Board Staff Interrogatory #131

Interrogatory

Reference:
Exhibit D2 / Tab 2 / Schedule 2 / p. 10
Exhibit D2 / Tab 2 / Schedule 3

Preamble:

The first reference above outlines various lessons learned on the feeder series during the execution of Unit 2, including delays in the receipt of new feeders, higher than expected weld failure rates, congestion on the reactor face and upper feeder pipe installation complexity. The second reference above describes collaboration efforts with Bruce Power.

Question(s):

a) What was the relative impact of each of the challenges identified above on the timing and cost performance of Unit 2 refurbishment? For instance, which factor had the largest impact and which had the least impact?

b) What was the cost and schedule impact of congestion on the reactor face in particular?

c) Please comment on why OPG's work with the mock-reactor or its collaboration with Bruce Power did not prepare OPG for the congestion on the reactor face experienced during Unit 2 refurbishment?

Response

a) Exhibit D2-2-2, pp.10-11, is a high-level description of Lessons Learned on the feeder work series. Exhibit D2-2-3, Attachment 6, provides additional detail on Lessons Learned on the feeder work. As such, OPG did not track the causes of delays or lost productivity in the categories mentioned in Ex. D2-2-2, pp. 10-11. The tracking of delays and productivity losses was at a more granular level, in categories such as engineering, tooling, trades labour availability, weld wire shortages, procurement issues, etc. In addition, the factors mentioned on pp. 10-11 of Ex. D2-2-2, had different impacts on the work at different times during the execution of the work, and the effects on the work would often overlap making it difficult to determine a relative ranking or determine the exact impact caused by a single factor.

However, OPG's assessment of the impacts of the categories mentioned in Ex. D2-2-2, pp. 10-11, based on an overall effort required to resolve each issue are ranked as follows, from highest to lowest cost and schedule impact:

1. Qualification, fabrication and delivery of feeders
2. Higher than expected weld failure rates
3. Upper feeder installation complexity
4. Congestion on the reactor face

b) See part a). It is not possible to separate out the exact delays caused by congestion on the reactor face and determine the exact cost and schedule impacts of that particular issue.

c) OPG has leveraged the reactor mock-up facility to the best of its ability given the knowledge of field conditions prior to execution of the work in the field. However, actual field conditions could not be exactly mimicked in the mock-up. Examples include the air flow in the reactor vault and primary heat transport header temperatures, which both impacted the weld failure rate, and which led to lower productivity than planned in the earlier portion of the feeder work series.

Congestion on the reactor face is not a challenge that OPG could have been made aware of through its collaboration with Bruce Power. While Bruce Power did refurbish Bruce Units 1 and 2 during the period 2005 to 2012, the scope of the feeder work was different on those units (lower feeders only). OPG replaced the entire length of the feeder pipes from the reactor face to the feeder cabinets. A major reason there was congestion on the reactor face was that, delays to installation of upper feeders resulted in the installation of upper feeders being done "in parallel" with the installation of lower feeders for a period.

Also, OPG's Darlington Unit 2 was the first of the current set of Darlington and Bruce Power refurbishment outages to be completed. There was no very recent Bruce Power experience in this type of work which could have helped OPG predict the congestion issues that did occur.

Given the experience with Unit 2, for subsequent units, OPG has invested in an additional upper feeder mock-up (separate and distinct from the main reactor mock-up), which will allow for dedicated feeder installation training away from the main mock-up to increase the probability that upper feeder installation is complete prior to the start of lower feeder installation. In addition, mock-up facilities, to the extent possible, have also been updated to align more closely with field conditions.