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May 11, 2018

Mr. Mike Yanacheak  
Chair, Variable Annuities Issues (E) Working Group  
National Association of Insurance Commissioners  
Via Email: Dan Daveline ([ddaveline@naic.org](mailto:ddaveline@naic.org))

Re: Follow-up Comments to Recommendation #9

Dear Mr. Yanacheak,

On behalf of the AG43/C3P2 Work Group of the American Academy of Actuaries<sup>1</sup> (the Academy Work Group), appreciates the opportunity to follow up on our comments to recommendation #9—Lower minimum allowable CDHS “error factor,” but require back-testing to support chosen “error factor” —within the documents<sup>2</sup> exposed by the Variable Annuities Issues (E) Working Group (VAIWG) on December 1, 2017.

During the March 21 VAIWG meeting in Milwaukee, the Academy Work Group discussed our comments on this recommendation (see Attachment 1 for the original comment), and noted that the specific approaches for incorporating hedging mentioned in the proposed redline version of AG 43 are not necessarily allowed by the other requirements of AG 43, specifically Appendix 7. The language in the proposal suggests that any implicit method of reflecting hedging is appropriate. We agreed to provide the VAIWG with suggested language to address the comments and recommendations, and the language can be found in Attachment 2.

We want to clarify that our providing the suggested language in Attachment 2 does not necessarily mean we are in agreement with the proposal. We continue to stand behind our original comments in Attachment 1. However, if the VAIWG decides to move forward with the proposal in recommendation #9, we think the suggested changes in Attachment 2 should be considered.

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<sup>1</sup> The American Academy of Actuaries is a 19,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 50 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

<sup>2</sup> This includes *20171201 NAIC VA QIS II Recommendations vF.pdf*, *20171201 Revised AG43 (REDLINE on ORIGINAL) vF.pdf*, and *20171201 Revised RBC LR027 (REDLINE on ORIGINAL) vF.pdf*.

## Additional Comments

When developing these follow-up comments, we noticed two additional portions of the proposed language in Section A7.3) that need further consideration. We did not include these comments in Attachment 2, but rather discuss them below.

1. The proposal for back-testing the explicit method of incorporating hedges into the reserve calculation includes the following language:

“The actuary may also support the choice of a low value of E by achieving a high R-squared – e.g., 0.80 or higher – when using a regression analysis technique.”

We think this language needs to be removed or further clarified. The value of E represents the ability of the stochastic model to properly reflect the hedging strategy. A regression analysis is used to determine how well the actual hedging strategy covers the actual target being hedged. Since these are two different concepts, we do not think such a regression analysis will appropriately measure the ability of the model to reflect the hedging strategy.

2. The last paragraph of proposed Section A7.3) adds the following requirement: “A company that does not have 12 months of experience to date shall set E to a value no lower than 0.50.”

We don't believe this restriction is necessary. As noted above, the value of E represents the ability of the stochastic model to properly reflect the hedging strategy. It is not necessary to have actual experience with the hedging strategy in order to determine the ability of the stochastic model to reflect that strategy. Such a determination could be accomplished by using mock testing. This would be consistent with the requirements in the current version of AG43, which allows a new or revised hedging strategy to be reflected in the reserve calculation by “mock testing or by having effectively implemented the strategy with similar annuity products for at least three months.

We welcome the opportunity to continue to help you shape proposed modifications to Actuarial Guideline XLIII (AG43) and C-3 Phase II (C3P2). If you have any questions, please contact Ian Trepanier, life policy analyst at the American Academy of Actuaries ([trepanier@actuary.org](mailto:trepanier@actuary.org)).

Sincerely,

Thomas A. Campbell, MAAA, FSA, CERA  
Chair, AG43/C3 Phase II Work Group  
American Academy of Actuaries

## The Academy AG43/C3P2 Work Group's Original Comment

### Recommendation #9—Lower minimum allowable CDHS “error factor,” but require back-testing to support chosen “error factor” (Slide 29)

To the extent the CDHS criteria are retained, we agree with lowering the minimum allowable “E” factor, and with the update to the CTE Amount (reported) formula in Appendix 7 of the redline version of proposed AG43. The updated formula addresses the suggestion in our [Nov. 14, 2016](#); and [Feb. 3, 2017](#), letters to provide more guidance on how to treat “E” when CTE (best efforts) exceeds CTE (adjusted).

While we agree with supporting the treatment of hedging in the CTE Amount calculation with back-testing, we need to more carefully review the requirements in Recommendations #21 and 22 (which have not been tested to our knowledge) to better understand and interpret the calculations, regulatory approval requirements, and E-factor restrictions and to review them for practicality.

The discussion of back-testing in the redline version of proposed AG43 mentions three different approaches: explicit method, implicit method, and cost of reinsurance method. We have two comments regarding these approaches. First, the latter two approaches are categorized as methods where the company doesn't directly model hedge cash flows. It is not clear whether the requirements of AG43 allow these approaches. As drafted, the back-testing proposal may inadvertently legitimize these approaches. If these various approaches are all appropriate, or if they are considered safe harbor approaches, then we recommend adding language to Appendix 7 that specifically states this.

Second, the specificity of the back-testing requirements seems to vary based on the modeling method used. Back-testing principles for explicit and all potential implicit methods should be consistent and not disadvantage or discourage companies from employing more direct modeling approaches.

## Attachment 2

### **Suggested Redline Changes to the Proposal in Sections A7.2) and A7.3)**

#### **A7.2) Background**

The analysis of the impact of the hedging strategy on cash flows is typically performed using either one of two methods as described below. Although a hedging strategy would normally be expected to reduce risk provisions, the nature of the hedging strategy and the costs to implement the strategy may result in an increase in the amount of the Conditional Tail Expectation Amount otherwise calculated.

The fundamental characteristic of the first method is that hedging positions, and the projected cash flows from these positions, are directly included in the stochastic cash flow model used to determine the Scenario Greatest Present Value, as discussed in Section IV(D), for each scenario (“explicit method”).

The fundamental characteristic of the second method is that the effectiveness of the current hedging strategy (including currently held hedge positions) on future cash flows is evaluated, in part or in whole, outside of the stochastic cash flow model (“implicit method”). In this case, the reduction to the Conditional Tail Expectation Amount otherwise calculated should be commensurate with the degree of effectiveness of the hedging strategy in reducing accumulated deficiencies otherwise calculated.

Regardless of the methodology used by the company, the ultimate effect of the current hedging strategy, on the Conditional Tail Expectation Amount needs to recognize all risks, associated costs, imperfections in the hedges and hedging mismatch tolerances associated with the hedging strategy. The risks include, but are not limited to: basis, gap, price, parameter estimation, and variation in assumptions (mortality, persistency, withdrawal, annuitization, etc.). Costs include, but are not limited to: transaction, margin (opportunity costs associated with margin requirements) and administration. In addition, the reduction to the Conditional Tail Expectation Amount attributable to the hedging strategy may need to be limited due to the uncertainty associated with the company’s ability to implement the hedging strategy in a timely and effective manner. The level of operational uncertainty varies indirectly with the amount of time that the new or revised strategy has been in effect or mock tested.

No hedging strategy is perfect. A given hedging strategy may eliminate or reduce some but not all risks, transforms some risks into others, introduces new risks or has other imperfections. For example, a delta-only hedging strategy does not adequately hedge the risks measured by the “Greeks” other than delta. Another example is that financial indices underlying typical hedging instruments typically do not perform exactly like the separate account funds, and hence the use of hedging instruments has the potential for introducing basis risk.

#### **A7.3) Calculation of CTE Amount (reported)**

The company should begin by calculating “CTE Amount (best efforts)” – the results obtained when the Conditional Tail Expectation Amount (or “CTE Amount”) is based on incorporating the hedging strategy (including currently held hedge positions) into the stochastic cash flow model, including all of the factors and assumptions needed to execute the hedging strategy (e.g., stochastic implied volatility).

Because most models will include at least some approximations or idealistic assumptions, CTE Amount (best efforts) may overstate the impact of the hedging strategy. To compensate for potential overstatement of the impact of the hedging strategy, the company shall recalculate the Conditional Tail Expectation Amount assuming the company has no dynamic hedging strategy – i.e., reflect either:

- A) Only hedge positions held by the company on the valuation date; or
- B) No hedge positions – in which case the hedge positions held on the valuation date are replaced with cash or other general account assets in an amount equal to the aggregate market value of these hedge positions. This amount shall also be referred to as CTE Amount (unhedged).

The result so obtained is called “CTE Amount (adjusted).” In some situations the determination of CTE Amount (adjusted) may include both direct and indirect techniques.

Finally, the reported value for the Conditional Tail Expectation Amount is given by:

$$\begin{aligned} \text{CTE Amount(reported)} &= \text{CTE Amount(best efforts)} + E \\ &\times \max(0, \text{CTE Amount(adjusted)} - \text{CTE Amount(best efforts)}) \end{aligned}$$

The value for E (the “error factor”) reflects the actuary’s view as to the level of sophistication of the stochastic cash flow model and its ability to properly reflect the parameters of the hedging strategy (i.e., the “Greeks” being covered by the strategy) as well as the associated costs, risks, and benefits. As the sophistication of the stochastic cash flow model increases, the value for E decreases (i.e., the greater the ability of the CTE Amount (best efforts) model to capture all risks and uncertainties, the lower the value of E). If the model used to determine the “CTE Amount (best efforts)” effectively reflects all of the parameters used in the hedging strategy, the value of E may be as low as 0.05. If certain economic risks are not hedged, yet the model does not generate scenarios that sufficiently capture those risks, E must be in the higher end of the range between 0.05 and 1.0. Likewise, simplistic hedge cash flow models will have a value of E in the high range between 0.05 and 1.0.

The company shall demonstrate via a formal back-test that, based on an analysis of at least the most recent 12 months, the model is able to replicate the hedging strategy in a way that justifies the value used for E. The results of this back-test shall subsequently be disclosed in the Required Memorandum.

Such a back-test shall involve one of the following analyses:

- A) For companies that model hedge cash flows directly, using the (“explicit method”), replace the stochastic scenarios used in calculating the CTE Amount (best efforts) with a single scenario that represents the market path that actually manifested over the selected back-testing period and compare the projected hedge asset gains and losses against the actual hedge asset gains and losses – both realized and unrealized – observed over the same time period.

Alternatively, companies may use the analysis outlined in B) below for the back-test, subject to a demonstration of appropriateness.

Regardless of the back-test analysis used, To support the choice of a low value of E, the actuary should be able to demonstrate that the projected hedge asset gains and losses are within close range of 100 percent – e.g., 80 to 125 percent – of the actual hedge asset gains and losses. The actuary may also support the choice of a low value of E by achieving a high R-squared – e.g., 0.80 or higher – when using a regression analysis technique.;

- B) For companies that do not model hedge cash flows explicitly, but use an implicit method that quantifies the cost and benefit of hedging as equal in amount to the fair value of the hedged item

(~~“implicit method”~~, or ~~“cost of reinsurance method”~~), calculate the delta, rho, and vega coverage ratios in each month over the selected back-testing period in the following manner:

- 1) Determine the hedge asset gains and losses – both realized and unrealized – incurred over the month attributable to equity, interest rate, and implied volatility movements;
- 2) Determine the change in the fair value of the hedged item over the month attributable to equity, interest rate, and implied volatility movements. The hedged item should be defined in manner that reflects the proportion of risks hedged – for example, if a company elects to hedge 50% of a contract’s market risks should quantify the fair value of the hedged item as 50% of the fair value of the contract;
- 3) Calculate the delta coverage ratio as the ratio between 1) and 2) attributable to equity movements;
- 4) Calculate the rho coverage ratio as the ratio between 1) and 2) attributable to interest rate movements;
- 5) Calculate the vega coverage ratio as the ratio between 1) and 2) attributable to implied volatility movements.

To support the choice of a low value of E, the actuary should be able to demonstrate that the delta and rho coverage ratios are both within close range of 100 percent – e.g., 80 to 125 percent – consistently across the back-testing period.

In addition, the actuary should be able to demonstrate that the vega coverage ratio is within close range of 100 percent in order to use the prevailing implied volatility levels as of the valuation date in quantifying the fair value of the hedged item for the purpose of calculating CTE Amount (best efforts). Otherwise, the actuary shall quantify the fair value of the hedged item for the purpose of calculating CTE Amount (best efforts) in a manner consistent with the realized volatility of the scenarios captured in the Conditional Tail Expectation. The actuary shall also disclose in the Required Memorandum both the implied volatility level used to quantify the fair value of the hedged item as well as the methodology undertaken to determine the appropriate level used.

C) For Ccompanies that ~~do not model hedge cash flows explicitly, but that also do not use the “cost of reinsurance use an implicit method”~~as other than the one outlined in B) above, shall conduct the formal back-test in a manner that clearly illustrates the appropriateness of the selected method for reflecting the cost and benefit of hedging as well as the value used for E.

A company that does not have 12 months of experience to date shall set E to a value no lower than 0.50. In addition, a company may not change the value of E from one valuation date to the next without the approval of the Domiciliary Commissioner.