Q. **Reference: Bates White Addendum Report, June 5, 2026, page 22.**

> "The new Contingency amount is 11.0% of the revised Base Cost estimate, compared to 11.1% of Base Cost in the Build Application. While the uncertainty captured by Contingency may remain for a range of project costs, the CT package cost is now known with high (if not exact) certainty, since this is contracted. A Contingency of 11% on Base Cost excluding the $280 million CT contract cost would come to approximately $45 million, rather than the $75 million in the updated Authorized Budget Request."

a) Please detail the risks and associated costs that remain outstanding for the GE contract which would support the level of contingency proposed for CWP2000.

b) With the award of the CT contract and the narrowing/tightening of cost and scope estimates, the uncertainty would be expected to be reduced but the proposed contingency amount has increased and the combined management reserve and contingency have increased. Please explain.

A. **a)** The scope of Construction Work Package ("CWP") 2000 is broader than the purchase of the Combustion Turbine ("CT") units; it includes the entire scope of the CT plant itself. The CWP includes civil works, building erection, architectural, electrical, and mechanical equipment, piping, instrumentation and controls, building systems, and all other CT building elements. As a result, significant residual cost uncertainties remain, primarily related to potential design maturity changes as the project progresses from FEED[1] through to detailed design, scope execution, including integration, completions and commissioning for the plant.

Further, despite the award of the CT contract for the units themselves, a number of contractual cost uncertainties remain. These include foreign exchange exposure, transportation costs, on-site original equipment manufacturer support, CRN[2] certification requirements, tariffs and design growth. In addition to the contractual uncertainties, project

[1] Front-End Engineering Design ("FEED").
[2] Canadian Registration Number ("CRN").

systemic risks still influence the cost of the CTs, and because the cost of the CTs is much greater, the resulting cost impact of the project systemic risk is greater, hence greater contingency cost. For example, poor planning can result in the CTs remaining in storage longer, which can increase the risk of some electronic components corroding or becoming damaged, which means the parts have to be replaced. More expensive CTs suggest any repairs or replacement parts will be more expensive. Another risk factor evaluated in the QRA[3] model was the impact of the size of the construction labour force. The greater the size of the construction crew required for the project, the greater the risk of having more inexperienced construction labour on site. Inexperienced labour increases the probability of doing something incorrect, which could result in the CTs being damaged during installation, and again, because the CT is more expensive, the replacement parts or repair will be more expensive. Another example would be if the CTs are damaged during shipment, then the repair or replacement parts will be more expensive because this factor is applied to a greater equipment cost. Another systemic risk factor is environmental conditions. Bad weather can cause project delays as well as damage equipment, and again applying this risk factor to a greater CT cost results in a greater contingency cost. These are just a few of the examples of how project systemic risks can impact the CT costs. Essentially, even though the contractual cost for the CTs is considered to be more firm, many of the systemic risks, such as those previously mentioned, can still impact the cost of the CTs, and because the cost of the CTs is greater, the resulting cost impacts of the systemic risks are greater, hence higher contingency cost.

b) In the impact analysis of the increased CT price on the project estimate,[4] Newfoundland and Labrador Hydro ("Hydro") replicated the hybrid QRA performed during FEED and updated the model only for CT-related changes. Specifically, Hydro increased the CT value in the model by $102 million to reflect the actual contracted cost increase above the CT price included in the FEED estimate and added a [redacted] allowance for CRN certification.[5]

[3] Quantitative Risk Analysis ("QRA").
[4] Please refer to "Briefing Note: Impact Analysis of CT Price Increase on Project Estimate," Newfoundland and Labrador Hydro, April 9, 2026, provided in "2025 Build Application – Avalon Combustion Turbine Evidentiary Update," Newfoundland and Labrador Hydro, April 16, 2026, att. 2, att. 5.
[5] CRN for certification of boilers, pressure vessels, or pressure fittings.

Hydro also added an expected-value risk item to address the remaining variable elements of the CT contract that continued to carry uncertainty.

All other inputs to the hybrid QRA model remain consistent with those used during FEED. This approach was used to isolate the impact of the CT-related changes while preserving comparability with the original FEED QRA.

The original Hatch Ltd. ("Hatch") QRA reflected the estimate, market information, and risk assumptions available during FEED. At that time, CT price escalation was assessed as a low post-mitigation risk, based on the understanding that firm pricing had been obtained. For this reason, the FEED QRA did not include a separate specific risk item for a further CT price increase.

The following sections explain how the hybrid parametric and expected-value QRA model treats systemic project risk and specific identified risk events, and how that framework was used to assess the impact of CT-related cost changes on contingency and management reserve.

Hybrid Parametric + Expected Value QRA

A hybrid parametric + expected value QRA approach like that used by Hatch on the Avalon CT FEED consists of two elements: a systemic parametric model and a risk event expected value model, which gets combined in a Monte Carlo Simulation ("MCS") model as shown in Figure 1. The parametric portion addresses broader project risk characteristics that are common across major capital projects, while the expected-value portion addresses specific identified risk events. The award of the CT contract affected a specific contract cost and certain remaining contract variables, but it did not eliminate the broader project-wide risk factors captured through the parametric portion of the model.

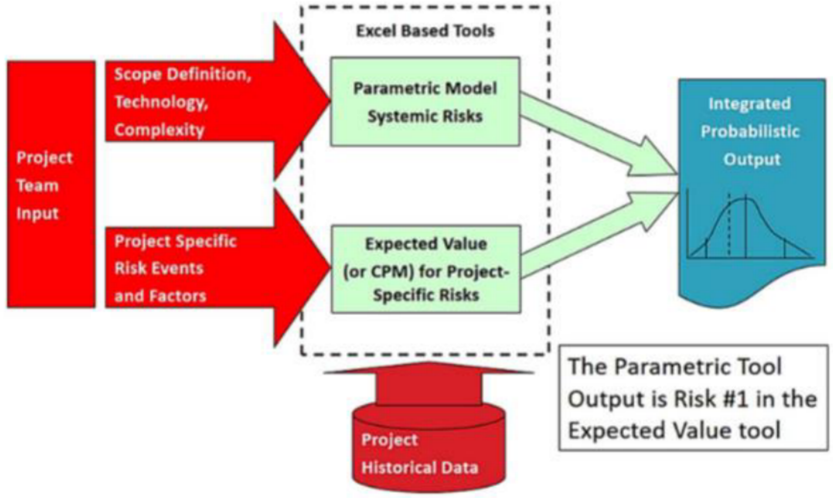

Figure 1: Parametric Risk Model Structure[6]

Parametric Systemic Model

The parametric portion of the model is used to assess systemic factors affecting projects, those underlying elements that operate across the project system that research has shown carry significant weight in major project outcomes. The model uses a structured set of project questions, ratings, and pre-defined responses to assess the condition of the project against factors that have historically been associated with cost and schedule outcomes on comparable major projects. These factors include, among others, scope definition, estimate and schedule basis, project complexity, execution planning, engineering maturity, owner capability, exclusions, and estimate or schedule aggressiveness.

Within the parametric portion of the model, the emphasis is not on pricing a specific contract item, but on assessing the overall maturity and risk profile of the project estimate and execution plan. The model considers broad categories such as scope development and maturity, estimate and schedule basis, and project technology and complexity. These categories are further broken down into specific risk drivers, including matters such as

[6] "Parametric QRA Report," Hatch Ltd., November 29, 2024, provided in "2025 Build Application – Avalon Combustion Turbine Evidentiary Update," Newfoundland and Labrador Hydro, April 16, 2026, att. 2, att. 3, p. 4, fig. 4-1, as well as AACE International Recommended Practice 113R-20, *Integrated Cost and Schedule Risk Analysis and Contingency Determination Using Combined Parametric and Expected Value*, Figure 1.

project team development and staffing, operations interface and demolition planning, key engineering deliverables, estimate exclusions, schedule basis, organizational capability, and technology complexity.[7]

The ratings for these factors are selected from predefined options within the parametric QRA tool.[8] Based on those selections, the model applies factors developed from analysis of historical project data linking project system attributes and practices to cost growth and schedule outcomes.[9]

An equipment risk factor is applied after the parametric algorithm is run to reflect the maturity of the estimate and the extent to which equipment costs are defined at the applicable stage of project development. For example, equipment included in a less mature estimate would generally carry greater uncertainty than equipment included in a more mature estimate.

The remaining CT contract uncertainty addressed in Hydro's update related to specific variable elements of the awarded CT contract, rather than to the broader systemic condition of the project estimate. Those contract-specific items were therefore addressed through the expected-value portion of the model. By contrast, the CT contract award improved cost definition for a major equipment package but did not independently remove the broader project-wide risks assessed through the parametric model.

Expected Value Model

The second portion of the hybrid model is an expected value model. In this portion of the model, specific risks are entered, along with corresponding probability of occurrence and assessed ranges of outcomes. This is similar to other modeling techniques such as line-item

[7] The categories, groups and factors, as well as the specific selections for the Avalon CT project, can be found in the "Parametric QRA Report," Hatch Ltd., November 29, 2024, provided in "2025 Build Application – Avalon Combustion Turbine Evidentiary Update," Newfoundland and Labrador Hydro, April 16, 2026, att. 2, att. 3, app. A.
[8] ValidRisk, either the newer cloud-based system or the older spreadsheet model like that used by Hatch during FEED, are such parametric tools.
[9] Hollmann, J. K., *"Validating the output of a parametric QRA model,"* Validation Estimating LLC, June 19, 2026, provided as PUB-NLH-007, Attachment 1.

ranging. Typically, critical or higher-ranked risks from a project risk register are entered into the expected value model.[10]

This portion of the model is focused on specific identified risks and, in the integrated MCS, assesses values for these risks based on the likelihood and potential cost impact of those risks. For the CT contract update, Hydro used the expected-value portion of the model to assess the remaining variable elements of the CT contract. This allowed the analysis to recognize that some CT contract uncertainty remained, without assuming that those uncertain amounts were either zero or certain to occur at their full potential value.

Integrated Monte Carlo Simulation

When all parts of the model are prepared and the model is analyzed the output results of the parametric model is automatically entered into the expected value portion of the model, with the ranges determined from the underlying linear regression analysis, and assigned a probability of 100% (in other words, there is no uncertainty assigned to the systemic modelling, just the range of outcomes based on the selected entered project system attributes and factors, and the outcomes based on research analysis).[11]

The expected-value model therefore includes both the specific identified risk events entered by the analyst and the broader systemic risk range generated by the parametric model. The MCS then combines these elements to produce the resulting reserve values. This reflects the hybrid nature of the QRA model: specific risks are assessed through expected value, while systemic project uncertainty is carried forward from the parametric analysis.

Avalon Combustion Turbine QRA

During the preparation of the Avalon CT QRA performed by Hatch, the risk of price increases for the CTs was assessed and was reduced to a post-mitigated score of 'low', based on

[10] Please refer to PUB-NLH-007, Attachment 1 for further information on this portion of the hybrid modelling technique.
[11] *Supra,* f.n. 10.

obtaining what Hatch deemed to be firm pricing.[12] Based on this scoring, this risk was not used as a variable input in the expected value portion of the QRA.[13]

[redacted]

Figure 2: Project Specific Risk Events from Hatch QRA Report

The inputs and outcomes of the Hatch hybrid QRA model are documented in the Hatch Parametric QRA Report.[14] In this report, Figure 6-3 indicates the significant systemic factors deemed to have the greatest influence on the Avalon CT project cost. This cost risk influence diagram did not include equipment costs. As noted earlier, in the parametric model, equipment costs are factored based on project and estimate maturity.

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[12] "Risk and Assumption Register," Hatch Ltd., November 18, 2024, provided in "2025 Build Application – Avalon Combustion Turbine Evidentiary Update," Newfoundland and Labrador Hydro, April 16, 2026, att. 2, att. 4, Risk ID 012.
[13] "Parametric QRA Report," Hatch Ltd., November 29, 2024, provided in "2025 Build Application – Avalon Combustion Turbine Evidentiary Update," Newfoundland and Labrador Hydro, April 16, 2026, att. 2, att. 3, Table 6-1.
[14] "Parametric QRA Report," Hatch Ltd., November 29, 2024, provided in "2025 Build Application – Avalon Combustion Turbine Evidentiary Update," Newfoundland and Labrador Hydro, April 16, 2026, att. 2, att. 3.

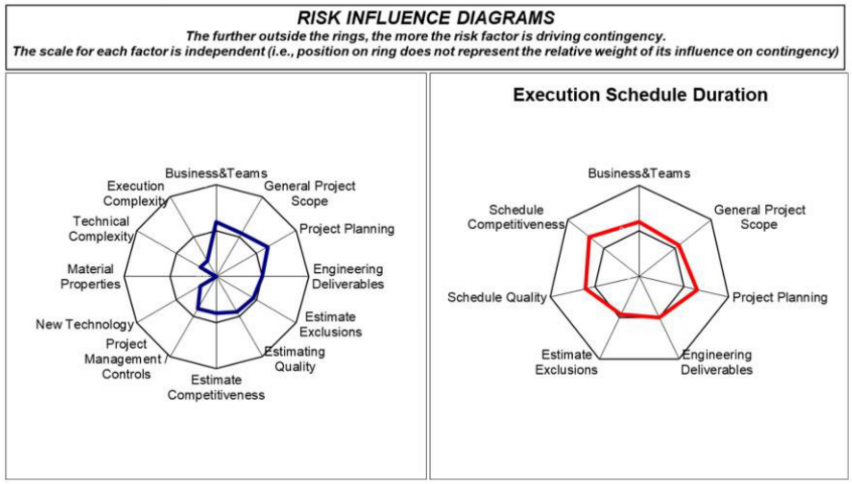

Figure 3: Systemic Risk Influence Diagrams from Hatch QRA Report

During the impact analysis of the effect of the contracted CT price upon the project estimate,[15] the ValidRisk model was minimally adjusted. The purpose of this analysis was to determine the impact on the project cost estimate due to the change in the CT price. The number of changes made to the model was limited only to those items directly related to that change.[16] Maintaining the other model inputs allowed the analysis to isolate the effect of the CT price change and remaining CT contract uncertainty, while preserving comparability with the original FEED QRA.

As previously mentioned, an additional specific risk was added as part of the impact analysis to account for the variable portions of the CT contract, as it was felt that this would be a transparent and reasonable approach to include these items with remaining uncertainty in the CT contract. It was felt that it would be inappropriate to either omit these items or to include them at full potential value. This means that in the impact analysis model, there was a specific risk added to the list already included in the Hatch model (Please refer to [redacted]) for this extra uncertainty.[17] With the parameters assigned to this risk ([redacted] at [redacted] probability), most of the outcomes for this specific item would range in the model

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[15] *Supra,* f.n. 4.
[16] As noted in the briefing note, other items were reviewed, but there were no significant deviations noted from the estimated values.
[17] *Supra,* f.n. 4, Table 2.

from approximately [redacted] to [redacted], with a median value of around [redacted].

In this analysis, the parametric systemic inputs remained the same as the FEED model, except for increased equipment pricing ($102 million, reflecting the increase to the CT cost, and an allowance for CRN certification).[18] The expected value inputs also remained the same, except for the addition of the single item for the variable portions of the CT contract, as noted above. The model output resulted in slightly different values in terms of project reserves (contingency and management reserve).

The updated reserve values reflect the application of the same hybrid QRA framework used during FEED, with targeted adjustments for the higher confirmed CT cost and the remaining variable elements of the CT contract. The analysis did not simply maintain an 11% allowance on the CT contract value, nor did it treat the CT award as removing all CT-related or project-wide uncertainty from the reserve analysis.

Hydro recognizes that, when viewed only from the perspective of contract award, the change in contingency and management reserve may appear counter-intuitive. That expectation assumes that the CT price-escalation risk was fully captured in the FEED QRA. The FEED QRA did not include a specific expected-value risk item for the CT price increase that later materialized because, at the time, that risk had been assessed as mitigated based on the information available during FEED. The subsequent speed and magnitude of changes in the CT market were not forecast at that time.

The CT contract award improved cost definition for a major equipment package, but it also confirmed a materially higher cost than the amount assumed during FEED. In addition, certain CT contract variables remained uncertain, and the broader systemic risks assessed through the parametric portion of the model continued to apply. Those risks relate to the overall maturity, definition, and execution characteristics of the project, not solely to whether one major contract had been awarded.

[18] *Supra,* f.n. 17.

For these reasons, the revised contingency and management reserve values are consistent with the structure and purpose of the hybrid QRA model. The updated analysis incorporates the actual CT cost outcome and remaining CT-related uncertainty into the same QRA framework used during FEED, while preserving the broader project-wide risk assessment. This provides a consistent basis for assessing the impact of the CT-related cost changes on the overall project estimate.

NLH-MP001-000-VEL-NLH-MEM-0003

Date: June 19, 2026
From: John K. Hollmann, CCP CEP DRMP; Owner, Validation Estimating LLC (Consultant)
To: Tony Scott, Newfoundland and Labrador Hydro (Hydro)
Subject: Validating the output of a parametric QRA model

At Hydro request, this memo provides the Consultant's brief comments on how the results of a project parametric cost and/or schedule tool can be validated. In this case, "validation" means assuring the output represents the tool's intent, design, and basis and has not been manipulated in some way that is not readily apparent.

Background

This memo speaks directly to ValidRisk®, a commercial, cloud-based project cost and schedule QRA tool that applies a hybrid of parametric analysis of systemic risks and expected value with Monte Carlo simulation (EV w/MCS). ValidRisk® is managed by Koff & Guerrero (KGC) in advisory alliance with the Consultant's firm Validation Estimating LLC (VE is the intellectual property owner.) The parametric method quantifies systemic risks (i.e., similar to inherent uncertainty) while the EV w/MCS method quantifies project-specific risks (i.e., similar to contingent or event risks). Together, the tool produces predicted, integrated cost growth and schedule slip outputs.

Note that parametric QRA models aligned with AACE Recommended Practice (RP) 42R-08, are fundamentally based on multiple linear regression (MLR) of actual historical project data on project system attributes and practices (risk drivers) and cost growth and schedule slip results (outcomes).

In respect to tools that might be used in validation (e.g., a comparison analysis), the Consultant is aware of only one competing *commercial* parametric QRA product and that is offered by Independent Project Analysis, Inc (IPA), but it is generally only applied for IPA's benchmarking clients. Other possible validation approaches are identified.

Relevant Features of ValidRisk®

The following are features of ValidRisk® related to validation:

<u>Parametric Component</u>

- The parametric tool uses algorithms (i.e., analytic engine) developed originally through multiple linear regression modelling (MLR) of actual project system attributes (risk drivers) and project cost growth and schedule slip outcomes.
- The parametric engine is not accessible to ValidRisk® users. In older Excel® spreadsheet versions of the tool (pre-2022), the parametric engine was accessible to the user and exposed to manipulation to the user's potential detriment.
- The ValidRisk® parametric tool cost and schedule engines are designed to be easily "calibrated" using factors in a way that does not change the core engines. The factors are derived by the user studying a dataset of the user's actual projects. The purpose is to account for not readily apparent potential company, asset type or other risk behavior

differences. If present, the differences are usually an artifact of significant project culture biases and/or unidentifiable idiosyncrasies in the company's project system.

- Most companies have sufficient estimate and actual data on hand to perform high level calibration checks, but the amount of data needed to show *statistically significant* differences from model predictions may not be available. For example, the company may have few examples of Class 4 estimates (perhaps the company often skips that phase) and the smaller the comparison dataset, the less useful the calibration findings will be.

- User input / entry data into the parametric model is based on a selectable range of inputs that are mostly picklist ratings of project system attributes (e.g., definitive to poor scope definition rating) or valued from a range (e.g., 0-10 for low to aggressive bias). Input is based on a systemic risk workshop with key project team members. Parameter descriptors and user guide aid the team/analyst in determining the appropriate, objective rating or value. This input data is fully visible and transparent.
  - Biased inputs will bias the output. For example if a plan element or deliverable is rated definitive or complete when it is not. The visibility of the entries facilitates review and audit. Facilitator independence / impartiality is important.
- The ValidRisk® parametric models are precisely repeatable and consistent (i.e., two users or teams entering the same inputs to a calibrated model will get the same result).
- ValidRisk® stores the input data and output results for each analysis.

<u>EV w/MCS Component</u>

- For the EV w/MCS part of the hybrid tool, the user first identifies *critical* event risks or uncertainties from a screened qualitative risk register[1]. As pre-work, the user then completes a worksheet of direct and indirect cost "burn-rates" that will be used later to calculate the time-driven cost of delays. Any correlations between the occurrence of the risks is also entered.
- Then, for each risk the user inputs its probability of occurrence, 3-point triangular distribution entries for duration of delays to project completion and for cost of non-time driven impacts, The probabilities and 3-point values (and degree of risk correlation if any) are based on input from a specific-risk workshop with key project team members.
  - There will be few critical risks (e.g., 5 to 15), therefore each risk can be discussed in detail in the workshop.
  - The focus for critical risk impact quantification is the high value (i.e., don't start with and get anchored by the most likely value.) The high value largely determines the risk profile in respect to risk events. Impacts are entered in

[1] "Critical" risks are risks that individually could result in material economic impact (i.e., the project will fail to achieve the cost and/or schedule objective of the business case if worst case impacts occur). If a project has more than a handful of these, it is unlikely to be successful. These are typically the risks with severe (e.g., red or 5 on a 1-5 scale) in qualitative risk register impact ratings. The data used to develop the original parametric model was cleaned of the impacts of such risks, so the hybrid method must add them back over and above the parametric result. Note that for early project phases, these risks may not yet have been identified but the impact of poor scope definition (a systemic risk) is dominant.

absolute months and costs, not +/- percents around a most likely. Notes should be taken describing the assumptions behind the high impact estimate.
    - ValidRisk® deemphasizes MCS "expert" details which tend to be an analyst focus for MCS-only methods. There is no choice of impact distribution; triangle is assumed with 5,000 MCS iterations. Consultant experience is that because of the typical dominance of systemic risks and the dominance of the high impact value for a small number of critical risk events (the focus of the workshop), MCS details are of minimal importance.
- The above inputs are all entered by the analyst and all are visible and available for review and audit.
- Additional inputs used in the EV w/MCS tool are the cost and schedule distribution outputs of the parametric model. The overall systemic risk impacts are in effect risk #1 in the EV tool for which, being an uncertainty, the probability of occurrence is 100%. These parametric tool outputs are automatically transferred. The parametric tool reports these distributions directly so they are visible.
- Standard MCS calculations are performed in ValidRisk® with 5,000 iterations.

<u>Validation</u>

- All the inputs to the ValidRisk® parametric and EV w/MCS tool, and the calibration factors if any, are visible for review and audit.
- If used on all projects in a portfolio, being cloud-based (if desired, on the user's server) the inputs for comparable projects are available for internal review and validation.
- As mentioned, the parametric analytic engine (and the MCS calculation routine) is inaccessible and the same for all ValidRisk licenses.
- Once calibrated, the ValidRisk® parametric model is essentially a mirror of the owner's cost and schedule reality. To validate parametric outputs, a third party (validator) may consider these approaches:
    - Create their own parametric model, or
    - Use ValidRisk® themselves with the same calibration factors applied, or
    - Contract with IPA, Inc to leverage their parametric model (the Consultant is not aware of what the terms are for such an arrangement), or
    - Apply the Hackney or Rand models which are available as Excel® worksheets as an attachment to AACE RP 43R-08, or
    - Apply the free demonstration model available with the Consultant's "Project Risk Quantification – Volume 1" book.
    - Apply high level benchmarking using whatever estimate and actual cost is available to the validator (e.g., reference class forecasting (RCF)), however this is usually limited to gross, wide ranging cost or schedule "overrun" metrics for a general asset type.
- To validate the overall parametric + EV w/MCS output of ValidRisk®, EV is a generic approach that can be readily replicated with an Excel® spreadsheet and an MCS add-on such as @Risk®. Two approaches for that are:

- Use a subjective Ranging + EV w/MCS method such as documented in AACE RP 123R-22 using the validator's inputs.
- Use the EV approach in RP 123-22, but with ValidRisk parametric output (if accepted). The user would enter the parametric output as an independent first risk with 100% probability and an impact distribution such as RiskCumul (to replicate the parametric curve closely) or RiskLognormAlt (an approximation of the parametric distribution which has a lognormal basis).