

**ONTARIO ENERGY BOARD**

**EB-2016-0152**

**IN THE MATTER OF** the *Ontario Energy Board Act*, 1998, S. O.  
1998, c. 15, Schedule B;

**AND IN THE MATTER OF** an application by Ontario Power  
Generation (OPG) pursuant to section 78.1 of the *Ontario Energy  
Board Act*, 1998 for payment amounts for the period from January 1,  
2017 to December 31, 2021.

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**ENVIRONMENTAL DEFENCE COMPENDIUM  
FOR PANEL 1**

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**KLIPPENSTEINS**

Barristers & Solicitors

160 John Street, Suite 300

Toronto, Ontario M5V 2E5

**Murray Klippenstein**

**Kent Elson**

Tel: (416) 598-0288

Fax: (416) 598-9520

**Lawyers for Environmental Defence**

## ED Interrogatory #6

### **Issue Number: 4.5**

**Issue:** Are the proposed test period in-service additions for the Darlington Refurbishment Program appropriate?

### Interrogatory

#### **Reference:**

Reference: "For the purpose of OPG's request for approval of in-service additions, \$4,800.2M is forecast to come into service in 2020 for the Unit 2 refurbishment." Ex. D2, Tab 2, Schedule 1, Page 5

Please provide OPG's forecast of its cumulative capital expenditures and interest costs with respect to the Unit 2 refurbishment, at the end of each quarter, starting with the first quarter in 2017 and ending with the 4<sup>th</sup> quarter in 2020. Please include contingency amounts. Please base the quarterly estimates based on the \$4,800.2M high confidence budget. Presumably the cumulative capital expenditures for the 4<sup>th</sup> quarter of 2020 will equal approximately \$4,800.2 million, but if that is not the case please explain why not.

### Response

The cumulative Unit 2 capital expenditures including contingency and interest costs based on the RQE high confidence schedule are shown below. The total adds up to \$4,800.2M, noted in Ex. D2-2-1, p. 5, at the end of 2020.

M\$	LTD 2016 FCST	2017				2018	2019	2020
		Q1	Q2	Q3	Q4	Annual	Annual	Annual
Capital including contingency	2,065	193	188	205	191	782	328	70
Interest	215	29	31	34	37	178	214	40
<b>Total Capital Costs</b>	<b>2,280</b>	<b>221</b>	<b>220</b>	<b>239</b>	<b>228</b>	<b>959</b>	<b>542</b>	<b>110</b>
<b>Cumulative Total Capital Costs</b>	<b>2,280</b>	<b>2,502</b>	<b>2,722</b>	<b>2,961</b>	<b>3,189</b>	<b>4,148</b>	<b>4,690</b>	<b>4,800</b>

Note: numbers may not add due to rounding.

As part of the RQE development, annual flows are available for the estimates from 2018 onwards.

Witness Panel: Darlington Refurbishment Program

**UNDERTAKING JT1.17**  
**ATTACHMENT C**

**Undertaking**

**ED INTERROGATORY #6**

This interrogatory requested the quarterly cumulative capital expenditures for 2017-2020. OPG provided the information for 2017 but not for 2018 to 2020. Please provide a complete response to this interrogatory including the quarterly figures for all years from 2017 to 2020. Please provide this as a revised and updated response so that all the information is clearly laid out in one place.

**Response**

This Undertaking requests OPG to provide quarterly cost flows for 2018, 2019 and 2020 for the Unit 2 in-service amount of \$4.8B. OPG had provided quarterly cost flows for 2017 only and had noted in its response to Ex. L-4.3-7 ED-6 that only annual cost flows were produced at the time of the Release Quality Estimate (RQE) for 2018 onwards. OPG has approximated the quarterly flows for 2018, 2019 and 2020. Please note that these flows will be re-forecast on an ongoing basis as the Unit 2 refurbishment project progresses.

\$M	LTD 2016 F/Cast at RQE	2017				2018			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Capital inc. Contingency	2,065	193	188	205	191	205	198	189	189
Interest	215	29	31	34	37	40	43	46	49
Total Capital Cost	2,280	221	220	239	228	245	241	235	238
Cumulative Total Capital Cost	2,280	2,502	2,722	2,961	3,189	3,434	3,675	3,910	4,148

\$M		2019				2020
		Q1	Q2	Q3	Q4	Q1
Capital inc. Contingency		94	90	74	70	70
Interest		51	53	54	56	40
Total Capital Cost		145	143	128	126	110
Cumulative Total Capital Cost		4,293	4,436	4,564	4,690	4,800

**Notes to the Table:**

- OPG has used the LTD 2016 forecast at RQE to match the RQE flows. The actual expenditures to date in 2016 have been lower compared to the forecast at the time of RQE.

**ED Interrogatory #9**

**Issue Number: 4.3**

**Issue:** Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

**Interrogatory**

**Reference:**

Reference: "OPG plans to issue status reports to the public for the duration of the Program."  
Ex. D2, Tab 2, Schedule 1, Page 5

Is OPG planning to report its actual cumulative capital expenditures and interest costs with respect to the Unit 2 refurbishment in its quarterly financial reports? If "no", please explain why not.

**Response**

OPG will continue to report the year-to-date and life-to-date total actual capital expenditures for the Darlington Refurbishment Program ("DRP"), inclusive of interest costs, in its publicly available quarterly and annual Management's Discussion and Analysis ("MD&A") documents. OPG will also be reporting in the MD&A its progress towards the planned in-service addition of \$4.8 billion associated with the scheduled return to service of refurbished Unit 2 in February 2020.



# ONTARIO ENERGY BOARD

**FILE NO.:** EB-2016-0152      **Ontario Power Generation Inc.**

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**VOLUME:** Technical Conference

**DATE:** November 14, 2016

1 expenditures and interest costs with respect to unit 2  
2 refurbishment on a quarterly basis?

3 MR. ROSE: Yes, we will.

4 MR. ELSON: And that will be in the MD&A document?

5 MR. ROSE: Yes, it will be.

6 MR. ELSON: Thank you. If we could turn to IR number  
7 6, in this interrogatory we asked for the budget for unit 2  
8 broken down on a quarterly basis. And so will we be able  
9 to compare the numbers in this chart with the quarterly  
10 cumulative capital expenditure reporting that we just  
11 discussed?

12 MR. SAAGI: The answer to that question is yes.

13 MR. ELSON: Thank you. And the quarterly reporting, I  
14 take it that will happen a month or two after the end of  
15 the quarter in question?

16 MR. ROSE: It will happen in alignment with -- as I  
17 said earlier this morning, in alignment with our financial  
18 statements. So our financial statements for year-end  
19 December 31st are issued in March; our financial statements  
20 for June 30th are issued in August, and it will be within  
21 days after -- obviously the MD&A will go the same date as  
22 the financial statements, and our report will go shortly  
23 after that, our public report with the additional  
24 information that's provided beyond what's in the MD&A.

25 MR. ELSON: And that is roughly around the one to two  
26 month period.

27 MR. ROSE: That's correct, so June to August, correct.

28 MR. SAAGI: Sorry, I will have to correct something I

1 had said. With reference to reporting the financial -- the  
2 numbers in the quarterly financial statements, OPG's, with  
3 the chart and the response under ED 6, they will not be  
4 comparable.

5 These costs here are just for unit 2, including the  
6 definition phase. It does not include the early in-service  
7 projects, and those numbers that we would carry in the  
8 financial statements would be all inclusive across all  
9 units as well. I apologize.

10 MR. ELSON: No, thank you for that clarification and  
11 that was just the kind of thing I was trying to get at. So  
12 let me unpack that a little bit.

13 The numbers in ED 6 do not include, which? They don't  
14 include?

15 MR. SAAGI: So these numbers will be just unit 2 in-  
16 service amounts. So it does not include any of the  
17 subsequent units, and it doesn't include any of the early  
18 in-service projects such as the FNIP and the SIO.

19 MR. ELSON: So I think what I am trying to say is will  
20 you provide something that -- just provide quarterly  
21 figures just relating to unit 2?

22 MR. SAAGI: Yes, we will.

23 MR. ELSON: And will that be part of what document?

24 MR. SAAGI: The vision currently is to include those  
25 numbers as part of the semi-annual project status update.

26 MR. ELSON: So that wouldn't be quarterly; that would  
27 be twice a year?

28 MR. SAAGI: Correct. I believe the reporting is every

1 it's something that you don't have a full position on, I  
2 would appreciate a position on monthly and quarterly  
3 reporting of those figures.

4 MR. REINER: We will give it consideration. As I  
5 said, we hadn't thought about quarterly reporting. The  
6 public reporting is coordinated through our shareholder,  
7 and the current arrangement that we operate under is semi-  
8 annual reporting, and it actually works through our  
9 shareholder.

10 So we would need to make a change to that process, and  
11 it's not something I could commit to here.

12 MR. MILLAR: So I am hearing there is an undertaking,  
13 and it's JT1.18.

14 **UNDERTAKING NO. JT1.18: TO PROVIDE THE OPG POSITION**  
15 **ON MONTHLY AND QUARTERLY REPORTING OF THOSE FIGURES**

16 MR. ELSON: That was JT1-point...

17 MR. MILLAR: 18.

18 MR. ELSON: Thank you. For the CPI and cost variance,  
19 how is contingency treated?

20 MR. ROSE: When contingency is drawn down it is  
21 allocated to the work package for which the cost basis CPI  
22 is calculated on. So CPI -- normally speaking, CPI is  
23 based on the work package, the original work package, plus  
24 the cost of any changes. Cost variance is done different  
25 levels, but we will ultimately be doing a cost variance on  
26 the overall cost of the project, including contingency and  
27 non-contingent items.

28 MR. ELSON: So the CPI would be one if you spend all



1 of your contingency, no more, no less.

2 MR. ROSE: Depends on the basis for how we change --  
3 we process our changes. So if the change -- this is  
4 getting a little bit technical, but try and hear me out for  
5 a moment. If the change is due to a vendor not executing  
6 per its approved plan with no change in scope or direction,  
7 generally speaking we will not -- we will draw down  
8 contingency but not change the original base line for which  
9 we measure CPI.

10 So their CPI will be degraded at the work package  
11 level because it costs them more money to do the work that  
12 was originally planned. If we are making a strategic  
13 change where we are directing the vendor to take on new  
14 components or we are moving them on a schedule and it's an  
15 agreed-to change, in certain cases we would adjust the base  
16 line for which we are measuring CPI, so we are not  
17 penalizing the vendor, so to speak, in CPI space for cases  
18 like that.

19 MR. ELSON: Okay. Well, I guess there is an overall  
20 CPI for the DRP; is that fair to say?

21 MR. ROSE: CPI is rolled up based -- it's measured at  
22 the work-package level, at quite a detailed level, and we  
23 roll it up to the multiple levels.

24 MR. ELSON: Will you be providing reporting in your  
25 semi-annual reports at the work-package level for the CPI?

26 MR. ROSE: No. Only at the rolled-up level.

27 MR. ELSON: Is there any reason you couldn't do that?

28 MR. ROSE: Because it would be thousands of line items

1 that we would be providing data on. We would not provide  
2 it at that low level of detail.

3 MR. ELSON: Oh, I just mean for each work package.

4 MR. ROSE: Sorry, at the work-package level, bundle  
5 level?

6 MR. ELSON: Yes, let's say -- I think the bundle level  
7 is -- makes more sense.

8 MR. ROSE: So balance the plan R&FR --

9 MR. ELSON: Precisely.

10 [Witness panel confers.]

11 MR. ROSE: I am just looking for what we had said in  
12 our IRs. I think right now we are not advocating to  
13 provide it at the bundle level. We are advocating to  
14 provide it at the all-in unit-2 level.

15 MR. ELSON: And I am just wondering if you know of any  
16 impediment to providing it at the work-bundle level.

17 MR. ROSE: There is no impediment. Obviously we are  
18 doing it internally. It gets back to the same conversation  
19 we recently had with the -- whether we would go monthly or  
20 -- you know, this is obviously more detail than we had  
21 planned to provide.

22 MR. ELSON: Your forecast at completion and variance  
23 at completion, is that something you also report on  
24 internally monthly?

25 MR. ROSE: Yes.

26 MR. ELSON: Perhaps you could add to the previous  
27 undertaking to provide your position on also providing  
28 those metrics on a monthly or quarterly basis and including

**UNDERTAKING JT1.18**

**Undertaking**

TO PROVIDE THE OPG POSITION ON MONTHLY AND QUARTERLY REPORTING OF THOSE FIGURES

**Response**

The context for this undertaking is shown in the Technical Conference transcript of November 14, 2016, p. 96, line 23 through to p. 100, line 13 and with reference to OPG's responses to Ex. L-4.3-7 ED-006 and Ex. L-4.3-7 ED-009 with respect to Unit 2 costs and public reporting on the Darlington Refurbishment Program (DRP) respectively.

OPG has considered the request and will issue public reporting on the status of the DRP and specifically on Unit 2 safety, quality, cost performance and schedule performance on a quarterly basis shortly after the issuance of its quarterly Management Discussion and Analysis (MD&A) and external financial reports.

OPG will also issue frequent updates on the status of the project on OPG's website, with the current plan being monthly.

In addition, as discussed in Ex. L-10.4-1 Staff-223, OPG proposes to report annually to the OEB on the DRP performance measures set out in Ex. D2-2-9, pp. 9-10, in conjunction with the reporting on the hydroelectric and nuclear performance measures set out in Ex. A1-3-2, pp. 41-42.

### ED Interrogatory #4

#### **Issue Number: 4.3**

**Issue:** Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

#### Interrogatory

#### **Reference:**

Reference: Exhibit D2, tab 2, schedule 3, p. 14

Please provide the total cost of the DRP based on cost overrun scenarios of: a) 25%; b) 50%; c) d) 100%; e) 150%; f) 200%, and g) 250%. Please assume that the cost overrun percentages are applied equally to each of the program components (e.g. a 25% increase of each work bundle cost, 25% increase of the safety improvement costs, 25% increase of the facility & infrastructure project costs, and so on). Please apply the cost overruns both to the contractor costs (i.e. the work bundles) and the cost of the work to be undertaken by OPG itself. Please assume that the cost overruns are in addition to the amounts set aside for contingency (seeing as "contingency refers to amounts that are *expected* to be expended" per Ex. D2, Tab 2, Schedule 7, p. 1)). Please also calculate and include the consequential increases to interest and escalation.

Please provide a breakdown of each scenario in a chart similar to chart 4 on page 14 of Ex. D2-2-3 (pasted below). This will require adding rows for the other work bundles, the sub-components of the other work bundles, the remainder of the work components, interest and escalation, and contingency to the chart. The chart will help confirm that all costs are included and how the overrun scenarios have been applied.

**Chart 4 - Illustrative Scenarios of RFR Target Pricing (Contractor 10% Cost Overrun)**

#	Category (\$ Million)	Contract Costs (from table 3)	% Contractor Cost Overrun = 10%				
			Contractor Cost	Cost Variance	Impact to Contractor	Impact to OPG	OPG Payment to Contractor
1	Definition Phase Target Cost (Incl RWPB)	185	204	19	0	19	204
2	Definition Phase Fixed Fee	74	81	7	7	0	74
3	Definition Phase Fixed Fee Incentive/ Disincentive	0			0	0	0
4	Execution Phase Target Cost	1,667	1,834	167	0	167	1,834
5	Execution Phase Fixed Fee	492	541	49	49	0	492
6	Execution Phase Fixed Fee Incentive/ Disincentive	0	0	0	18	(18)	(18)
7	Mock-up Fixed Price	38	42	4	4	0	38
8	Non-target Reimbursable Costs	6	7	1	0	1	7
9	Tooling Fixed Price	375	413	38	38	0	375
10	OSM with Fee (estimate)	579	637	58	0	58	637
11	Goods with Fee (estimate)	48	53	5	0	5	53
12	<b>Total</b>	<b>3,464</b>	<b>3,810</b>	<b>346</b>	<b>116</b>	<b>230</b>	<b>3,694</b>

Witness Panel: Darlington Refurbishment Program

Response

OPG has provided the results of pro-rating OPG's RQE estimate by: a) 25%; and, d) 100%.

a) For the 25% cost overrun scenario, the total cost of the DRP mathematically evaluates to \$15.5B.

b) For the 100% cost overrun scenario, the total cost of the DRP mathematically evaluates to \$23.5B.

The detailed cost breakdowns for the above two scenarios, in a similar format to Chart 4 in Ex. D2-2-3 p. 14 are provided in Attachment 1. The additional scenarios cannot be provided with reasonable effort given the modeling work required to develop the responses. Development of these scenarios requires detailed assessment of the incentive mechanisms in the contracts in order to assess costs borne by OPG versus costs which would be borne by each contractor. Simplifying assumptions needed to be made to provide the two scenarios in this response.

While OPG has responded to this interrogatory as requested, OPG does not believe that the information provides a reasonable basis to assess the potential future costs that may be expended by OPG in executing the Darlington Refurbishment Program (DRP).

OPG has learned significantly from the experiences of past large complex projects and has executed a robust planning process. Please see Ex. D2-2-4 regarding OPG's planning process, including the application of lessons learned. The Release Quality Estimate (RQE) produced in 2015 is a high confidence estimate with a high degree of certainty for each of the contractors' estimates, and with adequate contingency based on the class of estimate.

There will be risks associated with the execution of the project. OPG is the general contractor and will play an active role in monitoring the work and ensuring that all risks are actively managed. OPG would intervene and take appropriate actions to mitigate the costs and schedule impacts long before the circumstances contemplated in this interrogatory manifested. The contractors are responsible and have incentives to mitigate and recover delays and cost overruns. There are also off-ramps in the contracts that allow OPG to terminate contracts in situations where performance is not meeting expectation. OPG has full transparency on the status of the overall DRP, in terms of safety, quality, schedule, and cost performance, and would take corrective actions very early in the process, if required.

The target price contracts are structured in a way to incent OPG's contract partners to achieve (and beat) the target price and schedule, and contain disincentives for failure to meet these targets. If the contractor exceeds the target price, OPG will pay the direct costs, i.e. actual costs for trades and project management labour; however, the contractors would be unable to recover profit or overheads on the cost overruns, and receive a contract disincentive which would reduce their recovery of overheads.

In order to respond to this undertaking, OPG has adhered to the assumptions requested, but which OPG does not view as reasonable. Specifically:

Witness Panel: Darlington Refurbishment Program

- i. OPG was asked to assume all contingency is spent before applying the cost overrun percentages. OPG does not believe that is appropriate. Contingency would be used to offset risks and cost growth in executing the DRP and should first be reduced to zero before the cost overrun percentages are applied;
- ii. OPG has artificially pro-rated all of its functional costs, including project management associated with each major work bundle by the cost overrun percentage. OPG does not believe that this is reasonable as the functional costs would be unlikely to grow at the same proportion as the costs in a major work bundle; and
- iii. OPG has applied the cost overrun scenario to all costs, including costs that are already expended, some of which has already been placed in service.

OPG has not pro-rated contingency, as there is no basis for assuming that, should there be a cost overrun, there would also be a need to increase contingency in the estimate.

To re-iterate, OPG has provided the information as requested; however in OPG's view, none of the scenarios are a reasonable representation of any likely outcome of the DRP.

Attachment to L-04.3-7 ED-004 (includes summary calculations for L-04.3-7 ED-003)  
Cost Overrun Scenarios

2015\$M (except for Interest and Escalation line item)

2015\$M (except for Interest and Escalation line item)			ED-004					ED-003	
			1.25	25% Cost Growth					
Major Category	Category/ Contract Type	RQE Base Case	Base cost + % Increase	Cost Variance	Impact to Contractor	Impact to OPG	Actual Cost to OPG	Proportion of Increase paid by OPG	
Retube Feeder Replacement	OPG Project Management & Oversight Costs	167	209	42		42	209	67%	
	Contractor Costs	Definition Phase Target Price (Incl RWPB)	185	231	46	0	46		231
		Definition Phase Fixed Fee	74	92	18	18	0		74
		Definition Phase Fixed Fee Incentive/ Disincentive				9	(9)		(9)
		Execution Phase Target Price	1,667	2,084	417	0	417		2,084
		Execution Phase Fixed Fee	492	615	123	123	0		492
		Execution Phase Fixed Fee Incentive/ Disincentive				68	(68)		(68)
		Mock-up Fixed Price	38	48	10	10	0		38
		Non-target Reimbursable Costs	6	8	2	0	2		8
		Tooling Fixed Price	375	469	94	94	0		375
		OSM with Fee(estimate)	579	724	145	0	145		724
		Goods with Fee(estimate)	48	60	12	0	12		60
Fuel Handling/ Defueling	OPG Project Management & Oversight Costs	49	61	12		12	61	67%	
	Cont. Costs	Defueling - Eng Services (Fixed/Firm Price)	16	20	4	4	0		16
		Defueling - Eng Services (Misc Reimbursable)	7	9	2	0	2		9
		Fuel Handling (ESMSA - see assumptions)	126	157	31				
Steam Generators	OPG Project Management & Oversight Costs	13	16	3		3	16	67%	
	Contractor Costs								
Turbine Generator	OPG Project Management & Oversight Costs	41	51	10		10	51	100%	
	Contractor Costs	ESES - Fixed/ Firm Cost - Equipment Supply	257	321	64	64	0		257
		ESES - Target Cost - Installation & Static Commissioning	38	48	10	0	10		48
		ESES - Target Cost - Incentive/ Disincentive				5	(5)		(5)
		ESES - Target Cost - Dynamic Commissioning	14	17	3	0	3		17
		ESES - Target Cost - Incentive/ Disincentive				2	(2)		(2)
		ESES - Reimbursable (no markup)	28	35	7	0	7		35
		EPC - Definition Phase Target Cost	21	27	5	0	5		27
		EPC - Definition Phase Fixed Fee	13	16	3	3	0		13
		EPC - Definition Phase Fixed Fee Incentive/ Disincentive				1	(1)		(1)
		EPC - Execution Phase Target Cost	161	202	40	0	40		202
		EPC - Execution Phase Fixed Fee	53	66	13	13	0		53
		EPC - Execution Phase Fixed Fee Incentive/ Disincentive				7	(7)		(7)
		EPC - Dynamic Commissioning Work (Trades)	2	3	1	0	1		3
		EPC - Goods	5	6	1	0	1		6
		EPC - Reimbursable Costs with no-markup	11	14	3	0	3		14
Balance of Plant	OPG Project Management & Oversight Costs	183	229	46		46	229	100%	
	Contractor Costs (mainly ESMSA)	784	980	196					
F&IP & SIO Projects	Facility and Infrastructure Projects (mainly ESMSA)	640	800	160				100%	
	Safety Improvement Opportunities (mainly ESMSA)	205	256	51					
Functions	Project Execution	322	402	80		80	402	100%	
	Contract Management	52	65	13		13	65		
	Engineering	283	353	71		71	353		
	Managed Systems Oversight	41	51	10		10	51		
	Planning & Controls	136	170	34		34	170		
	Nuclear Safety	83	104	21		21	104		
	Program Fees & Other Support	341	426	85		85	426		
	Supply Chain	86	107	21		21	107		
	Work Control	80	99	20		20	99		
	Operations and Maintenance	805	1,006	201		201	1,006		
	Early Release 3	102	127	25		25	127		
	Early Release 4	7	9	2		2	9		
Contingency		1,706	1,706	0		0	1,706	N/A	
Sub Total		10,429	12,611	2,181	465	1,716	12,138		
Interest & Escalation (\$M)		2,371	2,866	496		496	2,866	100%	
Total		12,800	15,477	2,677	465	2,212	15,004	82%	

			ED-004					ED-003
			2	100% Cost Growth				
Base cost + % Increase	Cost Variance	Impact to Contractor	Impact to OPG	Actual Cos to OPG	Proportion of Increase paid by OPG			
334	167		167	334	68%			
370	185	0	185	370				
147	74	74	0	74				
		35	(35)	(35)				
3,334	1,667	0	1,667	3,334				
984	492	492	0	492				
		236	(236)	(236)				
76	38	38	0	38				
12	6	0	6	12				
750	375	375	0	375				
1,158	579	0	579	1,158				
96	48	0	48	96				
98	49		49	98				
32	16	16	0	16				
14	7	0	7	14				
252	126							
26	13		13	26				
					68%			
82	41		41	82				
513	257	257	0	257				
77	38	0	38	77				
		19	(19)	(19)				
28	14	0	14	28				
		7	(7)	(7)				
56	28	0	28	56				
43	21	0	21	43				
26	13	13	0	13				
		4	(4)	(4)				
323	161	0	161	323				
106	53	53	0	53				
		25	(25)	(25)				
5	2	0	2	5				
10	5	0	5	10				
23	11	0	11	23				
366	183		183	366				
1,567	784							
1,280	640							
410	205							
643	322		322	643	100%			
104	52		52	104				
565	283		283	565				
82	41		41	82				
272	136		136	272				
166	83		83	166				
682	341		341	682				
171	86		86	171				
159	80		80	159				
1,610	805		805	1,610				
203	102		102	203				
15	7		7	15				
1,706	0		0	1,706				
19,154	8,724	1,820	6,904	17,320				
4,354	1,983		1,983	4,354				
23,507	10,707	1,820	8,887	21,674	83%			

Notes and assumptions:

- Based on OPG's Release Quality Estimate (RQE). All numbers except interest and escalation are in 2015\$.
- These are illustrative examples; assumption is that all contractor incentives/disincentives and performance fee mechanisms are applicable.
- Cost overrun factors are also applied to life-to-date actual costs (costs with no risk of overruns).
- Cost overrun factors are applied to all costs excluding contingency.
- RFR contract costs are as per Ex. D2-2-3, pp. 10 and 11.
- De-fuelling contract is mainly fixed/ firm price. Reimbursable fixed fees are capped for certain costs; however, this was not incorporated into the calculations due to lack of materiality.
- Steam Generator contract includes [REDACTED]
- For work bundles that are mainly under ESMSA contracts (e.g. BOP, FH, FIP, SIO), it was assumed, for simplicity, that the increase is caused by the contractor; therefore, the cost to OPG is [REDACTED] of the cost overrun (performance fee of [REDACTED] withheld).
- For simplicity, for all of the target cost contracts, a 20% cost disincentive was applied above any neutral band specified in the contracts. The actual percentage is calculated using a graded approach.
- For simplicity, interest and escalation were pro-rated.

**UNDERTAKING JT1.20**

**Undertaking**

TO RECALCULATE IR 3 AND 4 BASED ONLY ON FUTURE COSTS, OR WHY OPG WILL NOT ANSWER.

**Response**

Please note that OPG's response to this undertaking should be read in conjunction with the responses to interrogatory L-4.3-7 ED-003 and interrogatory L-4.3-7 ED-004 with particular emphasis on the qualifications OPG has noted in preparing these scenario assessments.

This response is an update to interrogatories L-04.3-7 ED-003 and L-04.3-7 ED-004 to apply the cost overruns scenarios to only the future costs. These calculations assume all costs to date are on plan with respect to the cost incentive and disincentive calculations.

As in interrogatories L-04.3-7 ED-003 and L-04.3-7 ED-004, OPG has provided the results of pro-rating OPG's RQE estimate on costs remaining to be spent by: a) 25%; and, d) 100%.

**Update to Interrogatory L-04.3-7 ED-003**

The calculated percentage of these cost overruns that would be passed on to OPG when the cost overrun percentages are applied only to the future costs are: a) 85% of the 25% cost overrun; d) 86% of the 100% cost overrun.

**Update to Interrogatory L-04.3-7 ED-004**

When the cost overrun percentages are applied only to the future costs:

- a) For the 25% cost overrun scenario, the total cost of the DRP mathematically evaluates to \$14.7B
- b) For the 100% cost overrun scenario, the total cost of the DRP mathematically evaluates to \$20.6B.

The detailed cost breakdowns for the above two scenarios, in a similar format to Chart 4 in Ex. D2-2-3 p. 14 are provided in Attachment 1 (Attachment 1 contains confidential information).



Attachment to L-04.3-7 ED-004 (includes summary calculations for L-04.3-7 ED-003) - Amended for JT1.20  
Cost Overrun Scenarios

2015\$M (except for Interest and Escalation line item)

			ED-004/ JT-1.20					ED-003
			1.25	25% Cost Growth				
Major Category	Category/ Contract Type	RQE Base Costs (1)	Base cost + % Increase on Remaining Costs	Cost Variance on Remaining Costs	Impact to Contractor	Impact to OPG	Actual Cost to OPG	Proportion of Increase paid by OPG
Retube Feeder Replacement	OPG Project Management & Oversight Costs	167	191	24		24	191	73%
	Contractor Costs	Definition Phase Target Price (Incl RWPB)	186	1	0	1	186	
		Definition Phase Fixed Fee	76	2	2	0	74	
		Definition Phase Fixed Fee Incentive/ Disincentive	0		0	0	0	
		Execution Phase Target Price	2,076	409	0	409	2,076	
		Execution Phase Fixed Fee	613	121	121	0	492	
		Execution Phase Fixed Fee Incentive/ Disincentive	0		67	(67)	(67)	
		Mock-up Fixed Price	38	0	0	0	38	
		Non-target Reimbursable Costs	6	2	0	2	8	
		Tooling Fixed Price	377	2	2	0	375	
		OSM with Fee(estimate)	579	125	0	125	704	
		Goods with Fee(estimate)	48	12	0	12	60	
Fuel Handling/ Defueling	OPG Project Management & Oversight Costs	49	58	9		9	58	73%
	Cont. Costs	Defueling - Eng Services (Fixed/Firm Price)	16	0	0	0	16	
		Defueling - Eng Services (Misc Reimbursable)	7	0	0	0	7	
		Fuel Handling (ESMSA - see assumptions)	126	29				
Steam Generators	OPG Project Management & Oversight Costs	13	15	2		2	15	73%
	Contractor Costs							
Turbine Generator	OPG Project Management & Oversight Costs	41	48	7		7	48	73%
	Contractor Costs	ESES - Fixed/ Firm Cost - Equipment Supply	299	43	43	0	257	
		ESES - Target Cost Installation & Static Commissioning	38	10	0	10	48	
		ESES - Target Cost - Incentive/ Disincentive	0		5	(5)	(5)	
		ESES - Target Cost - Dynamic Commissioning	14	3	0	3	17	
		ESES - Target Cost - Incentive/ Disincentive	0		2	(2)	(2)	
		ESES - Reimbursable (no markup)	28	5	0	5	33	
		EPC - Definition Phase Target Cost	21	0	0	0	22	
		EPC - Definition Phase Fixed Fee	13	0	0	0	13	
		EPC - Definition Phase Fixed Fee Incentive/ Disincentive	0		0	0	0	
		EPC - Execution Phase Target Cost	161	39	0	39	201	
		EPC - Execution Phase Fixed Fee	53	13	13	0	53	
		EPC - Execution Phase Fixed Fee Incentive/ Disincentive	0		7	(7)	(7)	
		EPC - Dynamic Commissioning Work (Trades)	2	1	0	1	3	
		EPC - Goods	5	1	0	1	6	
		EPC - Reimbursable Costs with no-markup	11	3	0	3	14	
Balance of Plant	OPG Project Management & Oversight Costs	183	213	30		30	213	73%
	Contractor Costs (mainly ESMSA)	784	933	149				
F&IP & SIO Projects	Facility and Infrastructure Projects (mainly ESMSA)	640	655	15				73%
	Safety Improvement Opportunities (mainly ESMSA)	205	239	34				
Functions	Project Execution	322	395	73		73	395	100%
	Contract Management	52	62	10		10	62	
	Engineering	283	330	47		47	330	
	Managed Systems Oversight	41	47	6		6	47	
	Planning & Controls	136	150	14		14	150	
	Nuclear Safety	83	94	11		11	94	
	Program Fees & Other Support	341	413	72		72	413	
	Supply Chain	86	103	17		17	103	
	Work Control	80	96	16		16	96	
	Operations and Maintenance	805	984	179		179	984	
	Early Release 3	102	102	0		0	102	
	Early Release 4	7	7	0		0	7	
Contingency		1,706	1,706	0		0	1,706	N/A
Sub Total		10,429	11,987	1,557	288	1,269	11,699	
Interest & Escalation (\$M)		2,371	2,799	429		429	2,799	100%
Total		12,800	14,786	1,986	288	1,698	14,498	85%

			ED-004/ JT-1.20					ED-003
			2	100% Cost Growth				
Major Category	Category/ Contract Type	RQE Base Costs (1)	Base cost + % Increase on Remaining Costs	Cost Variance on Remaining Costs	Impact to Contractor	Impact to OPG	Actual Cos to OPG	Proportion of Increase paid by OPG
Retube Feeder Replacement	OPG Project Management & Oversight Costs	167	265	98		98	265	74%
	Contractor Costs	Definition Phase Target Price (Incl RWPB)	190	5	0	5	190	
		Definition Phase Fixed Fee	83	10	10	0	74	
		Definition Phase Fixed Fee Incentive/ Disincentive	0		0	(0.400)	(0)	
		Execution Phase Target Price	3,301	1,634	0	1,634	3,301	
		Execution Phase Fixed Fee	974	482	482	0	492	
		Execution Phase Fixed Fee Incentive/ Disincentive	0		236	(236)	(236)	
		Mock-up Fixed Price	38	0	0	0	38	
		Non-target Reimbursable Costs	12	6	0	6	12	
		Tooling Fixed Price	383	8	8	0	375	
		OSM with Fee(estimate)	1,078	499	0	499	1,078	
		Goods with Fee(estimate)	96	48	0	48	96	
Fuel Handling/ Defueling	OPG Project Management & Oversight Costs	49	85	36		36	85	74%
	Cont. Costs	Defueling - Eng Services (Fixed/Firm Price)	16	0	0	0	16	
		Defueling - Eng Services (Misc Reimbursable)	7	0	0	0	7	
		Fuel Handling (ESMSA - see assumptions)	242	117				
Steam Generators	OPG Project Management & Oversight Costs	13	22	9		9	22	74%
	Contractor Costs							
Turbine Generator	OPG Project Management & Oversight Costs	41	69	28		28	69	74%
	Contractor Costs	ESES - Fixed/ Firm Cost - Equipment Supply	428	171	171	0	257	
		ESES - Target Cost Installation & Static Commissioning	77	38	0	38	77	
		ESES - Target Cost - Incentive/ Disincentive	0		19	(19)	(19)	
		ESES - Target Cost - Dynamic Commissioning	28	14	0	14	28	
		ESES - Target Cost - Incentive/ Disincentive	0		7	(7)	(7)	
		ESES - Reimbursable (no markup)	47	19	0	19	47	
		EPC - Definition Phase Target Cost	23	2	0	2	23	
		EPC - Definition Phase Fixed Fee	14	1	1	0	13	
		EPC - Definition Phase Fixed Fee Incentive/ Disincentive	0		0	(0)	(0)	
		EPC - Execution Phase Target Cost	318	157	0	157	318	
		EPC - Execution Phase Fixed Fee	104	52	52	0	53	
		EPC - Execution Phase Fixed Fee Incentive/ Disincentive	0		25	(25)	(25)	
		EPC - Dynamic Commissioning Work (Trades)	5	2	0	2	5	
		EPC - Goods	10	5	0	5	10	
		EPC - Reimbursable Costs with no-markup	23	11	0	11	23	
Balance of Plant	OPG Project Management & Oversight Costs	183	304	122		122	304	74%
	Contractor Costs (mainly ESMSA)	784	1,382	598				
F&IP & SIO Projects	Facility and Infrastructure Projects (mainly ESMSA)	640	699	59				74%
	Safety Improvement Opportunities (mainly ESMSA)	205	239	34				
Functions	Project Execution	322	614	293		293	614	100%
	Contract Management	52	92	40		40	92	
	Engineering	283	471	188		188	471	
	Managed Systems Oversight	41	66	25		25	66	
	Planning & Controls	136	191	54		54	191	
	Nuclear Safety	83	127	44		44	127	
	Program Fees & Other Support	341	630	290		290	630	
	Supply Chain	86	155	69		69	155	
	Work Control	80	144	65		65	144	
	Operations and Maintenance	805	1,523	718		718	1,523	
	Early Release 3	102	102	0		0	102	
	Early Release 4	7	7	0		0	7	
Contingency		1,706	1,706	0		0	1,706	N/A
Sub Total		10,429	16,556	6,127	1,114	5,013	15,442	
Interest & Escalation (\$M)		2,371	4,057	1,686		1,686	4,057	100%
Total		12,800	20,613	7,813	1,114	6,699	19,499	86%

Notes and assumptions:

- Based on OPG's Release Quality Estimate (RQE). All numbers except interest and escalation are in 2015\$.
- These are illustrative examples; assumption is that all contractor incentives/disincentives and performance fee mechanisms are applicable.
- Cost overrun factors are modelled based on remaining to go costs only.
- Cost overrun factors are not applied to contingency.
- RFR contract costs are as per Ex. D2-2-3, pp. 10 and 11.
- De-fuelling contract is mainly fixed/ firm price. Reimbursable fixed fees are capped for certain costs; however, this was not incorporated into the calculations due to lack of materiality.
- Steam Generator contract includes [REDACTED]
- For work bundles that are mainly under ESMSA contracts (e.g. BOP, FH, FIP, SIO), it was assumed, for simplicity, that the increase is caused by the contractor; therefore, the cost to OPG is [REDACTED] of the cost overrun (performance fee of [REDACTED] withheld).
- For simplicity, for all of the larger target cost contracts, a 20% cost disincentive was applied above any neutral band specified in the contracts. The actual percentage is calculated using a graded approach.
- For simplicity, interest and escalation were pro-rated.

## CONTINGENCY

### 1.0 OVERVIEW

Risk management is a systematic approach for proactively identifying, analyzing, managing and responding to project risks. OPG has implemented a comprehensive and robust risk management system for the Darlington Refurbishment Program "(DRP)", a key product of which is the contingency that is included in the Release Quality Estimate ("RQE"). Contingency is an important tool for managing uncertainty and risk throughout the life of a project. The process that OPG has used to develop the DRP contingency is set out in this Ex. D2-2-7. The process that OPG will use to manage contingency during the Execution Phase is described in Ex. D2-2-9.

### 2.0 CONTINGENCY

Determining the amount of contingency for a particular project or program is integral to the estimating, scheduling and risk management processes.

Importantly, contingency refers to amounts that are *expected* to be expended because there are risk items and uncertainties that will occur and cannot be entirely mitigated or avoided. Contingency is included as a component of a project estimate just like any other component of a project. It is not an extra amount that will not be spent if the project goes as planned, nor is it a tool to compensate for an underdeveloped project plan. It is a necessary, legitimate and thoughtfully developed part of the estimated project cost based on residual (post-mitigated) risk and uncertainty.

Association for the Advancement of Cost Engineering ("AACE") , a leading authority in the area of cost engineering, management and estimation, defines "contingency" as an amount that is 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. In addition, the AACE definition states that "contingency is generally