Board Staff Interrogatory #173

Interrogatory

Reference:
Exhibit D2 / Tab 2 / Schedule 11 / Attachment 3 / pp. 56-59

Preamble:

Bates White multiplied the 1.7 factor for the productivity adjustment by the wage factor adjustment of 1.46 to derive a combined factor of 2.5.

Bates White noted that the RSMeans database does not contain data that is applicable for procuring or installing materials required to meet nuclear quality standards. Thus, for those items in the BOQ requiring nuclear quality assurance, Bates White supplemented the RSMeans data with additional crew members (welders and quality assurance specialists) and adjusted for specialized material and labour costs based on cost factors in the EMWG guidelines.

Question(s):

a) Please confirm that the 2.5 combined productivity and wage was applied on top of the EMWG factor for those categories of costs requiring nuclear quality assurance.

b) Using SS Pipe > 50mm as an example (Table C-6 at Exhibit D2 / Tab 2 / Schedule 11 / Attachment 3 / p. 58) and assuming a $100 RSMeans Labour cost, OEB staff has attempted to derive the formula and calculation that would apply for the EMWG and combined labour wage and productivity adjustment:

   (1) RSMeans average wage rate x RSMeans hours = RSMeans Cost
   (2) RSMeans Cost * EMWG Factor = EMWG Cost
   (3) EMWG Cost + RSMeans Cost = “Initial Cost” (before 2.5x Combined Wage and Productivity Factor)
   (4) Initial Cost * 2.5 (combined Wage and Productivity Factor) = Bates White Cost

   (1) $100 x 1.54 = $154 (RSMeans Cost)
   (2) $154 (RSMeans Cost) x 55.73 (EMWG Factor) = $8,582.4 (EMWG Cost)
   (3) $154 (RSMeans Cost) + $8,582.4 (EMWG Cost) = $8,736.4 (Initial Cost)
   (4) $8,736.4 (Initial Cost) * 2.5 (combined Wage and Productivity Factor) = $21,841 (Bates White Cost)

Please confirm or revise the above as necessary to reflect Bates White’s calculation for the combined EMWG and labour wage / productivity adjustment factor (2.5) (in the context of the provided scenario).

c) Please add to the above calculation any further adjustments for crew size.

d) Please provide the total cost that added crew members reflect in the total project cost of $517.7 million.

Response

The following responses were prepared by Bates White:

a) We cannot confirm that understanding. The three labor adjustments mentioned in the question represent three distinct phenomena: (1) the difference between the actual wages on-site at Darlington and the metropolitan average for Toronto (1.46), (2) the "wrench time" labor adjustment, determined via two referenced studies of the actual work environment on the Darlington Refurbishment Project (1.7), and (3) the labor adjustment applied to account for the nature of nuclear work (reflected in the unit installation costs presented in the EMWG, which vary according to the type of work). Their application is different.

Factors that account for the differential cost of labor on-site and "wrench time" are applied to all on-site construction labor; therefore we combined them (2.48, rounded to 2.5) and show them on one line in the spreadsheets in Appendix D. The adjustment to account for EMWG estimates of unit costs for nuclear construction work, was applied only to work that was identified as requiring this level of quality and the factor applied was specific to the type of work as opposed to work that could be modelled as standard fossil power plant work. Thus, it would be more accurate to state that the wrench time labor adjustment was applied for all on-site construction labor work, while the EMWG labor adjustment was applied only for work that required nuclear quality levels and then that adjustment was specific to the type of work being performed.

Also please see response to Ex. L-D2-02-Staff-175.

b) The Bates White approach for estimating labour costs of each construction task required to meet nuclear safety and quality standards comprised three steps. In step 1, Bates White computed the RSMeans labour cost based on typical crew compositions for the task, each crew member's hourly rate, and average task duration in hours. Thus for each crew member, the computation model for the RSMeans cost can be expressed as follows:

(1) RSMeans hourly wage rate * RSMeans hours = RSMeans cost

In step 2, Bates White adjusted the RSMeans cost to reflect the average project duration of the task needed to comply with nuclear safety and quality standards. To do

that, Bates White added the product of RSMeans cost and the relevant EMWG factor to the RSMeans cost computed in step 1. The result can be described as the EMWG-enhanced cost:

(2) RSMeans cost + (RSMeans cost * EMWG factor) = EMWG-enhanced cost

In step 3, Bates White multiplied the RSMeans-EMWG-enhanced cost by an appropriate productivity factor to reflect the expected average productivity of the construction contractor's workforce. The result was the Bates White labour cost estimate.

(3) EMWG-enhanced cost * Productivity factor = Bates White labour cost

Example for a task with a crew member earning $100/hour. The RSMeans average time to complete this task is 1.54 hours. This task involves nuclear-grade construction. The EMWG factor is 55.73, and the productivity factor is 2.5.

(1) $100 (RSMeans hourly rate) * 1.544 (hours) = $154.40 (RSMeans cost)

(2) 154.40 (RSMeans cost) + $154.40 (RSMeans cost * 55.73 (EMWG factor) = $8,759 (EWMG enhanced cost)

(3) $8,759 (EMWG enhanced cost) * 2.5 (productivity factor) = $21,897.50 (Bates White labour cost)

EMWG factors ranged from 1.35 to 55.73.

c) To determine the cost of an additional crew member, Bates White used RSMeans cost factors for the particular crew type and multiplied that rate by an estimated time that additional crew member(s) would work on the task. Bates White then added the additional crew cost to the previously computed RSMeans cost in step 1. Bates White then completed steps 2 and 3 to compute its cost estimate.
Based on the information set forth in part (b) to this question, the cost of an extra welder on a crew would be calculated as follows:

Assume, the welder's rate is $120/hour and it is estimated that the welder will work half-time on the project. The base crew member's labour rate remains $100/hr and the expected duration of the project remains 1.54 hours.

(1) $100 (RSMeans hourly rate) * 1.544 (hours) + $120 (RSMeans welder hourly rate) x 1.544/2 (hours) = $247.04 (RSMeans cost)
(2) $247.04 (RSMeans cost) + $247.04 (RSMeans cost) * 55.73 (EMWG factor) = $14,014.40 (EMWG-enhanced cost)

(3) $14,014.44 (EMWG enhanced cost) *2.5 (Productivity factor) = $35,036 (Bates White labour cost)

d) The total cost of added crew members within the total project cost of $517.7 million is $30.68 million. The distribution by BOQ section is depicted in Chart 1 below.

Chart 1: Cost of Added Crew Members by BOQ Section

Section	**Added Crew Costs ($M)**
B. Architectural /Civil	$1.04
C. Process Systems Tie-In	$1.16
D. Process Systems	$19.86
E. Process Support Systems	$9.17
F. Building Support Systems	$0.02
G. Building Support Systems	$0.47
H. Electrical	$0.00
Total	$31.72