the Bar' in Engineering Education," *Licensure Exchange*, Publication of National Council of Examiners for Engineering and Surveying, Clemson, South Carolina, March 2004

Conference Presentations / Teaching / Instruction

- Panel Member, *"Making the Case for STEM Education, Part III: A Perspective from Outside the K-12 Educational System,"* Washington State LASER's STEM Education Leadership Institute, Seattle, Washington, June 26, 2012
- Panel Moderator, "*The Future of Science and Engineering Research and Education as the National Science Foundation Celebrates Its 60 th Anniversary*," Advancing Science Serving Society (AAAS)Annual Conference "Bridging Science and Society, " San Diego, California, February 20, 2010
- Panel Moderator "*The Creative Science Studio (CS squared,"* Advancing Science Serving Society (AAAS)Annual Conference "Bridging Science and Society, "San Diego, Ca, February 19, 2010
- "New Trends in Engineering Management Education," ASEE Conference, Pittsburgh PA, June 23, 2008
- Panel Member, "Engineering Education Reform-Solutions for Professional Survival," Workplace Dynamic Panel, September 28, 2006
- Panel Member, "Engineering Education Reform-Solutions for Professional Survival," American Association of Engineering Societies, Chicago, Illinois, June 19 - 20, 2006
- Engineering Educational Reform, Panelist, Curriculum Reform Leader's Conference, Purdue University, West Lafayette, Indiana, August 30, 2005

Women in Engineering / Diversity Issues

Invited and Keynote Presentations

- "Are Engineers Human," TEDx Manhattan Beach, Manhattan Beach, CA, November 2014
- "The Construction Industry: From an Industry to a Profession," ENR Groundbreaking Women in Construction Conference, New York City, May 9, 2012
- Keynote Address, "The Four C's of Success," Expanding Your Horizons, Washington State University – Tri-Cities Campus, March 24, 2012
- Keynote Address, "The Four C's of Success," Kiewit 4th Annual Women in Construction Leadership Conference, Omaha, Nebraska, December 11, 2011

- Keynote Address, "Using Organizations to Advance Tomorrow's Leaders," Keynote Luncheon Speaker, Annual Conference, NSF ADVANCE, Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers, Program Meeting on "Broadening Participation", NSF/Association for Women in Science Advance Workshop, Washington, D.C., October 29, 2009
- Keynote Luncheon Speaker, "What it Takes to Be a Leader," National Women in Construction Leadership Forum, San Francisco, California, September 2004
- Keynote Address, "The Love for Amelia Earhart and the Undying Quest for her Discovery," Zonta Awards Luncheon, Albany, New York, May 2004
- Keynote Address, "What it takes To Be A Leader," Women in Engineering Leadership Institute (WELI) Leadership Summit, University of Connecticut, Windsor, Connecticut, May 2004
- Keynote Speaker, "Breaking Through the Glass Ceiling," HDR Women's Forum 2000, Embassy Suites, Kansas City, Missouri, March 31, 2000

Publications

- "Using Professional Organizations to Advance Tomorrow's Leaders," Forum, Leadership and Management in Engineering Journal, American Society of Civil Engineers, October, 2010
- Engineering Education "Today in History" Blog: First Female Engineer in ASCE, Engineering Pathway, March 14, 2009
- "What Girls Want From Their Profession," *Geo-Strata*, Volume 6, Issues 1 pp.19-21, January / February 2006
- "Extraordinary Stories of Women in Engineering," National Academy of Engineering, May 3, 2004
- "Emily, Amelia, *et. al*,: Who Are These Women And Why Should We Care?", American Society of Civil Engineers, *ASCE News*, May 2004
- "Leadership: Women's Role in Engineering," A Civil Engineered World, a publication of ASCE's International Affairs Department, Volume 13, Issue 1, March 2000
- "The 2-Engineer Family," Proceedings, Society of Women Engineers, National Convention, Detroit, Michigan, June 1982

Conference Presentations / Teaching / Instruction

- "Advocacy and Outreach, Best Practices," Panel, Powering the Network, U.S. Women in Nuclear Conference, Seattle, WA, July 19, 2010
- "How to Increase the Number of Women in Engineering," ADVANCE luncheon, University of Washington, Seattle, WA, October 23, 2008.
- "The Critical Need to Change the Face Of Science and Engineering," NSF sponsored workshop-Building Diversity in Higher Education: Strategies for Broadening Participation in the Sciences and Engineering, Charleston, WVA, October 21, 2008
- "Becoming a Leader in the 21st Century," West Virginia University Center for Women's Studies Residency Program, March 31-April 4, 2008
- "Footprints for Success: Being a Female Leader in Engineering," National Symposium for the Advancement of Women in Science (NSAWS), Harvard University, April 13, 2007
- "Creating an Effective Media / Public Affairs Campaign," First National Summit on the Advancement of Girls in Math and Science, Washington, D.C., May 15, 2006
- Panelist, "Ground Breaking Women in Construction," Los Angeles, California, September 21, 2005
- Panelist, "Rising to Lead," Women's Leaders Tour, Advancement of Technology for Women (ATW), Albany, New York, Austin, Texas; San Jose, California, April - May 2004
- Panelist, "How to Become a Leader," Women in Engineering Leadership Institute (WELI) Leadership Summit, University of Connecticut, Windsor, Connecticut, May 2004
- Moderator, "High Heels are Replacing Hard Hats in the Boardroom," Construction Superconference, The Fairmont Hotel, San Francisco, California, December 8, 2000

- "So Mrs. Roebling-What's Your Side of the Story?", a one-woman play, written by P. Galloway, 1995 ASCE Annual Convention, San Diego, California, October 1995 (over 50 play performances, multiple venues, 1995-1998)
- "The 2-Engineer Family," Society of Women Engineers, National Convention, Detroit, Michigan, June 1982

Climate Change / Sustainability

Invited and Keynote Presentations

- Keynote Address, "The Role of the 21st Century Engineer in the Midst of Global Engineering Crisis," International Symposium on Futures in Civil & Construction Engineering Institution, Seoul Korea, June 17, 2008
- Keynote Address, "The Framework of Sustainability for Engineering Design Considerations," Society for Social Management Systems 2008 Kochi, Japan. March 6, 2008
- Keynote Address, "Role, Responsibility and Risk Considerations of the Engineer Regarding Sustainability," 10th Annual INFTRA-ARHCA-CEA 2007 Transportation Conference, Alberta, Canada, March 19 - 20, 2007
- Keynote Address, "The Mission of the Civil Engineer in the Movement of Globalization," Vechellio Special Lecture Series, Virginia Tech, Blacksburg, Virginia, October 2004
- Annual Convention Keynote Speaker, "Engineer for a Sustainable World," Stanford University, California, September 2004
- Keynote Speaker, "Does Scheduling Make Any Sense in Today's World?", On the Road to Better Scheduling-PMICOS Conference, Montreal, Canada, April 25 - 28, 2004

Publications

- "Problems in Underground Construction: Lessons Learned from Failures and Methods Developed for Success," co-authored with M. Petrov, Proceedings, Underground Space for Sustainable Urban Development, ITA-AITES 2004 World Tunnel Congress, Singapore, May 2004
- "Mission of the Civil Engineer in the Movement of Globalization," published proceedings, Japan Society of Civil Engineers, JSCE First International Symposium on Construction and Project Management-Human Resources Development under Globalization, Tokyo, Japan, October 16 - 17, 2003
- "Mission of the Civil Engineer in the Movement of Globalization," ASCE *Journal of Leadership and Management in Engineering*, Journal Issue 3, Volume 3, pp. 122 - 127, July 2003

Conference Presentations / Teaching / Instruction

- "Responding to Climate Change: The Role of the Engineer," ASCE International Program, American Society of Civil Engineers, International Program, November 6, 2008
- "The Engineer's Role in Public Policy," Institution of Civil Engineers Sustainable Development Forum, New York, New York, September 9, 2005
- "Problems in Underground Construction: Lessons Learned from Failures and Methods Developed for Success," Underground Space for Sustainable Urban Development, ITA-AITES 2004 World Tunnel Congress, Singapore, May 2004

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Power	**Nuclear**	Darlington Nuclear Generating Station, Darlington Refurbishment Project, Canada
Power	**Nuclear**	Bellefonte Nuclear Power Plant, Unit 1 Completion, United States (Alabama)
Power	**Nuclear**	Levy 1 & 2 Nuclear Power Plant, United States (Florida)
Power	**Nuclear**	Vogtle 3 & 4 Nuclear Generating Station, United States (Georgia)
Power	**Nuclear**	Seabrook Unit 2 Nuclear Generating Station, United States (New Hampshire)
Power	**Nuclear**	Millstone Nuclear Generating Station Unit 3, United States (Connecticut)
Power	**Nuclear**	Cooper Nuclear Station, United States (Nebraska)
Power	**Nuclear**	Connecticut Yankee Nuclear Plant, United States (Connecticut)
Power	**Nuclear**	Millstone Point Nuclear Generating Station, Units 1, 2 and 3, United States (Connecticut)
Power	**Nuclear**	Indian Point Nuclear Power Plant Unit 3, United States (New York)
Power	**Nuclear**	Salem and Hope Creek Nuclear Power Plants, United States (New Jersey)
Power	**Nuclear**	South Texas Nuclear Plant, United States (Texas)
Power	**Nuclear**	Trojan Nuclear Power Plant, United States (Oregon)
Power	**Nuclear**	Shoreham Nuclear Plant, United States (New York)
Power	**Nuclear**	Nine Mile Power Plant, United States (New York)
Power	**Nuclear**	Bellefonte Nuclear Power Plant, United States (Alabama)
Power	**Nuclear**	Millstone 2 Nuclear Power Plant, Waterford, United States (Connecticut)
Power	**Nuclear**	Washington Public Power Supply Nuclear Plants, United States (Washington)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Power	**Nuclear**	Diablo Canyon Nuclear Power Plant, United States (California)
Power	**Nuclear**	Comanche Peak Steam Nuclear Electric Station, Units 1 & 2, United States (Texas)
Power	**Nuclear**	Clinton Nuclear Generating Station, Decatur, United States (Illinois)
Power	**Nuclear**	Pilgrim I Nuclear Power Plant, United States (Massachusetts)
Power	**Nuclear**	Vogtle 1 & 2, Nuclear Generating Station, United States (Georgia)
Power	**Nuclear**	Palo Verde Nuclear Generating Station, United States (Arizona)
Power	**Nuclear**	Perry Nuclear Generating Station, United States (Ohio)
Power	**Nuclear**	Seabrook Nuclear Generating Station Unit 1 and Unit 2, United States (New Hampshire)
Power	**Nuclear**	Waterford Nuclear Power Plant Unit 3, United States (Louisiana)
Power	**Nuclear**	Shoreham Nuclear Power Plant, United States (New York)
Power	**Nuclear**	Hanford, United States (Washington)
Power	**Nuclear**	Wolf Creek, United States (Kansas)
Power	**Nuclear**	Maine Yankee Nuclear Power Plant, United States (Maine)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Western U.S. Combined Cycle Plant, United States
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Salem Harbor Combined Cycle Plant, United States (Massachusetts)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Duke Energy Coal Ash Basin Closure Program, United States

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Kemper County IGCC Power Plant, United States (Mississippi)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Edwardsport IGCC Power Plant, United States (Indiana)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Iatan Unit 1 & 2 Super-critical pulverized coal plant, United States (Kansas, Missouri)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Scherer Fossil Power Plant (4 Units), United States (Georgia)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	La Paloma Combined Cycle Power Plant, United States (California)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Sacramento Municipal Utility District (SMUD) Cosumnes Combined Cycle Plant, United States (California)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Marshall Islands Power Plant Demolition, United States Territory (Marshall Islands)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Paiton Units 1 & 2, Indonesia
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Paiton Units 7 & 8, Indonesia
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	JEA Northside, United States (Florida)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Osbourne, Australia
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Jiu Jiang Power Plant, China
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Cleveland Electric Illuminating Company, Fossil Power Plants, United States (Ohio)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Jeffrey Energy Center, United States (Kansas)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Wolf Hollow Plant, United States (Texas)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Covert Plant, United States (Michigan)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Dearborn Industrial Generation Project, United States (Michigan)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Illinois Power Company, United States (Illinois)
Power	**Cogeneration/ Combined Cycle/Fossil Fuel**	Fossil Power Plant, Bulgaria
Power	**Geothermal**	Wayang Windu Geothermal Power Project, Indonesia
Power	**Hydro**	Alto Maipo Project, Chile
Power	**Hydro**	Xiaolangdi Dam, China
Power	**Hydro**	Casecnan Multi-Purpose Project, Philippines
Power	**Hydro**	Cirata II, Indonesia
Power	**Hydro**	Sulpher Creek Hydro Power Plant, United States (California)
Power	**Hydro**	Mill to Bull Creek Tunnel, United States (California)
Power	**Waste to Energy**	Valorsul Waste-To-Energy Plant, Portugal
Power	**Solar**	Eastern U.S. Solar Program, United States
Power	**Wind Power**	Brazos Wind Farm, United States (Texas)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Power	**Wind Power**	Caprock Wind Farm, United States (New Mexico)
Power	**Transmission**	Rockdale-West Middleton Project, United States (Wisconsin)
Power	**Transmission**	Interstate Transmission Line Project, (Western Region) United States
Power	**Storm Hardening**	PSE&G, United States (New Jersey)
Infrastructure / Transportation	**Roadways**	SR-99 Alaskan Way Viaduct Replacement Project, United States (Washington)
Infrastructure / Transportation	**Roadways**	SR-520, United States (Washington)
Infrastructure / Transportation	**Roadways**	Shawnee Mission Parkway, United States (Kansas)
Infrastructure / Transportation	**Roadways**	KDOT Project, United States (Kansas)
Infrastructure / Transportation	**Roadways**	New Jersey Turnpike, Section 5B-3, United States (New Jersey)
Infrastructure / Transportation	**Roadways**	Melbourne City Link, Australia
Infrastructure / Transportation	**Roadways**	Turnpike Operations Management System, United States (Florida)
Infrastructure / Transportation	**Roadways**	State Highway US 290 Travis County, United States (Texas)
Infrastructure / Transportation	**Roadways**	State Highway SR-21, United States (Florida)
Infrastructure / Transportation	**Roadways**	Asphalt Resurfacing Project, Highway 9, United States (Nebraska)
Infrastructure / Transportation	**Roadways**	Electronic Toll Collection System, United States (Florida)
Infrastructure / Transportation	**Roadways**	Blue Route Section 200, United States (Pennsylvania)
Infrastructure / Transportation	**Roadways**	Lief Erikson Tunnel, United States (Minnesota)
Infrastructure / Transportation	**Roadways**	Veteran's Expressway, Tampa, United States (Florida)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Infrastructure / Transportation	**Roadways**	Interstate 75, Kentucky (Lexington and Covington Road) United States (Kentucky)
Infrastructure/ Transportation	**Bridges**	Tappan Zee Bridge, United States (New York)
Infrastructure / Transportation	**Bridges**	Columbia River Crossing, Independent Review Panel, United States (Oregon, Washington)
Infrastructure / Transportation	**Bridges**	Houston Ship Channel (Baytown) Cable-Stayed Bridge, United States (Texas)
Infrastructure / Transportation	**Bridges**	Hillsborough Avenue Bridge, United States (Tampa, Florida)
Infrastructure / Transportation	**Bridges**	151st Street Bridge Project, United States (Kansas)
Infrastructure / Transportation	**Bridges**	Hong Kong Tsing Ma Bridge, China
Infrastructure / Transportation	**Bridges**	Nairn Avenue Overpass Project, Canada
Infrastructure / Transportation	**Bridges**	New Smyrna Beach Bridge, United States (Florida)
Infrastructure / Transportation	**Bridges**	Hastings Bridge, Hastings, United States (Minnesota)
Infrastructure / Transportation	**Bridges**	Post Tensioned Segmental Bridge, Bexar County, United States (Texas)
Infrastructure / Transportation	**Bridges**	Interstate Highway Bridges, United States (Indiana)
Infrastructure / Transportation	**Bridges**	Gloucester Inlet Bridge, United States (Massachusetts)
Infrastructure / Transportation	**Airports**	Yosemite International Airport, United States (California)
Infrastructure / Transportation	**Airports**	Port of Seattle, United States (Washington)
Infrastructure / Transportation	**Airports**	Kuala Lumpur International Airport, Malaysia
Infrastructure / Transportation	**Airports**	Indianapolis International Airport, United Airlines Maintenance Operation Center, United States (Indiana)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Infrastructure / Transportation	**Telecommunication**	AT&T Broadband, United States (Illinois, Missouri, Michigan)
Infrastructure / Transportation	**Defense**	TADRS (Tactical Air Defense Radar System), Australia
Infrastructure / Transportation	**Rail**	Sound Transit Light Rail, United States (Washington)
Infrastructure / Transportation	**Rail**	Phoenix Light Rail Transit, United States (Arizona)
Infrastructure / Transportation	**Rail**	Vancouver Millennium Sky Train Project, Canada
Infrastructure / Transportation	**Rail**	Pentagon City Subway Station, United States (Virginia)
Infrastructure / Transportation	**Rail**	Rohr Transit Cars, United States (Washington, D.C)
Infrastructure / Transportation	**Rail**	North Harlem To Brewster (Hudson Harlem Lines) Electrification Program, United States (New York)
Infrastructure / Transportation	**Rail**	London Crossrail Project, United Kingdom
Infrastructure / Transportation	**Rail**	Taisei-Metro Extension Project, Bulgaria
Infrastructure / Transportation	**Rail**	Regional Fast Rail Project (RFRP), Australia
Infrastructure / Transportation	**Rail**	Southern New Jersey Light Rail Transit System, United States (New Jersey)
Infrastructure / Transportation	**Rail**	Singapore Mass Rail Transit, Singapore
Infrastructure / Transportation	**Rail**	Toronto Transit Commission Subway Line Expansion, Canada
Infrastructure / Transportation	**Rail**	Shaw Subway Station, United States (Washington, D.C.)
Infrastructure / Transportation	**Rail**	Stamford Railroad Station Stamford, United States (Connecticut)
Infrastructure / Transportation	**Ship / Seaport**	Central Terminal Expansion Claim Review, United States (Washington)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Infrastructure / Transportation	**Ship / Seaport**	Port of Seattle, United States (Washington)
Infrastructure / Transportation	**Ship / Seaport**	Lahad Datu Port Expansion, Malaysia
Infrastructure / Transportation	**Ship / Seaport**	Panamá Canal Transfer Station, Panamá
Infrastructure / Transportation	**Ship / Seaport**	Riofil / Manila South Harbor Pier 5 Extension, Philippines
Infrastructure / Transportation	**Ship / Seaport**	City of Venice Floodgate, Italy
Infrastructure / Transportation	**Ship / Seaport**	F/V Arctic Storm Ship Conversion, United States (Washington)
Infrastructure / Transportation	**Ship / Seaport**	Deep Sea Drilling Ship, United States (Texas)
Infrastructure / Transportation	**Other**	American Concrete Pipe Association (ACPA) Independent Research, United States (Tennessee)
Infrastructure / Transportation	**Other**	Japan Ministry of Land, Infrastructure and Transport, Analysis of US Public Construction Contracting Practice, Japan
Infrastructure / Transportation	**Other**	Fish Barrier Project (FBP) United States (Washington)
Infrastructure / Transportation	**Other**	Seattle Public Utilities (SPU) and SeaTran, United States (Washington)
Industrial / Process	**Chemical / Petrochemical**	Palmetto Lime Facility, United States (South Carolina)
Industrial / Process	**Chemical / Petrochemical**	PET Production Plants, Argentina, Holland, Spain
Industrial / Process	**Chemical / Petrochemical**	Zinc Recovery Plant, United States (California)
Industrial / Process	**Chemical / Petrochemical**	FMC Baltimore Sulfentrazone Plant, United States (Maryland)
Industrial / Process	**Chemical / Petrochemical**	Seraya Island Petrochemical Project, Singapore
Industrial / Process	**Oil / Gas**	Nations Petroleum Steam – Flood Project, United States (California)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Industrial / Process	**Oil / Gas**	PML Project, Singapore
Industrial / Process	**Oil / Gas**	Minerva Project, Australia
Industrial / Process	**Oil / Gas**	PEMEX Combisa EPC 22, Mexico
Industrial / Process	**Oil / Gas**	GASYRG Pipeline, Bolivia
Industrial / Process	**Oil / Gas**	PEMEX, Cantarell Project, Mexico
Industrial / Process	**Oil / Gas**	Foster Wheeler SINCOR Coker Project, Venezuela
Industrial / Process	**Oil / Gas**	Luberef Refinery Project, Saudi Arabia
Industrial / Process	**Oil / Gas**	PEMEX Demineralization Plant, Mexico
Industrial / Process	**Oil / Gas**	Perez Companc-Norcen-Corod Oritupano-Leona Oil Fields, Eastern Venezuela
Industrial / Process	**Oil / Gas**	Altona Refinery Expansion, Australia
Industrial / Process	**Oil / Gas**	INCO 92 Project, Gas Recompression Plants, Venezuela
Industrial / Process	**Oil / Gas**	Ahmadi Oil Distribution Facility, Kuwait
Industrial / Process	**Oil / Gas**	Nippon Steel On-Site Auditing / Risk Management
Industrial / Process	**Pulp & Paper Mill**	Chemical Recovery System at Pulp & Paper Mill, United States (Mississippi)
Industrial / Process	**Pulp & Paper Mill**	Weyerhaeuser Pulp and Paper Mill, Training, Contract and Administration
Industrial / Process	**Microchip**	Sperry Micro-Chip Manufacturing & Research Facility, United States (Minnesota)
Industrial / Process	**Pipelines**	Sakhalin Pipeline Project, Russia
Industrial / Process	**Pipelines**	Bolivia Pipeline, Bolivia
Industrial / Process	**Pipelines**	Bombax Pipeline Project, Trinidad, Tobago
Industrial / Process	**Pipelines**	HBJ Gas Pipeline, India
Industrial / Process	**Pipelines**	Santa Ana Watershed Project Pipeline, United States (California)
Industrial / Process	**Water Plant**	Central Brown County, United States (Wisconsin)
Industrial / Process	**Water Plant**	Pinellas County Water System Pipeline, United States (Florida)
Industrial / Process	**Water Plant**	Mount Hope Water Main Project, Panama

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Industrial / Process	**Water Plant**	Water Treatment Plant, United States (Georgia)
Industrial / Process	**Wastewater / Environmental**	Upper Rouge Tunnel, United States (Michigan)
Industrial / Process	**Wastewater/ Environmental**	Passaic Valley Sewerage Commissioners Thickening Centrifuge Facility, United States (New Jersey)
Industrial / Process	**Wastewater / Environmental**	Milwaukee Water Pollution Abatement Program, United States (Wisconsin)
Industrial / Process	**Wastewater / Environmental**	South Bay Wastewater Treatment Plant, California, United States (California)
Industrial / Process	**Wastewater / Environmental**	Babylon Solid Waste Recovery Plant, United States (New York)
Industrial / Process	**Wastewater / Environmental**	Hamilton Wastewater Treatment Plant, United States (New York)
Industrial / Process	**Wastewater / Environmental**	Rockland County Sewer District Treatment Plant, United States (New York)
Industrial / Process	**Wastewater / Environmental**	Secondary Facilities At Newark Bay Pumping Station, United States (New Jersey)
Industrial / Process	**Wastewater / Environmental**	Bowery Bay Wastewater Treatment Plant, United States (New York)
Industrial / Process	**Wastewater / Environmental**	St. Joseph Wastewater Treatment Plant, United States (Missouri)
Industrial / Process	**Wastewater / Environmental**	Bergen Point Wastewater Treatment Plant, United States (New York)
Industrial / Process	**Wastewater / Environmental**	Coney Island Water Pollution Control Project, United States (New York)
Industrial / Process	**Environmental**	New Jersey Sludge Drying / Fertilizer Facility, United States (New Jersey)
Industrial / Process	**Environmental**	Blydenburgh Landfill, United States (New York)
Industrial / Process	**Environmental**	Transuranic Storage Area Retrieval Enclosure, United States (Idaho)
Industrial / Process	**Environmental**	Warren County Landfill, United States (New Jersey)
Industrial / Process	**Environmental**	Weyerhaeuser Fish Hatchery, United States (Oregon)
Industrial / Process	**Environmental**	Asbestos White Paper Development-Evert & Weathesby

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Industrial / Process	**Environmental**	Foster Wheeler Asbestos Litigation, United States (New Jersey)
Industrial / Process	**Wastewater / Environmental**	Wastewater Treatment Plant, Canada
Industrial / Process	**Iron / Steel Manufacturing**	POSVEN Hot Briquette Iron Plant, Venezuela
Industrial / Process	**Iron / Steel Manufacturing**	Delta Brands Subcontract PPPL and ARP Expediting Services
Industrial / Process	**Iron / Steel Manufacturing**	IPSCO Mini-Mill, United States (Iowa)
Industrial / Process	**Iron / Steel Manufacturing**	NKK Steel Continuous Galvanizing Project, United States (Michigan)
Industrial / Process	**Iron / Steel Manufacturing**	Republic Steel Mill Project, United States (Ohio)
Industrial / Process	**Iron / Steel Manufacturing**	Union Park CSO Pump Station and Detention Facility, United States (Massachusetts)
Industrial / Process	**Pharmaceutical**	Bulk Pharmaceutical Production Plant, Singapore
Industrial / Process	**Pharmaceutical**	Squibb Animal Test Facility, United States (New Jersey)
Industrial/Process	**Mining**	Iron Mining Expansion Project, Quebec, Canada
Industrial / Process	**Mining**	Nickel-Cobalt Refinery, Western Australia
Industrial / Process	**Fertilizer Plant**	Petro Vietnam Fertilizer Plant, Phu My Province, Vietnam
Buildings	**Educational Facilities**	Princeton University, United States (New Jersey)
Buildings	**Educational Facilities**	DeKalb County School District, United States (Georgia)
Buildings	**Educational Facilities**	Delgado Community College, United States (New Orleans)
Buildings	**Educational Facilities**	Rutgers University Records Center, United States (New Jersey)
Buildings	**Educational Facilities**	Washoe County School District, United States (Nevada)
Buildings	**Educational Facilities**	Plainsboro Middle School, United States (New Jersey)
Buildings	**Educational Facilities**	Hunter College, United States (New York)
Buildings	**Educational Facilities**	York College, United States (New York)
Buildings	**Educational Facilities**	School Project, United States (Indiana)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Buildings	**Resorts / Casinos / Hotels**	Regent Las Vegas Resort, United States (Nevada)
Buildings	**Resorts / Casinos / Hotels**	Hotel / Condominium Complex, Indonesia
Buildings	**Resorts / Casinos / Hotels**	Phoenician Hotel and Resort, (Arizona)
Buildings	**Resorts / Casinos / Hotels**	Westin Hotel, United States (Texas)
Buildings	**Resorts / Casinos / Hotels**	Safety Harbor Spa, United States (Florida)
Buildings	**Resorts / Casinos / Hotels**	Intercontinental Hotel, United States (Texas)
Buildings	**Resorts / Casinos / Hotels**	Hyatt Regency Hotel, United States (Missouri)
Buildings	**Apartments / Condominiums / Housing**	99100 Park Towers at Hughes Center, United States (Nevada)
Buildings	**Apartments / Condominiums / Housing**	Ortley Beach Commons, United States (New Jersey)
Buildings	**Apartments / Condominiums / Housing**	Louisville Housing Authority Project, United States (Kentucky)
Buildings	**Centers / Arenas**	University of Washington Basketball Arena, United States (Washington)
Buildings	**Centers / Arenas**	Jacksonville Pre-Trial Detention Center, United States (Florida)
Buildings	**Centers / Arenas**	San Diego Convention Center, United States (San Diego, California)
Buildings	**Centers / Arenas**	Washington State Convention Center, United States (Washington)
Buildings	**Centers / Arenas**	Worcester Civic Center (Centrum), United States (Massachusetts)
Buildings	**Centers / Arenas**	Riverside Civic Center, United States (New York)
Buildings	**Stadiums**	Fresno Multipurpose Stadium, (Grizzlies Stadium) United States (California)

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Buildings	**Stadiums**	Arizona State University, Sun Devil Stadium Expansion, United States (Arizona)
Buildings	**Medical / Hospitals**	Alameda County Medical Center / Highland General Hospital, United States (California)
Buildings	**Medical / Hospitals**	Colombo General Hospital, Sri Lanka (Colombo)
Buildings	**Medical / Hospitals**	Stoney Brook Hospital, United States (New York)
Buildings	**Medical / Hospitals**	Madigan VA Hospital, United States (Washington)
Buildings	**Medical / Hospitals**	Kodiak Health Care Facility, United States (Alaska)
Buildings	**Medical / Hospitals**	University Medical Center, United States (Louisiana)
Buildings	**Research Laboratory**	TA-35 Los Alamos National Laboratory, United States (New Mexico)
Buildings	**Offices**	Unit Atrium One Building, United States (Ohio)
Buildings	**Offices**	One Summit Square Office Building, United States (Indiana)
Buildings	**Offices**	Equitable Tower Office Building, United States (New York)
Buildings	**Offices**	Loney Construction Brattleboro Projects, United States (Vermont)
Buildings	**Offices**	IBM Office Complex, United States (New York)
Buildings	**Offices**	Gold Building Parking Garage, United States (Connecticut)
Buildings	**Offices**	American Standard Office Building, United States (Oklahoma)
Buildings	**Distribution / Storage / Warehouse**	Olefins Terminal Storage Complex
Buildings	**Distribution / Storage / Warehouse**	TRW Record Storage Complex, United States (New Jersey)
Buildings	**Distribution / Storage / Warehouse**	New Jersey State Food Distribution Center, United States (New Jersey)
Buildings	**Distribution / Storage / Warehouse**	Trenton Record Storage Center, United States (New Jersey)
Buildings	**Other**	Courthouse Construction Program Oversight, United States (California)
Buildings	**Other**	Parking Garage, United States (Ohio)
Other	**Seminar/Training**	Addressing Delay and Disruption Seminar, Panama Canal Authority, Panama

PATRICIA D. GALLOWAY *Representative Engagement Experience [Does not include engagements where served as arbitrator]*		
Industry	**Type**	**Project Name**
Other	**Seminar / Training**	Nexen Corporate Management, Risk Management / Program /Project Management Training, United States.
Other	**Seminar / Training**	AES: Corporate / Project Management, Risk Management Training, United States & Canada
Other	**Seminar / Training**	Japan Bank for International Cooperation, Japan
Other	**Seminar / Training**	West Virginia DOT Training Seminar, United States (West Virginia)
Other	**Seminar / Training**	Claims Seminar, Texas Department of Transportation, United States (Texas)
Other	**Seminar / Training**	Project Risk Management Seminar, Contract Administration Seminar, Panama Canal Commission, Panama
Other	**Seminar / Training**	Partnering Seminar, Kentucky Transportation Cabinet, United States (Kentucky)
Other	**Seminar / Training**	Florida Department of Transportation, United States (Florida)
Other	**Seminar / Training**	Seminar: Department of Energy, United States (West Virginia)
Other	**Seminar / Training**	University of Wisconsin-Madison Seminar, United States (Wisconsin)
Other	**Seminar / Training**	Fluor Corporate Risk / Claims Management, United States (California)
Other	**Seminar / Training**	Claims Avoidance & Management Training, United States (Arizona)
Other	**Seminar / Training**	Identifying, Minimizing & Quantifying Risk, England
Other	**Seminar / Training**	Claims Seminar On Construction Issues, Canada
Other	**Seminar / Training**	CPM Scheduling Course, United States (Pennsylvania)
Other	**Seminar / Training**	Claims Minimization Seminar, United States (New Hampshire)
Other	**Other**	Nunez Employment Discrimination Suit, United States (Texas)
Other	**Other**	Foster Wheeler Risk Management Corporate Advisor
Other	**Other**	Royal Grading Golf Course and Country Club

TORYS LLP

79 Wellington St. W., 30th Floor
Box 270, TD South Tower
Toronto, Ontario M5K 1N2 Canada
P. 416.865.0040 | F. 416.865.7380
www.torys.com

Charles Keizer
ckeizer@torys.com
P. 416.865.7512

April 11, 2016

PRIVILEGED AND CONFIDENTIAL
EMAIL

Dr. Patricia D. Galloway
President and CEO
Pegasus Global Holdings, Inc.
1750 Emerick Road
Cle Elum, WA 98922

Attention: Dr. Galloway

Re: Ontario Power Generation

We represent Ontario Power Generation Inc. ("OPG") in connection with its pending payment amounts application (the "Application") to the Ontario Energy Board (the "Board"), which Application includes a request for Board approval of certain costs relating to the refurbishment of four nuclear reactor units at the Darlington Nuclear Generating Station (the "Darlington Refurbishment Program").

We confirm that Torys LLP ("Torys") is retaining Pegasus Global Holdings, Inc. ("Pegasus-Global"), effective from April 1, 2016, in order to assist us in advising OPG in connection with the Application. In particular, Pegasus-Global will:

(a) provide Torys with advice in respect of matters that are at issue in the Application, as requested, including in particular an independent and objective assessment of the degree to which OPG's plan and approach to the execution of the Darlington Refurbishment Program, including the processes in place for management of costs and schedule, program controls and its application of any contingency, are consistent with the way other projects of comparable magnitude, scale and complexity have been carried out;

(b) prepare a report or reports for filing with the Board as part of the Application, if requested; and

(c) testify before the Board in connection with the Application, if requested.

Our agreement is subject to the following terms:

1. Pegasus-Global understands that all work performed by Pegasus-Global in connection with this retainer, including all findings, opinions and conclusions Pegasus-Global reaches in relation to this retainer, and any communications relating thereto, is strictly privileged and confidential and shall not be disclosed to any other person or party without the prior written consent of Torys. Pegasus-Global agrees to designate all written communications and material accordingly. Pegasus-Global further agrees to notify Torys in the event that Pegasus-Global receives a request to disclose information relating to this matter, and agrees to cooperate with us, to the fullest extent permitted by law, to prevent or limit the disclosure of such material or otherwise preserve the privileged and confidential status of such material.

2. Pegasus-Global agrees to hold in confidence: (a) the fact of this retainer, (b) all information provided to Pegasus-Global by Torys or OPG, and (c) Pegasus-Global's opinions to us as they relate to the information, whether the information or opinions are documentary or oral (the "Confidential Information"). Pegasus-Global will not disclose the information or opinions to any person unless Torys authorizes Pegasus-Global in writing to do so, or as may be required for purposes of providing testimony before the Board in which case Pegasus-Global shall identify and only disclose Confidential Information in accordance with the Board's protocols for the treatment of confidential information. All documents given to Pegasus-Global in connection with this retainer remain the property of Torys, and are held in trust by Pegasus-Global as agent. Pegasus-Global agrees to return or destroy these documents on request.

3. Pegasus-Global agrees during this engagement not to provide, directly or indirectly, without the prior written consent of Torys, Pegasus-Global's advisory services to the Board or to any person, corporation or other entity that is a participant in any regulatory proceeding relating to the Application, or to any person, corporation or other entity related to them.

4. Pegasus-Global confirms that it is free to provide services to Torys in connection with Torys' representation of OPG, and that Torys is free to use and disclose such information in any manner whatsoever.

5. Pegasus-Global agrees to refrain from referring to Torys or OPG, directly or indirectly, in connection with the promotion of Pegasus-Global's services, without obtaining the prior written approval of Torys.

6. Pegasus-Global acknowledges and agrees that it has received a copy of Rule 13A of the Board's *Rules of Practice and Procedure* concerning expert evidence, a copy of which is attached as "**Schedule 1**" hereto, and agrees to accept the responsibilities that are or may be imposed on Pegasus-Global by that rule with respect to testimony before the Board, should we request that Pegasus-Global testify before the Board.

7. With respect to Pegasus-Global's advice, Pegasus-Global agrees to provide us with a proposed workplan by April 22, 2016 setting out the activities that Pegasus-Global intends to undertake, including the relevant individuals, estimated timing and estimated costs (the "Proposed Workplan"). Torys will notify Pegasus-Global in writing once it has approved the Proposed Workplan.

8. With respect to the work described herein, including the preparation of any report(s) and testifying before the Board, Pegasus-Global will be compensated at the following hourly rates:

   (a) Patricia Galloway [redacted]/hr

   (b) Jeremy Clark [redacted]/hr

   (c) William Riggins [redacted]/hr

9. Torys will reimburse Pegasus-Global for travel expenses related to this retainer only in accordance with OPG's Standard Form Business Expense Schedule (the "Expense Schedule"), a copy of which is attached as "**Schedule 2**" hereto. Any disbursements for additional incidentals incurred by Pegasus-Global in relation to this retainer must be pre-approved by Torys in writing and in accordance with the Expense Schedule. Torys reserves the right to deduct any applicable non-resident withholding taxes from any amounts owing to Pegasus-Global under this retainer and remit such amounts to the applicable taxation authority. Due to the confidential nature of this assignment, Pegasus-Global agrees to submit:

   (a) a summary sheet only of each account, showing: (i) the fee, (ii) expenses, (iii) all applicable taxes, (iv) a subtotal, excluding taxes, and (v) the grand total;

   (b) a detailed account which will include at least the following information:

      (i) identification of the billing period to which the account relates;

      (ii) an itemized summary of the work that has been undertaken, including a brief description of each service, the date on which each service was rendered, the time spent on each service, the individual who performed the service and the billing rate of such individual; and

      (iii) an itemization and brief description of all expenses incurred during the billing period, with copies of supporting invoices for any expenses in excess of [redacted], unless Torys indicates that such invoices are not required.

   (c) Pegasus-Global shall direct its accounts to my attention at the address indicated above.

Please indicate Pegasus-Global's agreement to the terms of this retainer as set out herein, by signing a copy of this letter and returning it to me.

Thank you for your assistance.

Yours truly,

Torys LLP

Charles Keizer

* * *

Agreed, this 11 day of April, 2016.

for Dr. Patricia D. Galloway
Pegasus Global Holdings, Inc.

CK

SCHEDULE 1

Rule 13A of the Board's *Rules of Practice and Procedure*

13A. Expert Evidence

13A.01 A party may engage, and two or more parties may jointly engage, one or more experts to give evidence in a proceeding on issues that are relevant to the expert's area of expertise.

13A.02 An expert shall assist the Board impartially by giving evidence that is fair and objective.

13A.03 An expert's evidence shall, at a minimum, include the following:

(a) the expert's name, business name and address, and general area of expertise;

(b) the expert's qualifications, including the expert's relevant educational and professional experience in respect of each issue in the proceeding to which the expert's evidence relates;

(c) the instructions provided to the expert in relation to the proceeding and, where applicable, to each issue in the proceeding to which the expert's evidence relates;

(d) the specific information upon which the expert's evidence is based, including a description of any factual assumptions made and research conducted, and a list of the documents relied on by the expert in preparing the evidence; and

(e) in the case of evidence that is provided in response to another expert's evidence, a summary of the points of agreement and disagreement with the other expert's evidence.

(f) an acknowledgement of the expert's duty to the Board in **Form A** to these Rules, signed by the expert.

13A.04 In a proceeding where two or more parties have engaged experts, the Board may require two or more of the experts to:

(a) in advance of the hearing, confer with each other for the purposes of, among others, narrowing issues, identifying the points on which their views differ and are in agreement, and preparing a joint written statement to be admissible as evidence at the hearing; and

(b) at the hearing, appear together as a concurrent expert panel for the purposes of, among others, answering questions from the Board and others as permitted by the Board, and providing comments on the views of another expert on the same panel.

13A.05 The activities referred to in **Rule 13A.04** shall be conducted in accordance with such directions as may be given by the Board, including as to:

(a) scope and timing;

(b) the involvement of any expert engaged by the Board;

(c) the costs associated with the conduct of the activities;

(d) the attendance or non-attendance of counsel for the parties, or of other persons, in respect of the activities referred to in paragraph (a) of **Rule 13A.04**; and

(e) any issues in relation to confidentiality.

13A.06 A party that engages an expert shall ensure that the expert is made aware of, and has agreed to accept, the responsibilities that are or may be imposed on the expert as set out in this **Rule 13A** and **Form A**.

SCHEDULE 2

OPG's Standard Form Business Expense Schedule
(updated December 10, 2014)

STANDARD FORM BUSINESS EXPENSE SCHEDULE FOR CONTRACTORS

Effective June 17, 2009

ONTARIO POWER GENERATION INC.

Updated December 10, 2014

Table of Contents

BUSINESS EXPENSE SCHEDULE

RECITALS

A. Ontario Power Generation Inc., (**"OPG"**) entered into an Agreement (the **"Agreement"**) with the other party to the Agreement (the **"Contractor"**). This schedule (this **"Schedule"**) forms part of the Agreement. Under the Agreement, OPG agreed to reimburse the Contractor for certain business expenses incurred by employees of the Contractor (**"Eligible Employees"**) in performing work for OPG under the Agreement.

B. This Schedule sets out the terms on which OPG will reimburse the Contractor for business expenses incurred by Eligible Employees in performing work for OPG.

SECTION 1 – INTERPRETATION

1.1 Three Types of Reimbursement

OPG will reimburse the Contractor for expenses that are eligible for reimbursement in accordance with the Schedule. OPG will make the reimbursements in 1 of 3 ways respecting each Eligible Employee in respect of whom reimbursements are payable. The 3 ways of reimbursements are:

(a) reimbursement of individually incurred Allowable Expenses as set out in section 2 through section 5;

(b) payment on a flat rate daily basis as set out in section 6; or

(c) payment on a flat rate monthly basis as set out in section 7.

Except as expressly set out in section 6 or section 7, if OPG pays the Contractor the daily or monthly rate in respect of an Eligible Employee, OPG will reimburse the Contractor no Allowable Expenses in respect of that Eligible Employee.

1.2 Definitions

In this Schedule, the following terms have the respective meanings set out below.

(a) **Agreement** is defined in Recital A.

(b) **Allowable Expenses** is defined in Section 2.1.

(c) **Business Day** means any day other than a Saturday, Sunday, New Year's Day, Family Day, Good Friday, Easter Monday, Victoria Day, Canada Day, Civic Holiday, Labour Day, Remembrance Day, Thanksgiving Day, Christmas Day and Boxing Day.

(d) **Contractor** is defined in Recital A.

(e) **Eligible Employees** is defined in Recital A.

(f) **Home Base** means the permanent place of residence (home) of Eligible Employee.

(g) **Reporting Location** means the normal work location or base office for Eligible Employee. For all work at Darlington Nuclear (DN) and Pickering Nuclear (PN) sites, this is further defined as an area consisting of a 100km radius around the midpoint between DN and PN site. Bruce Nuclear (BN) is also considered a reporting location.

(h) **OPG Representative** is defined in Section 2.1 (d).

(i) **Schedule** is defined in Recital A.

(j) **Work Site** means a location at which the Eligible Employee may be required to provide service that is different from the Eligible Employee's normal reporting location.

1.3 Headings

The division of the Schedule into sections, the insertion of headings and the provision of a table of contents are for convenience of reference only and are not to affect the construction or interpretation of this Schedule.

1.4 Expanded Definitions

Unless otherwise specified, words importing the singular include the plural and vice versa and words importing gender include all genders. The term **"including"** means "including without limitations", and the terms **"include"**, **"includes"** and **"included"** have similar meanings. The term **"will"** means "shall".

1.5 Business Day

If under this Schedule any payment or calculation is to be made on or as of a day which is not a Business Day that payment or calculation is to be made on or as of the next day that is a Business Day

1.6 Payment Currency

Except as expressly set out in the Agreement, amounts to be paid or calculated under this Schedule will be paid or calculated in Canadian dollars. Any amounts to be paid or calculated which are denominated in a foreign currency will be converted into Canadian dollars, within three Business Days of the invoice date, using the Bank of Canada nominal noon exchange rate, as posted on the Bank of Canada website (currently located at www.bankofcanada.ca).

1.7 Conflict

If there is conflict between any term of this Schedule and any term in another part of the Agreement, the relevant term in the other part of the Agreement will prevail.

1.8 Notice

Any notices to be given under this Schedule will be given in accordance with the notice terms set out elsewhere in the Agreement.

SECTION 2 – REIMBURSEMENT OF ALLOWABLE EXPENSES

2.1 Allowable Expenses

OPG will only reimburse the Contractor for the following eligible expenses (**"Allowable Expenses"**) to the extent they otherwise meet the requirements of this Schedule and the rest of the Agreement:

(a) air, rail and bus travel expenses permitted under section 3;

(b) vehicle expenses permitted under section 4;

(c) lodging expenses permitted under section 5; and

(d) any other expenses which have been approved in writing by the OPG individual managing the Agreement (the **"OPG Representative"**).

2.2 Expenses Minimised

Notwithstanding any term in this Schedule, the Contractor will use all reasonable efforts to ensure that Eligible Employees minimise Allowable Expenses and the Contractor will ensure that all Allowable Expenses are reasonable and properly incurred in a manner consistent with effective and efficient business practice. OPG is not obliged to reimburse any expenses which are not so incurred. Eligible Employees who normally live together are expected to share accommodations and vehicle expenses, where reasonable.

2.3 Excluded Items

Notwithstanding any term in this Schedule, OPG will not reimburse any amounts to the Contractor or any Eligible Employee for any hospitality, food or incidental expenses, including, but not limited to, in respect of the following:

(a) meals, snacks, alcoholic and non-alcoholic beverages;

(b) any expense whatsoever if the one way distance between the Eligible Employee's Home Base or Reporting Location and the Work Site is less than 100 kilometers;

(c) gratuities;

(d) airline or railway club dues, fees or other charges;

(e) personal service expenses, including hair care, shoe shine, toiletry and spa treatment expenses;

(f) laundry, dry cleaning or valet expenses;

(g) hotel telephone charges or internet access;

(h) personal telephone calls;

(i) cellular telephones, data devices (for example, Blackberries) or other communication devices;

(j) entertainment or recreation expenses, including pay-per-view, video, compact disk or DVD rental, in-room entertainment, games, gaming, reading, sports or exercise expenses;

(k) headsets or other in-flight expenses;

(l) dependent care expenses;

(m) pet care expenses;

(n) mini bar charges or sundry items (including gum and snacks);

(o) credit card interest or other credit card expenses;

(p) automobile washes;

(q) fines or other expenses assessed or otherwise incurred in respect of traffic or parking violations; or

(r) fees or other expenses for toll highways or vehicle rental agency administration charges for use of toll highways.

2.4 Method of Reimbursement

OPG will reimburse the Contractor for Allowable Expenses which otherwise meet the requirements of this Schedule and the rest of the Agreement in accordance with the following terms.

(a) **Monthly Invoice.** The Contractor will deliver to OPG, to the address indicated in the purchase order or Agreement, on a monthly basis, an invoice for Allowable Expenses in a form and manner acceptable to the OPG Representative, acting reasonably. The Contractor will deliver to the OPG Representative, a copy of the invoice and will ensure that the invoice legibly itemises and, if necessary, briefly describes all allowable expenses. The Contractor will not invoice or otherwise charge OPG for any expenses other than allowable expenses. The Contractor will ensure that all expenses claimed on each such invoice meet the requirements of this Schedule and the rest of the Agreement and are first approved by the Contractor. If the Contractor fails to deliver an invoice

to OPG for an expense within six months of the expenses being incurred, OPG will not be obliged to reimburse the Contractor for such expense.

(b) **Receipts.** The Contractor will deliver to the OPG Representative, together with a copy of the invoice, original official itemised receipts for each allowable expense claimed (including airline, railway or bus ticket passenger coupons or electronic ticket, boarding passes, vehicle rental contracts, itemised hotel bills and travel itineraries). The Contractor will separate expenses for each Eligible Employee. Debit card and credit card receipts are not acceptable without the itemised receipt. OPG will accept electronic, photocopied or fax copies of receipts.

(c) **GST/HST Deducted.** The Contractor will deduct all Canadian goods and services tax/harmonized sales tax levied under the *Excise Tax Act* (Canada) recovered or recoverable by the Contractor on the payment of expenses before submitting any invoice to OPG covering any allowable expenses. The Goods and Services Tax/Harmonized Sales Tax levied under the *Excise Tax Act* (Canada) and reimbursable by OPG under this Schedule.

(d) **Reimbursement.** OPG will reimburse the Contractor for Allowable Expenses which meet all of the requirements of this Schedule, received and approved by OPG before the 25th of each month on the 25th of the following month. The Contractor will ensure that all Eligible Employees initially pay for expenses using their own payment methods. OPG will not provide any advances respecting allowable expenses. The Contractor is exclusively responsible for the reimbursement of expenses to all Eligible Employees. Failure by the Contractor to comply with the requirements of this Schedule and the rest of the Agreement may result in delay of reimbursement of expenses or rejection of any invoice in whole or in part.

2.5 Travel Agency

OPG has and may in the future negotiate rates with a travel service to reduce travel and lodging expenses. Unless OPG provides the Contractor with written notice stating otherwise, or the Contractor can demonstrate it can obtain lower rates from providers other than American Express Business Travel, the Contractor will ensure that all Eligible Employees process travel requirements through American Express Business Travel. OPG also encourages the Contractor to have all vehicle rental and hotel arrangements made through American Express Business Travel. American Express Business Travel may be reached in Canada and the United States at 1-866-868-4441. The Contractor will ensure that all Eligible Employees travelling for the purpose of providing services under the Agreement identify themselves to American Express Business Travel as such.

2.6 Confirming Rates

The Contractor will ensure that the rates booked by it or an Eligible Employee are the same or lower than that listed on the travel itinerary.

2.7 Home Base and Work Site

Where applicable, the Contractor will specify in each invoice the Home Base, Reporting Location and the Work Site for each Eligible Employee. At OPG's request, the Contractor will provide written confirmation from each Eligible Employees as to the employee's permanent residence and street address. A post office box is not acceptable street address.

2.8 Non EPSCA Eligible Employees and Extended Staff

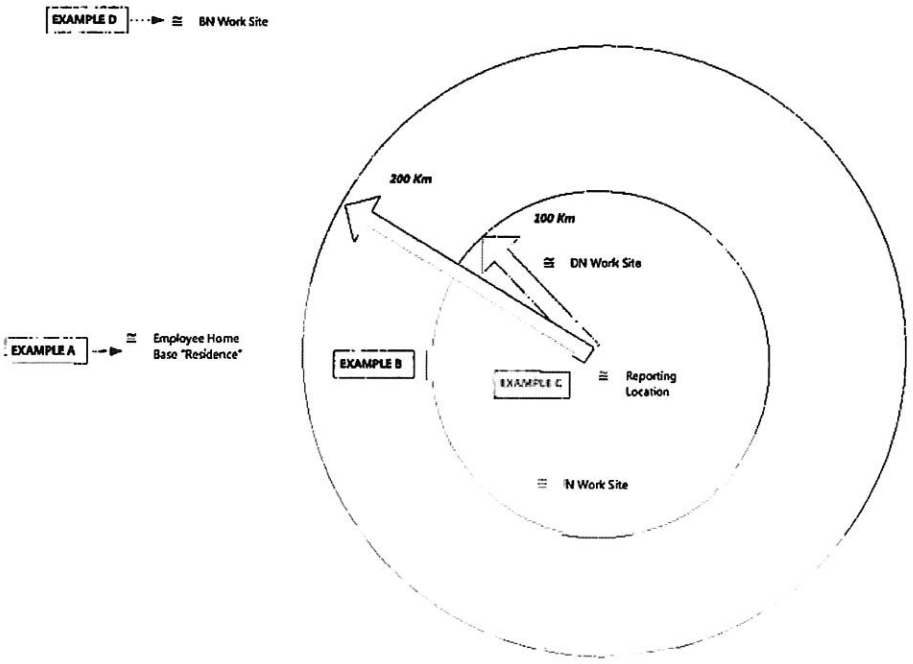
OPG will only reimburse the Contractor's Eligible Employees and extended staff, not subscribed to an EPSCA Agreement, expenses incurred from their Home Base to the designated reporting location as per the illustration below and detailed examples provided:

Example A: Home Base is outside the 200 kilometers ring from the reporting location. Prior approval from an OPG Representative is required and depending on the duration of the assignment, either section 6 or section 7 applies. If the duration is greater than one month, section 7 applies and the Eligible Employee will be paid an "all inclusive" monthly rate (or prorated portion of the month). If the assignment is less than one month, section 6 applies and the Eligible Employee will be paid an "all inclusive" daily rate.

Example B: Home Base is outside the 100 km ring but inside the 200 kilometers ring from the reporting location. Prior approval from an OPG Representative is required and OPG will pay the less of a daily "all inclusive" rate per section 6 or rates in accordance with sections 2 through 5. If sections 2 through 5 apply, the Eligible Employee will only be entitled to one round trip per week, from Home Base to the reporting location.

Example C: Home Base is within a 100 kilometers radius of the reporting location. In this scenario, the Eligible Employee is not entitled to any expenses whatsoever. This would include any and all trips to the Work Site within the 100 kilometers radius.

Example D: In this example, the reporting location and Work Site is one and the same. Prior approval from an OPG Representative is required and the preceding examples A, B and C apply.


EXAMPLE D
≅ BN Work Site
200 Km
100 Km
≅ DN Work Site
EXAMPLE A
≅ Employee Home Base "Residence"
EXAMPLE B
EXAMPLE C
≅ Reporting Location
≅ N Work Site

SECTION 3 – AIR, RAIL OR BUS TRAVEL

3.1 Air, Rail or Bus Travel

The expense of air, rail and bus travel is an allowable expense to the extent the actual amount of airfare or, rail or bus fare was incurred by an Eligible Employee in providing services to OPG under the Agreement and to the extent of compliance with the other requirements of this Schedule and the rest of the Agreement. Pre approval by an OPG Representative is required for all air, rail or bus travel. The Contractor will cause Eligible Employees, to the extent possible, to take advantage of hotel and airport shuttles where available. OPG will reimburse the Contractor for the expenses actually incurred by an Eligible Employee for travel between the Eligible Employee's Home Base, reporting location or Work Site and the airport, rail way station or bus terminal where the Eligible Employee arrives or departs. In addition, the amount of any such reimbursement may not exceed the lesser of:

(a) the expense of the taxi fare or other similar out of pocket charge to travel to or from the airport, railway station or bus terminal; and

(b) if applicable, parking charges at the airport, railway station or bus terminal.

3.2 Economy Class

Air expenses are not Allowable Expenses unless the Eligible Employee travels on economy class or equivalent. Rail expenses will be permitted for travel by VIA 1 or equivalent.

3.3 Vehicle Instead of Air, Rail or Bus Travel

OPG will only reimburse the Contractor for use of a personal vehicle or rental car (the lesser of) for trips which would customarily be travelled by air, rail or bus, for the amount which is equal to the lesser of:

(a) the expense of the airfare, rail fare or bus fare that would have been reimbursed by OPG to the Contractor under section 3; and

(b) the amount that would otherwise be reimbursable by OPG to the Contractor for vehicle travel pursuant to section 4. OPG will not reimburse the Contractor for any lodging that would not have been incurred had the trip been made by air, rail or bus.

3.4 Visits Home

OPG will reimburse air, rail or bus travel expenses for a maximum of one round trip home per month for each Eligible Employee on assignment at a Work Site where the duration is more than 45 days and the Home Base of that employee is greater than 400 kilometers from the Work Site.

3.5 Minimising Expenses

The Contractor will, to the extent possible, cause all air travel, to be by "lowest logical airfare", to take advantage of weekend specials and other discount fares and to reduce overall expenses and plan ahead (booking at least 2 weeks before the departure date is expected).

SECTION 4 – VEHICLES

4.1 Reimbursable Vehicle Expenses

The expense of rental vehicles or personal vehicles (the lesser of) used by Eligible Employees will be and allowable expense to the extent that:

(a) the use of the vehicle was for official OPG business;

(b) the one way distance between the Eligible Employee's reporting location and the Work Site is greater than 100 kilometers;

(c) the use of the rental vehicle was pre-approved in writing by the OPG Representative; and

(d) the expense otherwise meets the requirements of this Schedule and the rest of the Agreement.

4.2 Personal Vehicle

If the Eligible Employee is required to provide services at a location other than the Eligible Employee's reporting location, OPG will reimburse the Contractor as an allowable expense for all personal vehicle travel by an Eligible Employee in excess of 200 kilometers (round trip), at the published rates per kilometre on the date of invoice, for vehicle expenses for Ontario set on the Canada Revenue Agency website (www.cra-arc.gc.ca/tx/llrts/menu-eng.html). This Canada Revenue Agency amount covers all vehicle related expenses, except parking.

4.3 Reducing Expenses

The Contractor will use all reasonable attempts to reduce the expenses of vehicle travel by:

(a) arranging for employees to share vehicles to minimise travel expense;

(b) requiring Eligible Employees to use rental vehicle and refuel it before returning it;

(c) considering a long-term lease for lengthy work assignments (that is, more than 30 consecutive days) when the Eligible Employee requires a rental vehicle; and

(d) requiring Eligible Employees to use public transit when travelling to locations within or around urban centres.

4.4 Multiple Users

OPG will only reimburse the Eligible Employee whose vehicle is used when two or more Eligible Employees travel in one vehicle. If two or more Eligible Employees share a rental vehicle, OPG will only reimburse the Eligible Employee who incurred the expense.

SECTION 5 – LODGING

5.1 Overnight Accommodation

The expense of overnight accommodation for Eligible Employees will be an allowable expense to the extent that the overnight stay was pre-approved in writing by OPG Representative and to the extent that the expense otherwise meets the requirements of this Schedule and the rest of the Agreement. The OPG Representative will not approve any overnight accommodation unless:

(a) the presence of the Eligible Employee is required at a Work Site which is more that 200 km (one way) from that Eligible Employee's reporting locations or;

(b) poor weather creates hazardous driving conditions and the Eligible Employee cannot safely return to the Eligible Employee's Home Base;

(c) the Contractor will include a written explanation for all overnight accommodation with the invoice.

SECTION 6 – DAILY RATES

6.1 Daily Rates Instead of Allowable Expenses

To the extent this section 6 applies to any Eligible Employee, none of the terms of section 2 to section 5 apply, except for any Allowable Expenses for air, rail or bus travel between an Eligible Employee's reporting location and a Work Site that is reimbursable in accordance with section 3. Notwithstanding the previous sentence, the temporary residence (where the Eligible Employee resides while working on the OPG project), or in some instances the Home Base will be

considered the reporting location for the purpose of calculating Allowable Expenses in the event the Eligible Employee is required to travel to a location other than the reporting location.

6.2 Daily Rates

Before the commencement of, or at any time during, a work assignment for any Eligible Employee, OPG may elect based on the remaining duration of the work assignment, the distance between the Eligible Employee's reporting location and the work site or for other reasons to pay the Contractor a daily rate in respect of that Eligible Employee rather than to reimburse the Contractor for allowable expenses.

6.3 All Inclusive

Except as expressly set out in this section 6, the daily rate set out in section 6.4 is inclusive of all expenses whatsoever that will be reimbursed by OPG, including expenses respecting accommodation, local transportation, work permits and fees, utilities, communication charges, furnishings, insurance and any Allowable Expenses that would otherwise be reimbursable to the Contractor under section 2 to section 5.

6.4 Rates

Subject to adjustment under section 6.5, the following are the daily rates that OPG will pay the Contractor in respect of Work Sites:

(a) City of Toronto, $150 and;

(b) all other locations, $120 (including Mississauga, Pickering, Whitby and Darlington).

6.5 Application of Rate

Where OPG has elected to pay the daily rate for an Eligible Employee, OPG will pay the daily rate to the Contractor on a monthly basis for that Eligible Employee for each full day that the Eligible Employee provided services under the Agreement and for each weekend day unless the Eligible Employee surrendered his or her accommodations. The daily rate will not be paid for any period of an unexcused absence or when the Eligible Employee has surrendered the Eligible Employee's accommodations during a home visit or absence (includes unavailability to work on weekends if trip home was taken on the weekend). The daily rate will be reduced by $35 for each day of approved trips home and on the last day of providing services under the Agreement. Where OPG has elected to pay the daily rate for Eligible Employees who normally live together, the Eligible Employees are expected to share accommodations. Adjustments may be made to the daily rate set out in section 6.4 if Eligible Employees share accommodations and other expenses.

6.6 Method of Reimbursement

OPG will pay the Contractor the applicable daily rate in accordance with the following terms:

(a) **Monthly Invoice.** The Contractor will provide OPG, on a monthly basis, with an invoice listing the number of Eligible Employees from whom the Contractor is claiming the daily rate and the number of days being claimed for each Eligible Employee. The Contractor will ensure that the invoice includes a description of the work package or project name and project number (and work breakdown structure element if applicable).

(b) Evidence of Expenses. The Contractor will provide OPG with original or electronic photocopies itemised receipts and time sheets evidencing that the Eligible Employee attended the Work Site and made use of temporary accommodation on each day for which the daily rate is being requested. Debit card and credit card receipts are not acceptable without the itemised receipt. Failure by the Contractor to comply with the requirements of this Schedule and the rest of the Agreement may result in delay of reimbursement of expenses or rejection of any invoice whole or in part.

6.7 Absences

Unless authorised in writing by the OPG Representative, OPG will not be required to pay daily rates for an Eligible Employee where that Eligible Employee was absent from the Work Site without having been excused by the OPG Representative or where that Eligible Employee did not make use of the Eligible Employee's accommodations during an absence for the Work Site (other than an absence required to perform services to OPG under the Agreement). The OPG Representative may consider authorising payment of the daily rate for absences such as an infrequent sick day or medical appointments requiring exams or tests.

Section 7 – MONTHLTY RATES

To the extent this section 7 applies to any Eligible Employee, none of the terms of section 2 to section 6 apply, except for any Allowable Expenses for air, rail or bus travel between and Eligible Employee's reporting location and a Work Site that is reimbursable in accordance with section 3. Where OPG elects to pay on a monthly basis in respect of any Eligible Employee, OPG will pay the Contractor $1800 per month (on pro-rated portion of a month). All the terms of section 6 apply to the calculation of this monthly rate, with such modifications as the circumstances require.