

PROGRAM SCHEDULE

1.0 OVERVIEW

The ability to validate, integrate, oversee and ultimately to retain control over the program schedule is one of the key factors that has driven OPG's Darlington Refurbishment Program ("DRP") strategy. OPG has developed a fully integrated Program schedule, which incorporates the project schedules for each of the major work bundles that are detailed down to the individual work packages or components within each bundle. OPG is in a position to effectively leverage the control it retains over the Program schedule to ensure Program success since the schedule has a direct impact on Program costs. This schedule describes (1) the manner in which OPG developed its integrated Program schedule, (2) OPG's multi-level scheduling approach, (3) the Unit 2 critical path, and (4) the difference between the schedule that is being used as the Program control schedule and the planned outage duration.

2.0 SCHEDULE DEVELOPMENT

Establishing an accurate and realistic schedule is a critical planning tool for the DRP. The schedule reflects the sum total of the estimated duration of the individual tasks included within the Program scope. The schedule is critical to properly strategize, plan and prepare for upcoming project work, to determine resource requirements, to understand how work is progressing and to apply corrective actions if required.

OPG and its contractors have developed schedules with inputs from appropriate project stakeholders. Scheduling includes:

- the scope of work to be completed;
- identification of key activities including their start and finish date, duration and resources;
- the sequence and logical interrelationship of activities and milestones;
- identification and optimization of the critical path;
- regular monitoring and updating to track performance, forecasting, and initiate corrective action for schedule threats; and

- look ahead at planning and strategizing to identify and manage priorities, opportunities, and threats.

The overall planning and scheduling process can be represented in two major stages: (1) the formation of a baseline schedule; and (2) schedule management, including monitoring, analysis, reporting, and mitigation.

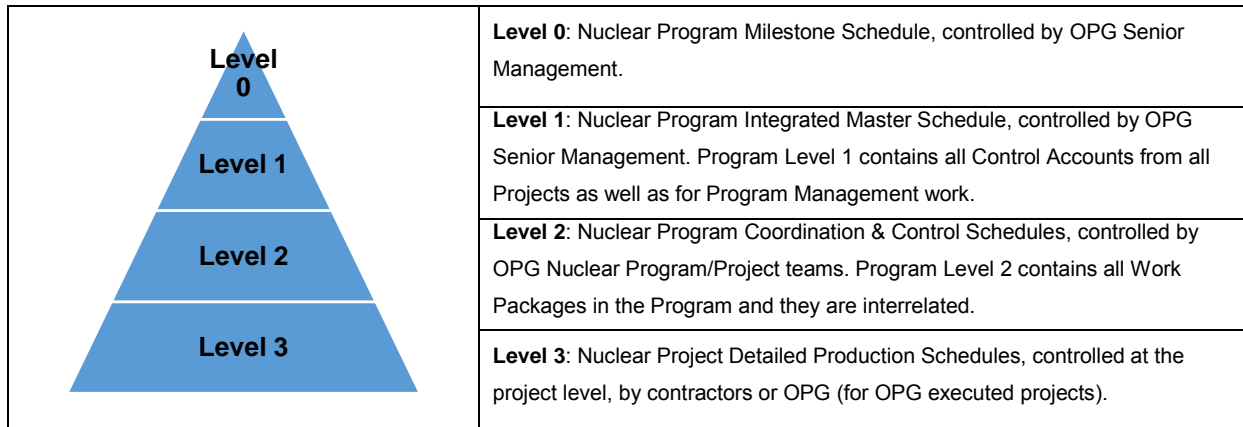
This Ex. D2-2-6 focuses on schedule formation and Ex. D2-2-9 focuses on schedule management. OPG project teams have established a breakdown of work that is deliverable-oriented and which addresses 100 per cent of project work, down to the individual work components that make up a bundle (also referred to as “work packages”). The work breakdown reflects the corresponding contracting strategies so that work scope, budgets and responsibilities are clearly allocated.

The project schedules have been reviewed for overall quality to ensure they meet process requirements. These reviews will be performed on a regular basis as part of normal updating of the schedule. Furthermore, the schedules have been reviewed through an iterative process and approved by the project team members and key project stakeholders. These reviews considered project and Program constraints, milestones, resource requirements, and critical path to determine the acceptability of the schedule.

3.0 MULTI-LEVEL SCHEDULING APPROACH

Based on recommended practices, OPG has established its schedule using a multi-level scheduling approach. As shown in Figure 1 below, project schedules are prepared with up to four levels of detail, from Level “0”, which contains the Program milestones managed by OPG which identify the major deliverables and timelines for the overall DRP , to Level “3”, which contains the greatest level of detail showing individual work components at the task level. For example, projects where most of the work will be performed by contractors utilize detailed Level 3 schedules. OPG as the owner performs project management and control activities utilizing Level 0 to 2 schedules.

Figure 1
Multi-level Scheduling Framework¹



Level 0 consists of the *Nuclear Program/Project Milestone Schedule*, and is used by OPG senior management to provide the basis for establishing the master schedule. This includes program release milestones, regulatory milestones, outage preparation milestones and outage execution milestones.

The Level 1 schedule is the *Nuclear Program/Project Integrated Master Schedule* that contains particular work scopes, a time window and a responsible organization. The Level 1 schedule provides a high-level management summary of the Program or project, represents all units, phases and bundles, and is used by project managers, contractors and scheduling functions.

Level 2 schedules are the *Nuclear Program/Project Coordination & Control Schedules*. This is the schedule used by OPG to track the overall status of the Program. It will be updated and controlled by OPG and is based on the contractors' detailed Level 3 schedules.

Level 3 schedules are *Nuclear Program/Project Detailed Production Schedules* which further break down work into detailed activities. Level 3 schedules are prepared by the group

¹ A Level 1 schedule is comprised of Control Accounts, which represent high level execution windows in each outage segment. A Level 2 schedule is comprised of Work Packages, which are used to integrate costs and schedule as well as provide grouping for related Level 3 activities. Earned Value Management is done at this level.

1 executing the work (typically by contractors, and in some cases by OPG where OPG is self-
2 performing work). The lowest level of tasks to be executed are developed here.

3
4 Once approved, schedules are 'baselined' by the project owners as a benchmark for
5 measuring implementation performance. Baselined schedules are archived and will not be
6 modified, except by means of a re-baselining process involving cost and schedule analysis
7 and only through authorized change control. This process is discussed in Ex. D2-2-9.

8 9 **4.0 CRITICAL PATH AND SCHEDULE OVERVIEW**

10 The critical path refers to the longest sequence of activities in a project plan which must be
11 completed on time for the timely delivery of the overall project. Activities on the critical path
12 cannot be started until one or more predecessor activities are complete. If the critical path is
13 delayed for one day, the entire project will be delayed for one day unless the critical path
14 activities following the delay are completed one day earlier than planned or future critical
15 path activities are forecast to be completed earlier than the original plan.

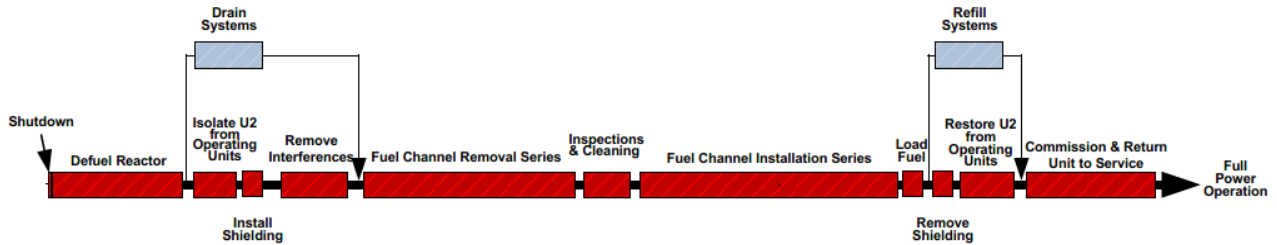
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17 Figure 2 presents a simplified outage schedule and illustrates the major phases for the
18 execution of Unit 2. The phases are:

- 19 • Reactor shutdown
- 20 • Defuel reactor
- 21 • Drain systems and isolate from containment
- 22 • Fuel channel removal, inspection and cleaning and installation
- 23 • Refuel
- 24 • Refill and re-establish normal containment boundary
- 25 • Commission and return to service

26
27 A more detailed schedule for Unit 2 is provided in Attachment 1.

Figure 2

Simplified Unit 2 Refurbishment Outage Schedule



5.0 PLANNED OUTAGE DURATION VERSUS HIGH CONFIDENCE SCHEDULE

As part of the schedule development process, OPG has integrated all contractor schedules, determined the critical path and created the schedule provided in Attachment 1 for the Unit 2 critical path. This is the planned outage duration and OPG will manage day-to-day performance using this schedule. It will also be used to determine contractor incentives and disincentives, where applicable.

OPG also evaluated risks and uncertainties for each segment of the schedule, and determined the amount of contingency required to deliver the Unit 2 refurbishment in consideration of the risks and uncertainties evaluated. This resulted in the production of a schedule that includes contingency for certain schedule risks that may be encountered during the execution of the refurbishment outages. Through probabilistic analysis, OPG expects to execute the Unit 2 refurbishment within this schedule. This high confidence schedule is the basis for Release Quality Estimate ("RQE"), which is the program level control budget. This schedule is also the schedule from which project success will be assessed.

As discussed in Ex. A1-3-3, if refurbishment of Unit 2 is completed earlier or later than scheduled, production may vary. In addition, there is a risk that the post-refurbishment forced loss rate at Darlington may vary from OPG's current forecast. These factors have the potential to either decrease or increase production, depending on the circumstances. Given the long term of this application and the uncertainty of nuclear production during that period,

- 1 a mid-term review of nuclear production and related fuel costs for the second half of the
- 2 application term (i.e., July 1, 2019 to December 31, 2021) would help address the forecast
- 3 uncertainty inherent in OPG's production forecast as it looks further into the future and
- 4 provides a basis to set reasonable production performance targets for the second half of the
- 5 application term.

1 **ATTACHMENTS**

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3 Attachment 1: Project Schedule Diagram

