

UNDERTAKINGS

Undertaking

To provide lessons learned from G7 that informed the rescheduling of G9 and G10, if available.

Response

See attached.



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LESSON LEARNED

Plant/Plant Group: Beck 1 GS, Niagara Plant Group
Project Name: Beck 1 G7 Frequency Conversion
Project No: SAB10032
Project Description:

The Beck 1 GS G7 Frequency Conversion project included the removal of an existing 54 MVA, 25 cycle generator and associated electrical equipment and replacing it with a new 68.5 MVA, 60 cycle generator, a new transformer and new protection and control equipment. A turbine overhaul was undertaken and a new runner was installed. The internal components of the Johnson valve were removed and new headgates were installed at the same time.

Category	Lesson Learned	Benefits
Project Management	<p>Issue: The G7 project was a complex project with many activities and contracts. The Project Engineer was fully occupied in issuing contracts for work, coordinating resolution of technical issues and dealing with day-to-day issues leaving insufficient time to manage and address the global aspects of the project.</p> <p>Recommendation: Provide a project organization/resourcing review by an experienced project manager to ensure that adequate resources are available to the project. Providing additional technical resources with authority to direct contractors would have allowed the Project Engineer to focus more on Project Management.</p>	Better coordination of activities, improved completion times, more focus on Project Management.
Technical Support Resources (turbine overhaul)	<p>Issue: Mechanical technical support was provided by a consultant hired by the Plant Group Technical Services Department. The mechanical consultant was not at site frequently enough to monitor and direct the work. He became involved in issues too late several times and delays/rework were forced on the contractor. This strained the relationship between OPG and the contractor. The turbine overhaul contractor delegated his responsibility to the overhaul site subcontractor. Consequently, the turbine elevations were not verified during assembly and the runner was incorrectly positioned.</p> <p>Recommendation: Technical resources should be on-site for the duration of the field work. The turbine overhaul contractor must have a presence on site, especially during critical aspects of the work.</p>	<p>Ensure timely identification of technical issues leading to proper resolution.</p> <p>Assure quality site work.</p>



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Technical Support Resources (generator)	<p>Issue: Hydro Engineering Division (HED) provided electrical and mechanical technical support for the new generator. This support proved to be valuable for both the generator engineering and generator construction on site. A consultant with extensive generator erection experience was hired to provide full time monitoring of the generator contractor with respect to quality assurance, workmanship and adherence to the generator manufacturer's own installation instructions.</p> <p>Recommendation: Technical resources should be available to discuss and resolve engineering and design issues and on site construction issues. An experienced generator erector consultant can identify issues during generator erection and ensure proper assembly of the generator.</p>	Ensure that the generator manufacturer provides a generator that meets OPG specifications.
Work Permits	<p>Issue: There were several instances when work permit changes were requested to take place with insufficient lead time to follow the Work Protection process. This lead to delays for the contractor and subsequent charges for the delay.</p> <p>Recommendation: Improved communication between Production, Project (Contract Monitors) and Operations to ensure each are aware of upcoming needs to change work protection. Major work permit changes should be scheduled to ensure adequate awareness and the focus of resources.</p>	Better work coordination, avoidance of delay charges by contractors.
Equipment turnover at start of project (from Production to Projects)	<p>Issue: The Johnson valve plunger was not left in the optimal and expected condition for plunger removal. This meant that extraordinary, unanticipated effort was required by the contractor to move the plunger prior to beginning the removal process. A high MRPH accident resulted when the contractor used come-alongs to move the plunger prior to removal. This could have been avoided if there had been more communication between Production and the Project.</p> <p>Recommendation: The contract administrator or contract monitor should assure that conditions are suitable for the contractor to carry out the scope of work.</p>	Safer work environment and reduced cost if conditions are better suited for contractor to carry out the work.



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Equipment turnover at end of project (from Projects to Production)	<p>Issue: A commissioning plan was not developed in time to be useful in planning the execution of that phase of the project.</p> <p>Recommendation: Develop a commissioning plan early in the project so other participants can comment and provide input. Commitment to a plan can help ensure that milestones required for commissioning have been achieved.</p> <p>Issue: There were a large number of deficiencies identified after transfer of control. The resolution of these deficiencies needs to be addressed by the appropriate staff. There is a risk that inappropriate priority may be applied to this task.</p> <p>Recommendation: Assign the resolution of the outstanding deficiencies to specific staff or establish teams to address the issues. Set time line for satisfactory resolution.</p>	<p>Avoid delays and contractor standby charges.</p> <p>Timely resolution of deficiencies.</p>
Material delivery, storage, housekeeping	<p>Issue: A project of this magnitude includes delivery of many parts and materials. Sometimes the parts were delivered during off hours. The parts were often left in any vacant area of the operating floor. The delivery vehicles brought in sand and salt during the winter months. A significant amount of time was required to keep the operating floor clean. This was addressed by OPG and the major contractor sharing the cost of a janitor.</p> <p>Recommendation: The contractor should be given dedicated floor space with any floor loading restrictions noted. This should be conveyed at the RFP stage so the implications can be factored in to the contract cost. The entire responsibility for housekeeping should be placed on the contractor. This should be identified at the RFP stage and included in the contractor's scope of work.</p>	<p>Avoid conflict between Production and the contractor regarding use of floor space.</p> <p>Housekeeping costs become the responsibility of the contractor.</p>
Overtime for OPG staff	<p>Issue: The RFP for the generator and overhaul contractors did not specify any restrictions for hours of work at site. During some construction activities, the major contractors preferred to work 6-10s. Therefore, contract monitors were required to work 6-10s as well. The Plant Group's aversion to overtime caused some delays and lost time for the contractors. Contractor standby/delay costs were charged to the project on several occasions.</p> <p>Recommendation: The project schedule and hours of work plans of the contractor and the OPG support required should be pre-approved by the Plant Group Manager. Alternatively, any restrictions on hours of work should be detailed in the RFP.</p>	<p>Avoid delays to the contractor and possible delay charges to the project.</p> <p>Avoid continually requesting the use of overtime.</p>

LESSON LEARNED

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Cable locates	<p>Issue: Cable locates were the responsibility of the Production staff. Production crews were often understaffed and had to prioritize between Production work and cable locates and often the cable locates were deferred. The contractor expected cable locates to be completed in less time than Production was able to undertake them.</p> <p>Recommendation: At the beginning of the project, have the contractor provide a list of all the cable locates required. This will allow Production to plan the work required and put together drawing packages associated with the locates. Consider hiring a contractor to undertake the cable locates.</p>	<p>Better planning and use of resources.</p> <p>Potentially less overtime.</p> <p>Reduced delays to the contractor.</p>
Lack of documentation from contractors	<p>Issue: The turbine overhaul contractor provided reports of as-found conditions and of as-built details but there was not a comprehensive turbine overhaul report containing the information required by Production.</p> <p>Recommendation: Ensure that providing a turbine overhaul report is included in the scope of work. The content of the report needs to be specified at the contractor RFP stage.</p>	<p>Sufficient and accurate documentation for future maintenance</p>
Spare parts for equipment purchased	<p>Issue: Spare parts for the exciter were not ordered at the time of the exciter purchase.</p> <p>Recommendation: Spare parts for equipment should be purchased at the time of equipment purchase.</p>	<p>Ensures spare parts compatibility and likely ensures a better price</p>
Electrical component commissioning	<p>Issue: There were a large number of electrical components that required commissioning by Production staff at the end of the project, immediately prior to unit commissioning. This created a resource issue for Production and delays to the commissioning activities.</p> <p>Recommendation: Stage the component commissioning to take place as the equipment is installed to avoid resource issues at the end of the project.</p>	<p>Reduces chance of delays.</p> <p>Eases commissioning resource issues.</p>
Contract monitors	<p>Issue: For some work, it is advantageous to have a contract monitor with a background/training or experience in field of the work being undertaken.</p> <p>Recommendation: Have contract monitors available with a variety of backgrounds. Ensure contract monitors are more visible.</p>	<p>More assurance that contractors are working safely.</p> <p>More understanding of the work being done by contractors</p>
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Operations support - Switching agents	<p>Issue: The commissioning of the generator, turbine and other major components requires coordination and cooperation between the Project commissioning team and Operations staff. On several occasions, Operations staff were not available or prepared to undertake the switching requested by the commissioning team in the time requested.</p> <p>Recommendation: Provide Operations staff with a commissioning plan well in advance so that commissioning support (switching agent) can be arranged. It is desirable that a dedicated switching agent be arranged for the commissioning of both the generator and turbine.</p>	Reduced delays in providing work permits.
Interaction with Other Stakeholders (Hydro One)	<p>Issue: Hydro One had bus reconfiguration work and equipment to remove in order to connect the unit to the grid. It was identified that, in order to make connections to the future Floral Clock Switchyard, additional bus installation would be required by Hydro One. Hydro One proactively undertook this work during the G7 project outage in order to avoid taking a lengthy unit 7 outage in several years time to do the work.</p> <p>Recommendation: Encourage Hydro One, and other entities, to utilize the outage taken by the project to undertake all known future work in the project work zone.</p>	Future outages eliminated, or length reduced, reducing costs to OPG.
Work by Consultant	<p>Issue: A consultant was contracted to provide the engineering for the new electrical equipment, including the installation of the new Protection and Control equipment. The consultant submitted drawings with cable layout and configuration that was not consistent with the rest of the Plant. Extensive re-work of the drawings was required.</p> <p>Recommendation: Consultants should be given guidelines and expectations prior to starting work. Frequent meetings with the consultant during the design phase should be arranged in order to monitor the direction of the consultant.</p>	<p>Avoid schedule delays.</p> <p>Avoid costly re-work effort.</p> <p>Assure the product is acceptable.</p>

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