COMPARISON OF PRODUCTION FORECASTS – NUCLEAR

1.0 PURPOSE
This evidence presents period-over-period comparisons of nuclear production forecasts. This evidence supports the approval of OPG’s nuclear production forecast for the test period.

2.0 OVERVIEW
Variances between actual and forecast production in any year are typically the result of OPG experiencing more or fewer forced outages, forced extensions to planned outages, or unplanned outages than budgeted:

- The number of planned outage days per station in the production forecast reflects the work needed to complete the routine maintenance, inspections and project work that can only be performed while the units are shut-down. Forced extensions to planned outages (“FEPO”) typically occur from unanticipated requirements for additional work resulting from inspections during the outage.

- The budgeted Forced Loss Rate (“FLR”) in the production forecast is OPG’s best estimate of the number of unplanned outage days that OPG will experience in the year due to unforeseen events that result in unit shutdowns (forced outages) and forced derates. Actual experience at a station may lead to the number of unplanned outage days exceeding or being less than the budgeted FLR.

A discussion of the work undertaken to transition OPG Nuclear to a more reliable and predictable level of performance can be found in Ex. E2-T1-S1.

3.0 PERIOD-OVER-PERIOD CHANGES – TEST PERIOD
2012 Plan versus 2011 Plan
The nuclear production forecast for 2012 of 50.0 TWh is 1.1 TWh higher than the 2011 Plan of 48.9 TWh.

The improved nuclear production performance in 2012 relative to 2011 is primarily due to a forecast of increased production at Pickering B, driven by a reduction in the number of
planned outage days (i.e., a reduction of 50 days). This year-over-year reduction in planned outage days is due to lower planned outage days for the Pickering B Continued Operations initiative (55 days) offset by slightly higher planned outage days (5 days) for other planned outage activities in 2012, including feeder replacements. An explanation of the Pickering B Continued Operations initiative can be found at Ex. F2-T2-S3. Planned outage days at Darlington and Pickering A, year-over-year, are also slightly lower.

There is also increased production at Pickering A and Pickering B in 2012 compared to 2011 due to a forecast year-over-year improvement in the FLR at these stations while Darlington's FLR is forecast to remain constant. The forecast improvement in FLR at Pickering A and Pickering B is due to expected improvements in outage planning and execution as well as improvements to the material condition and reliability of these stations as a result of various initiatives being undertaken by OPG.

2011 Plan versus 2010 Budget
The production forecast for 2011 of 48.9 TWh is 2.7 TWh higher than the 2010 budget of 46.2 TWh. A major contributor to this improvement is a decrease in the number of planned outage days at all three sites in 2011. Pickering B's planned outage days decline by 69 days in 2011 as compared to 2010. This decline is largely a result of the fact that there is no Vacuum Building Outage ("VBO") scheduled at Pickering B in 2011. Pickering is undertaking a VBO in 2010. This planned outage will take all six Pickering units off-line for approximately four weeks. The VBO is required to complete a thorough inspection and maintenance program on the station’s containment system. The inspection and maintenance activities are prescribed by the Canadian Nuclear Safety Commission ("CNSC") and are required to maintain Pickering’s operating licence. However, the reduction of 152 VBO planned outage days in 2011 as compared to 2010 is offset by 83 additional planned outage days for the Pickering B Continued Operations initiative.
Planned outage days are also forecast to decline in 2011 as compared to 2010 at Pickering A and Darlington. Pickering A’s decline in planned outage days is primarily driven by the fact that there is no VBO at Pickering A in 2011 as there was in 2010. The reduction in the number of planned outage days at Darlington is primarily the result of its 36 month outage cycle, resulting in only one planned outage in 2011 as compared to the two planned outages in 2010.

Nuclear production is also forecast to improve in 2011 versus 2010 due to an expected year-over-year improvement in the FLR at all three stations. The forecast fleet-wide improvement in FLR is due to the material condition and reliability improvements at the stations, as discussed in Attachment 1 of Ex. F2-T1-S1 and to fewer and shorter duration forced outages based on improvements in OPG’s outage planning procedures and processes to increase productivity and reduce outage duration.

4.0 PERIOD-OVER-PERIOD CHANGES – BRIDGE YEAR

2010 Budget versus 2009 Actual

The nuclear production forecast for 2010 of 46.2 TWh is 0.6 TWh lower than the 2009 actual production of 46.8 TWh. There are various factors impacting the year-over-year change in planned production.

Production is forecast to decrease in 2010 compared to 2009 due to an increase in the number of planned outage days at Pickering A and Pickering B as a result of:

- Pickering A and B undertaking a VBO in 2010. This planned outage will take all six Pickering units off-line for approximately four weeks.
- An additional 28 planned outage days at Pickering B in 2010 as part of the Continued Operations initiative. There was no planned outage days in 2009 related to Continued Operations.

Production at Darlington in 2010 compared to 2009 is forecast to increase due to a reduced number of planned outage days at this station. The Darlington VBO in 2009 resulted in a significant number of planned outage days as all four Darlington units were off-line for
approximately four weeks. There is no Darlington VBO in 2010. However, the 36-month outage cycle at Darlington will result in two planned outages in 2010 at this station compared to one planned outage in 2009. This will partially offset the reduction in planned outage days due to the VBO.

Nuclear production is also anticipated to improve in 2010 as compared to 2009 due to an expected year-over-year improvement in the FLR at Pickering A and Pickering B, while Darlington’s FLR remains flat. The forecast 2010 FLR for the nuclear fleet is 3.5 per cent compared to 6.4 per cent in 2009. The primary driver of the improved fleet FLR in 2010 is the expectation that Pickering A’s FLR will decline to 8 per cent in 2010 from 24.6 per cent in 2009.

The 2010 nuclear production forecast includes an allowance for major unforeseen events of 2.0 TWh, as described at Ex. E2-T1-S1.

5.0 PERIOD-OVER-PERIOD CHANGES – HISTORICAL PERIOD

2009 Actual versus 2009 Budget

The actual nuclear production for 2009 of 46.8 TWh is 3.1 TWh lower than the 2009 forecast of 49.9 TWh.

Darlington’s performance was 0.5 TWh lower than forecast, primarily due to a Unit 3 forced extension of the planned outage related to the VBO. Darlington’s actual FLR for 2009 of 1.64 per cent was better than the forecast of 1.7 per cent.

Pickering A’s actual 2009 production was 1.6 TWh less than forecast. This difference was driven by a 32.5-day forced extension to the Unit 4 planned outage. The forced extension was required due to discovery during the planned outage that additional work was required on the shutdown cooling system and repairs were needed to the turbine release valves. Pickering A’s actual production was also lower than forecast due to higher than forecast FLR. The actual 2009 FLR was 24.6 per cent compared to a forecast FLR of 11.5 per cent. Pickering A Unit 4 experienced a 21.1-day forced outage in order to repair the main output.
transformer, and three separate forced outages, totaling 74 days, due to problems with Unit 4’s liquid zone control system. Pickering A’s FLR benefited from a decision by the CNSC on November 16th, 2009 to remove the forced derate (3.0 per cent annually) at Pickering A.

Pickering B’s actual 2009 production was 1.0 TWh less than budget primarily as a result of a 27.7-day forced extension to the Unit 5 planned outage to address high pressure service water and shutdown cooling pump discovery work. Pickering B’s actual FLR in 2009 was 5.8 per cent, an improvement over the forecast FLR of 6.2 per cent. A significant achievement at Pickering B during 2009 was the successful completion of the 70 day planned outage at Unit 6 ahead of schedule.

2009 Actual versus 2008 Actual
The nuclear production for 2009 of 46.8 TWh was 1.4 TWh lower than the 2008 actual nuclear production of 48.2 TWh. As shown in Ex. E2-T1-S2 Table 1b, Darlington and Pickering A production in 2009 is lower than in 2008, while Pickering B’s production is greater.

The main reason that Darlington’s production in 2009 was lower than 2008 is the increase in the number of planned outage days due to the 2009 VBO. This outage resulted in all four Darlington units being off-line for approximately four weeks. The VBO was required to complete a thorough inspection/maintenance program of the station’s containment system, one of its major safety systems. The inspection/maintenance activities are prescribed by the CNSC and are required to maintain Darlington’s operating licence (CNSC licensing is further discussed at Ex. A1-T6-S1). Consequently, in 2009, Darlington required 101.2 additional outage days as compared to 2008 resulting in a production decline of 2.9 TWh compared to 2008. Darlington’s performance was also impacted by a total of 11.9 days of forced extension to the planned outages related to the VBO.

Darlington’s 2009 FLR also increased from 2008. Darlington’s FLR in 2008 was exceptionally good at 0.7 per cent. While Darlington’s FLR in 2009 of 1.6 per cent exceeded Darlington’s 2008 FLR, Darlington’s 2009 FLR was still better than forecast.
The improvement in Pickering B production in 2009 versus 2008 is primarily a result of the significant improvement in Pickering B’s FLR. In 2008, Pickering B’s Unit 7 was subject to a lengthy 237.5-day forced outage due to a calandria tube replacement and Unit 8 experienced a 25.7-day forced outage due to a heat transport system leak, resulting in an FLR of 24.2 per cent for the year. In 2009, Pickering B was able to reduce the number and duration of forced outages (28.1 forced days spread across 5 outages) that it experienced, such that the FLR for the year was 5.8 per cent. Offsetting the improved FLR at Pickering B were additional planned outage days and a 27.7-day forced extension to the Unit 5 planned outage for shutdown cooling pump discovery work and system maintenance.

Pickering A’s 2009 production of 5.7 TWh was slightly less than the 2008 production of 6.4 TWh. The lower production in 2009 was mainly due to an increase in the number of planned outage days. In 2009, Pickering A’s Unit 4 underwent a combined 74-day planned outage that was also subject to a 32.5-day FEPO. In 2008 there were no planned outages or FEPO days at Pickering A as a result of the deferral of Pickering A’s Unit 4 outage from the fall of 2008 to 2009.

Offsetting the increase in planned outage days in 2009 was a reduction in 2009 in the number and duration of forced outages. Pickering A’s FLR was 24.6 per cent in 2009 compared to 27.9 per cent in 2008. Pickering A’s FLR was also positively impacted in November 2009 when OPG obtained CNSC concurrence to remove the 3 per cent derate on the Pickering A units imposed in August 2007.

2008 Actual versus 2008 Budget

The actual nuclear production in 2008 of 48.2 TWh was 3.3 TWh lower than the 2008 production forecast of 51.4 TWh.

Darlington exceeded expectations by achieving a 94.5 per cent Unit Capability Factor (“UCF”). The positive results from Darlington are a function of the station’s ability to realize a FLR of 0.7 per cent compared to a budgeted FLR of 2.2 per cent. There were no FEPO days
in 2008 and the actual planned outage days were lower than budget due to the early
completion of the Unit 1 planned outage in the spring.

Pickering A’s actual 2008 production of 6.4 TWh was 0.7 TWh lower than the budget of 7.1
TWh, as production at Pickering A was negatively impacted by forced outages, reflected in
an actual FLR of 27.9 per cent. Production was positively impacted by zero planned outage
days in 2008 compared to the budget of 67.0 days as a result of a decision to defer Pickering
A’s Unit 4 planned outage from the fall of 2008 to 2009.

Pickering B’s actual 2008 production of 12.9 TWh was 2.8 TWh lower than the budget of
15.7 TWh. The Pickering B Unit 7 extended forced outage was the major cause of reduced
production in 2008. It was subject to a forced outage from April 6 to November 29. The FLR
for Pickering B was 24.2 per cent compared to the budgeted FLR of 6.2 per cent. Offsetting
the FLR increase was a reduction in the number of planned outage days from 112.0 days to
62.1 days, reflecting, in part, the fact that OPG was able to complete most of the fall Unit 7
planned outage work during the Unit 7 forced outage.

2008 Actual versus 2007 Actual
As shown in Ex. E2-T1-S2 Table 1a, nuclear production for 2008 of 48.2 TWh was 3.9 TWh
higher than the actual production in 2007 of 44.2 TWh.

The improvement in 2008 production is due, in part, to a reduction in the number of planned
outage days from 331.2 days in 2007 to 131.2 days in 2008. The main drivers for the
reduction in planned outage days are:
• Darlington’s move to a three-year outage cycle from a two-year cycle was completed in
  2007. Accordingly, only one Darlington unit went through a planned outage in 2008,
  reducing by 65 days the number of planned outage days in the year.
• There were zero planned outage days in 2008 at Pickering A compared to 65.1 planned
  outage days in 2007. The reduction in the number of planned outage days in 2008 was a
  result of Pickering A’s Unit 4 fall planned outage being deferred to 2009.
• OPG was able to complete most of the Pickering B Unit 7 fall planned outage work during the Unit 7 forced outage.

Partially offsetting the impact of reduced planned outage days on nuclear production in 2008 was a higher fleet-wide FLR in 2008 as compared to 2007. The increase in fleet-wide FLR was primarily due to a major unforeseen event, the extended forced outage at Pickering B Unit 7 which increased Pickering B’s FLR from 12.5 per cent to 24.2 per cent. Partially offsetting the increase in FLR at Pickering B were decreases in FLR at Darlington and Pickering A. The year-over-year reduction in Pickering A’s FLR is a reflection of the fact that Pickering A’s 2007 FLR had been significantly impacted by a major unforeseen event at Unit 1 and Unit 4 due to the inter-station transfer bus issue. Pickering A’s FLR improved from 49.8 per cent to 27.9 per cent. Pickering A experienced several extended forced outages in 2008, including a 59 day forced outage of Unit 1 due to an in-operable fuel loading machine, and a 23.5-day forced outage at unit 4 due to problems with the heat transport system related to pump seal design. Pickering A’s FLR in 2008 also experienced the full year impact of the 3 per cent derate of the Pickering A Units 1 and 4 that started in August 2007 due to an inability of OPG to obtain CNSC concurrence with OPG shutdown system trip set methodology.

2007 Actual versus 2007 Budget
As shown on Ex. E2-T1-S2 Table 1a, OPG’s 2007 actual nuclear generation was 5.6 TWh lower than the 2007 budget production.

Darlington’s production exceeded the budget by 0.4 TWh, largely due to Darlington’s better than budgeted FLR results (15.1 days of forced loss equivalent versus a budget of 44.4 days).

At Pickering A the 2007 production was 3.6 TWh, 3.9 TWh below the 2007 budget of 7.5 TWh. The decrease in actual production compared to budget is primarily due to the increased in FLR equivalent days in 2007 as a result of a series of unique, major unforeseen events at Pickering A (the inter-station transfer bus issues) which impaired generation.
At Pickering B the actual 2007 generation was 13.4 TWh, 2.2 TWh less than the 2007 budget of 15.6 TWh. The decrease in actual generation compared to budget was due to a combination of additional planned outage days compared to budget and additional forced loss rate equivalent days. The main driver to the additional forced loss equivalent days was the inadvertent release of resin into the station's demineralized water supply by a contractor. This release resulted in an unscheduled loss of 60 production days and in FEPO days at Pickering B.