

Lower Churchill Project

Status of CH0030 and CH0032 Packages

06-January-2017

Boundless Energy



Take a
MOMENT
for Safety

Current Status CH0030 T/G Supply & Install

Engineering

- 99.8 % Complete vs 100% Planned
- Remaining design work is related to changes to the switchyard protection panels

Fabrication

- 84% complete vs 100% Planned
- Stator bar manufacturing has been suspended as a result of the failure of two bars during production testing. Investigations have been completed. Andritz to advise on way forward.
- Manufacturing has been completed in China, India and Europe. The remaining work is within Canada and includes the stator bars, P&C panels and deluge piping.

Construction

- Installation of draft tube embedment anchors is underway.
- The spiral case door was installed in Unit 1.

Current Status CH0030 T/G Supply & Install

Commercial Strategy

- Delays in the civil construction has resulted in a delay in the execution of the T&G installation phase by approximately 2 years. This along with changing site conditions versus the original contract (i.e. powerhouse staged erection, wash cars, etc.) will result in additional costs.
- Discussions have been held with Andritz to identify the primary issues around the changing installation conditions in order to determine if mitigating measures could be taken. Andritz provided an analysis which was feed into the civil planning. The result was an adjustment to the plans in the areas of crane capacity during the embedment phase, enclosure of the powerhouse and measures to minimize congestion.
- Change Orders have been put in place to cover storage, inspections and increased preservation. Storage and preservation is an area which will require continued focus.

Current Status CH0030 T/G Supply & Install

Outstanding Commercial Issues

- Schedule/Extension of Time
- Exhibit 12 Update – revised site conditions including supply of wash cars and powerhouse staged erection, lighting, hoarding.
- Apprentice Ratio
- Change Requests related to offloading and the hold placed on the P&C panels are under negotiation with an exchange of information. These are close to resolution.

LCP Management Effort to Date to Progress Scope

- Discussions were held with Andritz last fall regarding the schedule and staged erection of the powerhouse. Next step is to feed the milestones and revised civil plans back to Andritz.
- Dispute over the design of the cover brackets has been settled.

Current Status CH0030 T/G Supply & Install

Issues

- **Apprentice Ratio**
 - The claim is for loss of productivity due to the addition of the apprentice ratio to the contract.
 - The disagreement has been around the magnitude of the productivity impact.
 - The initial claim was \$6.2M. LCP countered with \$1.8M and Andritz replied by reducing their claim to \$5M.
 - Each time the issue is raised internally no agreement can be reached on the way forward.

Other Updates for Management

- None

CH0032 Status - General

Majority of Spillway Hydro-Mechanical construction activities were completed in 2016 and most of Andritz workforce has demobilized , Remaining activities include:

- Commissioning of controls and back up power
- Corrective work on gate guide heating system
- Completion of telecoms scopes
- Training

Gate operations by Andritz, using local controls, have been ongoing during the construction and commissioning phases.

Gates have been under LCP operational control since water-up of the upstream channel this past summer.

Hoists and gates are performing well. Overall alignment and sealing is excellent with no visible leaks.

Gate body heaters are all operational and are currently set to maintain 15°C during initial operation. Design set-point is 5°C.

CH0032 Status - Issues

LCP Package team including Engineering, Quality , Completions and Construction personnel have had to repeatedly remind Andritz of outstanding design deliverables, coaching of commissioning requirements both in scope and timely delivery of commissioning documentation for review and approval, focus on construction scope to meet schedule requirements, Quality requirements and general management of site construction.

Andritz have had less than adequate site staff since mobilization in all aspects of the work including :

Site Management

Labor Relations

Technical Engineering

Construction Management

Quality Control

Completions and Commissioning

PCS System Administration.

Significant work remains to complete base construction scope

CH0032 Status - Issues

1. Schedule and Gate Openings required by LCP to progress work. Andritz have advised that each OPEN/CLOSE sequence to manage river to be a Change to the Work
2. Engineering Deliverables
 - Quality of Design and LCP Effort to Code 1 Status
 - Timing of Issue
 - Outstanding non Code 1 Drawings
3. Quality Issues
4. Construction issues
 - Poor Planning, Productivity, Installation docs, Re-work,
5. Completions and Commissioning Issues
 - Quality of PCS documentation, LCP assistance required to progress work, substandard documentation of testing, planning, use of systems w/o commissioning,
6. Site Management Issues
 - Poor Schedule planning and updating , no base line, reporting of progress, ready for installation (Hoarding, craneage, productivity of subs, sequence of work, site coverage for key positions etc
7. Preservation / Maintenance Requirements

CH0032 Status - Commercial

Commercial Strategy

Change Order 10 is for the acceleration of the spillway installation work

Delays in the civil work caused a delay in the start of mechanical work in the spillway reducing the time available and pushing the work into the winter months.

LCP was unsuccessful in negotiating a price with Andritz and Change Order 10 was unilaterally issued for \$3.4M.

Andritz had requested \$10M at that time.

Andritz has taken the position that the work should be cost reimbursable and have submitted invoices totaling \$21M.

A settlement needs to be negotiated.

Recent settlement of long standing 'disputed' CHRs has not been reciprocated . Little work was accomplished over the XMA's break and they still struggle with getting the Guide Heaters fully installed and commissioned

CH0032 Status - Engineering

Synopsis

- More detailed and exhaustive LCP design reviews required due to incomplete design submissions by Andritz and its sub contractors (ISO 9000)
- Re-work of Drawings due to whole scale design changes after commentary from LCP on first draft of documents (ISO 9000)
- Changes made to the gate control design that affects control philosophy. Some of the changes affects other systems and no updates have been made accordingly.
- Installation in field without Code 1 Drawings.
- No drawings available for some work scope installed until after installation completed.
- Issue of Equipment Data Sheets for review and acceptance long after equipment has been installed Ex.: TT for Gate Body Heating rec'd 26-Oct-2016 A1
- As Builts and Design changes to approved drawings without engineering review/approval
- Completions and Commissioning documentation not issued for review in a timely manner, though Contractor was continually coached on timing requirements by LCP
- Shipping of Equipment without FATs and field rework as a result

Status Engineering Documents as of 05-January-2017

Spillway	TCM	Intake
Code 01: 1171	Code 01: 176	Code 01: 341
Code 02: 222	Code 02: 20	Code 02: 53
Code 03: 7	Code 03: 2	Code 03: 7
Reserved: 330	Reserved: 136	Reserved: 261

CH0032 Status - Construction

- Lack of Sufficient Resources to progress work effectively.
- Andritz lack of field supervision to push sub contractors and progress work. (LCP has made this comment on the first rev of the Org chart and every rev since)
- Installation without approval
 - Installation without approval was mostly on the electrical scope. On the mechanical/structural side but we had some instances like temporary shelters (ie the roof over the spillway bay), diesel fuel system, etc. Procedures for hydro mobile use, shelter, critical lifts, etc even though submitted in preliminary revisions often got approved after the work started.
- Rework in field
 - Bay 1 concreting required a fair amount of repair, it improved as time went on. Welding of the transition plates and guides was subject to significant weld rework. The failure of the dog device lugs created a lot of rework. Damage to tower cladding and galvanization during transportation, handling and the tower crane incident created more rework.
 - Approximately 40 Site NCRs in the system that required additional work in the field (BD compiling list for separate letter to ensure costs are segregated)
- Coordination effort required by LCP to progress work
 - Many times Andritz had workfronts they could work, but were unable to work due to manpower, equipment and/or material issues.
- Lost opportunities and poor planning to complete work.
 - Example: Damaged cladding on the North/South Towers could have been replaced when the towers were sitting for weeks on the ground. Instead they decided to replace it after the towers were installed on top of the spillway.
 - Key personnel left site for T/A with no back to back coverage (Control System Engineers)

CH0032 Status - Construction

Roller Gates Body Heating Status

- Bays 1 to 5 Gate Body Heating Systems operational, there are some Performance Issues, Commissioning Ongoing
- Results from Air Flow Tests do not meet spec
- SRG's Body Heating Ducts field Installation not as per approved design and industry standards, thus poor airflow distribution.
- Blower not installed as per drawings – Risk of fatigue failure with installation
- Hi Temp Cut Outs Switches defective

Roller Gates Guides Heating Status

- Bays 1 to 5 Gate Guide Heating Systems 75% complete, Operational issues, Commissioning Ongoing
- Bay 1: 6 of 6 Guide Heaters Operating
- Bay 2: 2 of 6 Guide Heaters Operating, Installation issues with blockages in pipework
- Bay 3: 5 of 6 Guide Heaters Operating, Installation issues with blockages in pipework
- Bay 4: 3 of 6 Guide Heaters Operating, Installation issues with blockages in pipework and electrical
- Bay 5: 6 of 6 Guide Heaters Operating

Remaining Completed Scope Status

- Emergency D/G Set – Fuel System Delivery Issues, Code 1 DWGs outstanding,
- Spillway Control System – Commissioning not Completed , Issues with Software alignment with issued design documents

CH0032 Status - Construction

Outstanding Scopes

Architectural (Cable Penetrations, Safety Rails around Hoist Drums, Handrails Stair Tower Pinch Points)

Lighting & Small Power and Emergency Lighting requires completion and commissioning

Operator Warning System (HORN) not connected

Fire Detection System Commissioning not witnessed by LCP (Not Invited)

CCTV and Building Access Systems not Installed

Load Tests on TRCM not completed

HVAC System - Many Code 2 documents with significant comments returned to Andritz

General Deficiencies

- Hoist Motor coupling not to Specification – All Bays affected
- Hoist 5 Motor to be replaced
- Hoist House and Stair Towers weather tight outstanding – cable entries, doors , windows etc.

Outstanding Field Work Orders

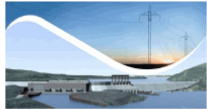
- Installation of Telecoms Panels to Support River Instrumentation
- Fiber Optic Feed to Spillway Ehouse

Other

- Spare Parts Turnover
- O&M Manuals
- Training Formal Schedule and Syllabus to be determined

CH0032 Status – PCS System

Completion Certificate Status



Lower Churchill Project

Andritz Hydro CH0032 Certificate Completions Summary

Mechanical Completion and Static and Dynamic Commissioning



	LCP DCC			MCC			SCC			Total		
Systemization	14	0	0.0%	124	76	61.3%	53	24	45.3%	191	100	52.4%
C1 - Muskrat Falls Power Generation	14	0	0.0%	124	76	61.3%	53	24	45.3%	191	100	52.4%
2000 - Reservoir, Diversion, Dam and	14	0	0.0%	124	76	61.3%	53	24	45.3%	191	100	52.4%
2410 - Spillway Structure	0	0	0.0%	6	6	100.0%	0	0	0.0%	6	6	100.0%
2420 - Gates Guides Stop Logs and	3	0	0.0%	0	0	0.0%	0	0	0.0%	3	0	0.0%
2421 - Gates Guides Stop Logs and	2	0	0.0%	18	10	55.6%	6	4	66.7%	26	14	53.8%
2422 - Gates Guides Stop Logs and	2	0	0.0%	18	11	61.1%	6	5	83.3%	26	16	61.5%
2423 - Gates Guides Stop Logs and	2	0	0.0%	18	11	61.1%	6	5	83.3%	26	16	61.5%
2424 - Gates Guides Stop Logs and	2	0	0.0%	18	11	61.1%	6	5	83.3%	26	16	61.5%
2425 - Gates Guides Stop Logs and	2	0	0.0%	18	10	55.6%	6	4	66.7%	26	14	53.8%
2441 - Spillway Auxilliary Services	1	0	0.0%	28	17	60.7%	23	1	4.3%	52	18	34.6%

Status of Check Sheets

Mechanical Completion 89 % Completed <https://lcp.ceccms.com/reporting/ReportViewer.aspx?Mode=SavedReport&ID=62&requestID=1481566721127>

Static Commissioning 55 % Completed <https://lcp.ceccms.com/reporting/ReportViewer.aspx?Mode=SavedReport&ID=63&requestID=1481566747602>

Dynamic Commissioning 0 % Completed <https://lcp.ceccms.com/reporting/ReportViewer.aspx?Mode=SavedReport&ID=66&requestID=1481566769421>

Punch List Status: 926 Reported to Date with 169 or 18% closed

<https://lcp.ceccms.com/reporting/ReportViewer.aspx?Mode=SavedReport&ID=66&requestID=1481566769421>

CH0032 Status - Quality, Fabrication & NCRs

- NCRs due to lack of design focus, lack of QC etc.
- Changing Material without notice
- Fabrication Without Approved Documents/Drawings
- Inadequate Material Testing/Failed Material:
- Failure to Stop Work
- Inadequate Documentation/Documentation Review
- Shipping Releases w/o Approval
- Inspection issues
- Fabrication/Manufacturing Error
- Supply of Incorrect components/Materials
- Substandard Equipment Ex. not CSA
- Late submittal of datasheets revealed non-compliant components incorporated in the work
- Lack of Vendor Quality Control by Andritz Staff - saving \$ by relying on LCP QA TPIs

Completions

- PCS System Coaching and Work Done by LCP to progress work including population of system databases to allow completions to begin
- Lack of notice for Quality inspections
- Lack of inspections in timely manner for some equipment (i.e. gate exteriors)
- Quality of documentation for Completions and commissioning is sub standard
- Subsystem definitions not thoughtfully administered by Andritz to promote continued progress through livening up with properly established Mechanical Completion systems and Check Sheets
- Andritz have routinely energized equipment without LCP approval – i.e. TCM and Spillway Control Panel
- Andritz have not been keeping progress up to date in PCS, records are coming in after most / all records are complete instead of progressively – Lack of dedicated Completions administrative personnel on Site

CH0032 Status - Completions

- Premature equipment failure without sufficient cause and no follow-up root cause
 - Fuses routinely blowing
 - Relays failing (surge suppressor in re-design)
 - High Temperature Cut Out switches not working
 - Bearing Failure in Gate 5 Hoist motor
 - Guide Heater Failures (3 of 18 to our knowledge to date)
 - Gate 2 Body Heater failures – All installed 10 motors had to be replaced after motors were damaged as a result of incorrectly set protective devices
 - Failure of power Distribution Blocks in gate Heating Panels due to poor Quality Control in Fabrication and equipment shipped without FAT being performed
- Andritz continually do a lot of the Completions type activities independently of LCP and consider work done (i.e. TCM installation and energization without LCP review, battery load test on UPS system which was done twice so LCP could attend
- As-Builts being submitted to engineering with unapproved new equipment allocated

Sharing our ideas in an open and supportive manner to achieve excellence.

Teamwork

Open Communication

Fostering an environment where information moves freely in a timely manner.

Honesty and Trust

Being sincere in everything we say and do.

Relentless commitment to protecting ourselves, our colleagues, and our community.

Safety

Respect and Dignity

Appreciating the individuality of others by our words and actions.

Leadership

Empowering individuals to help, guide and inspire others.

Holding ourselves responsible for our actions and performance.

Accountability