**Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force**

**Amendment Proposal Form\***

1. Identify yourself, your affiliation and a very brief description (title) of the issue.

**Identification:**

Rachel Hemphill and Karen Jiang, Texas Department of Insurance

**Title of the Issue:**

Create consistency between CDHS determination in VM-20 and VM-21. Revise hedge modeling to only require CDHS if modeling future hedging reduces the reserves under VM-20 or TAR under VM-21.

2. Identify the document, including the date if the document is “released for comment,” and the location in the document where the amendment is proposed:

VM-01, VM-20 Section 6.A.1.b, VM-20 Section 7.E.1.g, VM-20 Section 7.K, VM-20 Section 7.L, VM-21 Section 1.D.2, VM-21 Section 4.A.4, VM-21 Section 4.D.4.b, VM-21 Section 6.B.3.a.ii, VM-21 Section 6.B.3.b.ii, VM-21 Section 6.B.5, VM-21 Section 9, VM-31 Section 3.C.5, VM-31 Section 3.D.6.f, VM-31 Section 3.D.14.a and 3.D.14.b, VM-31 Section 3.E.5, VM-31 Section 3.F.8, VM-31 Section 3.F.12.c, VM-31 Section 3.F.16.a and Section 3.F.16.b

January 1, 2021 NAIC Valuation Manual

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted or changed by providing a red-line (turn on “track changes” in Word®) version of the verbiage. (You may do this through an attachment.)

See attached.

4. State the reason for the proposed amendment? (You may do this through an attachment.)

**Summary of 4/2/2021 Updates:**

1. Revisions were made to VM-20 Section 7.K.4 (add “supporting the policies”) and VM-21 Section 9.A.6 (add “supporting the contracts”) in response to Nationwide’s comments.
2. We added a definition for “hedging transactions,” taken from the APPM but modified slightly to be consistent with Valuation Manual terminology in response to Will Wilton’s comments.
3. We have updated the list of CDHS criteria in response to Will Wilton’s comments where we agreed:
   1. Added “significant” before risks in item (c) of the CDHS definition.
   2. Combined items (f) – (h) in the CDHS definition.
   3. Change “person or persons” to “group or area, including whether internal or external,” in item (j) of the CDHS definition.
   4. We did not remove items (k) or (l) as suggested by Will Wilton, as we find this information useful to regulators. Given that these are retained, and because we were uncertain what else would be included in the new “primary risks” item suggested by Will Wilton, we have not added it. If we can be provided additional information on the risks to be reflected under this new item, an edit could be made.
4. We modified the definition of a SHS to clarify “normally modelled” in response to the ACLI comment and clarify what may be a SHS in response to Will Wilton’s comment (e.g., a single bond would not be a SHS).

We have added comment bubbles in the draft below to flag where we have made edits or chosen not to make edits and why.

We propose having consistent requirements for a CDHS in VM-20 and VM-21, as well as any future work on VM-22, and consolidating these requirements in the VM-01 definition of a CDHS. This involves adding two criteria to VM-21’s definition of CDHS that currently exist for VM-20:

* Areas where basis, gap or assumption risk related to the hedging strategy have been identified.
* The circumstances under which hedging strategy will not be effective in hedging the risks.

These criteria are both reasonable and apply in principle to VM-21, and to any future work on VM-22, as well as VM-20.

Further, we propose revising the requirement for hedging to be a CDHS in order for future hedging to be modeled under VM-20, VM-21, and LR027’s C-3 RBC Amount calculation to only apply when modeling such hedging reduces the life reserve level or variable annuity Total Asset Requirement (TAR) level.

The current regulatory requirements for hedging to be a CDHS in order for future hedging to be modeled under VM-20, modeled under VM-21, modeled for the C-3 RBC Amount calculation for variable annuities, and to be eligible for SSAP 108 treatment are all logical requirements when one considers whether hedging should be allowed to reduce the life reserve level or variable annuity TAR level, or whether any mismatch between movements in hedge assets and movements in the corresponding reserve levels should be allowed to be amortized over time.

However, this same requirement has led to a situation of there being unintended optionality in whether a hedging strategy that is like a CDHS is modeled or is not modeled, since a company may choose to satisfy or not satisfy certain of the criteria. This has been especially relevant for cases where modeling a company’s hedging strategy would increase reserves or variable annuity TAR.

As noted in the current guidance note in VM-20 Section 7.K.1 in the 2021 *Valuation Manual*:

*“The prohibition in these modeled reserve requirements against projecting future hedging transactions other than those associated with a clearly defined hedging strategy is intended to address initial concerns expressed by various parties that reserves could be unduly reduced by reflection of programs whose future execution and performance may have greater uncertainty. The prohibition appears, however, to be in conflict with Principle 2 listed in VM-21. Companies may actually execute and reflect in their risk assessment and evaluation processes hedging strategies similar in many ways to clearly defined hedging strategies but lack sufficient clarity in one or more of the qualification criteria. By excluding the associated derivative instruments, the investment strategy that is modeled may also not reflect the investment strategy the company actually uses. Further, because the future hedging transactions may be a net cost to the company in some scenarios and a net benefit in other scenarios, the exclusion of such transactions can result in a modeled reserve that is either lower or higher than it would have been if the transactions were not excluded. The direction of such impact on the reserves could also change from period to period as the actual and projected paths of economic conditions change. A more graded approach to recognition of non-qualifying hedging strategies may be more theoretically consistent with Principle 2. It is recommended that as greater experience is gained by actuaries and state insurance regulators with the principle-based approach and as industry hedging programs mature, the various requirements of this section be reviewed.”*

We propose to continue addressing the regulatory concern that reserves could be unduly reduced by reflection of programs whose future execution and performance may have greater uncertainty, by continuing to only allowing hedging strategies that qualify as a CDHS to reduce life reserves and variable annuity TAR. However, we propose that the treatment of CDHS be made more principles-based and less subject to manipulation. To accomplish this, the proposal requires that any hedging strategy **that is a part of the investment strategy** supporting the policies and is **normally modeled as part of the company’s risk assessment and evaluation processes** be modeled as if it were a CDHS if doing so results in an increase in life reserves or variable annuity TAR.

That is, CDHS becomes a requirement solely for hedging strategies that reduce life reserves or variable annuity TAR, and so becomes a more clear regulatory guardrail requiring that hedging strategies that reduce life reserves or variable annuity TAR must be clearly defined.

We continue to need the concept of a CDHS. A CDHS simply formally documents items that a company should be able to document for a robust, well-defined hedging strategy. It requires that the following be identified:

1. The specific risks being hedged (e.g., cash flow, policy interest credits, delta, rho, vega, etc.).
2. The hedge objectives.
3. The risks that are not hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.).
4. The financial instruments used to hedge the risks.
5. The hedge trading rules, including the permitted tolerances from hedging objectives.
6. The metrics for measuring hedging effectiveness.
7. The criteria used to measure hedging effectiveness.
8. The frequency of measuring hedging effectiveness.
9. The conditions under which hedging will not take place.
10. The person or persons responsible for implementing the hedging strategy.
11. Areas where basis, gap or assumption risk related to the hedging strategy have been identified.
12. The circumstances under which hedging strategy will not be effective in hedging the risks.

While the last two criteria have historically applied for life but not variable annuities, these are all reasonable documentation items that for a robust, well-defined hedging strategy regardless of whether the product is life or variable annuity.

The concept of a CDHS is used for accounting in SSAP 108. SSAP 108 allows companies to set up a deferred asset or liability to amortize the mismatch between changes in the value of the liability and changes in the value of the hedging instruments attributable to the hedged risk underlying a highly effective CDHS modeled for VM-21. Allowing this treatment encourages companies to reduce risk through robust, well-defined and highly effective hedging. Without having the hedging strategy be well-defined, regulators could not rely on past effectiveness being indicative of future effectiveness, and so could not offer companies the benefit of SSAP 108 treatment. Once we recognize the need for a concept of a well-defined hedging strategy, the only question is what criteria would need to be met to be considered well-defined – that is, what criteria should be required to be considered a CDHS. This is a distinct question from whether the concept of a CDHS is needed. We have not heard critiques of individual criteria in the CDHS definition, but consideration of the criteria is appropriate as we go forward to make the definitions in VM-20 and VM-21 consistent. Similarly, in reserve and capital calculations, we rely on the concept of historical effectiveness to determine an error factor. If modeling hedging reduces the reserve or capital amount, the error factor determines the magnitude to which this is reflected. However, this use of the historical effectiveness relies on the hedging strategy being well-documented and comparable between historical hedging and planned future hedging. So, again, a need for hedging strategies to be well-defined presents itself – a CDHS concept is needed.

Finally, edits to VM-31 are needed to reflect these updates and bring VM-20 and VM-21 reporting requirements more in line with one another where appropriate.

**Note on Coordination with RBC and APPM**: We have reviewed, and with these edits there are no corresponding edits necessary for LR027 for RBC but corresponding edits are necessary for SSAP 108. A referral to SAPWG is to be concurrently considered with this APF.

**VM-01**

* The term “clearly defined hedging strategy” (CDHS) means a strategy undertaken by a company to manage risks through the future purchase or sale of hedging instruments and the opening and closing of hedging positions. A CDHS must identify:

1. The specific risks being hedged (e.g., cash flow, policy interest credits, delta, rho, vega, etc.).
2. The hedge objectives.
3. The significant risks that are not hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.).
4. The financial instruments used to hedge the risks.
5. The hedge trading rules, including the permitted tolerances from hedging objectives.
6. The metrics, criteria, and frequency for measuring hedging effectiveness.
7. The conditions under which hedging will not take place.
8. The group or area, including whether internal or external, responsible for implementing the hedging strategy.
9. Areas where basis, gap or assumption risk related to the hedging strategy have been identified.
10. The circumstances under which hedging strategy will not be effective in hedging the risks.

The hedge strategy may be dynamic, static or a combination thereof. A strategy involving the offsetting of the risks associated with products falling under the scope of different requirements within the *Valuation Manual* (e.g., VM-20, VM-21, or VM-22) does not qualify as CDHS. A CDHS must meet all of the principles outlined in VM-21 Section 1.B (the most relevant of which may be Principle 5).

**Guidance Note:** For purposes of the above criteria, “effectiveness” need not be measured in a manner as defined in *SSAP No. 86—Derivatives* in the AP&P Manual.

* The term “hedging transaction” means a derivative(s) transaction which is entered into and maintained to reduce:
  1. The risk of a change in the fair value or cash flow of assets and liabilities which the company has acquired or incurred or has a firm commitment to acquire or incur or for which the company has a forecasted acquisition or incurrence; or
  2. The currency exchange rate risk or the degree of foreign currency exposure in assets and liabilities which the company has acquired or incurred or has a firm commitment to acquire or incur or for which the company has forecasted acquisition or incurrence.
* The term “Seasoned Hedging Strategy” (SHS) means a hedging strategy that is part of the company’s investment strategy and for which future hedging transactions are normally modeled as part of the company’s risk assessment and evaluation process. A SHS may or may not be a CDHS.

The hedge strategy may be dynamic, static, or a combination thereof. A strategy involving the offsetting of the risks associated with products falling under the scope of different requirements within the *Valuation Manual* (e.g., VM-20, VM-21, or VM-22) does not qualify as SHS. A SHS must meet all of the principles outlined in VM-21 Section 1.B (the most relevant of which may be Principle 5).

**VM-20 Section 6.A.1.b**

A company may not exclude a group of policies for which there is one or more CDHS or one or more SHS required to be modeled pursuant to Section 7.K.4 from stochastic reserve requirements, except in the case where all CDHS and all SHS required to be modeled pursuant to Section 7.K.4 are solely associated with product features that are determined to not be material under Section 7.B.1 due to low utilization.

**VM-20 Section 7.E.1.g**

Notwithstanding the above requirements, the modeled reserve shall be the higher of that produced by the model investment strategy and that produced by substituting an alternative investment strategy in which the fixed income reinvestment assets have the same weighted average life (WAL) as the reinvestment assets in the model investment strategy and are all public non-callable corporate bonds with gross asset spreads, asset default costs and investment expenses by projection year that are consistent with a credit quality blend of 50% PBR credit rating 6 (A2/A) and 50% PBR credit rating 3 (Aa2/AA).

Policy loans, equities and derivative instruments associated with the execution of a CDHS (in compliance with the definition of CDHS in VM-01) or a SHS that is required to be modeled pursuant to Section 7.K.4 are not affected by this requirement.

**VM-20 Section 7.K**

K. Modeling of Derivative Programs

1. When determining the deterministic reserve and the stochastic reserve, the company shall include in the projections the appropriate costs and benefits of derivative instruments that are currently held by the company in support of the policies subject to these requirements. The company shall also include the appropriate costs and benefits of anticipated future derivative instrument transactions associated with the execution of a CDHS or a SHS that is required to be modeled pursuant to Section 7.K.4, as well as the appropriate costs and benefits of anticipated future derivative instrument transactions associated with non-hedging derivative programs (e.g., replication, income generation) undertaken as part of the investment strategy supporting the policies, provided they are normally modeled as part of the company’s risk assessment and evaluation processes.
2. For each derivative program that is modeled, the company shall reflect the company’s established investment policy and procedures for that program; project expected program performance along each scenario; and recognize all benefits, residual risks and associated frictional costs. The residual risks include, but are not limited to: basis, gap, price, parameter estimation and variation in assumptions (mortality, persistency, withdrawal, etc.). Frictional costs include, but are not limited to: transaction, margin (opportunity costs associated with margin requirements) and administration. For CDHS or SHS required to be modeled pursuant to Section 7.K.4, the company may not assume that residual risks and frictional costs have a value of zero, unless the company demonstrates in the PBR Actuarial Report that “zero” is an appropriate expectation.

1. In circumstances where one or more material risk factors related to a derivative program are not fully captured within the cash-flow model used to calculate CTE 70, the company shall reflect such risk factors by increasing the stochastic reserve as described in Section 5.E.
2. If a SHS supporting the policies is not a CDHS but modeling it would result in an increase to the company’s minimum reserve, then the company shall model the SHS as if it were a CDHS when calculating reserves under VM-20.

**VM-20 Section 7.L (Remove entire Section 7.L)**

**VM-21 Section 1.D.2 (Delete entire definition and renumber subsequent sections VM-21 Section 1.D.3 and VM-21 Section 1.D.4)**

**VM-21 Section 4.A.4**

Modeling of Hedges

1. For a company that does not have a CDHS or a SHS that is required to be modeled pursuant to Section 9.A.6:
2. The company shall not consider the cash flows from any future hedge purchases or any rebalancing of existing hedge assets in its modeling.
3. Existing hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements shall be included in the starting assets. The hedge assets may then be considered in one of two ways:
4. Include the asset cash flows from any contractual payments and maturity values in the projection model; or
5. No hedge positions – in which case the hedge positions held on the valuation date are replaced with cash and/or other general account assets in an amount equal to the aggregate market value of these hedge positions.

**Guidance Note:** If the hedge positions held on the valuation date are replaced with cash, then as with any other cash, such amounts may then be invested following the company’s investment strategy.

A company may switch from method a) to method b) at any time, but it may only change from b) to a) with the approval of the domiciliary commissioner.

1. For a company with a CDHS or a SHS that is required to be modeled pursuant to Section 9.A.6, the detailed requirements for the modeling of hedges are defined in Section 9. The following paragraphs are a high-level summary and do not supersede the detailed requirements.
2. The appropriate costs and benefits of hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements shall be included in the projections used in the determination of the stochastic reserve.
3. The projections shall take into account the appropriate costs and benefits of hedge positions expected to be held in the future through the execution of the CDHS or the SHS that is required to be modeled pursuant to Section 9.A.6. Because models do not always accurately portray the results of hedge programs, the company shall, through back-testing and other means, assess the accuracy of the hedge modeling. The company shall determine a stochastic reserve as the weighted average of two CTE values; first, a CTE70 (“best efforts”) representing the company’s projection of all of the hedge cash flows, including future hedge purchases, and a second CTE70 (“adjusted”) which shall use only hedge assets held by the company on the valuation date and no future hedge purchases. These are discussed in greater detail in Section 9. The stochastic reserve shall be the weighted average of the two CTE70 values, where the weights reflect the error factor (E) determined following the guidance of Section 9.C.4.
4. The company is responsible for verifying compliance with CDHS requirements, or SHS requirements if required to be modeled pursuant to Section 9.A.6, and any other requirements in Section 9 for all hedging instruments included in the projections.
5. The use of products not falling under the scope of these requirements (e.g., equity-indexed annuities) as a hedge shall not be recognized in the determination of accumulated deficiencies.

**VM-21 Section 4.D.4.b**

Notwithstanding the above requirements, the model investment strategy and any non-prescribed asset spreads shall be adjusted as necessary so that the aggregate reserve is not less than that which would be obtained by substituting an alternative investment strategy in which all fixed income reinvestment assets are public non-callable corporate bonds with gross asset spreads, asset default costs, and investment expenses by projection year that are consistent with a credit quality blend of 50% PBR credit rating 6 (A2/A) and 50% PBR credit rating 3 (Aa2/AA).

Policy loans, equities and derivative instruments associated with the execution of a CDHS (in compliance with the definition of CDHS in VM-01) or a SHS that is required to be modeled pursuant to Section 9.A.6 are not affected by this requirement.

**VM-21 Section 6.B.3.a.ii – Footnote (Footnote at Bottom of Page 21-22)**

1. Throughout this Section 6, references to CTE70 (adjusted) shall also mean the Stochastic Reserve for a company that does not have a CDHS or a SHS that is required to be modeled pursuant to Section 9.A.6 as discussed in Section 4.A.4.a.

**VM-21 Section 6.B.3.b.ii**

Calculate the Prescribed Projections Amount as the CTE70 (adjusted) using the same method as that outlined in Section 9.C (which is the same as the stochastic reserves following Section 4.A.4.a for a company that does not have a CDHS or a SHS that is required to be modeled pursuant to Section 9.A.6) but substituting the assumptions prescribed by Section 6.C. The calculation of this Prescribed Projections Amount also requires that the scenario reserve for any given scenario be equal to or in excess of the cash surrender value in aggregate on the valuation date for the group of contracts modeled in the projection.

**VM-21 Section 6.B.5**

Cash flows associated with hedging shall be projected in the same manner as that used in the calculation of the CTE70 (adjusted) as discussed in Section 9.C or Section 4.A.4.a for a company without a CDHS or a SHS that is required to be modeled pursuant to Section 9.A.6.

**VM-21 Section 9**

**Section 9: Modeling of Hedges under a CDHS**

A. Initial Considerations

1. Subject to Section 9.C.2, the appropriate costs and benefits of hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements shall be included in the calculation of the stochastic reserve, determined in accordance with Section 3.D and Section 4.D.
2. If the company is following a CDHS, in accordance with an investment policy adopted by the board of directors, or a committee of board members, the company shall take into account the costs and benefits of hedge positions expected to be held by the company in the future along each scenario based on the execution of the hedging strategy, and it is eligible to reduce the amount of the stochastic reserve using projections otherwise calculated. The investment policy must clearly articulate the company’s hedging objectives, including the metrics that drive rebalancing/trading. This specification could include maximum tolerable values for investment losses, earnings, volatility, exposure, etc. in either absolute or relative terms over one or more investment horizons vis-à-vis the chance of occurrence. Company management is responsible for developing, documenting, executing and evaluating the investment strategy, including the hedging strategy, used to implement the investment policy.
3. For this purpose, the investment assets refer to all the assets, including derivatives supporting covered products and guarantees. This also is referred to as the investment portfolio. The investment strategy is the set of all asset holdings at all points in time in all scenarios. The hedging portfolio, which also is referred to as the hedging assets, is a subset of the investment assets. The hedging strategy is the hedging asset holdings at all points in time in all scenarios. There is no attempt to distinguish what is the hedging portfolio and what is the investment portfolio in this section. Nor is the distinction between investment strategy and hedging strategy formally made here. Where necessary to give effect to the intent of this section, the requirements applicable to the hedging portfolio or the hedging strategy are to apply to the overall investment portfolio and investment strategy.
4. This particularly applies to restrictions on the reasonableness or acceptability of the models that make up the stochastic cash-flow model used to perform the projections, since these restrictions are inherently restrictions on the joint modeling of the hedging and non-hedging portfolio. To give effect to these requirements, they must apply to the overall investment strategy and investment portfolio.
5. Before either a new or revised hedging strategy can be used to reduce the amount of the stochastic reserve otherwise calculated, the hedging strategy should be in place (i.e., effectively implemented by the company) for at least three months. The company may meet the time requirement by having evaluated the effective implementation of the hedging strategy for at least three months without actually having executed the trades indicated by the hedging strategy (e.g., mock testing or by having effectively implemented the strategy with similar annuity products for at least three months).
6. If a SHS supporting the contracts is not a CDHS but modeling it as if it were a CDHS would result in an increase in the company’s TAR, then the company shall model the SHS as if it were a CDHS when calculating reserves under AG43 and/or VM-21 and when calculating the C-3 RBC Amount under LR027. The company shall not treat the SHS as a CDHS for purposes of *SSAP 108.*

B. Modeling Approaches

1. The analysis of the impact of the hedging strategy on cash flows is typically performed using either one of two types of methods as described below. Although a hedging strategy normally would 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 stochastic reserve otherwise calculated.
2. The fundamental characteristic of the first type of method, referred to as the “explicit method,” is that hedging positions and their resulting cash flows are included in the stochastic cash-flow model used to determine the scenario reserve, as discussed in Section 3.D, for each scenario.
3. The fundamental characteristic of the second type of method, referred to as the “implicit method,” is that the effectiveness of the current hedging strategy on future cash flows is evaluated, in part or in whole, outside of the stochastic cash-flow model. There are multiple ways that this type of modeling can be implemented. In this case, the reduction to the stochastic reserve otherwise calculated should be commensurate with the degree of effectiveness of the hedging strategy in reducing accumulated deficiencies otherwise calculated.
4. Regardless of the methodology used by the company, the ultimate effect of the current hedging strategy (including currently held hedge positions) on the stochastic reserve 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 stochastic reserve 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.

**Guidance Note:** No hedging strategy is perfect. A given hedging strategy may eliminate or reduce some but not all risks, transform some risks into others, introduce new risks, or have 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

1. A safe harbor approach is permitted for CDHS reflection for those companies whose modeled hedge assets comprise only linear instruments not sensitive to implied volatility. For companies with option-based hedge strategies, electing this approach would require representing the option-based portion of the strategy as a delta-rho two-Greek hedge program. The normally modeled option portfolio would be replaced with a set of linear instruments that have the same first-order Greeks as the original option portfolio.

C. Calculation of Stochastic Reserve (Reported)

* + 1. The company shall calculate CTE70 (best efforts)—the results obtained when the CTE70 is based on incorporating the CDHS (including both currently held and future hedge positions) into the stochastic cash-flow model on a best efforts basis, including all of the factors and assumptions needed to execute the CDHS (e.g., stochastic implied volatility). The determination of CTE70 (best efforts) may utilize either explicit or implicit modeling techniques.
    2. The company shall calculate a CTE70 (adjusted) by recalculating the CTE70 assuming the company has no CDHS, therefore following the requirements of Section 4.A.4.a.
    3. Because most models will include at least some approximations or idealistic assumptions, CTE70 (best efforts) may overstate the impact of the hedging strategy. To compensate for potential overstatement of the impact of the hedging strategy, the value for the stochastic reserve is given by:

Stochastic reserve = CTE70 (best efforts) + E × max[0, CTE70 (adjusted) – CTE70 (best efforts)]

* + 1. The company shall specify a value for *E* (the “error factor”) in the range from 5% to 100% to reflect the company’s view of the potential error resulting from 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. The greater the ability of the stochastic model to capture all risks and uncertainties, the lower the value of *E.* The value of *E* may be as low as 5% only if the model used to determine the CTE70 (best efforts) effectively reflects all of the parameters used in the hedging strategy. 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, reflecting the greater likelihood of error. Likewise, simplistic hedge cash-flow models shall assume a higher likelihood of error.
    2. The company shall conduct a formal back-test, based on an analysis of at least the most recent 12 months, to assess how well the model is able to replicate the hedging strategy in a way that supports the determination of the value used for *E*.
    3. Such a back-test shall involve one of the following analyses:

a. For companies that model hedge cash flows directly (“explicit method”), replace the stochastic scenarios used in calculating the CTE70 (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. For this calculation, the model assumptions may be replaced with parameters that reflect actual experience during the back-testing period. In order to isolate the comparison between the modeled hedge strategy and actual hedge results for this calculation, the projected liabilities should accurately reflect the actual liabilities throughout the back-testing period; therefore, adjustments that facilitate this accuracy (e.g. reflecting actual experience instead of model assumptions, including new business, etc.) are permissible.

To support the choice of a low value of E, the company should ascertain that the projected hedge asset gains and losses are within close range of 100% (e.g., 80–125%) of the actual hedge asset gains and losses. The company 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 model hedge cash flows implicitly by quantifying the cost and benefit of hedging using the fair value of the hedged item (an “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:

i. Determine the hedge asset gains and losses—both realized and unrealized—incurred over the month attributable to equity, interest rate, and implied volatility movements.

ii. 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 a manner that reflects the proportion of risks hedged (e.g., if a company elects to hedge 50% of a contract’s market risks, it should quantify the fair value of the hedged item as 50% of the fair value of the contract).

iii. Calculate the delta coverage ratio as the ratio between (i) and (ii) attributable to equity movements.

iv. Calculate the rho coverage ratio as the ratio between (i) and (ii) attributable to interest rate movements.

v. Calculate the vega coverage ratio as the ratio between (i) and (ii) attributable to implied volatility movements.

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

vii. In addition, the company should be able to demonstrate that the vega coverage ratio is within close range of 100 % 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 CTE70 (best efforts). Otherwise, the company shall quantify the fair value of the hedged item for the purpose of calculating CTE70 (best efforts) in a manner consistent with the realized volatility of the scenarios captured in the CTE (best efforts).

c. Companies that do not model hedge cash flows explicitly, but that also do not use the implicit method as outlined in Section 9.C.6.b above, shall conduct the formal back-test in a manner that allows the company to clearly illustrate the appropriateness of the selected method for reflecting the cost and benefit of hedging, as well as the value used for E.

* + 1. A company that does not have 12 months of experience to date shall set E to a value that reflects the amount of experience available, and the degree and nature of any change to the hedge program. For a material change in strategy, with no history, E should be at least 0.50. However, E may be lower than 0.50 if some reliable experience is available and/or if the change in strategy is a refinement rather than a substantial change in strategy.

**Guidance Note:** The following examples are provided as guidance for determining the E factor when there has been a change to the hedge program:

* The error factor should be temporarily large (e.g., ≥ 50%) for substantial changes in hedge methodology (e.g., moving from a fair-value based strategy to a stop-loss strategy) where the company has not been able to provide a meaningful simulation of hedge performance based on the new strategy.
* A temporary moderate increase (e.g., 15–30%) in error factor should be used for substantial modifications to hedge programs or CDHS modeling where meaningful simulation has not been created (e.g., adding second-order hedging, such as gamma or rate convexity).
* No increase in the error factor may be used for incremental modifications to the hedge strategy (e.g., adding death benefits to a program that previously covered only living benefits, or moving from swaps to Treasury Department futures).

D. Additional Considerations for CTE70 (best efforts)

If the company is following a CDHS, the fair value of the portfolio of contracts falling within the scope of these requirements shall be computed and compared to the CTE70 (best efforts) and CTE70 (adjusted). If the CTE70 (best efforts) is below both the fair value and CTE70 (adjusted), the company should be prepared to explain why that result is reasonable.

For the purposes of this analysis, the stochastic reserve and fair value calculations shall be done without requiring the scenario reserve for any given scenario to be equal to or in excess of the cash surrender value in aggregate for the group of contracts modeled in the projection.

E. Specific Considerations and Requirements

* + 1. As part of the process of choosing a methodology and assumptions for estimating the future effectiveness of the current hedging strategy (including currently held hedge positions) for purposes of reducing the stochastic reserve, the company should review actual historical hedging effectiveness. The company shall evaluate the appropriateness of the assumptions on future trading, transaction costs, other elements of the model, the strategy, the mix of business and other items that are likely to result in materially adverse results. This includes an analysis of model assumptions that, when combined with the reliance on the hedging strategy, are likely to result in adverse results relative to those modeled. The parameters and assumptions shall be adjusted (based on testing contingent on the strategy used and other assumptions) to levels that fully reflect the risk based on historical ranges and foreseeable future ranges of the assumptions and parameters. If this is not possible by parameter adjustment, the model shall be modified to reflect them at either anticipated experience or adverse estimates of the parameters.
    2. A discontinuous hedging strategy is a hedging strategy where the relationships between the sensitivities to equity markets and interest rates (commonly referred to as the Greeks) associated with the guaranteed contract holder options embedded in the variable annuities and other in-scope products and these same sensitivities associated with the hedging assets are subject to material discontinuities. This includes, but is not limited to, a hedging strategy where material hedging assets will be obtained when the variable annuity account balances reach a predetermined level in relationship to the guarantees. Any hedging strategy, including a delta hedging strategy, can be a discontinuous hedging strategy if implementation of the strategy permits material discontinuities between the sensitivities to equity markets and interest rates associated with the guaranteed contract holder options embedded in the variable annuities and other in-scope products and these same sensitivities associated with the hedging assets. There may be scenarios that are particularly costly to discontinuous hedging strategies, especially where those result in large discontinuous changes in sensitivities (Greeks) associated with the hedging assets. Where discontinuous hedging strategies contribute materially to a reduction in the stochastic reserve, the company must evaluate the interaction of future trigger definitions and the discontinuous hedging strategy, in addition to the items mentioned in the previous paragraph. This includes an analysis of model assumptions that, when combined with the reliance on the discontinuous hedging strategy, may result in adverse results relative to those modeled.
    3. A strategy that has a strong dependence on acquiring hedging assets at specific times that depend on specific values of an index or other market indicators may not be implemented as precisely as planned.
    4. The combination of elements of the stochastic cash-flow model—including the initial actual market asset prices, prices for trading at future dates, transaction costs and other assumptions—should be analyzed by the company as to whether the stochastic cash-flow model permits hedging strategies that make money in some scenarios without losing a reasonable amount in some other scenarios. This includes, but is not limited to:

a. Hedging strategies with no initial investment that never lose money in any scenario and in some scenarios make money.

b. Hedging strategies that, with a given amount of initial money, never make less than accumulation at the one-period risk-free rates in any scenario but make more than this in one or more scenarios.

* + 1. If the stochastic cash-flow model allows for such situations, the company should be satisfied that the results do not materially rely directly or indirectly on the use of such strategies. If the results do materially rely directly or indirectly on the use of such strategies, the strategies may not be used to reduce the stochastic reserve otherwise calculated.
    2. In addition to the above, the method used to determine prices of financial instruments for trading in scenarios should be compared to actual initial market prices. In addition to comparisons to initial market prices, there should be testing of the pricing models that are used to determine subsequent prices when scenarios involve trading financial instruments. This testing should consider historical relationships. For example, if a method is used where recent volatility in the scenario is one of the determinants of prices for trading in that scenario, then that model should approximate actual historic prices in similar circumstances in history.

**VM-31 Section 3.C.5**

Assets and Risk Management – A brief description of the asset portfolio, and the approach used to model risk management strategies, such as hedging, and other derivative programs, including a description of any CDHS and any SHS that is required to be modeled pursuant to VM-20 Section 7.K.4.

**VM-31 Section 3.D.6.f**

Risk Management – Detailed description of model risk management strategies, such as hedging and other derivative programs, specific to the groups of policies covered in this sub-report and not discussed in the Life Summary Section 3.C.5. This should include documentation for any hedging strategy that meets the requirements to be a CDHS. It should also include, for any SHS that is required to be modeled pursuant to VM-20 Section 7.K.4, documentation of any CDHS criteria met, listing of CDHS criteria not met, and documentation of the reserve level with and without the SHS being modeled as if it were a CDHS.

**VM-31 Section 3.D.14.a and 3.D.14.b**

1. Investment Officer on Investments – A certification from a duly authorized investment officer that the modeled company investment strategy, including any CDHS and any SHS that is required to be modeled pursuant to VM-20 Section 7.K.4, is representative of and consistent with the company’s investment policy.
2. Qualified Actuary on Investments – A certification by a qualified actuary, not necessarily the same qualified actuary that has been assigned responsibility for the PBR Actuarial Report or this sub-report, that the modeling of any CDHS and any SHS that is required to be modeled pursuant to VM-20 Section 7.K.4 was performed in accordance with VM-20 and in compliance with all applicable ASOPs, and the alternative investment strategy as defined in VM-20 Section 7.E.1.g reflects the prescribed mix of assets with the same WAL as the reinvestment assets in the company investment strategy.

**VM-31 Section 3.E.5**

Assets and Risk Management – A brief description of the general account asset portfolio, and the approach used to model risk management strategies, such as hedging and other derivative programs, including a description of any CDHS or any SHS that is required to be modeled pursuant to VM-21 Section 9.A.6, and any material changes to the hedging strategy from the prior year.

**VM-31 Section 3.F.8**

Hedging and Risk Management – The following information regarding the hedging and risk management assumptions used by the company in performing a principle-based valuation under VM-21:

1. Strategies – Detailed description of risk management strategies, such as hedging and other derivative programs, including any CDHS or any SHS that is required to be modeled pursuant to VM-21 Section 9.A.6, specific to the groups of contracts covered in this sub-report.
2. Descriptions of basis risk, gap risk, price risk and assumption risk.
3. Methods and criteria for estimating the a priori effectiveness of the strategy.
4. Results of any reviews of actual historical hedging effectiveness.
5. CDHS – Documentation for any hedging strategy that meets the requirements to be a CDHS.
6. Other Modeled Hedging Strategies – Documentation for any SHS that is required to be modeled pursuant to VM-21 Section 9.A.6, including documentation of any CDHS criteria met, listing of CDHS criteria not met, and documentation of the TAR level with and without the SHS being modeled as if it were a CDHS.
7. Strategy Changes – Discussion of any changes to the hedging strategy during the past 12 months, including identification of the change, reasons for the change, and the implementation date of the change.
8. Hedge Modeling – Description of how the hedge strategy was incorporated into modeling, including:
9. Differences in timing between model and actual strategy implementation.
10. For a company that does not have a CDHS or a SHS that is required to be modeled pursuant to VM-21 Section 9.A.6, disclosure of the method used to consider hedge assets included in the starting assets, either (1) including the asset cash flows in the projection model; or (2) replacing the hedge positions with cash and/or other general account assets in an amount equal to the market value of the hedge positions, as discussed in VM-21 Section 4.A.4.a.
11. Evaluations of the appropriateness of the assumptions on future trading, transaction costs, other elements of the model, the strategy, and other items that are likely to result in materially adverse results.
12. If residual risks and frictional costs are assumed to have a value of zero, a demonstration that a value of zero is an appropriate expectation.
13. Any discontinuous hedging strategies modeled, and where such discontinuous hedging strategies contribute materially to a reduction in the stochastic reserve, any evaluations of the interaction of future trigger definitions and the discontinuous hedging strategy, including any analyses of model assumptions that, when combined with the reliance on the discontinuous hedging strategy, may result in adverse results relative to those modeled.
14. Disclosure of any situations where the modeled hedging strategies make money in some scenarios without losing a reasonable amount in some other scenarios, and an explanation of why the situations are not material for determining the CTE 70 (best efforts).
15. Results of any testing of the method used to determine prices of financial instruments for trading in scenarios against actual initial market prices, including how the testing considered historical relationships. If there are substantial discrepancies, disclosure of the substantial discrepancies and documentation as to why the model-based prices are appropriate for determining the stochastic reserve.
16. Any model adjustments made when calculating CTE 70 (adjusted), in particular, any liquidation or substitution of assets for currently held hedges.
17. Error Factor (*E)* and Back-Testing – Description of *E*, the error factor, and formal back-tests performed, including:
18. The value of *E*, and the approach and rationale for the value of *E* used in the reserve calculation.
19. For companies that model hedge cash flows using the explicit method, as described in VM-21 Section 9.C.6.a, and have 12 months of experience, an analysis of at least the most recent 12 months of experience and the results of a back-test showing that the model is able to replicate the hedging results experienced in a way that justifies the value used for *E*. Include at least a ratio of the actual change in market value of the hedges to the modeled change in market value of the hedges at least quarterly.
20. For companies that model hedge cash flows using the implicit method, and have 12 months of experience, as described in VM-21 Section 9.C.6.b, the results of a back-test in which (a) actual hedge asset gains and losses are compared against (b) proportional fair value movements in hedged liability, including:
21. Delta, rho and vega coverage ratios in each month over the back-testing period, which may be presented in a chart or graph.
22. 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.
23. For companies that do not model hedge cash flows using either the explicit method or the implicit method, as described in VM-21 Section 9.C.6.c, and have 12 months of experience, the results of the formal back-test conducted to validate the appropriateness of the selected method and value used for E.
24. For companies that do not have 12 months of experience, the basis for the value of *E* is chosen based on the guidance provided in VM-21 Section 9.C.7, considering the actual history available and the degree and nature of any changes made to the hedge strategy.
25. Safe Harbor for CDHS – If electing the safe harbor approach for CDHS, as discussed in VM-21 Section 9.C.8, a description of the linear instruments used to model the option portfolio.
26. Hedge Model Results – Disclosure of whether the calculated CTE 70 (best efforts) is below both the fair value and CTE 70 (adjusted), and if so, justification for why that result is reasonable, as discussed in VM-21 Section 9.D.

**VM-31 Section 3.F.12.c**

CTEPA – If using the CTEPA method, a summary including:

1. Disclosure (in tabular form) of the scenario reserves using the same method and assumptions as those used by the company to calculate CTE 70 (adjusted) as outlined in VM-21 Section 9.C (or the stochastic reserves following VM-21 Section 4.A.4.a for a company that does not have a CDHS or a SHS that is required to be modeled pursuant to VM-21 Section 9.A.6), as well as the corresponding scenarios reserves substituting the assumptions prescribed by VM-21 Section 6.C.
2. Summary of results from a cumulative decrement projection along the scenario whose reserve value is closest to the CTE 70 (adjusted), as outlined in VM-21 Section 9.C (or the stochastic reserves following VM-21 Section 4.A.4.a for a company that does not have a CDHS or a SHS that is required to be modeled pursuant to VM-21 Section 9.A.6), under the assumptions outlined in VM-21 Section 6.C. Such a cumulative decrement projection shall include, at the end of each projection year, the projected proportion (expressed as a percent of the total projected account value) of persisting contracts as well as the allocation of projected decrements across death, full surrender, account value depletion, elective annuitization, and other benefit election.
3. Summary of results from a cumulative decrement projection, identical to (ii) above, but replacing all assumptions outlined in VM-21 Section 6.C with the corresponding assumptions used in calculating the stochastic reserve.

**VM-31 Section 3.F.16.a and Section 3.F.16.b**

* 1. Investment Officer on Investments – A certification from a duly authorized investment officer that the modeled asset investment strategy, including any CDHS and any SHS that is required to be modeled pursuant to VM-21 Section 9.A.6, is consistent with the company’s current investment strategy except where the modeled reinvestment strategy may have been substituted with the alternative investment strategy, and also any CDHS meets the requirements of a CDHS.
  2. Qualified Actuary on Investments – A certification by a qualified actuary, not necessarily the same qualified actuary that has been assigned responsibility for the PBR Actuarial Report or this sub-report, that the modeling of any CDHS and any SHS that is required to be modeled pursuant to VM-21 Section 9.A.6 was performed in accordance with VM-21 and in compliance with all applicable ASOPs.