



LTR-CH0032001-0554

AH-Letter-PM-277

September 1st, 2016

Muskrat Falls Corporation
Lower Churchill Project Muskrat Falls Corporation
350 Torbay Road Plaza, Suite No. 2
St. John's, NL, A1A 4E1

Attention: Scott O'Brien – Project Manager, Muskrat Falls Generation

Subject: CH0032: Supply and Install Powerhouse and Spillway Hydro-Mechanical Equipment

Re: Adjustment to CHO-06 – Time impact of seasonal shift on the spillway work

Ref: Company's Change Order CHO No. 006 - dated 18 March 2015
Contractor's letter AH-Letter-PM-022 - dated 18 June 2015
Company's letter LTR-CH0032001-0036 - dated 10 July 2015

Dear Mr. O'Brien,

Further to our letter AH-Letter-PM-022 dated 18 June 2015, pertaining to Change Order 06 and as part of the ongoing evaluation of the impacts caused by Company's delay of Interface I1A, we have completed a critical path analysis to a level appropriate for the purpose of establishing the delays caused by the impact of weather conditions as a result of the modified timeframe for the performance of the work.

A summary of this analysis is attached hereto which demonstrates that Andritz would be entitled to an extension of time of 100 days to the M4 Milestone. These 100 days represent the additional time that would have been required to compensate for the impact of the weather condition had Company not imposed acceleration under Change Order 010.

Company should note that the details mentioned herein are specific to the time impact relating to the loss of output associated with the seasonal shift of a significant portion of the Work. Contractor reserves the right to claim any additional impacts relating to this event.



Yours Truly,

A handwritten signature in blue ink, appearing to read "Bill Mavromatis".

Bill Mavromatis
Project Manager
Andritz Hydro Canada Inc.

CC: Frank Gillespie - LCP Deputy Company Representative/Area Manager
Bruce Drover - LCP Package Leader - Hydro Mechanical Equipment
Line Tremblay - LCP Senior Contract Administrator
Luc Bourbeau – AH Project Director

Enclosure: Extension of Time – Execution Seasonal Shift



Preamble

The Agreement between Company and Contractor stipulates that Company has the obligation to provide free access to the work area to Contractor on February 16, 2015 as defined by Milestone I1a - "Upstream of Spillway ready for start of Hydro-mechanical Work".

On July 10, 2015, Company issued letter LTR-CH0032001- 0036 to Contractor confirming the Nov 1, 2015 date for Milestone "I1A". This represents a 258 day delay to the start of the upstream work of the spillway (the "Delay"), which entitled Contractor to a day-for-day delay for the completion of the works as a minimum. This minimum day-for-day delay for the completion of the works does not take into account the effect on the overall duration of the more severe winter conditions present in the Project area during the modified period for the performance of the works.

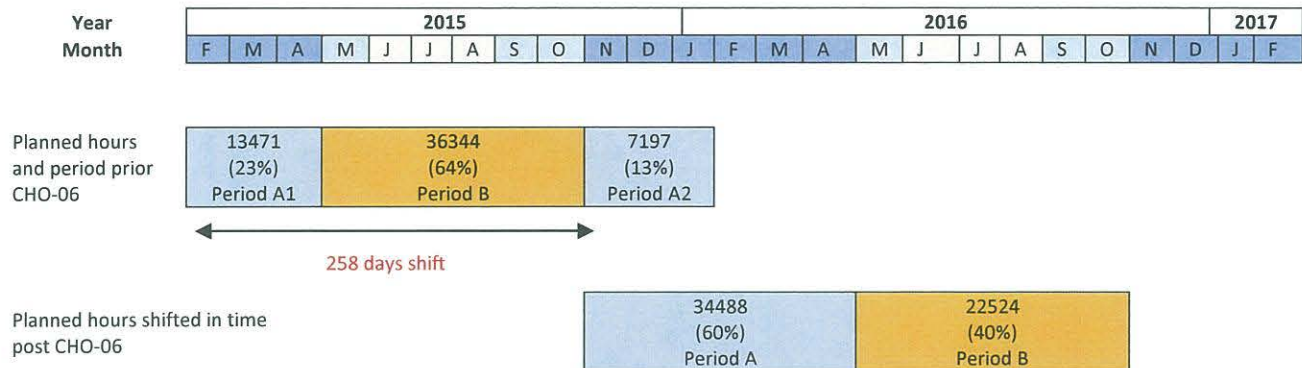
It is a known fact in the construction industry that such conditions result in a loss of productivity for the construction crews due to:

- Snow removal and deicing of work areas;
- Construction and removal of shelters and heating inside shelters;
- Loss of time and productivity as a result of:
 - Slow start and early finish of work shifts,
 - Loss of time at coffee breaks and lunch hour,
 - Reduced daytime hours,
 - Reduced flexibility due to heavy winter clothing.

As per Andritz' original schedule, a major portion of the manpower effort for the mechanical works would have taken place during the warmer months; however the Delay shifted this portion during the colder months and the Holiday shutdown period. Chart 1 summarizes the unadjusted seasonal shift of originally planned labor units resulting from the Delay. For greater clarity, this represents the difference between the original Agreement and the constraint resulting from the delayed mobilization of the upstream portion of the Spillway:



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Calendar legend
 Loss of efficiency not affected
 Loss of efficiency affected
 Loss of efficiency severely affected

Chart 1: Shift to manhours attribution over seasonal period

The purpose of this analysis is to evaluate and demonstrate the time impact shifting the Work into more severe winter conditions by assessing the net potential loss of output and resulting additional time that would be required to recover the loss of output.

Summary of analysis

In its analysis, Contractor has taken into account the seasonal variations of the schedule which resulted in a change on the originally planned output of the following activities:

1. Loss of output for work activities moved to the Holiday shutdown period which resulted in partial loss of output during the week prior and after the Holiday shutdown in addition to the complete loss of output cause by the shutdown (cumulatively referred as the Holiday shutdown period);
2. Similarly, gain of output for work activities moved away from the Holiday shutdown period;
3. Loss of output by moving work activities originally planned during a warmer to a colder timeframe;
4. Gain of output by moving work activities originally planned during a colder to a warmer timeframe;
5. No change to output as the work activities were moved to a period with similar climatic conditions.



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As demonstrated in Chart 1 above, a significant amount of work activities was moved to a colder timeframe. The analysis demonstrates a net loss for the periods. The various gains and losses of output were calculated and are summarized in Table 1:

Period	Mechanical Labor Unit prior to I1A notification - Critical activities ⁽¹⁾	Mechanical Labor Unit after I1A notification - Critical activities ⁽¹⁾	Adjusted Change in Labor Unit ⁽²⁾ (+loss /- gain)
Period A	34488	52212	17724
Period B	22524	20186	-2338
Total Period A, B & C	57012	72398	15386

- (1) Only mechanical hours were used as they are critical for time calculation. Other parts of the Work were also affected by loss of output but were assumed to be concurrent in the analysis.
- (2) Including loss of output and compounded impact (27 % additional average loss of efficiency on the calculated change in unit).

Table 1: Planned and adjusted man-hours per seasonal period

Chart 2 shows the adjusted labor units required to execute the work under more severe conditions resulting from seasonal shift losses and inherent compounded impact:

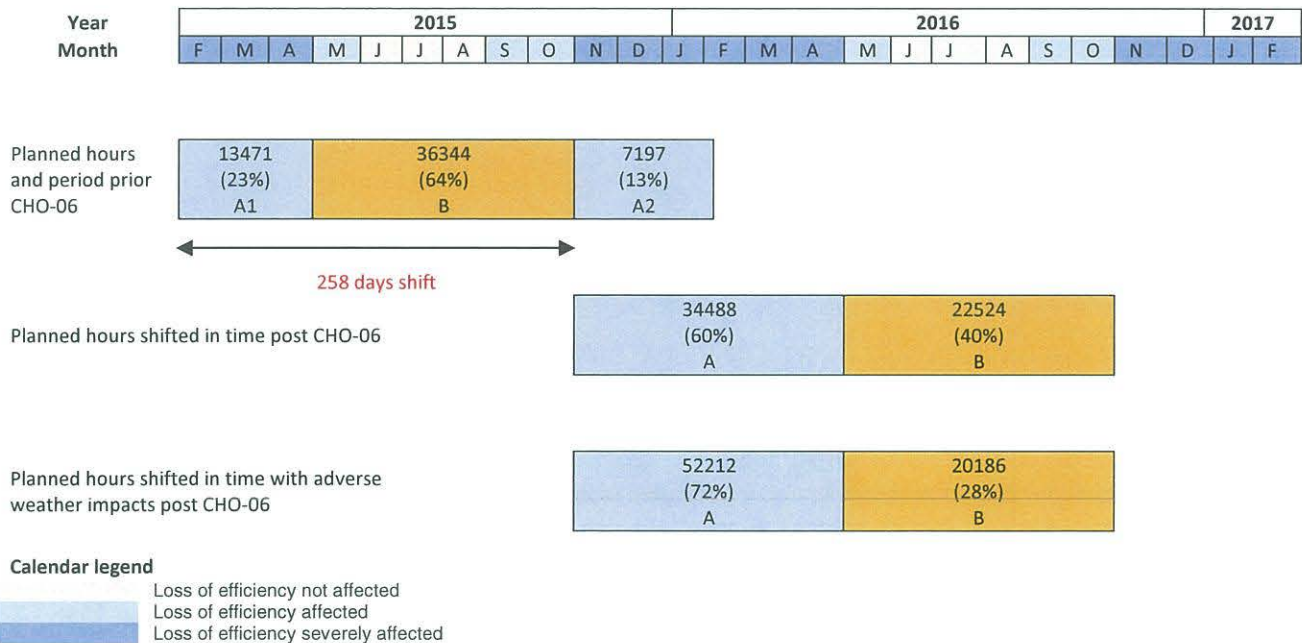


Chart 2: Shift and adjustment to man-hours attribution by seasonal period



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The additional man-hours were converted into days using the originally planned average daily productivity under normal running operation, meaning excluding initial ramp up and final ramp down of manpower. The normal running operation period was identified as the period from March 1, 2015 to November 22, 2015 which supports an average daily productivity of 185 man-hours per days of direct labor over the 9 months of the sampling period.

In addition to the delay caused by loss of output due to executing a significant portion of the work under more severe climatic conditions, Contractor was also affected by having considerably more work activities occurring during the Holiday shutdown period. The impact of such a shutdown was negligible under the original execution plan as fewer resources were planned to be on site by the end of December 2015. Having considerably more direct labor present before and after the 2015 Holidays season under the delayed plan, Contractor evaluated the direct loss of output to be half a week for each week before and after the shutdown period as this time is required for the preparation for shutdown of the site and restart after the shutdown respectively. The loss of output for the remaining time during those weeks was accounted for in the evaluation above. For similar reasons, Contractor was considerably more affected by the 14 days complete site shutdown. Table 2 summarizes the various time losses and gains expressed with this analysis:

Period	Change in in Labor Unit (+loss /- gain)	Adjusted Schedule Impact ⁽¹⁾ (days)
Period A	17724	91
Period B	-2338	-12
Total Period A, B & C	15386	79
<i>Week prior 2016 holiday shutdown ⁽²⁾</i>	<i>n/a</i>	3.5
<i>2016 holiday shutdown ⁽⁴⁾</i>	<i>n/a</i>	14
<i>Week after 2016 holiday shutdown ⁽³⁾</i>	<i>n/a</i>	3.5
Total additional entitlement (days)		100

⁽¹⁾ Calculated using planned average daily hours of 185 man-hours per day for each specific trade during the specific period.

⁽²⁾ 50 % loss of output during the weeks prior and after the holiday shutdown resulting in 3.5 days pure loss for each week.

Table 2: Original and adjusted man-hours per seasonal period



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2015												2016												2017	
F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	



Calendar legend
 Loss of efficiency not affected
 Loss of efficiency affected
 Loss of efficiency severely affected

Note 1: October 31 simply being a day-for-day duration based on the revised date for Milestone I1a.

Chart 3: Planned versus shifted / adjusted timeline of execution

Conclusion

This analysis demonstrates that Company’s delay to the Start of hydro-mechanical work on the upstream portion of the Spillway by 258 days clearly impacted Contractor’s ability to execute this portion of the Works as per the plan in place prior to the Delay.

As shown in Table 2 and Chart 3 above, the time impact of the 258 day delay amounts to 100 days of additional effort for Contractor to complete the hydro-mechanical work on the upstream portion of the Spillway.

Therefore, and as a direct result of this Delay, Contractor is entitled to the postponement of Milestone M4 by an equivalent 100 days.