Attachment 1 – Prior Initiatives

The following provides an update of the objectives, description of activities undertaken and benefits achieved of the six key fleet wide initiatives as identified in EB-2016-0152, Ex. F2-1-1 Section 3.5: (i) Parts Improvement, (ii) Outage Improvement, (iii) Equipment Reliability (iv) Human Performance, (v) Nuclear Inventory and (vi) Workforce Planning and Resourcing.

Parts Improvement Initiative

Objective

The objective of the Parts Improvement Initiative was to ensure the right parts are available at the right time and in the right place to improve OPG's ability to consistently schedule and execute the most important work in the plant, which maintains operational focus by improving plant and equipment reliability and improves efficiency.

Description

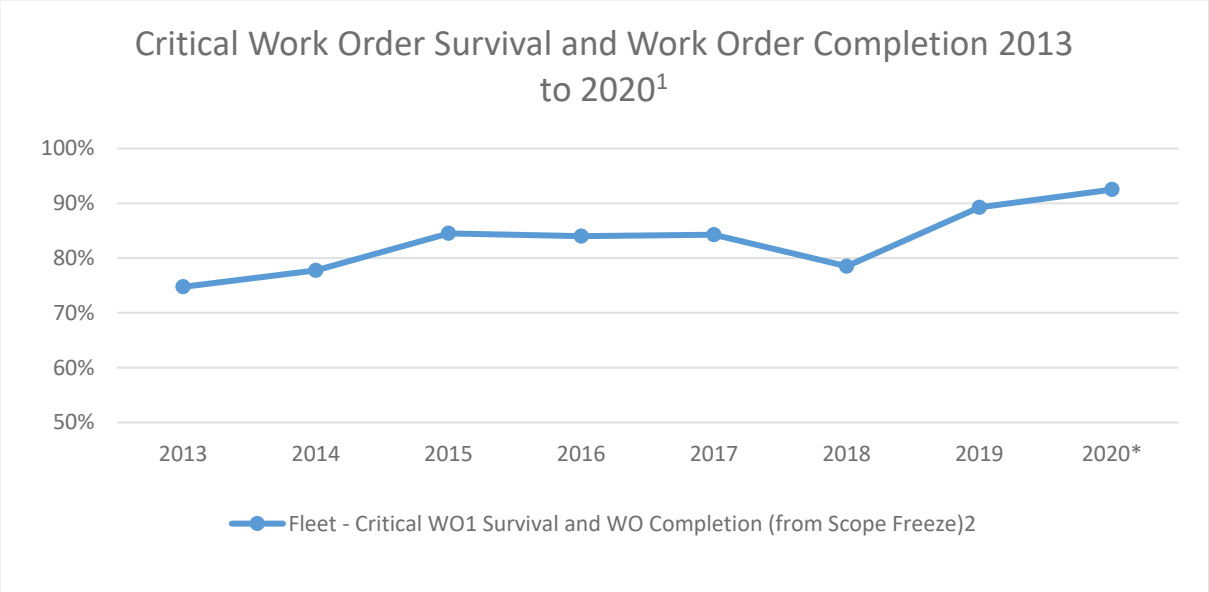
1. The initiative recognized that there was a breadth of contributing factors and need for behaviour change to address the inadequate parts availability. Led by a cross-functional team of knowledgeable subject matter experts, this multi-year project had a number of focus areas, including improving the accuracy of information about our nuclear assets to improve planning. For example, applying correct criticality ratings allows for accurate prioritization of work. Further, reclassifying critical components reduced the percentage of critical components in the plants from 28.0% to 19.5% across the fleet, enabling focused efforts on critical work and reducing focus on less critical work.
2. Aligning cross-functional groups with priority work in order to focus collective effort on maximizing throughput for our work program and balancing work to resources to better execute work plans.
3. Ensuring repeatable and transparent processes more efficiently meet our milestones and objectives.
4. Implementing an obsolescence program to ensure a robust, working obsolescence management capability. This allowed resolution of obsolescence issues impacting over 3,700 end-uses, 550 critical components, and 89 single-point vulnerabilities.

Benefits Realized

Based on the results achieved, the Parts Improvement initiative was successfully closed out in 2019. To measure overall initiative effectiveness, OPG used a metric called “Critical Work Order Survival/Completion from Scope Freeze to Execution”, a standard work management measure in the industry. By way of background, a key factor to managing the duration of planned outages is to control scope changes prior to the commencement (execution) of planned work. To this end, OPG procedures establish a “scope freeze” approximately 6 weeks prior to planned work startup, with the assumption that all approved work in place as of the scope freeze should proceed to completion.

Historically, as shown in Figure 1 below, the Critical Work Order Survival/Completion from Scope Freeze to Execution, measured as a percentage of work orders that survived the planning period and were successfully completed, was challenging. This reflected that a high percentage of approved work (including critical work orders) were not completed due to parts availability. However, the improvements made through this initiative reduced challenges with parts availability. This resulted in much improvement at both Darlington and Pickering, improving from 76% in 2013 to 93% as of Q2 2020.

Figure 1



1. Prior to 2016 only Critical WO1 Survival was tracked. Starting in 2016 OPG modified the measure to include WO Completion

2. Critical WO was Critical 1 & 2 equipment until 2017Q3, then Critical 1 only as per INPO AP-913

* 2020 is as of Q2 2020. All other years are Q4 Data.

Outage Improvement Initiative

Objective

The objective of the Outage Improvement Initiative was to reduce generation losses due to outage durations exceeding business plan targets. To improve outage performance, this initiative focused on improvements to the outage planning process, tooling, scope of work, and training.

Description

1. **Outage Planning Process:** An improvement to the outage planning process included transitioning Pickering from a 24 month to a 30 month outage cycle. The transition required component condition assessments, CNSC regulatory requirement reviews and changes to the generation plan. Following evaluation of issues impacting outage performance, improvements were also made to outage processes such as emergent issue resolution, outage shift schedules, risk management and fuelling machine outage readiness.

2. **Tooling:** OPG implemented two outage tooling improvements by transitioning to machine delivered scrape and implementation of universal delivery machine efficiencies. Utilizing these tools reduced planned outage durations to complete the inspection and setup for this outage activity, resulting in outage execution efficiency and also reduced radiation dose for employees.

3. **Outage Scope of Work:** Unanticipated outage scope of work can contribute to outages exceeding business plan duration. In addition, too much scope may have been added to an outage resulting in the outage duration exceeding plan. Outage scope of work improvements focused on right sizing the outage scope and improving scope stability. Right sizing outage scope occurs through continuously reviewing OPG's aging and life cycle management programs for fuel channel, reactor components and feeder inspections as well as steam generator maintenance. One example was the reevaluation of the requirement to complete a Low Level Drain state. The reevaluation determined this activity was not required and therefore two Low Level Drains were

removed from scope that had been scheduled for Unit 6 in 2017 and Unit 7 in 2018, and will not be rescheduled into future outages.

In other instances, scope was added to outages to improve subsequent outages. For example, in one outage, scope was added to fix select channels that require grapple to refuel, which provided outage duration improvements in subsequent outages on the same unit.

4. **Training:** Improvements include work control team leaders sessions on leadership, collaboration and sharing of best practices across the fleet.

Benefits Realized

Based on the results achieved, the Outage Improvement initiative was successfully closed out and outage improvement initiatives are incorporated into the Right Work Right Time Right Value initiative.

Efficiencies and improvements in outage planning and execution were one of the contributors to the reduction of planned outage days at both Pickering and Darlington over 2017-2019. Further details are set out in Ex. E2-1-1.

Equipment Reliablity

Objective

The objective of the Equipment Reliability initiative which commenced in 2015 was to focus on improving equipment reliability at Darlington and Pickering, in order to reduce OPG's forced loss rate ("FLR"). Equipment reliability has been a major contributor to OPG's historical FLR.

Description

The initiative was focused on preventive maintenance with the goal of improving equipment reliability program execution, improving cross-functional alignment with goals and targets, and improving condition-based maintenance.

Benefits Realized

This initiative has driven significant improvement in equipment reliability at both Pickering and Darlington. The initiative has been successful in such areas as improving component life cycle management plan execution, an improved preventative maintenance program, developing effective equipment reliability tools, and developing a leading system health program.

The initiative achieved two major successes. First, the initiative tracked its performance against the Equipment Reliability Index ("ERI"), an industry benchmark.[1] In 2015, Pickering and Darlington had ERI scores of 69 and 76 respectively. In 2019, Pickering and Darlington achieved their best ever ERI scores of 94 at Pickering (versus target of 86) and 95 at Darlington (versus target of 92).

Second, OPG has seen a significant decline in FLR at Pickering from 10.7% in 2014 to 1.6% in 2019, averaging 5.0%.from 2014 to 2019. Darlington's FLR has averaged 2.7% from 2014 to 2019.

[1] The ERI is a North American benchmark for assessing equipment reliability performance. The index uses key leading indicators projecting degradation in plant operations or reliability of key station equipment.

Based on the results achieved, the Equipment Reliability initiative was successfully closed out in 2019. Additional initiatives targeted at more specific equipment reliability issues were identified, including system/component monitoring through the Monitoring & Diagnostics Centre. These specific items have been included in the Right Work, Right Time, Right Value initiative.

Human Performance Initiative

Objective

The Human Performance strategic initiative was designed to reduce human performance events that have adverse consequences, such as impact to safety of workers or the public, damage to plant equipment and systems, financial impact, or reputation.

A variety of individual and team behaviours, management practices, leadership engagement, processes and values affect worker performance and influence the probability and consequences of human error, which can result in human performance consequential events.

Description

The Human Performance Initiative in the 2016-2018 Business Plan was made up of 3 key strategic initiatives, with subsets of actions.

1. **Leadership Accountability** – It is expected that leaders' behaviours promote excellence and nuclear professional behaviours at all levels of the organization.

    i. Improved documentation: The Human Performance program is executed through a series of documents that support management of human performance and lay the framework for improving and sustaining performance.

    ii. Management review boards perform oversight of shift crew performance and work program effectiveness. These meetings are scheduled on a quarterly basis, and drive self-critical review of crew performance, work program strengths, areas for improvement, and any required corrective actions. Improvement initiatives are tracked locally at sites via established oversight forums.

    iii. Managers use assessment tool as an aid to determine what individual behaviours, team behaviours, organizational factors contributed to an event and identify "lessons learned".

2. **Supervisory Effectiveness** – Supervisors positively shape field worker behaviours by providing effective coaching and feedback. They reinforce positive behaviours and results as well as provide candid feedback on performance gaps and development areas.

3. **Procedure Use and Adherence** – Nuclear procedures reflect a vast collection of operational experience, but they are only effective when they are followed. Following procedures as written positions OPG to achieve results in a consistent manner with known outcomes and reliable results. An awareness campaign was initiated to ensure that individuals at all levels value, and follow procedures to prevent events. Also measures are in place to provide oversight and monitoring of procedure adherence events that have resulted in significant errors or near misses.

Benefits Realized

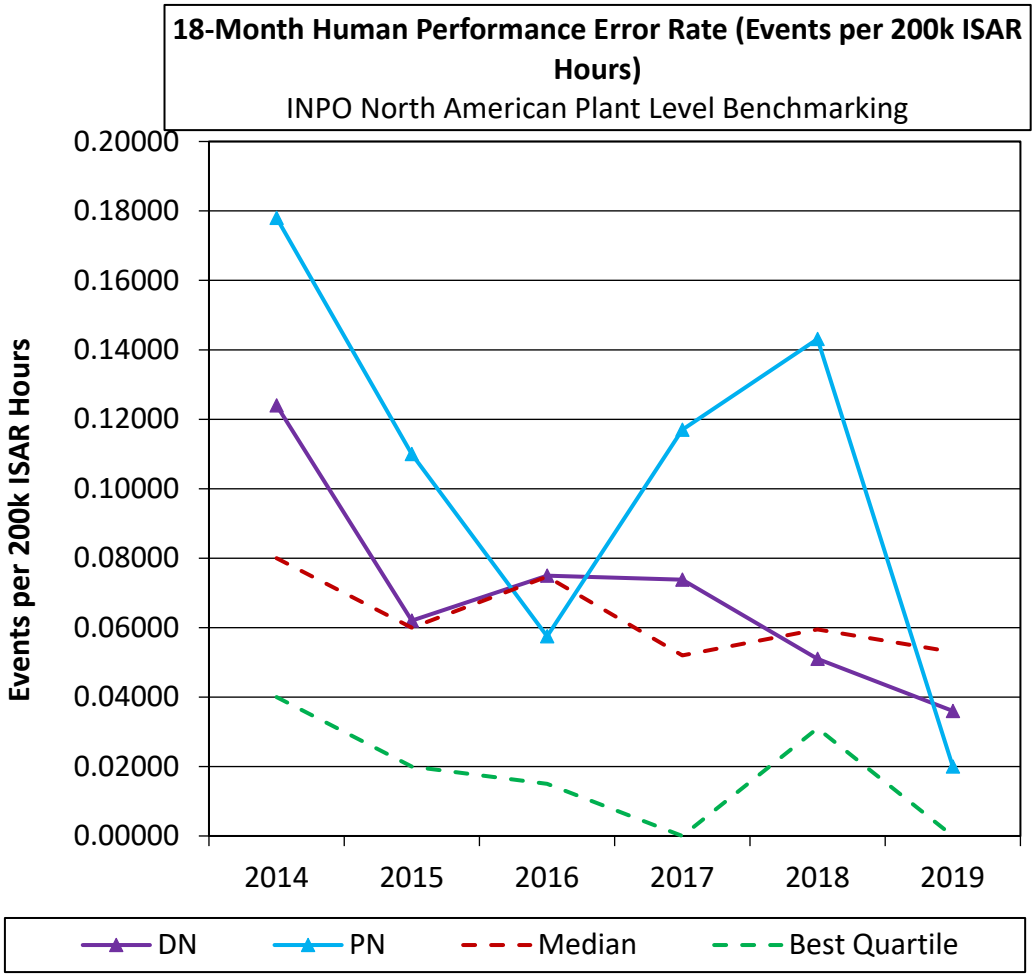
Based on the results achieved the Human Performance Improvement initiative was successfully closed out in 2017. However OPG continually seeks to reduce the potential for human performance events that have adverse consequences and continues ongoing tracking through lost generation and human performance error rate.

a) **Lost generation:** Improving Human Performance can reduce lost generation due to events triggered by human error. In 2015, approximately $65M in lost generation at both Pickering and Darlington Nuclear Generating Stations combined were attributed to Human Performance issues that resulted in outage delays and extensions, and work management inefficiencies. At the end of 2019, less than $5M in lost generation at Pickering and Darlington combined was attributed to Human Performance events.

b) **Human Performance Error Rate:** OPG benchmarks its human performance error rate against peers using an industry standard metric referred to as the 18 month Human Performance Error Rate ("HPER"), which tracks the number of site level human performance events in an 18-month period per 200,000 Industrial Safety Accident Rate and Contractor Hours.

As shown in Figure 2 below, Darlington's and Pickering's HPER has shown a favourable trend over the 2014-2019 period.

Figure 2



Nuclear Inventory Initiative

Objective

The purpose of this initiative was to establish targeted inventory growth rates that would minimize excess nuclear materials and supplies inventory. A reduction in the growth of inventory reduces the potential for additional obsolescence provision and added OM&A expense. This also reduces warehousing requirements and related expenses of carrying excess inventory.

The benefit of optimizing the inventory on hand and reducing the growth rate, while maintaining an expected order fulfillment service level, achieves better utilization of capital, that requires less OM&A expense in support of end of life obsolescence provision.

Description

Cross-functional teams reviewed different aspects of the inventory challenge. These teams worked to review stock modeling parameters which supported the procurement and order fulfillment workflow. Additionally, effort was made to identify and disposition slow moving and obsolete inventory.

Among the actions taken were:

1) Improving the tracking of the initiation, revision and cancellation of Material Requests (“MRs”). OPG was able to improve its management of required inventory by undertaking a procurement and order fulfillment review that allowed material to be “unreserved” from inventory for work that was no longer in scope and consequently allowing this inventory to be available for upcoming valid demand.

2) Improved balancing of supply with valid demand to minimize excess inventory by improving automated controls and implementing ongoing synchronization between the master production schedule requirements (outage/online station work management system) with material resource planning signals within our Enterprise Reporting Program Asset Suite 7 software.

3) Innovative tools and processes that provide improved visibility into available in-stock material during the design phase for the Darlington refurbishment such that final approved designs would consume existing OPG inventory first rather than triggering a new procurement.

Benefits Realized

Actual Darlington materials and supply inventory over the 2017-2019 period reflects inventory held for cyclical outages at Darlington[2] and expenditures on operational spares/inventory transfers arising from the Darlington Refurbishment Program ("DRP"). Targeted growth rates established in 2015 did not reflect the impact of inventory held for cyclical outages or operational spares/inventory transfers related to the DRP.

Figure 3 below provides actual and targeted growth rates for Pickering, Darlington and OPG Nuclear combined. As shown in Figure 3, Pickering's trend is improving as its material and supply inventory growth rate was at or below (i.e better than) target in 2018 and 2019. Darlington did not achieve its targeted growth rate in 2017 and 2019 but was below (i.e. better than) target in 2018. A factor driving inventory growth at Darlington was the higher than forecast growth in capital expenditures, resulting in increased purchases of materials including spare parts. In addition, the target growth rates for Darlington shown in Figure 3 excluded the impact of cyclical outages or capital spares/inventory transfers from the refurbishment of Unit 2 that are reflected in the actual growth rates.

Optimizing nuclear inventory and reducing the growth rates continues to be pursued as part of OPG's focus on continuous improvement. Further discussion on the 2020-2026 Business Plan target growth rates for materials and supplies inventory is provided in Ex. B1-1-1, Section 3.2.4.

[2] Cyclical outage costs are costs for various inspection and maintenance activities on units undergoing refurbishment associated with a planned outage in accordance with OPG's aging and life cycle management programs, that are in addition to and separate from the refurbishment of the units, as further discussed at Ex F2-4-1.

Figure 3

Targeted and Actual Inventory Growth Rates

Target	2017	2018	2019
PNGS	1.50%	0.50%	0.00%
DNGS	3.00%	2.00%	2.00%
All Facilities	2.00%	1.09%	0.82%
Actual			
PNGS	4.10%	0.50%	-0.20%
DNGS	6.60%	-0.40%	15.90%
All Facilities	5.68%	-0.04%	6.26%

Workforce Planning and Resource Initiative

Objective

The objective of this initiative was to develop and implement a resource stratetgy in order to support the safe operation of the plants during the Darlington Refurbishment Program, as well as planning for the shutdown of Pickering. The initiative was overseen by a Resource Planning and Control Team ("RPCT") that was established in 2016.

Description

The RPCT continues to function today to ensure deliverables are met to manage preparation activities in support of Pickering Optimized Shutdown by ensuring that headcount is within business plan guidelines, while at the same time mitigating risks and long term operational impacts.

The RPCT critically reviews and approves resourcing strategies to ensure staffing plans for key functional areas optimize the allocation of resources across the Nuclear fleet, including Darlington Refurbishment. Staffing plans are presented to the RPCT for approval and define opportunities for movement of staff between sites and functional areas, as well as recommend

both internal and/or external hiring based on OPG's Business Plan and workforce planning assumptions.

The staffing plans provide a 10-year outlook designed to reduce the impact of Pickering planned shutdown on employees and plant operations, while mitigating costs. The plans include these important objectives:

- Ensure an adequate number of qualified employees are available, including to facilitate DRP and the continued safe operation of Darlington and Pickering;
- Minimize external regular hiring into the Society of Energy Professionals ("Society") and Power Workers' Union ("PWU") bargaining unit so as to minimize the requirement for staff turnover and/or involuntary layoffs;
- Use Society ETEs and PWU Term employees to minimize the requirement for staff turnover and involuntary terminations when Pickering ceases commercial operations; and
- Facilitate the ongoing transfer of qualified regular Pickering employees to work at Darlington, Nuclear Waste Management, or other OPG locations where the resource demand extends beyond Pickering closure.

Benefits Realized A measure of the success of the workforce planning and resource initiative can be seen in the results from the Goodnight 2019 Nuclear Staffing Benchmarking study (see Ex. F2-1-1, Attachment 6). Goodnight benchmarked OPG Nuclear staffing to other North American nuclear operators and established that OPG is 239 Full-Time Equivalents ("FTEs") (4.5%) below the North American FTE benchmark of 5,255 FTEs, a consistent improvement since 2011 (see Section 3.2.1.3 for further details).

An "Operations Voluntary Deployment" process has successfully moved nuclear operators from Pickering to Darlington through a staged approach starting in 2018. This allows managers to proactively plan in advance for deployments by bringing in required external term employees to backfill for the Pickering transfer. Starting in 2016, maintenance successfully began deploying employees from Pickering to Darlington.

The Workforce Planning and Resource Initiative has since been incorporated into the People Powering the Future initiative with the objective to ensure an adequate number of qualified employees are available to facilitate DRP and the continued safe operation of Darlington and Pickering while minimizing external regular hiring by utilizing PWU Terms and Society ETE and facilitating the transfer of qualified regular Pickering employees to other OPG locations (e.g., Darlington).