



Valuation Manual

Jan. 1, 2024 Edition

VM-21: Requirements for Principle-Based Reserves for Variable Annuities

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Section 1: Background

A. Purpose

These requirements establish the minimum reserve valuation standard for VA contracts, and certain other policies and contracts (“contracts”) as defined in Section 2.A, issued on or after the operative date of the *Valuation Manual* as required by Model #820. These requirements constitute the Commissioners Annuity Reserve Valuation Method (CARVM) for all contracts encompassed by Section 2.A.

The contracts subject to these requirements may be aggregated with the contracts subject to *Actuarial Guideline XLIII—CARVM for Variable Annuities* (AG 43), published in Appendix C of the AP&P Manual, for purposes of performing and documenting the reserve calculations.

Guidance Note:

Effectively, through reference in AG 43, the reserve requirements in VM-21 also apply to those contracts issued prior to Jan. 1, 2017, that would not otherwise be encompassed by the scope of VM-21. Reserves for contracts subject to VM-21 or AG 43 may be computed as a single group. If a company chooses to aggregate business subject to AG 43 with business subject to VM-21 in calculating the reserve, then the provisions in VM-G apply to this aggregate principle-based valuation.

Guidance Note:

Relationship to RBC Requirements

These requirements anticipate that the projections described herein are used for the determination of RBC for all of the contracts falling within the scope of these requirements. These requirements and the RBC requirements for the topics covered within Sections 4.A through 4.E are identical. However, while the projections described in these requirements are performed on a basis that ignores federal income tax, a company may elect to conduct the projections for calculating the RBC requirements by including projected federal income tax in the cash flows and reducing the discount interest rates used to reflect the effect of federal income tax as described in the RBC requirements.

A company that has elected to calculate RBC requirements in this manner may not switch back to using a calculation that ignores the effect of federal income tax without approval from the domiciliary commissioner.

B. Principles

The projection methodology used to calculate the SR, as well as the approach used to develop the Alternative Methodology, is based on the following set of principles. These principles should be followed when interpreting and applying the methodology in these requirements and analyzing the resulting reserves.

Guidance Note: The principles should be considered in their entirety, and it is required that companies meet these principles with respect to those contracts that fall within the scope of these requirements and are in force as of the valuation date to which these requirements are applied.

Principle 1: The objective of the approach used to determine the SR is to quantify the amount of statutory reserves needed by the company to be able to meet contractual obligations in light of the risks to which the company is exposed.

Principle 2: The calculation of the SR is based on the results derived from an analysis of asset and liability cash flows produced by the application of a stochastic cash-flow model to equity return and interest rate scenarios. For each scenario, the greatest present value of accumulated deficiency is calculated. The analysis reflects prudent estimate assumptions for deterministic variables and is performed in aggregate (subject to limitations related to contractual provisions) to allow the natural offset of risks within a given scenario. The methodology uses a projected total cash flow analysis by including all projected income, benefit and expense items related to the business in the model and sets the SR at a degree of confidence using the CTE measure applied to the set of scenario specific greatest present values of accumulated deficiencies that is deemed to be reasonably conservative over the span of economic cycles.

Guidance Note: Examples where full aggregation between contracts may not be possible include experience rated group contracts and the operation of reinsurance treaties.

Principle 3: The implementation of a model involves decisions about the experience assumptions and the modeling techniques to be used in measuring the risks to which the company is exposed. Generally, assumptions are to be based on the conservative end of the confidence interval. The choice of a conservative estimate for each assumption may result in a distorted measure of the total risk. Conceptually, the choice of assumptions and the modeling decisions should be made so that the final result approximates what would be obtained for the SR at the required CTE level if it were possible to calculate results over the joint distribution of all future outcomes. In applying this concept to the actual calculation of the SR, the company should be guided by evolving practice and expanding knowledge base in the measurement and management of risk.

Guidance Note: The intent of Principle 3 is to describe the conceptual framework for setting assumptions. Section 10 provides the requirements and guidance for setting contract holder behavior assumptions and includes alternatives to this framework if the company is unable to fully apply this principle. More guidance and requirements for setting assumptions in general are provided in Section 12.

Principle 4: While a stochastic cash-flow model attempts to include all real-world risks relevant to the objective of the stochastic cash-flow model and relationships among the risks, it will still contain limitations because it is only a model. The calculation of the SR is based on the results derived from the application of the stochastic cash-flow model to scenarios, while the actual statutory reserve needs of the company arise from the risks to which the company is (or will be)

exposed in reality. Any disconnect between the model and reality should be reflected in setting prudent estimate assumptions to the extent not addressed by other means.

Principle 5: Neither a cash-flow scenario model nor a method based on factors calibrated to the results of a cash-flow scenario model can completely quantify a company's exposure to risk. A model attempts to represent reality but will always remain an approximation thereto and, hence, uncertainty in future experience is an important consideration when determining the SR. Therefore, the use of assumptions, methods, models, risk management strategies (e.g., hedging), derivative instruments, structured investments or any other risk transfer arrangements (such as reinsurance) that serve solely to reduce the calculated SR without also reducing risk on scenarios similar to those used in the actual cash-flow modeling are inconsistent with these principles. The use of assumptions and risk management strategies should be appropriate to the business and not merely constructed to exploit "foreknowledge" of the components of the required methodology.

C. Risks Reflected and Risks Not Reflected

1. The risks reflected in the calculation of reserves under these requirements arise from actual or potential events or activities that are both:
 - a. Directly related to the contracts falling under the scope of these requirements or their supporting assets; and
 - b. Capable of materially affecting the reserve.
2. Categories and examples of risks reflected in the reserve calculations include, but are not necessarily limited to:
 - a. Asset risks
 - i. Separate account fund performance.
 - ii. Credit risks (e.g., default or rating downgrades).
 - iii. Commercial mortgage loan roll-over rates (roll-over of bullet loans).
 - iv. Uncertainty in the timing or duration of asset cash flows (e.g., shortening (prepayment risk) and lengthening (extension risk)).
 - v. Performance of equities, real estate and Schedule BA assets.
 - vi. Call risk on callable assets.
 - vii. Risk associated with hedge instrument (includes basis, gap, price, parameter estimation risks and variation in assumptions).
 - viii. Currency risk.
 - b. Liability risks
 - i. Reinsurer default, impairment or rating downgrade known to have occurred before or on the valuation date.
 - ii. Mortality/longevity, persistency/lapse, partial withdrawal and premium payment risks.
 - iii. Utilization risk associated with guaranteed living benefits.

- iv. Anticipated mortality trends based on observed patterns of mortality improvement or deterioration, where permitted.
 - v. Annuitization risks.
 - vi. Additional premium dump-ins (high interest rate guarantees in low interest rate environments).
 - vii. Applicable expense risks, including fluctuation in maintenance expenses directly attributable to the business, future commission expenses, and expense inflation/growth.
 - c. Combination risks
 - i. Risks modeled in the company's risk assessment processes that are related to the contracts, as described above.
 - ii. Disintermediation risk (including such risk related to payment of surrender or partial withdrawal benefits).
 - iii. Risks associated with revenue-sharing income.
3. The risks not necessarily reflected in the calculation of reserves under these requirements are:
- a. Those not reflected in the determination of RBC.
 - b. Those reflected in the determination of RBC but arising from obligations of the company not directly related to the contracts falling under the scope of these requirements, or their supporting assets, as described above.
4. Categories and examples of risks not reflected in the reserve calculations include, but are not necessarily limited to:
- a. Asset risks
 - i. Liquidity risks associated with a "run on the bank."
 - b. Liability risks
 - i. Reinsurer default, impairment or rating downgrade occurring after the valuation date.
 - ii. Catastrophic events (e.g., epidemics or terrorist events).
 - iii. Major breakthroughs in life extension technology that have not yet fundamentally altered recently observed mortality experience.
 - iv. Significant future reserve increases as an unfavorable scenario is realized.
 - c. General business risks
 - i. Deterioration of reputation.

- ii. Future changes in anticipated experience (reparameterization in the case of stochastic processes), which would be triggered if and when adverse modeled outcomes were to actually occur.
- iii. Poor management performance.
- iv. The expense risks associated with fluctuating amounts of new business.
- v. Risks associated with future economic viability of the company.
- vi. Moral hazards.
- vii. Fraud and theft.

D. Definitions

1. The term “cash surrender value” means, for the purposes of these requirements, the amount available to the contract holder upon surrender of the contract. Generally, it is equal to the account value less any applicable surrender charges, where the surrender charge reflects the availability of any free partial surrender options. However, for contracts where all or a portion of the amount available to the contract holder upon surrender is subject to a market value adjustment, the cash surrender value shall reflect the market value adjustment consistent with the required treatment of the underlying assets. That is, the cash surrender value shall reflect any market value adjustments where the underlying assets are reported at market value, but it shall not reflect any market value adjustments where the underlying assets are reported at book value.
2. The term “guaranteed minimum death benefit” (GMDB) means a provision (or provisions) for a guaranteed benefit payable on the death of a contract holder, annuitant, participant or insured where the amount payable is either (i) a minimum amount; or (ii) exceeds the minimum amount and is:
 - is increased by an amount that may be either specified by or computed from other policy or contract values; and
 - has the potential to produce a contractual total amount payable on such death that exceeds the account value, or
 - in the case of an annuity providing income payments, guarantees payment upon such death of an amount payable on death in addition to the continuation of any guaranteed income payments.

Guidance Note: The definition of GMDB includes benefits that are based on a portion of the excess of the account value over the net of premiums paid less partial withdrawals made (e.g., an earnings enhanced death benefit).

3. The term “total asset requirement” (TAR) means the sum of the reserve determined from the VM-21 requirements prior to any adjustment for the elective phase-in pursuant to Section 2.B plus the C3 RBC amount from LR027 step (paragraph D) prior to any adjustment for phase-in or smoothing.

E. Materiality

The company shall establish a standard containing the criteria for determining whether an assumption, risk factor, or other element of the principle-based valuation has a material impact on the size of the reserve or TAR. This standard shall be applied when identifying material risks.

Section 2: Scope and Effective Date

A. Scope

1. The following categories of annuities or product features, issued on or after the operative date of the *Valuation Manual* directly written or assumed through reinsurance, are subject to the requirements of VM-21:
 - a. Variable deferred annuity contracts, whether or not such contracts contain GMDBs or VAGLBs.
 - b. Variable immediate annuity contracts, whether or not such contracts contain GMDBs or VAGLBs.
 - c. Any group annuity contract containing guarantees similar in nature to GMDBs, VAGLBs or any combination thereof.

Guidance Note: The term “similar in nature” as used in Section 2.A.1.c and Section 2.A.1.d is intended to capture current products and benefits, as well as product and benefit designs that may emerge in the future. Examples of the currently known designs are listed in the Guidance below following Section 2.A.3. Any product or benefit design that does not clearly fit the scope should be evaluated on a case-by-case basis taking into consideration factors that include, but are not limited to, the nature of the guarantees, the definitions of GMDB in VM-21 and VAGLB in VM-01, and whether the contractual amounts paid in the absence of the guarantee are based on the investment performance of a market-value fund or market-value index (whether or not part of the company’s separate account).

- d. Any other policy or contract which contains guarantees similar in nature to GMDBs or VAGLBs, even if the insurer does not offer the mutual funds, variable funds, or other supporting investments to which these guarantees relate, where there is no other explicit reserve requirement. If such a benefit is offered as part of a contract that has an explicit reserve requirement and that benefit does not currently have an explicit reserve requirement:
 - i. These requirements shall be applied to the benefit on a stand-alone basis (i.e., for purposes of the reserve calculation, the benefit shall be treated as a separate contract).
 - ii. The reserve for the underlying contract, excluding any benefits valued under (i) above, is determined according to the explicit reserve requirement.
 - iii. The reserve held for the contract shall be the sum of (i) and (ii).

Guidance Note: For example, a group life contract that wraps a GMDB around a mutual fund generally would fall under the scope of these requirements since there is not an explicit reserve requirement for this type of group life contract. However, for an individual variable life contract with a GMDB and a benefit similar in nature to a VAGLB, the requirements generally would apply only to the VAGLB-type benefit, since there is an explicit reserve requirement that applies to the variable life contract and the GMDB.

2. These requirements do not apply to contracts falling under the scope of VM-A-255: *Modified Guaranteed Annuities*; however, they do apply to contracts listed above that include one or more subaccounts containing features similar in nature to those contained in modified guaranteed annuities (MGAs) (e.g., market value adjustments).
3. Separate account contracts that guarantee an index and do not offer GMDBs or VAGLBs are excluded from the scope of these requirements.

Guidance Note: Current VAGLBs include GMABs, hybrid and traditional GMIBs, lifetime and non-lifetime GMWBs, and GPAFs. These requirements will be applied to future variations on these designs and to new guarantee designs.

B. Effective Date and Phase-In

These requirements apply for valuation dates on or after Jan. 1, 2020. A company may elect to phase in these requirements over a 36-month period beginning Jan. 1, 2020. A company may elect a longer phase-in period, up to seven years, with approval of the domiciliary commissioner. The election of whether to phase in and the period of phase-in must be made prior to the Dec. 31, 2020, valuation. At the company's option, a phase-in may be terminated prior to the originally elected end of the phase-in period; the reserve would then be equal to the unadjusted reserve calculated according to the requirements of VM-21 applicable for valuation dates on or after Jan. 1, 2020. If there is a material decrease in the book of business by sale or reinsurance ceded, the company shall adjust the amount of the phase-in provision. The phase-in amount ($C = R1 - R2$, as described below) must be scaled down in proportion to the reduction in the excess reserve, measured on the effective transaction date as the reserve amount in excess of cash surrender value before and after the impact of the transaction. The company must obtain approval for any other modification of the remaining phase-in amount. The method to be used for the phase-in calculation is as follows:

1. Compute $R1$ = the reserve as of Jan. 1, 2020, following the VM-21 requirements applicable in the 2020 NAIC *Valuation Manual* for all business in-force on the valuation date. The in-force used should include any reinsurance that is expected to be recaptured during 2020.
2. Separately, compute $R2$ = the reserve as of Jan. 1, 2020, following the VM-21 requirements applicable in the 2019 NAIC *Valuation Manual* for the same in-force contracts used to compute $R1$.
3. Compute the reported reserve on the valuation date as follows:
 $\text{Reserve} = D - (B - A) * C / B$, where
 - A is the number of months that have elapsed since Dec. 31, 2019. For example, for the March 31, 2020, valuation, $A = 3$.
 - $B = 36$ unless the company has obtained approval for a longer phase-in, in which case B = number of months of approved phase-in.
 - $C = R1 - R2$
 - D is the reserve on the valuation date determined according to these requirements, prior to the phase-in adjustment.

A company may elect to apply the VM-21 requirements applicable to the 2020 NAIC *Valuation Manual* as the requirements for the valuation on Dec. 31, 2019. For such election, the phase-in

provision of Section 2.B may not be elected. Any company electing early adoption of VM-21 shall also:

1. Apply the provisions of AG 43 as amended for 2020 to the Dec. 31, 2019, valuation of contracts within the scope of that guideline.
2. Apply the Life RBC instructions for 2020 in the calculation of C-3 RBC in LR027 for 2019.
3. Follow the documentation and certification requirements of VM-31 from the 2020 *Valuation Manual* for the VA Business. In the VA Summary, clearly indicate the use of the new requirements in the section on change in methods from prior year.
4. Notify the Commissioner of the state of domicile of such elections.

Section 3: Reserve Methodology

A. Aggregate Reserve

The aggregate reserve for contracts falling within the scope of these requirements shall equal the SR (following the requirements of Section 4) plus the additional standard projection amount (following the requirements of Section 6) less any applicable PIMR for all contracts not valued under the Alternative Methodology (Section 7), plus the reserve for any contracts determined using the Alternative Methodology (following the requirements of Section 7).

B. Impact of Reinsurance Ceded

Where reinsurance is ceded for all or a portion of the contracts, all components in the aggregate reserve shall be determined post-reinsurance ceded, that is net of any reinsurance treaties that meet the statutory requirements that would allow the treaty to be accounted for as reinsurance, and pre-reinsurance ceded, that is ignoring such costs and benefits.

C. The Additional Standard Projection Amount

The additional standard projection amount is determined by applying one of the two standard projection methods defined in Section 6. The same method must be used for all contracts within a group of contracts that are aggregated together to determine the reserve, and the additional standard projection amount excluding any contracts whose reserve is determined using the Alternative Methodology. The company shall elect which method they will use to determine the additional standard projection amount. The company may not change that election for a future valuation without the approval of the domiciliary commissioner.

D. The SR

The SR shall be determined based on asset and liability projections for the contracts falling within the scope of these requirements, excluding those contracts valued using the Alternative Methodology, over a broad range of stochastically generated projection scenarios described in Section 8 and using prudent estimate assumptions as required herein.

The SR may be determined in aggregate for all contracts falling within the scope of these requirements—i.e., a single model segment— or, at the option of the company, it may be determined by subgrouping contracts into model segments, in which case the SR shall equal the sum of the amounts computed for each model segment.

The SR for any group of contracts shall be determined as CTE70 of the scenario reserves following the requirements of Section 4.

E. Alternative Methodology

For a group of variable deferred annuity contracts that contain either no guaranteed benefits or only GMDBs—i.e., no VAGLBs—the reserve may be determined using the Alternative Methodology described in Section 7 rather than using the approach described in Section 3.C and Section 3.D. However, in the event that the approach described in Section 3.C and Section 3.D has been used in prior valuations for that group of contracts, the Alternative Methodology may not be used without approval from the domiciliary commissioner.

The reserve for the group of contracts to which the Alternative Methodology is applied shall not be less than the aggregate cash surrender value of those contracts.

Groups of contracts to which the Alternative Methodology is applied are only subject to the applicable requirements for the Alternative Methodology in VM-21. Groups of contracts to which the Alternative Methodology is applied are subject to the applicable sub-report requirements outlined in VM-31 Sections 3.E and 3.F. Groups of contracts to which the Alternative Methodology is applied are not subject to the requirements of VM-G Sections 2 and 3.

F. Allocation of the Aggregate Reserve to Contracts

The aggregate reserve shall be allocated to the contracts falling within the scope of these requirements using the method outlined in Section 12.

G. Reserve to Be Held in the General Account

The portion of the aggregate reserve held in the general account shall not be less than the excess of the aggregate reserve over the aggregate cash surrender value held in the separate account and attributable to the separate account portion of all such contracts. For contracts for which a cash surrender value is not defined, the company shall substitute for cash surrender value held in the separate account the implicit amount for which the contract holder is entitled to receive income based on the performance of the separate account. For example, for a variable payout annuity for which a specific number of units is payable, the implicit amount could be the present value of that number of units, discounted at the assumed investment return and defined mortality, times the unit value as of the valuation date.

Guidance Note: This approach is equivalent to assuming that the separate account performance is equal to the assumed investment return.

H. A company may use simplifications, approximations, and modeling efficiency techniques to calculate the SR and/or the additional standard projection amount required by this section if the company can demonstrate that the use of such techniques does not understate TAR by a material amount, and the expected value of TAR calculated using simplifications, approximations, and modeling efficiency techniques is not less than the expected value of TAR calculated that does not use them.

I. The company may calculate the SR and the additional standard projection amount as of a date no earlier than three months before the valuation date, using relevant company data, provided an appropriate method is used to adjust those amounts to the valuation date. Company data used for experience studies to determine prudent estimate assumptions are not subject to this three-month limitation.

Guidance Note:

Examples of modeling efficiency techniques include, but are not limited to:

1. Choosing a reduced set of scenarios from a larger set consistent with prescribed models and parameters.
2. Generating a smaller liability or asset model to represent the full serialtim model using grouping compression techniques or other similar simplifications.

There are multiple ways of providing the demonstration required by Section 3.H. The complexity of the demonstration depends upon the simplifications, approximations, or modeling efficiency techniques used. Examples include, but are not limited to:

1. Rounding at a transactional level in a direction that is clearly and consistently conservative or is clearly and consistently unbiased with an obviously immaterial impact on the result (e.g., rounding to the nearest dollar) would satisfy 3.H without needing a demonstration. However, rounding to too few significant digits relative to the quantity being rounded, even in an unbiased way, may be material and in that event, the company may need to provide a demonstration that the rounding would not produce a material understatement of TAR.
2. A brute force demonstration involves calculating the minimum reserve both with and without the simplification, approximation, or modeling efficiency technique, and making a direct comparison between the resulting TAR. Regardless of the specific simplification, approximation, or modeling efficiency technique used, brute force demonstrations always satisfy the requirements of Section 3.H.
3. Choosing a reduced set of scenarios from a larger set consistent with prescribed models and parameters and providing a detailed demonstration of why it did not understate TAR by a material amount and the expected value of TAR would not be less than the expected value of TAR that would otherwise be calculated. This demonstration may be a theoretical, statistical, or mathematical argument establishing, to the satisfaction of the insurance commissioner, general bounds on the potential deviation in the TAR estimate rather than a brute force demonstration.
4. Justify the use of randomly sampling withdrawal ages for each contract instead of following the exact prescribed WDCM method by demonstrating that the random sampling method is materially equivalent to the exact prescribed approach, and the simplification does not materially reduce the Additional Standard Projection Amount and the final reported TAR. In particular, the company should demonstrate that the statistical variability of the results based on the random sampling approach is immaterial by testing different random sets (e.g., if randomly selecting a withdrawal age for each contract, the probability distribution of the withdrawal age should be stable and not vary significantly when using different random number sets).

Section 4: Determination of the SR

- A. Projection of Accumulated Deficiencies
 1. General Description of Projection

The projection of accumulated deficiencies shall be made ignoring federal income tax in both cash flows and discount rates, and it shall reflect the dynamics of the expected cash flows for the entire group of contracts, reflecting all product features, including any guarantees provided under the contracts. Insurance company expenses (including overhead and investment expense), fund expenses, contractual fees and charges, revenue-sharing income received by the company (net of applicable expenses), and cash flows associated with any reinsurance or hedging instruments are to be reflected on a basis consistent with the requirements herein. Cash flows from any fixed account options also shall be included. Any market value adjustment assessed on projected withdrawals or surrenders also shall be included (whether or not the cash surrender value reflects market value adjustments). Throughout the projection, all assumptions shall be determined based on the requirements herein. Accumulated deficiencies shall be determined at the end of each projection year as the sum of the accumulated deficiencies for all contracts within each model segment.

Guidance Note: Section 4.A.1 requires market value adjustments (MVAs) on liability cash flows to be reflected because in a cash flow model, assets are assumed to be liquidated at market value to cover the cash outflow of the cash surrender; therefore, inclusion of the market value adjustment aligns the asset and liability cash flows. This may differ from the treatment of MVAs in the definition of cash surrender value (Section 1.D), which defines the statutory reserve floor for which the values must be aligned with the annual statement value of the assets.

2. Grouping of Variable Funds and Subaccounts

The portion of the starting asset amount held in the separate account represented by the variable funds and the corresponding account values may be grouped for modeling using an approach that recognizes the investment guidelines and objectives of the funds. In assigning each variable fund and the variable subaccounts to a grouping for projection purposes, the fundamental characteristics of the fund shall be reflected, and the parameters shall have the appropriate relationship to the stochastically generated projection scenarios described in Section 8. The grouping shall reflect characteristics of the efficient frontier (i.e., returns generally cannot be increased without assuming additional risk).

An appropriate proxy fund for each variable subaccount shall be designed in order to develop the investment return paths. The development of the scenarios for the proxy funds is a fundamental step in the modeling and can have a significant impact on results. As such, the company must map each variable account to an appropriately crafted proxy fund normally expressed as a linear combination of recognized market indices, sub-indices or funds.

3. Model Cells

Projections may be performed for each contract in force on the date of valuation or by assigning contracts into representative cells of model plans using all characteristics and criteria having a material impact on the size of the reserve. Assigning contracts to model cells may not be done in a manner that intentionally understates the resulting reserve.

4. Modeling of Hedges

- a. For a company that does not have a future hedging strategy supporting the contracts:
 - i. The company shall not consider the cash flows from any future hedge purchases or any rebalancing of existing hedge assets in its modeling, since they are not included in the company's investment strategy supporting the contracts.

- ii. 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.
- b. For a company with one or more future hedging strategies supporting the contracts:
 - i. For a future hedging strategy with hedge payoffs that solely offset index credits associated with index crediting strategies (index credits):
 - a) In modeling cash flows, the company shall include the cash flows from future hedge purchases or any rebalancing of existing hedge assets that are intended solely to offset index credits to contract holders.
 - b) Existing hedging instruments that are currently held by the company for offsetting the index credits in support of the contracts falling under the scope of these requirements shall be included in the starting assets.
 - c) An index credit hedge margin for these hedge instruments shall be reflected in both the “best efforts” and the “adjusted” runs, as applicable, by reducing index credit hedge payoffs by a margin multiple that shall be justified by sufficient and credible company experience and account for model error. It shall be no less than 1.5% multiplicatively of the portion of the index credit that is hedged. In the absence of sufficient and credible company experience, a margin of at least 20% shall be assumed. There is no cap on the index credit hedge margin if company experience indicates actual error is greater than these minimums.
 - ii. For a company with one or more future hedging strategies supporting the contracts that do not solely offset indexed interest credits, 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.
 - a) 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 SR.
 - b) 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 future hedging strategies supporting the contracts. 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 SR 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 only future hedge purchases associated solely with index credits. These are discussed in greater detail in Section 9. The SR 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.

- c) The company is responsible for verifying compliance with all requirements in Section 9 for all hedging instruments included in the projections.
 - d) 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.
- iii. If a company has a more comprehensive hedge strategy combining index credits with guaranteed benefit and/or other risks (e.g., full fair value or economic hedging), no portion of this hedge strategy is eligible for the treatment described in section 4.A.4.b.i.

Guidance Note:

The requirements of Section 4.A.4 govern the determination of reserves for annuity contracts and do not supersede any statutes, laws or regulations of any state or jurisdiction related to the use of derivative instruments for hedging purposes and should not be used in determining whether a company is permitted to use such instruments in any state or jurisdiction.

5. Revenue Sharing

- a. Projections of accumulated deficiencies may include income from projected future revenue-sharing, net of applicable projected expenses (net revenue-sharing income) if each of the following requirements are met:
 - i. The net revenue-sharing income is received by the company.

Guidance Note: For purposes of this section, net revenue-sharing income is considered to be received by the company if it is paid directly to the company through a contractual agreement with either the entity providing the net revenue-sharing income or an affiliated company that receives the net revenue-sharing income. Net revenue-sharing income also would be considered to be received if it is paid to a subsidiary that is owned by the company and if 100% of the statutory income from that subsidiary is reported as statutory income of the company. In this case, the company needs to assess the likelihood that future net revenue-sharing income is reduced due to the reported statutory income of the subsidiary being less than future net revenue-sharing income received.

- ii. Signed contractual agreement(s) are in place as of the valuation date and support the current payment of the net revenue-sharing income.
 - iii. The net revenue-sharing income is not already accounted for directly or indirectly as a company asset.
- b. The amount of net revenue-sharing income to be used shall reflect the company's assessment of factors that include, but are not limited to, the following (not all of these factors will necessarily be present in all situations):
- i. The terms and limitations of the agreement(s), including anticipated revenue, associated expenses and any contingent payments incurred or made by either the company or the entity providing the net revenue-sharing as part of the agreement(s).

- ii. The relationship between the company and the entity providing the net revenue-sharing income that might affect the likelihood of payment and the level of expenses.
 - iii. The benefits and risks to both the company and the entity paying the net revenue-sharing income of continuing the arrangement.
 - iv. The likelihood that the company will collect the net revenue-sharing income during the term(s) of the agreement(s) and the likelihood of continuing to receive future revenue after the agreement(s) has ended.
 - v. The ability of the company to replace the services provided to it by the entity providing the net revenue-sharing income or to provide the services itself, along with the likelihood that the replaced or provided services will cost more to provide.
 - vi. The ability of the entity providing the net revenue-sharing income to replace the services provided to it by the company or to provide the services itself, along with the likelihood that the replaced or provided services will cost more to provide.
- c. The amount of projected net revenue-sharing income shall reflect a margin (which decreases the assumed net revenue-sharing income) directly related to the uncertainty of the revenue. The greater the uncertainty, the larger the margin. Such uncertainty is driven by many factors, including the potential for changes in the securities laws and regulations, mutual fund board responsibilities and actions, and industry trends. Since it is prudent to assume that uncertainty increases over time, a larger margin shall be applied as time that has elapsed in the projection increases.
- d. All expenses required or assumed to be incurred by the company in conjunction with the arrangement providing the net revenue-sharing income, as well as any expenses assumed to be incurred by the company in conjunction with the assumed replacement of the services provided to it (as discussed in Section 4.A.5.b.v), shall be included in the projections as a company expense under the requirements of Section 4.A.1. In addition, expenses incurred by either the entity providing the net revenue-sharing income or an affiliate of the company shall be included in the applicable expenses discussed in Section 4.A.1 and Section 4.A.5.a that reduce the net revenue-sharing income.
- e. The company is responsible for reviewing the revenue-sharing agreements and verifying compliance with these requirements.
- f. The amount of net revenue-sharing income assumed in a given scenario shall be applied with a margin to reflect any uncertainty but shall not exceed the sum of (i) and (ii), where:
- (i) Is the contractually guaranteed net revenue-sharing income projected under the scenario; and
 - (ii) Is the company's estimate of non-contractually guaranteed net revenue-sharing income before reflecting any margins for uncertainty multiplied by the following factors:
 - a) 1.00 in the first projection year.

- b) 0.95 in the second projection year.
- c) 0.90 in the third projection year.
- d) 0.85 in the fourth projection year.
- e) 0.80 in the fifth and all subsequent projection years.

Guidance Note: Provisions such as one that gives the entity paying the revenue-sharing income the option to stop or change the level of income paid would prevent the income from being guaranteed. However, if such an option becomes available only at a future point in time, and the revenue up to that time is guaranteed, the income is considered guaranteed up to the time the option first becomes available.

Guidance Note: If the agreement allows the company to unilaterally take control of the underlying fund fees that ultimately result in the revenue sharing, then the revenue is considered guaranteed up until the time at which the company can take such control. Since it is unknown whether the company can perform the services associated with the revenue-sharing agreement at the same expense level, it is presumed that expenses will be higher in this situation. Therefore, the revenue-sharing income shall be reduced to account for any actual or assumed additional expenses.

6. Length of Projections

Projections of accumulated deficiencies shall be run for as many future years as needed so that no materially greater reserve value would result from longer projection periods.

7. Interest Maintenance Reserve (IMR)

The IMR shall be handled consistently with the treatment in the company's cash-flow testing, and the amounts should be adjusted to a pre-tax basis.

B. Determination of Scenario Reserve

1. General

For a given scenario, the scenario reserve is the sum of:

- a. The greatest present value, as of the projection start date, of the projected accumulated deficiencies; and
- b. The starting asset amount.

When using the direct Iteration method, the scenario reserve will equal the final starting asset amount determined according to Section 4.B.4.

The scenario reserve for any given scenario shall not be less than the cash surrender value in aggregate on the valuation date for the group of contracts modeled in the projection.

2. Discount Rates

In determining the scenario reserve, accumulated deficiencies shall be discounted at the NAER on additional assets, as defined in Section 4.B.3.

3. Determination of NAER on Additional Invested Asset Portfolio

- a. The additional invested asset portfolio for a scenario is a portfolio of general account assets as of the valuation date, outside of the starting asset portfolio, that is required in that projection scenario so that the projection would not have a positive accumulated deficiency at the end of any projection year. This portfolio may include only (i) general account assets available to the company on the valuation date that do not constitute part of the starting asset portfolio; and (ii) cash assets.

Guidance Note:

Additional invested assets should be selected in a manner such that if the starting asset portfolio were revised to include the additional invested assets, the projection would not be expected to experience any positive accumulated deficiencies at the end of any projection year.

It is assumed that the accumulated deficiencies for this scenario projection are known.

- b. To determine the NAER on additional invested assets for a given scenario:
 - i. Project the additional invested asset portfolio as of the valuation date to the end of the projection period,
 - a) Investing any cash in the portfolio and reinvesting all investment proceeds using the company's investment policy.
 - b) Excluding any liability cash flows.
 - c) Incorporating the appropriate returns, defaults and investment expenses for the given scenario.
 - ii. If the value of the projected additional invested asset portfolio does not equal or exceed the accumulated deficiencies at the end of each projection year for the scenario, increase the size of the initial additional invested asset portfolio as of the valuation date, and repeat the preceding step.
 - iii. Determine a vector of annual earned rates that replicates the growth in the additional invested asset portfolio from the valuation date to the end of the projection period for the scenario. This vector will be the NAER for the given scenario.

Guidance Note: There are multiple ways to select the additional invested asset portfolio at the valuation date. Similarly, there are multiple ways to determine the earned rate vector. The company shall be consistent in its choice of methods, from one valuation to the next.

4. Direct Iteration

In lieu of the method described in Section 4.B.2 and Section 4.B.3 above, the company may solve for the amount of starting assets which, when projected along with all contract cash flows, result in the defeasement of all projected future benefits and expenses at the end of the projection horizon with no accumulated deficiencies at the end of any projection year during the projection period.

C. Projection Scenarios

1. Number of Scenarios

The number of scenarios for which the scenario reserve shall be computed shall be the responsibility of the company, and it shall be considered to be sufficient if any resulting understatement in the SR, as compared with that resulting from running additional scenarios, is not material.

2. Economic Scenario Generation

Treasury Department interest rate curves, as well as investment return paths for general account equity assets and separate account fund performance shall be determined on a stochastic basis using the methodology described in Section 8. If the company uses a proprietary generator to develop scenarios, the company shall demonstrate that the resulting scenarios meet the requirements described in Section 8.

D. Projection of Assets

1. Starting Asset Amount

a. For the projections of accumulated deficiencies, the value of assets at the start of the projection shall be set equal to the approximate value of statutory reserves at the start of the projection plus the allocated amount of PIMR attributable to the assets selected. Assets shall be valued consistently with their annual statement values. The amount of such asset values shall equal the sum of the following items, all as of the start of the projection:

- i. All of the separate account assets supporting the contracts;
- ii. Any hedge instruments held in support of the contracts being valued; and
- iii. An amount of assets held in the general account equal to the approximate value of statutory reserves as of the start of the projections plus the allocated amount of PIMR attributable to the assets selected less the amount in (i) and (ii).

Guidance Note: Deferred hedge gains/losses developed under *SSAP No. 108—Derivatives Hedging Variable Annuity Guarantees* are not included in the starting assets

- b. If the amount of initial general account assets is negative, the model should reflect a projected interest expense. General account assets chosen for use as described above shall be selected on a consistent basis from one reserve valuation hereunder to the next.
- c. To the extent that the sum of the value of hedge assets, or cash, or other general account assets in an amount equal to the aggregate market value of such hedge assets, and the value of separate account assets supporting the contracts is greater than the approximate value of statutory reserves as of the start of the projections, then the company shall include enough negative general account assets or cash such that the starting asset amount equals the approximate value of statutory reserves as of the start of the projections.

2. Valuation of Projected Assets

For purposes of determining the projected accumulated deficiencies, the value of projected

assets shall be determined in a manner consistent with their value at the start of the projection. For assets assumed to be purchased during a projection, the value shall be determined in a manner consistent with the value of assets at the start of the projection that have similar investment characteristics. However, for derivative instruments that are used in hedging and are not assumed to be sold during a particular projection interval, the company may account for them at an amortized cost in an appropriate manner elected by the company.

3. Separate Account Assets

For purposes of determining the starting asset amounts in Section 4.D.1 and the valuation of projected assets in Section 4.D.2, assets held in a separate account shall be summarized into asset categories determined by the company as discussed in Section 4.A.2.

4. General Account Assets

a. General account assets shall be projected, net of projected defaults, using assumed investment returns consistent with their book value and expected to be realized in future periods as of the date of valuation. Initial assets that mature during the projection and positive cash flows projected for future periods shall be invested in a manner that is representative of and consistent with the company's investment policy, subject to the following requirements:

- i. The final maturities and cash flow structures of assets purchased in the model, such as the patterns of gross investment income and principal repayments or a fixed or floating rate interest basis, shall be determined by the company as part of the model representation;
- ii. The combination of price and structure for fixed income investments and derivative instruments associated with fixed income investments shall appropriately reflect the projected Treasury Department curve along the relevant scenario and the requirements for gross asset spread assumptions stated below;
- iii. For purchases of public non-callable corporate bonds, use the gross asset spreads over Treasuries prescribed in VM-20 Section 9.F.8.a through Section 9.F.8.c. (For the purposes of this subsection, "public" incorporates both registered and 144a securities). The prescribed spreads reflect current market conditions as of the model start date and grade to long-term conditions based on historical data at the start of projection year four;
- iv. For transactions of derivative instruments associated with fixed income investments, reflect the prescribed assumptions in VM-20 Section 9.F.8.d for interest rate swap spreads;
- v. For purchases of other fixed income investments, if included in the modeled company investment strategy, set assumed gross asset spreads over U.S. Treasuries in a manner that is consistent with, and results in reasonable relationships to, the prescribed spreads for public non-callable corporate bonds and interest rate swaps.

b. Notwithstanding the above requirements, the SR shall be the higher of that produced by the modeled company 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 modeled company 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 future hedging strategies supporting the contracts are not affected by this requirement.

Drafting Note: This limitation is being referred to Life Actuarial (A) Task Force for review.

- c. Any disinvestment shall be modeled in a manner that is consistent with the company's investment policy and that reflects the company's cost of borrowing where applicable, provided that the assumed cost of borrowing is not lower than the rate at which positive cash flows are reinvested in the same time period, taking into account duration, ratings, and other attributes of the borrowing mechanism. Gross asset spreads used in computing market values of assets sold in the model shall be consistent with, but not necessarily the same as, the gross asset spreads in Section 4.D.4.a.iii and Section 4.D.4.a.v, recognizing that initial assets that mature during the projection may have different characteristics than modeled reinvestment assets.

Guidance Note: The simple language above “provided that the assumed cost of borrowing is not lower than the rate at which positive cash flows are reinvested in the same time period” is intended to prevent excessively optimistic borrowing assumptions. If in any case, the assumed cost of borrowing restriction cannot be fully applied or followed precisely, then as with all other simplifications/approximations, the company shall not allow borrowing assumptions to materially reduce the reserve.

5. Cash Flows from Invested Assets

- a. Cash flows from general account fixed income assets and derivative asset programs associated with these assets, including starting and reinvestment assets, shall be reflected in the projection as follows:
 - i. Model gross investment income and principal repayments in accordance with the contractual provisions of each asset and in a manner consistent with each scenario. Grouping of assets is allowed if the company can demonstrate that grouping does not materially understate the modeled reserve that would have been obtained using a seriatim approach.
 - ii. Reflect asset default costs as prescribed in VM-20 Section 9.F and anticipated investment expenses through deductions to the gross investment income.
 - iii. Model the proceeds arising from modeled asset sales and determine the portion representing any realized capital gains and losses.
 - iv. Reflect any uncertainty in the timing and amounts of asset cash flows related to the paths of interest rates, equity returns or other economic values directly in the projection of asset cash flows. Asset defaults are not subject to this requirement, since asset default assumptions must be determined by the prescribed method in VM-20 Section 9.F.

- b. Cash flows from general account equity assets—i.e., non-fixed income assets having substantial volatility of returns, such as common stocks and real estate—and derivative asset programs associated with these assets, including starting and reinvestment assets, shall be reflected in the projection as follows:
 - i. Determine the grouping for asset categories and the allocation of specific assets to each category in a manner that is consistent with that used for separate account assets, as discussed in Section 4.A.2.
 - ii. Project the gross investment return including realized and unrealized capital gains in a manner that is consistent with the stochastically generated scenarios.
 - iii. Model the timing of an asset sale in a manner that is consistent with the investment policy of the company for that type of asset. Reflect expenses through a deduction to the gross investment return using prudent estimate assumptions.
- c. Determine cash flows for each projection interval for all other general account assets by modeling asset cash flows on other assets that are not described in Section 4.D.5.a and Section 4.D.5.b using methods consistent with the methods described in Section 4.D.5.a and Section 4.D.5.b. This includes assets that are a hybrid of fixed income and equity investments.
- d. Determine cash flows or total investment returns, as appropriate, for each projection interval for all separate account assets as follows:
 - i. Determine the grouping for each variable fund and sub-account (e.g., bonds funds, large cap stocks, international stocks, owned real estate, etc.) as described in Section 4.A.2.
 - ii. Project the total investment return for each variable fund and sub-account in a manner that is consistent with the prescribed returns described in Section 4.A.2 and Section 8.C.3.

E. Projection of Annuitization Benefits (Including GMIBs and GMWBs)

1. Assumed Annuitization Purchase Rates at Election

For purposes of projecting annuitization benefits (including annuitizations stemming from the election of a GMIB) and withdrawal amounts from GMWBs, the projected annuitization purchase rates shall be determined assuming that market interest rates available at the time of election are the interest rates used to project general account assets, as determined in Section 4.D.4.

2. Projected Election of GMIBs, GMWBs and Other Annuitization Options

- a. For contracts projected to elect annuitization options (including annuitizations stemming from the election of a GMIB) or for projections of GMWB benefits once the account value has been depleted, the projections may assume one of the following at the company's option:
 - i. The contract is treated as if surrendered at an amount equal to the statutory reserve that would be required at such time for a fixed payout annuity benefit equivalent to the guaranteed benefit amount (e.g., GMIB or

GMWB benefit payments).

- ii. The contract is assumed to stay in force and the projected periodic payments are paid.
- b. If the projected payout annuity is a variable payout annuity containing a floor guarantee (such as a GPAF) under a specified contractual option, only option (ii) under Section 4.E.2.a above shall be used.
- c. Where mortality improvement is used to project future annuitization purchase rates, as discussed in Section 4.E.1 above, mortality improvement also shall be reflected on a consistent basis in either the determination of the reserve in Section 4.E.2.a.i above or the projection of the periodic payments in Section 4.E.2.a.ii.

3. Projected Statutory Reserve for Payout Annuity Benefits

If the statutory reserve for payout annuity benefits referenced above in Section 4.E.2.a requires a parameter that is not determined in a formulaic fashion, the company must make a reasonable and supportable assumption regarding this parameter.

F. Frequency of Projection and Time Horizon

- 1. Use of an annual cash-flow frequency (“timestep”) is generally acceptable for benefits/features that are not sensitive to projection frequency. The lack of sensitivity to projection frequency should be validated by testing wherein the company should determine that the use of a more frequent—i.e., shorter—time step does not materially increase reserves. A more frequent time increment should always be used when the product features are sensitive to projection period frequency.
- 2. Care must be taken in simulating fee income and expenses when using an annual time step. For example, recognizing fee income at the end of each period after market movements, but prior to persistency decrements, would normally be an inappropriate assumption. It is also important that the frequency of the investment return model be linked appropriately to the projection horizon in the liability model. In particular, the horizon should be sufficiently long so as to capture the vast majority of costs (on a present value basis) from the scenarios.

Guidance Note: As a general guide, the forecast horizon should not be less than 20 years.

G. Compliance with ASOPs

When determining a SR, the analysis shall conform to the ASOPs as promulgated from time to time by the ASB.

Under these requirements, an actuary will make various determinations, verifications and certifications. The company shall provide the actuary with the necessary information sufficient to permit the actuary to fulfill the responsibilities set forth in these requirements and responsibilities arising from each applicable ASOPs.

Section 5: Reinsurance Ceded

A. Treatment of Reinsurance Ceded in the Aggregate Reserve

1. Aggregate Reserve Pre- and Post- Reinsurance Ceded

As noted in Section 3.B, the aggregate reserve is determined both pre-reinsurance ceded

and post-reinsurance ceded. Therefore, it is necessary to determine the components needed to determine the aggregate reserve—i.e., the additional standard projection amount, the SR determined using projections, and/or reserve amount determined using the Alternative Methodology, as applicable—on both bases. Sections 5.A.2 through 5.A.4 discuss adjustments to inputs necessary to determine these components on both a post-reinsurance ceded and a pre-reinsurance ceded basis. Note that due allowance for reasonable approximations may be used where appropriate.

2. SR

In order to determine the aggregate reserve post-reinsurance ceded, accumulated deficiencies, scenario reserves, and the resulting SR shall be determined reflecting the effects of reinsurance treaties that meet the statutory requirements that would allow the treaty to be accounted for as reinsurance within statutory accounting. This involves including, where appropriate, all anticipated reinsurance premiums or other costs and all reinsurance recoveries, where both premiums and recoveries are determined by recognizing any limitations in the reinsurance treaties, such as caps on recoveries or floors on premiums.

In order to determine the SR pre-reinsurance ceded, accumulated deficiencies, scenario reserves, and the resulting SR shall be determined ignoring the effects of reinsurance ceded within the projections. One acceptable approach involves a projection based on the same starting asset amount as for the aggregate reserve post-reinsurance ceded and by ignoring, where appropriate, all anticipated reinsurance premiums or other costs and all reinsurance recoveries in the projections.

3. Reserve Determined using the Alternative Methodology

If a company chooses to use the Alternative Methodology, as allowed in Section 3.E, it is important to note that the methodology produces reserves on a pre-reinsurance ceded basis. Therefore, where reinsurance is ceded, the Alternative Methodology must be modified to reflect the reinsurance costs and reinsurance recoveries under the reinsurance treaties in the determination of the aggregate reserve post-reinsurance ceded. In addition, the Alternative Methodology, unadjusted for reinsurance, shall be applied to the contracts falling under the scope of these requirements to determine the aggregate reserve prior to reinsurance.

4. Additional Standard Projection Amount

Where reinsurance is ceded, the additional standard projection amount shall be calculated as described in Section 6 to reflect the reinsurance costs and reinsurance recoveries under the reinsurance treaties. The additional standard projection amount shall also be calculated pre-reinsurance ceded using the methods described in Section 6 but ignoring the effects of the reinsurance ceded.

Section 6: Requirements for the Additional Standard Projection Amount

A. Overview

1. Determining the Additional Standard Projection Amount

- a. For valuation dates before January 1, 2025, the additional standard projection amount shall be the larger of zero and an amount determined in aggregate for all contracts falling under the scope of these requirements, excluding those contracts to which the Alternative Methodology is applied, by calculating the Prescribed

Projections Amount by one of two methods, the Company-Specific Market Path (CSMP) method or the CTE with Prescribed Assumptions (CTEPA) method. The company shall assess the impact of aggregation on the additional standard projection amount.

- b. For valuation dates on or after January 1, 2025, the additional standard projection amount shall be the larger of zero and an amount determined in aggregate for all contracts falling under the scope of these requirements, excluding those contracts to which the Alternative Methodology is applied, by calculating the Prescribed Projections Amount by the CTEPA method. The company shall assess the impact of aggregation on the additional standard projection amount.

Guidance Note: The following outlines one method that may be used to assess the impact of aggregation. If a company plans to use a different method, they should discuss that method with their domiciliary commissioner.

If a company uses the CSMP method, the benefit of aggregation is determined using the following steps, based on Path A, and using prescribed assumptions and discount rates used to calculate prescribed amount A:

1. Calculate the present value of each contract's accumulated deficiency up through the duration of the aggregate GPVAD. When determining the contract accumulated deficiency: (a) contract starting assets equal CSV; (b) contract level starting assets include both separate account and general account assets, and exclude any hedge assets; (c) discount rate for the PVAD is the NAER; and (d) for a contract that terminates prior to the duration of the GPVAD, there will no longer be liability cash flows, but assets (positive or negative) continue to accumulate.
2. The impact of aggregation is the sum of the absolute value of the negative amounts from step 1 above.

If a company uses the CTEPA method, it should apply steps 1 and 2 above to each model point, using the same scenario used for the cumulative decrement analysis, and using that scenario's NAER as the discount rates for discounting the accumulated deficiency from the time of the GPVAD. For GMWBs and hybrid GMIBs that use the Withdrawal Delay Cohort Method as specified in VM-21 Section 6.C.5, cash flows for each contract or for each model point shall be determined as the aggregate across all of the constituent cohorts of the contract or model point.

- c. The additional standard projection amount shall be calculated based on the scenario reserves, as discussed in Section 4.B, with certain prescribed assumptions replacing the company prudent estimate assumptions. As is the case in the projection of a scenario in the calculation of the SR, the scenario reserves used to calculate the additional standard projection amount are based on an analysis of asset and liability cash flows produced along certain equity and interest rate scenario paths.

B. Additional Standard Projection Amount

1. General

Where not inconsistent with the guidance given here, the process and methods used to determine the additional standard projection amount under either the CSMP method or the CTEPA method shall be the same as required in the calculation of the SR as described in Section 3.D of these requirements. Any additional assumptions needed to determine the additional standard projection amount shall be explicitly documented.

2. The company shall determine the Prescribed Projections Amount by following either the CSMP Method or the CTEPA Method below. A company may not change the method used from one valuation to the next without the approval of the domiciliary commissioner.
3. Calculation Methodology
 - a. CSMP Method:
 - i. Calculate the scenario reserve, as defined in VM-01 and discussed further in Section 4.B, for each of the prescribed market paths outlined in Section 6.B.6 using the same method and assumptions as those that the company uses to calculate scenario reserves for the purposes of determining the CTE70 (adjusted),¹ as outlined in Section 9.C. These scenario reserves shall collectively be referred to as a Company Standard Projection Set.
 - ii. Identify the market path from the Company Standard Projection Set such that the scenario reserve is closest to the CTE70 (adjusted), designated as Path A. This scenario reserve shall be referred to as Company Amount A.
 - iii. Identify the following four market paths:
 - Two paths with the same starting interest rate as Path A, but equity shocks $\pm 5\%$ from that of Path A.
 - Two paths with the same equity fund returns as Path A, but the next higher and next lower interest rate shocks.From the four paths, identify Path B whose reserve value is:
 - If Company Amount A is lower than CTE70 (adjusted), the smallest reserve value that is greater than CTE70 (adjusted).
 - If Company Amount A is greater than CTE70 (adjusted), the greatest reserve value that is less than CTE70 (adjusted).If none of the four paths satisfy the stated condition, discard the identified Path A, and redo steps (ii) and (iii) using the next closest scenario to CTE70 (adjusted) to be the new Path A in step (ii).For the path designated as Path B, the scenario reserve shall be referred to as Company Amount B.
 - iv. Recalculate the scenario reserves for Path A and Path B using the same method as outlined in step (i) above, but substitute the assumptions prescribed in Section 6.C and use a seriatim in force. These scenario reserves shall be referred to as Prescribed Amount A and Prescribed Amount B, respectively.

¹ Throughout this Section 6, references to CTE70 (adjusted) shall also mean the SR for a company that does not have a future hedging strategy supporting the contracts that does not solely offset index credits as discussed in Section 4.A.4.

- v. Calculate the Prescribed Projections Amount as:

Prescribed Projections Amount

$= \text{Prescribed Amount A} + (\text{CTE70 (adjusted)} - \text{Company Amount A})$

$$\times \left(\frac{\text{Prescribed Amount B} - \text{Prescribed Amount A}}{\text{Company Amount B} - \text{Company Amount A}} \right)$$

- b. CTEPA Method:

- i. If the company used a model office to calculate the CTE Amount, then the company may continue to use the same model office, or one that is no less granular than the model office that was used to determine the CTE Amount, provided that the company shall maintain consistency in the grouping method used from one valuation to the next.
 - 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 SR following Section 4.A.4.a for a company that does not have a future hedging strategy supporting the contracts) 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.
- c. Once the Prescribed Projections Amount is determined by one of the two methodologies above, then the company shall reduce the Prescribed Projections Amount by the CTE70 (adjusted). The difference shall be referred to as the Unbuffered Additional Standard Projection Amount.
- d. Reduce the Unbuffered Additional Standard Projection Amount by an amount equal to the difference between (i) and (ii), where (i) and (ii) are calculated in the following manner:
- i. Calculate the Unfloored CTE70 (adjusted), using the same procedure as CTE70 (adjusted) but without requiring that the scenario reserve for any scenario be no less than the cash surrender value in aggregate on the valuation date.
 - ii. Calculate the Unfloored CTE65 (adjusted), which is calculated in the same way as Unfloored CTE70 (adjusted) but averaging the 35% (instead of 30%) largest values.
- e. The additional standard projection amount shall subsequently be the larger of the quantity calculated in Section 6.B.3.d and zero.

4. Modeled Reinsurance

Cash flows associated with reinsurance shall be projected in the same manner as that used in the calculation of the SR as described in Section 3.

5. Modeled Hedges

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 future hedging strategy supporting the contracts.

6. Market Paths for CSMP Method

If the company elects the CSMP method described in Section 6.B.3.a, the additional standard projection amount shall be determined from the scenario reserves calculated for the prescribed market paths defined below. Each prescribed market path shall be defined by an initial equity fund stress and an initial interest rate stress, after which equity fund returns steadily recover and interest rates revert to the same long-term mean.

All combinations of prescribed equity fund return scenarios and interest rate scenarios shall be considered prescribed Standard Projection market paths. Accordingly, each company shall calculate scenario reserves for a minimum of 40 market paths.

a. Equity Fund Returns

Eight equity fund return market paths shall be used. These market paths differ only in the prescribed gross return in the first projection year.

The eight prescribed gross returns for equity funds in the first projection year shall be negative 25% to positive 10%, at 5% intervals. These gross returns shall be projected to occur linearly over the full projection year. After the first projection year, all prescribed equity fund return market paths shall assume total gross returns of 3% per annum.

If the eight prescribed equity fund market paths are insufficient for a company to calculate the additional standard projection amount via steps (i) through (v) outlined in Section 6.B.3.a, then the company shall include additional equity fund market paths that increase or decrease the prescribed gross returns in the first projection year by 5% increments at a time.

b. Interest Rates

Five interest rate market paths shall be used.

The five prescribed interest rate market paths shall differ in the starting Treasury Department rates used to generate the mean interest rate path. Specifically, the following five sets of starting Treasury Department rates shall be used:

- i. The actual Treasury Department rates as of the valuation date.
- ii. The actual Treasury Department rates as of the valuation date, reduced at each point on the term structure by 25% of the difference between the Treasury Department rate as of the valuation date and 0.01%.
- iii. The actual Treasury Department rates as of the valuation date, reduced at each point on the term structure by 50% of the difference between the Treasury Department rate as of the valuation date and 0.01%.
- iv. The actual Treasury Department rates as of the valuation date, reduced at each point on the term structure by 75% of the difference between the

Treasury Department rate as of the valuation date and 0.01%.

- v. The actual Treasury Department rates as of the valuation date, increased at each point on the term structure by 25% of the difference between the Treasury Department rate as of the valuation date and 0.01%.

For each of these five sets of starting Treasury Department rates, the prescribed interest rate market path is defined as the interest rate path generated by the prescribed interest rate scenario generator (described in Section 8.B) when the applicable set of starting rates is the initial yield curve for the generator and all random variables in the generator are set to zero across all time periods. The starting Treasury Department rates should not change any prescribed parameters in the generator, including the mean reversion parameter. After creating each vector of rates, the time 0 (valuation date) values should be set back to actual Treasury Department rates as of the valuation date so that the model will validate to current market values.

If the five prescribed interest rate market paths are insufficient for a company to calculate the Additional Standard Projection Amount via steps (i) through (v) outlined in Section 6.B.3.a, then the company shall include additional interest rate market paths that increase or decrease the prescribed starting Treasury Department rates at each point on the term structure by increments equal to 25% of the difference between the Treasury Department rate as of the valuation date and 0.01%. The lowest interest rate to be used in this analysis is 0.01%.

For projecting swap rates along the prescribed interest rate market paths, companies shall assume that the swap-to-Treasury spread term structure in effect as of the valuation date persists throughout each market path. The lowest swap rate to be used in this analysis is 0.01%.

c. **Indices and Returns That Are Not Scenario-Specific**

The following market indicators and fund returns are constructed in a consistent manner across all prescribed market paths:

Table 6.1: Returns and Indicators

Returns & indicators	All projection years
Bond fund returns	<p>Equal to the five-year trailing average of the five-year Treasury Department rate, plus an earned spread of 100 bps per annum.</p> <p>In the first projection year, adjust the projected return by an amount equal to 20% of the prescribed gross equity fund return—with the same directionality, reflected in a linear fashion over the full projection year.</p>
Money market fund returns	Follow the three-month Treasury Department rate projected in the prescribed scenario.
Balanced fund returns	Reflect the equity and bond allocations as of the valuation date and any expected asset rebalancing in the projection consistent with fund operations.
General account reinvestment rate	Consistent with the manner in which general account assets—including starting assets, reinvestment assets, and additional invested assets as defined in Section 4.B.3—are reflected via the method outlined in Section 4.D.4 and Section 4.D.5, including the requirement in Section 4.D.5.a for fixed income assets.
Fixed account returns	<p>At the option of the company, either (i) follow the company's documented crediting practices; or (ii) equal to the larger of the contract's minimum guaranteed crediting rate and the general account earned rate less 200 bps.</p> <p>For reinsurers that do not have visibility into the ceding company's general account earned rate, the company shall project the ceding company's general account earned rate as the five-year trailing average of the five-year Treasury Department rate, plus an earned spread of 100 bps per annum.</p>
Implied and realized volatility	Follow the forward volatilities implied by the implied volatility term structure in effect as of the valuation date.
Foreign exchange rates	Follow the exchange rates implied by spot exchange rates as of the valuation date and the relevant interest rate term structures.

C. Prescribed Assumptions

1. Assignment of Guaranteed Benefit Type

- a. Assumptions shall be set for each contract in accordance with the contract's guaranteed benefit type, where a number of common benefit types is specifically defined in VM-01 (e.g., GMDB, GMIB, GMWB, etc.). In addition, a simple 403(b) VA contract shall be defined as a variable annuity contract that:
 - i. Is issued within a 403(b) retirement savings plan.
 - ii. Does not have a VAGLB.

- b. Certain VAGLB products have features that can be described by multiple types of guaranteed benefits. If the VAGLB can be described by more than one of the definitions in VM-01 for the purpose of determining the additional standard projection amount, the company shall select the guaranteed benefit type that it deems best applicable and shall be consistent in its selection from one valuation to the next. For instance, if a VAGLB has both lifetime GMWB and non-lifetime GMWB features and the company determines that the lifetime GMWB is the most prominent component; assumptions for all contracts with such a VAGLB shall be set as if the VAGLB were only a lifetime GMWB and did not contain any of the non-lifetime GMWB features. If the company determines that the non-lifetime GMWB is the most prominent component; assumptions for all contracts with such a VAGLB shall be set as if the VAGLB were only a non-lifetime GMWB and did not contain any of the lifetime GMWB features.
- c. If a contract cannot be classified into any categories within a given assumption, the company shall determine the defined benefit type with the most similar benefits and risk profile as the company's benefit and utilize the assumption prescribed for this benefit.

2. Maintenance Expenses

Maintenance expense assumptions shall be determined as the sum of (a) plus (b) if the company is responsible for the administration or (c) if the company is not responsible for the administration of the contract:

- a. Each contract for which the company is responsible for administration incurs an annual expense equal to \$100 in the first projection year, increased by an assumed annual inflation rate of 2% for subsequent projection years.
- b. Seven basis points of the projected account value for each year in the projection.
- c. Each contract for which the company is not responsible for administration (e.g., if the contract were assumed by the company in a reinsurance transaction in which only the risks associated with a guaranteed benefit rider were transferred) incurs an annual expense equal to \$35 in the first projection year, increased by an assumed annual inflation rate of 2% for subsequent projection years.

Guidance Note: The framework adopted by the Variable Annuities Issues (E) Working Group includes the review and possible update of these assumptions every three to five years.

3. Guarantee Actuarial Present Value

The Guarantee Actuarial Present Value (GAPV) is used in the determination of the Withdrawal Delay Cohort Method (Section 6.C.5), full surrender rates (Section 6.C.6), annuitization rates (Section 6.C.7), and other voluntary contract terminations (Section 6.C.11). The GAPV represents the actuarial present value of the lump sum or income payments associated with a guaranteed benefit. For the purpose of calculating the GAPV, such payments shall include the portion that is paid out of the contract holder's Account Value.

The GAPV shall be calculated in the following manner:

- a. If a guaranteed benefit is exercisable immediately, then the GAPV shall be determined assuming immediate or continued exercise of that benefit unless otherwise specified in a subsequent subsection of Section 6.C.3.
- b. If a guaranteed benefit is not exercisable immediately (e.g., because of minimum age or contract year requirements), then the GAPV shall be determined assuming exercise of the guaranteed benefit at the earliest possible time unless otherwise specified in a subsequent subsection of Section 6.C.3.
- c. Determination of the GAPV of a guaranteed benefit that is exercisable or payable at a future projection interval shall take account of any guaranteed growth in the basis for the guarantee (e.g., where the basis grows according to an index or an interest rate), as well as survival to the date of exercise using the mortality table specified in Section 6.C.3.h.
- d. Once a GMWB is exercised, the contract holder shall be assumed to withdraw in each subsequent contract year an amount equal to 100% of the GMWB's guaranteed maximum annual withdrawal amount in that contract year.
- e. If account value growth is required to determine projected benefits or product features, then the account value growth shall be assumed to be 0% net of all fees chargeable to the account value.
- f. If a market index is required to determine projected benefits or product features, then the required index shall be assumed to remain constant at its value during the projection interval.
- g. The GAPV for a GMDB that terminates at a certain age or in a certain contract year shall be calculated as if the GMDB does not terminate. Benefit features such as guaranteed growth in the GMDB benefit basis may be calculated so that no additional benefit basis growth occurs after the GMDB termination age or date defined in the contract.
- h. The mortality assumption used shall follow the 2012 IAM Basic Mortality Table, improved to Dec. 31, 2017, using Projection Scale G2 but not applying any additional mortality improvement in the projection.

Guidance Note: Projecting mortality to a specific date rather than the valuation date in the above step is a practical expedient to streamline calculations. This date should be considered an experience assumption to be periodically reviewed and updated as the Life Actuarial (A) Task Force reviews and updates the assumptions used in the Standard Projection.

- i. The discount rate used shall be the 10-year Treasury Department bond rate on the valuation date unless otherwise specified in a subsequent subsection of Section 6.C.3.
- j. For hybrid GMIBs, two types of GAPVs shall be calculated: the Annuitization GAPV and the Withdrawal GAPV. The Annuitization GAPV is determined as if the hybrid GMIB were a traditional GMIB such that the only benefit payments used in the GAPV calculation are from annuitization. The Withdrawal GAPV is determined as if the hybrid GMIB were a lifetime GMWB with the same guaranteed benefit growth features and, at each contract holder age, a guaranteed maximum withdrawal

amount equal to the partial withdrawal amount below which partial withdrawals reduce the benefit by the same dollar amount as the partial withdrawal amount and above which partial withdrawals reduce the benefit by the same proportion that the withdrawal reduces the account value.

4. Partial Withdrawals

Partial withdrawals required contractually or previously elected (e.g., a contract operating under an automatic withdrawal provision, or that has voluntarily enrolled in an automatic withdrawal program, on the valuation date) are to be deducted from the Account Value in each projection interval consistent with the projection frequency used, as described in Section 4.F, and according to the terms of the contract. However, if a GMWB or hybrid GMIB contract's automatic withdrawals results in partial withdrawal amounts in excess of the GMWB's guaranteed maximum annual withdrawal amount or the maximum amount above which withdrawals reduce the GMIB basis by the same dollar amount as the withdrawal amount (the "dollar-for-dollar maximum withdrawal amount"), such automatic withdrawals shall be revised such that they equal the GMWB's guaranteed maximum annual withdrawal amount or the GMIB's dollar-for-dollar maximum withdrawal amount. However, for tax qualified contracts with ages greater than or equal to the federal required minimum distribution (RMD) age, if the prescribed withdrawal amount is below the RMD amount, the withdrawal amount may be reset to the RMD amount.

Guidance Note: Companies are expected to model withdrawal amounts consistent with the RMD amount where applicable and where practically feasible; however, it is understood that this level of modeling sophistication may not be available for all companies.

For any contract not on an automatic withdrawal provision as described in the preceding paragraph, depending on the guaranteed benefit type, other partial withdrawals shall be projected as follows but shall not exceed the free partial withdrawal amount above which surrender charges are incurred and may be floored at the RMD amount for tax qualified contracts with ages greater than or equal to the federal RMD age:

- a. For simple 403(b) VA contracts, the partial withdrawal amount each year shall equal the following percentages, based on the contract holder's attained age:

Table 6.2: Partial Withdrawals, 403(b)

Attained Age	Percent of account value
59 and under	0.5%
60 – 69	2.0%
70 – 74	3.0%
75 and over	4.0%

- b. For contracts that do not have VAGLBs but that have GMDBs that offer guaranteed growth—i.e., benefit growth that does not depend on the performance of the Account Value—in the benefit basis, the partial withdrawal amount each year shall equal 2% of the Account Value.

- c. For contracts that do not have VAGLBs but that have GMDBs that do not offer guaranteed growth in the benefit basis, the partial withdrawal amount each year shall equal 3.5% of the Account Value.
- d. For contracts with (1) traditional GMIBs that do not offer guaranteed growth in the benefit basis; or (2) GMABs, the partial withdrawal amount each year shall equal to 2.0% of the Account Value.
- e. For contracts with traditional GMIBs that offer guaranteed growth in the benefit basis, the partial withdrawal amount each year shall equal 1.5% of the Account Value.
- f. For contracts with GMWBs and Account Values of zero, the partial withdrawal amount shall be the guaranteed maximum annual withdrawal amount.
- g. For contracts with Lifetime GMWBs or hybrid GMIBs that, in the contract year immediately preceding that during the valuation date, withdrew a non-zero amount not in excess of the GMWB's guaranteed annual withdrawal amount or the GMIB's dollar-for-dollar maximum withdrawal amount, the partial withdrawal amount shall be 90% of the guaranteed annual withdrawal amount or the GMIB's dollar-for-dollar maximum withdrawal amount each year until the contract Account Value reaches zero.
- h. For other contracts with Lifetime GMWBs or hybrid GMIBs, no partial withdrawals shall be projected until the projection interval (the "initial withdrawal period") determined using the "withdrawal delay cohort method" as described in Section 6.C.5. During the initial withdrawal period and thereafter, the partial withdrawal amount shall be 90% of the GMWB's guaranteed annual withdrawal amount or the GMIB's dollar-for-dollar maximum withdrawal amount each year until the contract Account Value reaches zero.
- i. For contracts with Non-lifetime GMWBs that, in the contract year immediately preceding that during the valuation date, withdrew a non-zero amount not in excess of the GMWB's guaranteed annual withdrawal amount, the partial withdrawal amount shall be 70% of the GMWB's guaranteed annual withdrawal amount each year until the contract Account Value reaches zero.
- j. For other contracts with Non-lifetime GMWBs, no partial withdrawals shall be projected until the projection interval (the "initial withdrawal period") determined using the "withdrawal delay cohort method" as described in Section 6.C.5. During the initial withdrawal period and thereafter, the partial withdrawal amount shall be 70% of the guaranteed annual withdrawal amount each year until the contract Account Value reaches zero.
- k. For contracts with no minimum guaranteed benefits, the partial withdrawal amount each year shall equal 3.5% of the Account Value.
- l. There may be instances where the company has certain data limitations, (e.g., with respect to policies that are not enrolled in an automatic withdrawal program but have exercised a non-excess withdrawal in the

contract year immediately preceding the valuation date [Section 6.C.4.g and Section 6.C.4.i]). The company may employ an appropriate proxy method if it does not result in a material understatement of the reserve.

5. Withdrawal Delay Cohort Method

To model the initial withdrawal for certain GMWBs and hybrid GMIBs as discussed in Section 6.C.4.h and Section 6.C.4.j, the actuary shall adopt a modeling approach whereby a contract is split into several copies (referred to as “cohorts”), each of which is subsequently modeled as a separate contract with a different initial withdrawal period. The contract Account Value, bases for guaranteed benefits, and other applicable characteristics shall be allocated across the cohorts based on different weights that are determined using the method discussed below in this section.

For example, assume that the method discussed below results in the creation of two cohorts: the first, weighted 70%, has an initial withdrawal period of two years after the valuation date; and the second, weighted 30%, has an initial withdrawal period of ten years after the valuation date. The contract shall therefore be split into two copies; the first copy shall have Account Value and guaranteed benefit bases equal to 70% of those of the original contract, and the second copy shall have Account Value and guaranteed benefit bases equal to 30% of those of the original contract. The first copy shall be projected to begin withdrawing in two years, while the second shall be projected to begin withdrawing in 10 years. The cash flows from both copies shall thereafter be aggregated to yield the final cash flows of the overall contract.

The following steps shall be used to construct the cohorts and determine the weights attributed to each cohort. These steps shall be conducted for each issue age for each GMWB and hybrid GMIB product that the company possesses in the modeled in force.

- a. Calculate the GMWB GAPV or the Withdrawal GAPV (for hybrid GMIBs) for each potential age of initiating withdrawals (“initial withdrawal age”) until the end of the projection period or the contract holder reaches age 120 if sooner. In each of these GAPV calculations:
 - i. The calculation shall ignore the instructions of Section 6.C.3.d and instead assume that the contract holder takes no partial withdrawals until the initial withdrawal age.
 - ii. The calculation shall ignore the instructions of Section 6.C.3.i and instead use a discount rate assuming a 10-year Treasury Department bond rate of 3.0%.
 - iii. The GAPV for each initial withdrawal age shall be expressed in present value terms taking into account survival from issue to the initial withdrawal age, as well as time value of money during that period. For instance, if the issue age is 55, then the GAPV for an initial withdrawal age of 60 shall take into account survival of the annuitant or owner to age 60 using the mortality table specified in Section 6.C.3.h as well as the time value of money from age 55 to age 60.

- b. Raise each of the GAPV to the second power and multiply all of the resultant GAPV² values corresponding to initial withdrawal ages below 60 by 50%.
- c. For tax qualified GMWB contracts, scale each of the adjusted GAPV² values by a single multiplier such that the sum of the scaled GAPV² values equals 0.95.
- d. For non-qualified GMWB contracts, scale each of the adjusted GAPV² values by a single multiplier such that the sum of the scaled GAPV² values equals 0.80.
- e. For tax-qualified hybrid GMIB contracts, scale each of the adjusted GAPV² values by a single multiplier such that the sum of the scaled GAPV² values equals 0.85.
- f. For non-qualified hybrid GMIB contracts, scale each of the adjusted GAPV² values by a single multiplier such that the sum of the scaled GAPV² values equals 0.60.
- g. For contracts that offer guaranteed growth in the benefit basis or one-time bonuses to the benefit basis, add the following to the adjusted and scaled GAPV² values corresponding to the initial withdrawal age that occurs immediately after the termination of the guaranteed growth or the one-time bonus. If there is more than one such initial withdrawal age, the addition shall be made to the initial withdrawal age with the higher GAPV.

$$0.35 \times \left\{ \begin{array}{l} 0.95 - \sum_{i=Issue\ Age}^{Initial\ WD\ Age} GAPV_{Adjusted,Scaled}^2, \text{ if contract is a tax - qualified GMWB} \\ 0.80 - \sum_{i=Issue\ Age}^{Initial\ WD\ Age} GAPV_{Adjusted,Scaled}^2, \text{ if contract is a non - qualified GMWB} \\ 0.85 - \sum_{i=Issue\ Age}^{Initial\ WD\ Age} GAPV_{Adjusted,Scaled}^2, \text{ if contract is a tax - qualified hybrid GMIB} \\ 0.60 - \sum_{i=Issue\ Age}^{Initial\ WD\ Age} GAPV_{Adjusted,Scaled}^2, \text{ if contract is a non - qualified hybrid GMIB} \end{array} \right.$$

- h. Scale the adjusted and scaled GAPV² values at all future initial withdrawal ages—i.e., all ages greater than the initial withdrawal age that occurs immediately after the termination of the guaranteed growth or the one-time bonus with the greatest GAPV, as identified in the preceding step—such that the sum of the revised GAPV² values equals 0.95 for tax-qualified GMWB contracts, 0.80 for non-qualified GMWB contracts, 0.85 for tax-qualified hybrid GMIB contracts, and 0.60 for non-qualified hybrid GMIB contracts.
- i. For tax-qualified contracts, add the following to the revised GAPV² corresponding to an initial withdrawal age of the federal RMD age.

$$0.50 \times \begin{cases} 0.95 - \sum_{i=\text{Issue Age}}^{\text{Initial WD Age}} \text{GAPV}_{\text{Adjusted,Scaled}}^2, & \text{if contract is a tax-qualified GMWB} \\ 0.85 - \sum_{i=\text{Issue Age}}^{\text{Initial WD Age}} \text{GAPV}_{\text{Adjusted,Scaled}}^2, & \text{if contract is a tax-qualified hybrid GMIB} \end{cases}$$

- j. Scale the revised GAPV^2 values at all future initial withdrawal ages—i.e., all ages greater than the federal RMD age, as identified in the preceding step—such that the sum of the revised GAPV^2 values equals 0.95 for tax-qualified GMWB contracts and 0.85 for tax-qualified hybrid GMIB contracts again.
- k. For ease of calculation, the company may discard certain withdrawal ages and use others as representative. For example, for odd-numbered issue ages, discard the initial withdrawal ages that are odd-numbered; and for even-numbered issue ages, discard initial withdrawal ages that are even-numbered. One cohort shall subsequently be constructed for each of the remaining initial withdrawal ages.

Guidance Note: The instructions in Section 6.C.5 are meant to improve computational tractability for companies that have large in force portfolios; accordingly, companies may also elect not to discard any initial withdrawal ages in constructing the withdrawal cohorts. Additionally, if necessary to avoid unmanageable computational intensity, companies may discard more initial withdrawal ages in constructing withdrawal cohorts or assign only a small number of withdrawal cohorts to each contract via random sampling.

- l. The weight assigned to each of the cohorts constructed in Section 6.C.5 shall equal the revised GAPV^2 value of the corresponding initial withdrawal age less the revised GAPV^2 value of the initial withdrawal age in the preceding cohort; i.e., two years smaller for the example given in Section 6.C.5.k.
- m. Construct a final cohort that is modeled not to take a partial withdrawal in the contract lifetime. This final cohort (“never withdraw cohort”) shall be assigned a weight of 0.05 for tax-qualified GMWB contracts and 0.20 for non-qualified GMWB contracts, 0.15 for tax-qualified hybrid GMIB contracts, and 0.40 for non-qualified hybrid GMIB contracts.
- n. The cohorts and their associated weights as determined in Section 6.C.5.a through Section 6.C.5.k are for a contract with attained age equal to its issue age. Because the discount rate used in this determination is fixed, generally these calculations only need to be performed once for a given set of contracts with a certain issue age, guaranteed benefit product, and tax status.

Guidance Note: Cohorts and their associated weights may need to be revised if prescribed assumptions are updated.

- o. For a contract with a contract holder attained age exceeding its issue age and that must still follow the Withdrawal Delay Cohort Method, cohorts with initial withdrawal ages less than the attained age on the valuation date shall be discarded. The remaining cohorts shall be scaled such that the sum

of their re-scaled weights equals 1. For example, for a sample contract with issue age 58 and attained age 64 on the valuation date, the cohorts with initial withdrawal ages less than 64 should be discarded, and the weights of all remaining cohorts shall be re-scaled by dividing by the difference between 1 and the weight of the original cohort with initial withdrawal age of 64.

6. Full Surrenders

The full surrender rate for all contracts shall be calculated based on the Standard Table for Full Surrenders as detailed below in Table 6.3, except for simple 403(b) VA contracts. The Standard Table for Full Surrender prescribes different full surrender rates depending on the contract year and the in-the-moneyness (“ITM”) of the contract’s guaranteed benefit.

The ITM of a contract’s guaranteed benefit shall be calculated based on the ratio of the guaranteed benefit’s GAPV to the contract’s account value. Depending on the guaranteed benefit type, the ratio shall be adjusted via the following calculations:

- a. For GMDBs, the ITM shall be calculated as 75% of the ratio between the GMDB GAPV and the contract account value.
- b. For GMABs, the ITM shall be calculated as 150% of the ratio between the GMAB GAPV and the contract account value.
- c. For traditional GMIBs and all GMWBs, the ITM shall be calculated as 100% of the ratio between the GMIB or GMWB GAPV, calculated as described in Section 6.C.3, and the contract account value.
- d. For hybrid GMIBs, the ITM shall be calculated as 100% of the ratio between:
 - i. The larger of its Annuitization GAPV and its Withdrawal GAPV, calculated as described in Section 6.C.3 and Section 6.C.5, and
 - ii. The contract account value.

Table 6.3 – Standard Table for Full Surrenders

ITM	In surrender charge period, or in policy years 1–3 for contracts without surrender charges	First year after the surrender charge period	Subsequent years, or in policy years 4 and onwards for contracts without surrender charges
Under 50%	4.0%	25.0%	15.0%
50–75%	3.0%	18.0%	10.0%
75–100%	2.5%	12.0%	7.0%
100–125%	2.5%	8.0%	4.5%
125–150%	2.5%	6.0%	3.0%
150–175%	2.5%	5.0%	2.5%
175–200%	2.5%	4.5%	2.0%
Over 200%	2.5%	4.0%	2.0%

For contracts that have both a VAGLB and a GMDB, the full surrender rate projected shall be the lower of the full surrender rate obtained from the Standard Table for Full Surrender using the GMDB's ITM and that using the VAGLB's ITM.

For GMAB contracts, the full surrender rate of the remaining contract shall be modeled in accordance with that prescribed for any remaining benefits in the contract, except that for a contract with no other living benefits, the projected full surrender rate shall be 50% in the contract year immediately following the maturity of the guaranteed benefit.

For GMWB or hybrid GMIB contracts, for all contract years in which a withdrawal is projected, the full surrender rate obtained from the Standard Table for Full Surrender shall be multiplied by 60%.

For contracts with no minimum guaranteed benefits, ITM is 0%; and the row in the table for ITM < 50% would apply.

Notwithstanding all of the instructions above, the full surrender rate for a GMWB contract shall be 0% if the account value is zero.

- e. For simple 403(b) VA contracts, the full surrender rate projected shall be the lower of:
 - i. The full surrender rate obtained from the Standard Table for Full Surrender based on the ITM of the contract's GMDB, and
 - ii. The applicable full surrender rate from the following table:

Table 6.4: Full Surrender Incidence Rates, 403(b)

Full Surrender for simple 403(b) VA contracts			
Attained Age	In surrender charge period	First policy year after the surrender charge period	Subsequent policy years, or contracts without a surrender charge period
59 and under	2.0%	4.0%	4.0%
60 – 69	4.0%	11.0%	8.0%
70 – 74	4.0%	11.0%	8.0%
75 and over	2.0%	5.0%	5.0%

7. Annuitizations

- a. The annuitization rate for contracts that do not have a GMIB shall be 0% at all projection intervals. For GMIB contracts, the annuitization rate shall be synonymous with the benefit exercise rate. As such, the annuitization rate is 0% in projection intervals during which the GMIB is not exercisable.
- b. The annual annuitization rate for a traditional GMIB contract that is immediately exercisable in the projection interval and that has an account value greater than zero, shall follow the Standard Table for Traditional GMIB Annuitization as detailed below in Table 6.5. The Standard Table for Annuitization prescribes different annuitization rates depending on whether the contract is in the first contract year in which the GMIB is exercisable or in a subsequent contract year.

Table 6.5: Standard Table for Traditional GMIB Annuitization

Annuitization GAPV	First year of exercisability	Subsequent years
0–100% of Account Value	0.0%	0.0%
100–125% of Account Value	5.0%	2.5%
125–150% of Account Value	10.0%	5.0%
150–175% of Account Value	15.0%	7.5%
175–200% of Account Value	20.0%	10.0%
200%+ of Account Value	25.0%	12.5%

- c. The annual annuitization rate for a hybrid GMIB contract that is immediately exercisable in the projection interval and that has an Account Value greater than zero shall be determined via the following steps:
 - i. If the GMIB's Withdrawal GAPV exceeds its Annuitization GAPV, the GMIB's Annuitization GAPV exceeds the contract's account value, and the contract is not in the last three years in which the GMIB is exercisable, then the annual annuitization rate shall be 0.25%.
 - ii. If the GMIB's Annuitization GAPV exceeds or equals its Withdrawal GAPV, and the contract is not in the last three years in which the GMIB is exercisable, then the annual annuitization rate shall follow the Standard Table A for Hybrid GMIB Annuitization as detailed below in Table 6.6.

iii. If the contract is in the last three years in which the GMIB is exercisable, then the annual annuitization rate shall follow the Standard Table B for Hybrid GMIB Annuitization as detailed below in Table 6.7.

iv. Otherwise, the annual annuitization rate shall be zero.

Table 6.6: Standard Table A for Hybrid GMIB Annuitization

Annuitization GAPV	Annual annuitization rate
0–100% of Account Value	0.0%
100–125% of Account Value	0.5%
125–150% of Account Value	1.0%
150–175% of Account Value	1.5%
175–200% of Account Value	2.0%
200%+ of Account Value	2.5%

Table 6.7: Standard Table B for Hybrid GMIB Annuitization

Annuitization GAPV	Annual annuitization rate
0–100% of Account Value	0.0%
100–125% of Account Value	5.0%
125–150% of Account Value	10.0%
150–175% of Account Value	15.0%
175–200% of Account Value	20.0%
200–225% of Account Value	25.0%
225–250% of Account Value	30.0%
250%+ of Account Value	35.0%

- d. If during any projection interval, the GAPV of another guarantee on the contract (e.g., a GMDB) exceeds the Annuitization GAPV, the annual annuitization rate in that projection interval shall be further adjusted to equal 50% of the annual annuitization rate determined via the calculations detailed above, but not to exceed 12.5%. For these calculations, the Annuitization GAPV and Withdrawal GAPV shall follow the definition described in Section 6.C.3.
- e. The annuitization rate for all GMIB contracts shall be 100% immediately after the Account Value reaches zero. As discussed in Section 6.C.10, contractual features that terminate the GMIB upon account value depletion shall be voided such that the account value depletion event does not terminate the GMIB.
8. Account Transfers and Future Deposits
- a. No transfers between funds shall be assumed in the projection unless required by the contract (e.g., transfers from a dollar cost averaging fund or contractual rights given to the insurer to implement a contractually specified portfolio insurance management strategy or a contract operating under an automatic re-balancing option). When transfers must be modeled, to the extent not inconsistent with contract language, the allocation of

transfers to funds must be in proportion to the contract's current allocation to funds.

- b. Except for simple 403(b) VA contracts, no future deposits to account value shall be assumed unless required by the terms of the contract to prevent contract or guaranteed benefit lapse, in which case they must be modeled. When future deposits must be modeled, to the extent not inconsistent with contract language, the allocation of the deposit to funds must be in proportion to the contract's current allocation to such funds.
- c. For simple 403(b) VA contracts, total deposits to account value in any projected future policy year shall be modeled as a percentage of the total deposits from the immediately preceding policy year. The percentage shall be determined based on the following table:

Table 6.48: Deposit Rates, 403(b)

Attained Age	Percent of prior year's deposits
54 and under	90%
55 through 69	80%
70 and over	0%

9. Mortality

The mortality rate for a contract holder with age x in year $(2012 + n)$ shall be calculated using the following formula, where q_x denotes mortality from the 2012 IAM Basic Mortality Table multiplied by the appropriate factor (F_x) from Table 6.9 and $G2_x$ denotes mortality improvement from Projection Scale G2:

$$q_x^{2012+n} = q_x^{2012}(1 - G2_x)^n * F_x$$

Table 6.9

Attained Age (x)	F_x for VA with GLB	F_x for All Other
≤ 65	80.0%	100.0%
66	81.5%	102.0%
67	83.0%	104.0%
68	84.5%	106.0%
69	86.0%	108.0%
70	87.5%	110.0%
71	89.0%	112.0%
72	90.5%	114.0%
73	92.0%	116.0%
74	93.5%	118.0%
75	95.0%	120.0%
76	96.5%	119.0%
77	98.0%	118.0%
78	99.5%	117.0%

79	101.0%	116.0%
80	102.5%	115.0%
81	104.0%	114.0%
82	105.5%	113.0%
83	107.0%	112.0%
84	108.5%	111.0%
85	110.0%	110.0%
86	110.0%	110.0%
87	110.0%	110.0%
88	110.0%	110.0%
89	110.0%	110.0%
90	110.0%	110.0%
91	110.0%	110.0%
92	110.0%	110.0%
93	110.0%	110.0%
94	110.0%	110.0%
95	110.0%	110.0%
96	109.0%	109.0%
97	108.0%	108.0%
98	107.0%	107.0%
99	106.0%	106.0%
100	105.0%	105.0%
101	104.0%	104.0%
102	103.0%	103.0%
103	102.0%	102.0%
104	101.0%	101.0%
>=105	100.0%	100.0%

10. Account Value Depletions

The following assumptions shall be used when a contract's Account Value reaches zero:

- a. If the contract has a GMWB, the contract shall take partial withdrawals that are equal in amount each year to the guaranteed maximum annual withdrawal amount.
- b. If the contract has a GMIB, the contract shall annuitize immediately. If the GMIB contractually terminates upon account value depletion, such termination provision is assumed to be voided in order to approximate the contract holder's election to annuitize immediately before the depletion of the account value.
- c. If the contract has any other guaranteed benefits, including a GMDB, the contract shall remain in-force. If the guaranteed benefits contractually terminate upon account value depletion, such termination provisions are assumed to be voided in order to approximate the contract holder's retaining adequate Account Value to maintain the guaranteed benefits in-

force. At the option of the company, fees associated with the contract and guaranteed benefits may continue to be charged and modeled as collected even if the account value has reached zero. While the contract must remain in-force, benefit features may still be terminated according to contractual terms other than account value depletion provisions.

- d. If the contract has no minimum guaranteed benefits, the contract should be terminated according to contractual terms.

11. Other Voluntary Contract Terminations

For contracts that have other elective provisions that allow a contract holder to terminate the contract voluntarily, the termination rate shall be calculated based on the Standard Table for Full Surrenders as detailed above in Table 6.3 with the following adjustments:

- a. If the contract holder is not yet eligible to terminate the contract under the elective provisions, the termination rate shall be zero.
- b. After the contract holder becomes eligible to terminate the contract under the elective provisions, the termination rate shall be determined using the “Subsequent years” column of Table 6.3.
- c. In using Table 6.3, the ITM of a contract’s guaranteed benefit shall be calculated based on the ratio of the guaranteed benefit’s GAPV to the termination value of the contract. The termination value of the contract shall be calculated as the GAPV of the payment stream that the contract holder is entitled to receive upon termination of the contract; if the contract holder has multiple options for the payment stream, the termination value shall be the highest GAPV of these options.
- d. For GMWB or hybrid GMIB contracts, for all contract years in which a withdrawal is projected, the termination rate obtained from Table 6.3 shall be additionally multiplied by 60%.

For calculating the ITM of a hybrid GMIB, the guaranteed benefit’s GAPV shall be the larger of the Annuitization GAPV or the Withdrawal GAPV.

- e. For contracts with no minimum guaranteed benefits, the ITM is 0%; for all contract years in which a withdrawal is projected, the termination rate obtained from Table 6.3 shall be the row in the table for ITM < 50% using the “Subsequent years” column of Table 6.3.

Section 7: Alternative Methodology

A. General Methodology

1. General Methodology Description

- a. For variable deferred annuity contracts that either contain no guaranteed benefits or only GMDBs, including “earnings enhanced death benefits,” (i.e., no VAGLBs), the reserve may be determined by using the method outlined below

rather than by using the approach described in Section 3.C and Section 3.D—i.e., based on projections—provided the approach described in Section 3.D has not been used in prior valuations or else approval has been obtained from the domiciliary commissioner.

- b. The reserve determined using the Alternative Methodology for a group of contracts with GMDBs shall be determined as the sum of amounts obtained by applying factors to each contract in force as of a valuation date and adding this to the contract's cash surrender value.
- c. The amount that is added to an individual contract's cash surrender value may be negative, zero or positive, thus resulting in a reserve for a given contract that could be less than, equal to or greater than the cash surrender value. The resulting reserve in aggregate shall not be less than the greater of the cash surrender value or the reserve determined by applying *Actuarial Guideline XXXIII—Determining CARVM Reserves for Annuity Contracts with Elective Benefits* (AG 33) in VM-C, each in aggregate for the group of contracts to which the Alternative Methodology is applied.
- d. The reserve determined using the Alternative Methodology for a group of contracts that contain no guaranteed benefits shall be determined using an application of AG 33 in VM-C, as described below.

Guidance Note: The term “contracts that contain no guaranteed benefits” means that there are no guaranteed benefits at any time during the life of the contract (past, present or future).

- e. For purposes of performing the Alternative Methodology, materially similar contracts within the group may be combined together into subgroups to facilitate application of the factors. Specifically, all contracts comprising a “subgroup” must display substantially similar characteristics for those attributes expected to affect reserves (e.g., definition of guaranteed benefits, attained age, contract duration, years-to-maturity, market-to-guaranteed value, asset mix, etc.). Grouping shall be the responsibility of the actuary but may not be done in a manner that intentionally understates the resulting reserve.
- f. The Alternative Methodology, as described in this section, produces a pre-reinsurance-ceded reserve. The post-reinsurance-ceded reserve is discussed in Section 5.3.
- g. Instructions and factors for the Alternative Method can be found on the website of the Academy at: www.actuary.org/content/c3-phase-ii-rbc-and-reserves-project

2. Definitions of Terms Used in This Section

- a. **Annualized Account Charge Differential:** This term is the charge as percentage account value (revenue for the company) minus the expense as percentage of account value.
- b. **Asset Exposure:** Asset exposure refers to the greatest possible loss to the insurance company from the value of assets underlying general or separate account contracts falling to zero.
- c. **Benchmark:** Benchmarks have similar risk characteristics to the entity (e.g., asset class, index or fund) to be modeled.

- d. **Deterministic Calculations:** In a deterministic calculation, a given event (e.g., asset returns going up by 7% and then down by 5%) is assumed to occur with certainty. In a stochastic calculation, events are assigned probabilities.
- e. **Foreign Securities:** These are securities issued by entities outside the U.S.
- f. **Grouped Fund Holdings:** Grouped fund holdings relate to guarantees that apply across multiple deposits or for an entire contract instead of on a deposit-by-deposit basis.
- g. **Guaranteed Value:** The guaranteed value is the benefit base or a substitute for the account value (if greater than the account value) in the calculation of living benefits or death benefits. The methodology for setting the guaranteed value is defined in the variable annuity contract.
- h. **High-Yield Bonds:** High-yield bonds are below investment grade, with NAIC ratings (if assigned) of 3, 4, 5 or 6. Compared to investment grade bonds, these bonds have higher risk of loss due to credit events. Funds predominately containing securities that are not NAIC rated as 1 or 2 (or similar agency ratings) are considered to be high-yield.
- i. **Investment Grade Fixed Income Securities:** Securities with NAIC ratings of 1 or 2 are investment grade. Funds containing securities predominately with NAIC ratings of 1 or 2 or with similar agency ratings are considered to be investment grade.
- j. **Liquid Securities:** These securities can be sold and converted into cash at a price close to its true value in a short period of time.
- k. **Margin Offset:** Margin offset is the portion of charges plus any revenue-sharing allowed under Section 4.A.5 available to fund claims and amortization of the unamortized surrender charges allowance.
- l. **Multi-Point Linear Interpolation:** This methodology is documented in mathematical literature and calculates factors based on multiple attributes categorized with discrete values where the attributes' actual values may be between the discrete values.
- m. **Model Office:** A model office converts many contracts with similar features into one contract with specific features for modeling purposes.
- n. **Quota-Share Reinsurance:** In this type of reinsurance treaty, the same proportion is ceded on all cessions. The reinsurer assumes a set percentage of risk for the same percentage of the premium, minus an allowance for the ceding company's expenses.
- o. **Resets:** A reset benefit results in a future minimum guaranteed benefit being set equal to the contract's account value at previous set date(s) after contract inception.
- p. **Risk Mitigation Strategy:** A risk mitigation strategy is a device to reduce the probability and/or impact of a risk below an acceptable threshold.

- q. Risk Profile: Risk profile in these requirements relates to the prescribed asset class categorized by the volatility of returns associated with that class.
 - r. Risk Transfer Arrangements: A risk transfer arrangement shifts risk exposures (e.g., the responsibility to pay at least a portion of future contingent claims) away from the original insurer.
 - s. Roll-Up: A roll-up benefit results in the guaranteed value associated with a minimum contractual guarantee increasing at a contractually defined interest rate.
 - t. Volatility: Volatility refers to the annualized standard deviation of asset returns.
3. Contract-by-Contract Application for Contracts That Contain No Guaranteed Living or Death Benefits

The Alternative Methodology reserve for each contract that contains no guaranteed living or death benefits shall be determined by applying AG 33 in VM-C. The application shall assume a return on separate account assets equal to the valuation interest rate for a non-variable annuity with similar features issued during the first calendar quarter of the same calendar year less appropriate asset-based charges. It also shall assume a return for any fixed separate account and general account options equal to the rates guaranteed under the contract.

4. Contract-by-Contract Application for Contracts That Contain GMDBs Only

For each contract, factors are used to determine a dollar amount, equal to $R \times (CA + FE) + GC$ (as described below), that is to be added to that contract's cash surrender value as of the valuation date. The dollar amount to be added for any given contract may be negative, zero or positive. The factors that are applied to each contract shall reflect the following attributes as of the valuation date.

- a. The contractual features of the variable annuity product.
 - b. The actual issue age, period since issue, attained age, years-to-maturity and gender applicable to the contract.
 - c. The account value and composition by type of underlying variable or fixed fund.
 - d. Any surrender charges.
 - e. The GMDB and the type of adjustment made to the GMDB for partial withdrawals (e.g., proportional or dollar-for-dollar adjustment).
 - f. Expenses to be incurred and revenues to be received by the company as estimated on a prudent estimate basis and complying with the requirements for revenue sharing as described in Section 4.A.5.
5. Factor Components

Factors shall be applied to determine each of the following components.

CA = Provision for amortization of the unamortized surrender charges calculated by the insurer based on each contract's surrender charge schedule, using prescribed

assumptions, except that lapse rates shall be based on the insurer's prudent estimate, but with no provision for federal income taxes or mortality.

FE = Provision for fixed dollar expenses less fixed dollar revenue calculated using prescribed assumptions, the contract's actual expense charges, the insurer's anticipated actual expenses and lapse rates, both estimated on a prudent estimate basis, and with no provision for federal income taxes or mortality.

GC = Provision for the costs of providing the GMDB less net available spread-based charges determined by the formula $F \times GV - G \times AV \times R$, where GV and AV are as defined in Section 7.C.1.

R = A scaling factor that is a linear function of the ratio of the margin offset to total account charges (W) and takes the form $R(\beta_1, \beta_2) = \beta_1 + \beta_2 \times W$. The intercept and slope factors for this linear function may vary according to:

- Product type.
- Pro-rata or dollar-for-dollar reductions in guaranteed value following partial withdrawals.
- Fund class.
- Attained age.
- Contract duration.
- Asset-based charges.
- 90% of the ratio of account value to guaranteed value, determined in the aggregate for all contracts sharing the same product characteristics.

Tables of factors for F , G , β_1 and β_2 values reflecting a 65% confidence interval and ignoring federal income tax are available from the NAIC. In calculating $R(\beta_1, \beta_2)$ directly from the linear function provided above, the margin ratio W must be constrained to values greater than or equal to 0.2 and less than or equal to 0.6.

Interpolated values of F , G and R (calculated using the linear function described above) for all contracts having the same product characteristics and asset class shall be derived from the pre-calculated values using multi-point linear interpolation over the following four contract-level attributes:

- a. Attained age.
- b. Contract duration.
- c. Ratio of account value to GMDB.
- d. The total of all asset-based charges, including any fund management fees or allowances based on the underlying variable annuity funds received by the insurer.

The gross asset-based charges for a product shall equal the sum of all contractual asset-based charges plus fund management fees or allowances based on the underlying variable annuity funds received by the insurer determined on a prudent estimate basis and revenue sharing described in Section 4.A.5. Net asset-based

charges equal gross asset-based charges less any company expenses assumed to be incurred expressed as a percentage of account value. All expenses that would be assumed if a SR was being computed as described in Section 4.A.1 should be reflected either in the calculation of the net asset-based charges or in the expenses reflected in the calculation of the amount *FE*.

No adjustment is made for federal income taxes in any of the components listed above.

For purposes of determining the reserve using the Alternative Methodology, any interpretation and application of the requirements of these requirements shall follow the principles discussed in Section 1.B.

B. Calculation of *CA* and *FE*

1. General Description

Components *CA* and *FE* shall be calculated for each contract, thus reflecting the actual account value and GMDB, as of the valuation date, which is unique to each contract.

Components *CA* and *FE* are defined by deterministic “single-scenario” calculations that account for asset growth, interest and inflation at prescribed rates. Mortality is ignored for these two components. Lapse rates shall be determined on a prudent estimate basis. Lapse rates shall be adjusted by the formula shown below (the dynamic lapse multiplier), which bases the relationship of the GMDB (denoted as *GV* in the formula) to the account value (denoted as *AV* in the formula) on the valuation date. Thus, projected lapse rates are smaller when the GMDB is greater than the account value and larger when the GMDB is less than the account value.

$$\lambda = \text{MIN} \left[U, \text{MAX} \left[L, 1 - M \times \left(\frac{GV}{AV} - D \right) \right] \right], \text{ where } U=1, L=0.5, M=1.25, \text{ and } D=1.1.$$

Present values shall be computed over the period from the valuation date to contract maturity at a discount rate of 5.75%.

Projected fund performance underlying the account values is as shown in the table below. Unlike the *GC* component, which requires the entire account value to be mapped, using the fund categorization rules set forth in Section 7.D, to a single “equivalent” asset class (as described in Section 7.D.3), the *CA* and *FE* calculation separately projects each variable subaccount (as mapped to the eight prescribed categories shown in Section 7.D using the net asset returns shown in the following table). If surrender charges are based wholly on deposits or premiums as opposed to account value, use of this table may not be necessary.

Table 7.1: Guaranteed Rates by Asset Class

Asset Class/Fund	Net Annualized Return
Fixed Account	Guaranteed Rate
Money Market	0%
Fixed Income (Bond)	0%

Balanced	-1%
Diversified Equity	-2%
Diversified International Equity	-3%
Intermediate Risk Equity	-5%
Aggressive or Exotic Equity	-8%

2. Component *CA*

Component *CA* is computed as the present value of the projected change in surrender charges plus the present value of an implied borrowing cost of 25 bps at the beginning of each future period applied to the surrender charge at such time.

This component can be interpreted as the “amount needed to amortize the unamortized surrender charge allowance for the *persisting* policies plus the implied borrowing cost.” By definition, the amortization for non-persisting lives in each time period is exactly offset by the collected surrender charge revenue (ignoring timing differences and any waiver upon death). The unamortized balance must be projected to the end of the surrender charge period using the net asset returns and Dynamic Lapse Multiplier, both as described above, and the year-by-year amortization discounted also as described above. For simplicity, mortality is ignored in the calculations. Surrender charges and free partial withdrawal provisions are as specified in the contract. Lapse and withdrawal rates are determined on a prudent estimate basis and may vary according to the attributes of the business being valued including, but not limited to, attained age, contract duration, etc.

3. Component *FE*

Component *FE* establishes a provision for fixed dollar expenses (e.g., allocated costs, including overhead expressed as “per contract” and those expenses defined on a “per contract” basis) less any fixed dollar revenue (e.g., annual administrative charges or contract fees) through the earlier of contract maturity or 30 years. *FE* is computed as the present value of the company’s assumed fixed expenses projected at an assumed annual rate of inflation starting in the second projection year. This rate grades uniformly from the current inflation rate (CIR) into an ultimate inflation rate of 3% per annum in the 8th year after the valuation date. The CIR is the greater of 3% and the inflation rate assumed for expenses in the company’s most recent asset adequacy analysis for similar business.

C. Calculation of the *GC* Component

1. *GC* Factors

GC is calculated as $F \times GV - G \times AV \times R$, where *GV* is the amount of the GMDB and *AV* is the contract account value, both as of the valuation date. *F*, *G* and the slope and intercept for the linear function used to determine *R* (identified symbolically as β_1 and β_2) are pre-calculated factors available from the NAIC and known herein as the “pre-calculated factors.” The factors shall be interpolated as described in Section 7.C.6 and modified as necessary as described in Section 7.C.7 and Section 7.C.8.

2. Five Steps

There are five major steps in determining the *GC* component for a given contract:

- a. Classifying the asset exposure, as specified in Section 7.C.3.

- b. Determining the risk attributes, as specified in Section 7.C.4 and Section 7.C.5.
 - c. Retrieving the appropriate nodal factors from the factor grid, as described in Section 7.C.5.
 - d. Interpolating the nodal factors, where applicable (optional), as described in Section 7.C.6.
 - e. Applying the factors to the contract values.
3. Classifying Asset Exposure

For purposes of calculating GC (unlike what is done for components CA and FE), the entire account value for each contract must be assigned to one of the eight prescribed fund classes shown in Section 7.D, using the fund categorization rules in Section 7.D.

4. Product Designs

Factors F , G and $R(\beta_1, \beta_2)$ are available with the pre-calculated factors for the following GMDB product designs:

- a. Return of premium (ROP).
- b. Premiums less withdrawals accumulated at 3% per annum, capped at 2.5 times premiums less withdrawals, with no further increase beyond age 80 (ROLL3).
- c. Premiums less withdrawals accumulated at 5% per annum, capped at 2.5 times premiums less withdrawals, with no further increase beyond age 80 (ROLL5).
- d. An annual ratchet design (maximum anniversary value), for which the guaranteed benefit never decreases and is increased to equal the previous contract anniversary account value, if larger, with no further increases beyond age 80 (MAV).
- e. A design having a guaranteed benefit equal to the larger of the benefits in designs c and d, above (HIGH).
- f. An enhanced death benefit (EDB) equal to 40% of the net earnings on the account (i.e., 40% of account value less total premiums paid plus withdrawals made), with this latter benefit capped at 40% of premiums less withdrawals.

5. Other Attributes

Factors F , G and $R(\beta_1, \beta_2)$ are available within the pre-calculated factors for the following set of attributes:

- a. Two partial withdrawal rules—one for contracts having a pro-rata reduction in the GMDB and another for contracts having a dollar-for-dollar reduction.
- b. The eight asset classes described in Section 7.D.2.
- c. Eight attained ages, with a five-year age setback for females.
- d. Five contract durations.
- e. Seven values of GV/AV .

- f. Three levels of asset-based income.
6. Interpolation of F , G and $R(\beta_1, \beta_2)$
- a. Apply to a contract having the product characteristics listed in Section 7.E.1 and shall be determined by selecting values for the appropriate partial withdrawal rule and asset class and then using multipoint linear interpolation among published values for the last four attributes shown in Section 7.C.5.
 - b. Interpolation over all four dimensions is not required, but if not performed over one or more dimensions, the factor used must result in a conservative (higher) value of GC . However, simple linear interpolation using the $AV \div GV$ ratio is mandatory. In this case, the company must choose nodes for the other three dimensions according to the following rules: next highest attained age, nearest duration and nearest annualized account charge differential, as listed in Section 7.E.3 (i.e., capped at +100 and floored at -100 bps).
 - c. For $R(\beta_1, \beta_2)$, the interpolation should be performed on the scaling factors R calculated using β_1 , β_2 , using the ratio of margin offset to total asset charges (W), not on the factors β_1 and β_2 themselves.
 - d. The instructions referenced in Section 7.A.1.f above include guidance on determining the correct values and performing the multipoint linear interpolation. Alternatively, published documentation can be referenced on performing multipoint linear interpolation and the required 16 values determined using a key that is documented in the table *Components of Key Used for GC Factor Look-Up* located in Table 7.6.
7. Adjustments to GC for Product Variations and Risk Mitigation/Transfer

In some cases, it may be necessary to make adjustments to the published factors due to:

- a. A variation in product form wherein the definition of the guaranteed benefit is materially different from those for which factors are available. (See Section 7.C.8.)
- b. A risk mitigation or other management strategy, other than a hedging strategy, that cannot be accommodated through a straightforward and direct adjustment to the published values.

Adjustments may not be made to GC for hedging strategies.

Any adjustments to the published factors must be fully documented and supported through stochastic analysis. Such analysis may require stochastic simulations but would not ordinarily be based on full in-force projections. Instead, a representative “model office” should be sufficient. Use of these adjusted factors must be supported by a periodic review of the appropriateness of the assumptions and methods used to perform the adjustments, with changes made to the adjustments when deemed necessary by such review.

Note that minor variations in product design do not necessarily require additional effort. In some cases, it may be reasonable to use the factors/formulas for a different product form (e.g., for a roll-up GMDB near or beyond the maximum reset age or amount, the ROP GMDB factors/formulas shall be used, possibly adjusting the guaranteed value to reflect further resets, if any). In other cases, the reserves may be based on two different guarantee definitions and the results

interpolated to obtain an appropriate value for the given contract/cell. Likewise, it may be possible to adjust the Alternative Methodology results for certain risk transfer arrangements without significant additional work (e.g., quota-share reinsurance without caps, floors or sliding scales would normally be reflected by a simple pro-rata adjustment to the “gross” *GC* results).

However, if the contract design is sufficiently different from those provided and/or the risk mitigation strategy is nonlinear in its impact on the reserve, and there is no practical or obvious way to obtain a good result from the prescribed factors/formulas, any adjustments or approximations must be supported using stochastic modeling. Notably this modeling need not be performed on the whole portfolio, but can be undertaken on an appropriate set of representative policies.

8. Adjusting *F* and *G* for Product Design Variations

This subsection describes the typical process for adjusting *F* and *G* factors due to a variation in product design. Note that *R* (as determined by the slope and intercept terms in the factor table) would not be adjusted.

- a. Select a contract design among those described in Section 7.C.4 that is similar to the product being valued. Execute cash-flow projections using the documented assumptions (see table of *Liability Modeling Assumptions & Product Characteristics* in Section 7.E.1 and table of *Asset-Based Fund Charges* in Section 7.E.2) and the scenarios from the prescribed generator for a set of representative cells (combinations of attained age, contract duration, asset class, AV/GMDB ratio and asset-based charges). These cells should correspond to nodes in the table of precalculated factors. Rank (order) the sample distribution of results for the present value of net cost. Determine those scenarios that comprise CTE (65).

Guidance Note: Present value of net cost = PV [guaranteed benefit claims in excess of account value] – PV [margin offset]. The discounting includes cash flows in all future years (i.e., to the earlier of contract maturity and the end of the horizon).

- b. Using the results from step 1, average the present value of cost for the CTE (65) scenarios and divide by the current guaranteed value. For the J^{th} cell, denote this value by F_J . Similarly, average the present value of the margin offset revenue for the same subset of scenarios and divide by account value. For the J^{th} cell, denote this value by G_J .
- c. Extract the corresponding precalculated factors. For each cell, calibrate to the published tables by defining a “model adjustment factor” (denoted by asterisk) separately for the “cost” and “margin offset” components:

$$F_J^* = \frac{f(\tilde{\theta})}{F_J} \text{ and } G_J^* = \frac{g(\tilde{\theta})}{G_J}$$

- d. Execute “product specific” cash-flow projections using the documented assumptions and scenarios from the prescribed generator for the same set of representative cells. Here, the company should model the actual product design. Rank (order) the sample distribution of results for the present value of net cost. Determine those scenarios that comprise CTE (65).
- e. Using the results from step d, average the present value of cost for the CTE (65) scenarios and divide by the current guaranteed value. For the J^{th} cell, denote this

value by \bar{F}_J . Similarly, average the present value of margin offset revenue for the same subset of scenarios and divide by account value. For the J^{th} cell, denote this value by \bar{G}_J .

- f. To calculate the reserve for the specific product in question, the company should implement the Alternative Methodology as documented, but use $\bar{F}_J \times F_J^*$ in place of F and $\bar{G}_J \times G_J^*$ instead of G . The same R factors as appropriate for the product evaluated in step 1 shall be used for this step (i.e., the product used to calibrate the cash-flow model).

9. Adjusting GC for Mortality Experience

The factors that have been developed for use in determining GC assume male mortality at 100% of the 1994 Variable Annuity MGDB ALB Mortality Table. Females use a five-year age setback. Companies electing to use the Alternative Methodology that have not conducted an evaluation of their mortality experience shall use these factors, or they shall adjust the factors using the methodology below to apply the mortality defined in Section 11.C. for products without VAGLB. Other companies should use the procedure described below to adjust for the actuary's prudent estimate of mortality. The development of prudent estimate mortality shall follow the requirements and guidance of Section 11. Once a company uses the modified method for a block of business, the option to use the unadjusted factors is no longer available for that part of its business. In applying the factors to actual in-force business, a five-year age setback should be used for female annuitants.

- a. Develop a set of mortality assumptions based on prudent estimate assumptions. In setting these assumptions, the actuary shall be guided by the definition of prudent estimate and the principles discussed in Sections 10 and 11. (This step only applies to companies which have conducted an evaluation of their mortality experience).
- b. Calculate two sets of NSPs at each attained age:
 - i. One using 100% of the 1994 Variable Annuity MGDB Age Last Birthday (ALB) Mortality Table (with the aforementioned five-year age setback for females); and
 - ii. A second using either:
 - (a) The prudent estimate mortality if that has been established by the company.
 - (b) For companies that have not established a prudent estimate mortality assumption, the appropriate percentage of the 2012 IAM Basic Table with Projection Scale G2 ALB (as described in Section 12.B.3).

These calculations shall assume an interest rate of 3.75% and a lapse rate of 7% per year.

- c. The GC factor is multiplied by the ratio, for the specific attained age being valued, of the NSP calculated using the prudent estimate mortality for blocks with those assumptions or the NSP calculated using the adjusted 2012 IAM Basic Table for blocks without a prudent estimate assumption to the NSP calculated using the 1994 Variable Annuity MGDB ALB Mortality Table. The base factors for females use the values (with the aforementioned five-year age setback).

D. Fund Categorization**1. Criteria**

The following criteria should be used to select the appropriate factors, parameters and formulas for the exposure represented by a specified guaranteed benefit. When available, the volatility of the long-term annualized total return for the fund(s)—or an appropriate benchmark—should conform to the limits presented. For this purpose, “long-term” is defined as twice the average projection period that would be applied to test the product in a stochastic model (generally, at least 30 years).

Where data for the fund or benchmark are too sparse or unreliable, the fund exposure should be moved to the next higher volatility class than otherwise indicated. In reviewing the asset classifications, care should be taken to reflect any additional volatility of returns added by the presence of currency risk, liquidity (bid – ask) effects, short selling and speculative positions.

2. Asset Classes

Variable subaccounts must be categorized into one of the following eight asset classes. For purposes of calculating *CA* or *FE*, each contract will have one or more of the following asset classes represented, whereas for component *GC*, all subaccounts will be mapped into a single asset class.

- a. Fixed account: This class is credited interest at guaranteed rates for a specified term or according to a “portfolio rate” or “benchmark” index. This class offers a minimum positive guaranteed rate that is periodically adjusted according to company policy and market conditions.
- b. Money market/short-term: This class is invested in money market instruments with an average remaining term-to-maturity of less than 365 days.
- c. Fixed income: This class is invested primarily in investment grade fixed income securities. Up to 25% of the funds within this class may be invested in diversified equities or high-yield bonds. The expected volatility of the returns for this class will be lower than the balanced fund class.
- d. Balanced: This class is a combination of fixed income securities with a larger equity component. The fixed income component should exceed 25% of the portfolio. Additionally, any aggressive or “exotic” equity component should not exceed one-third (33.3%) of the total equities held. Should the fund violate either of these constraints, it should be categorized as an equity fund. This class usually has a long-term volatility in the range of 8%–13%.
- e. Diversified equity: This class is invested in a broad-based mix of U.S. and foreign equities. The foreign equity component (maximum 25% of total holdings) must be comprised of liquid securities in well-developed markets. Funds in this class would exhibit long-term volatility comparable to that of the S&P 500. These funds should usually have a long-term volatility in the range of 13%–18%.
- f. Diversified international equity: This class is similar to the diversified equity class, except that the majority of fund holdings are in foreign securities. This class should usually have a long-term volatility in the range of 14%–19%.

- g. Intermediate risk equity: This class has a mix of characteristics from both the diversified and aggressive equity classes. This class has a long-term volatility in the range of 19%–25%.
 - h. Aggressive or exotic equity: This class comprises more volatile funds where risk can arise from: underdeveloped markets, uncertain markets, high volatility of returns, narrow focus (e.g., specific market sector), etc. This class (or market benchmark) either does not have sufficient history to allow for the calculation of a long-term expected volatility, or the volatility is very high. This class would be used whenever the long-term expected annualized volatility is indeterminable or exceeds 25%.
3. Selecting Appropriate Investment Classes

The selection of an appropriate investment type should be done at the level for which the guarantee applies. For guarantees applying on a deposit-by-deposit basis, the fund selection is straightforward. However, where the guarantee applies across deposits or for an entire contract, the approach can be more complicated. In such instances, the approach is to identify for each contract where the “grouped holdings” fit within the categories listed and to classify the associated assets on this basis.

A seriatim process is used to identify the “grouped” fund holdings, to assess the risk profile of the current fund holdings (possibly calculating the expected long-term volatility of the funds held with reference to the indicated market proxies) and to classify the entire “asset exposure” into one of the specified choices. Here, “asset exposure” refers to the underlying assets (separate and/or general account investment options) on which the guarantee will be determined. For example, if the guarantee applies separately for each deposit year within the contract, then the classification process would be applied separately for the exposure of each deposit year.

In summary, mapping the benefit exposure (i.e., the asset exposure that applies to the calculation of the guaranteed minimum death benefits) to one of the prescribed asset classes is a multistep process:

- a. Map each separate and/or general account investment option to one of the prescribed asset classes. For some funds, this mapping will be obvious, but for others, it will involve a review of the fund’s investment policy, performance benchmarks, composition and expected long-term volatility.
- b. Combine the mapped exposure to determine the expected long-term “volatility of current fund holdings.” This will require a calculation based on the expected long-term volatility for each fund and the correlations between the prescribed asset classes as given in the table “*Correlation Matrix for Prescribed Asset Classes*” in Section 6.D.4.
- c. Evaluate the asset composition and expected volatility (as calculated in step b) of current holdings to determine the single asset class that best represents the exposure, with due consideration to the constraints and guidelines presented earlier in this section.
- d. In step a, the company should use the fund’s actual experience (i.e., historical performance, inclusive of reinvestment) only as a guide in determining the expected long-term volatility. Due to limited data and changes in investment objectives, style and/or management (e.g., fund mergers, revised investment policy, different fund managers, etc.), the company may need to give more weight

to the expected long-term volatility of the fund's benchmarks. In general, the company should exercise caution and not be overly optimistic in assuming that future returns will consistently be less volatile than the underlying markets.

- e. In step b, the company should calculate the “volatility of current fund holdings” (for the exposure being categorized) by the following formula:

$$\sigma = \sqrt{\sum_{i=1}^n \sum_{j=1}^n w_i w_j \rho_{ij} \sigma_i \sigma_j}$$

Using the volatilities and correlations in the following table, where

$$w_i = \frac{AV_i}{\sum_k AV_k}$$

is the relative value of fund i expressed as a proportion of total contract value, ρ_{ij} is the correlation between asset classes i and j, and σ_i is the volatility of asset class i. An example is provided after Table 7.3.

4. Correlation Matrix for Prescribed Asset Classes

Table 7.2: Correlation Matrix for Prescribed Asset Classes

Annual Volatility		Fixed Account	Money Market	Fixed Income	Balanced	Diverse Equity	Intl Equity	Interm Equity	Aggr Equity
1.0%	Fixed Account	1	0.50	0.15	0	0	0	0	0
1.5%	Money Market	0.50	1	0.20	0	0	0	0	0
5.0%	Fixed Income	0.15	0.20	1	0.30	0.10	0.10	0.10	0.05
10.0%	Balanced	0	0	0.30	1	0.95	0.60	0.75	0.60
15.5%	Diverse Equity	0	0	0.10	0.95	1	0.60	0.80	0.70
17.5%	Intl Equity	0	0	0.10	0.60	0.60	1	0.50	0.60
21.5%	Interm Equity	0	0	0.10	0.75	0.80	0.50	1	0.70
26.0%	Aggr Equity	0	0	0.05	0.60	0.70	0.60	0.70	1

5. Fund Categorization Example

As an example, suppose three funds (fixed income, diversified U.S. equity and aggressive equity) are offered to clients on a product with a contract level guarantee (i.e., across all funds held within the contract). The current fund holdings (in dollars) for five sample contracts are shown in the following table:

Table 7.3: Fund Categorization Example

	1	2	3	4	5
MV Fund X (Fixed Income)	5,000	4,000	8,000	-	5,000
MV Fund Y (Diversified Equity)	9,000	7,000	2,000	5,000	-
MV Fund Z (Aggressive Equity)	1,000	4,000	-	5,000	5,000
Total Market Value	15,000	15,000	10,000	10,000	10,000
Total Equity Market Value	10,000	11,000	2,000	10,000	5,000
Fixed Income % (<i>A</i>)	33%	27%	80%	0%	50%
Fixed Income Test (<i>A</i> > 75%)	No	No	Yes	No	No
Aggressive % of Equity (<i>B</i>)	10%	36%	n/a	50%	100%
Balanced Test (<i>A</i> > 25% & <i>B</i> < 33.3%)	Yes	No	n/a	No	No
Volatility of Current Fund Holdings	10.9%	13.2%	5.3%	19.2%	13.4%

Fund Classification	Balanced	Diversified ²	Fixed Income	Intermediate	Diversified
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As an example, the “volatility of current fund holdings” for contract #1 is calculated as $\sqrt{A + B}$ where:

$$A = \left(\frac{5}{15} \times 0.05 \right)^2 + \left(\frac{9}{15} \times 0.155 \right)^2 + \left(\frac{1}{15} \times 0.26 \right)^2$$

$$B = 2 \cdot \left(\frac{5}{15} \cdot \frac{9}{15} \right) (0.1 \times 0.05 \times 0.155) + 2 \cdot \left(\frac{5}{15} \cdot \frac{1}{15} \right) (0.05 \times 0.05 \times 0.26) + 2 \cdot \left(\frac{9}{15} \cdot \frac{1}{15} \right) (0.7 \times 0.155 \times 0.26)$$

$A = 0.0092$ and $B = 0.0026$: So, the volatility for contract #1 = $\sqrt{0.0092 + 0.0026} = 0.109$ or 10.9%

² Although the volatility suggests “balanced fund,” the balanced fund criteria were not met. Therefore, this “exposure” is moved “up” to diversified equity. For those funds classified as diversified equity, additional analysis would be required to assess whether they should be instead designated as “diversified international equity.”

E. Tables

1. Liability Modeling Assumptions and Product Characteristics used for GC Factors

Table 7.4: Liability Modeling Assumptions and Product Characteristics Used for GC Factors

Asset Based Charges (MER)	Vary by fund class. See Section 7.E.2.
Base Margin Offset	100 bps per annum.
GMDB Description	<ol style="list-style-type: none"> 1. ROP = return of premium. 2. ROLL3 = 3% roll-up, capped at 2.5×premium, frozen at age 80. 3. ROLL5 = 5% roll-up, capped at 2.5×premium, frozen at age 80. 4. MAV = annual ratchet (maximum anniversary value), frozen at age 80. 5. HIGH = higher of 5% roll-up and annual ratchet. <p>EDB = 40% enhanced death benefit (capped at 40% of deposit). Note that the pre-calculated factors were originally calculated with a combined ROP benefit, but they have been adjusted to remove the effect of the ROP. Thus, the factors for this benefit five are solely for the EDB.</p>
Adjustment to GMDB Upon Partial Withdrawal	Separate factors for “pro-rata by market value” and “dollar-for-dollar.”
Surrender Charges	Ignored (i.e., zero). Included in the <i>CA</i> component.
Single Premium/Deposit	\$100,000. No future deposits; no intra-contract fund rebalancing.
Base Contract Lapse Rate (Total Surrenders)	Pro-rata by MV: 10% p.a. at all contract durations (before dynamics). Dollar-for-dollar: 2% p.a. at all contract durations (no dynamics).
Partial Withdrawals	Pro-rata by MV: None (i.e., zero). Dollar-for-dollar: Flat 8% p.a. at all contract durations (as a % of AV). No dynamics or anti-selective behavior.
Mortality	100% of the 1994 Variable Annuity MGDB Mortality Table (MGDB 94 ALB). For reference, 1000 q_x rates at ages 65 and 70 for 100% of MGDB 94 ALB Male are 18.191 and 29.363, respectively. Note: Section 7.C.9 allows modification to this assumption.
Gender/Age Distribution	100% male. Methodology accommodates different attained ages. A five-year age setback will be used for female annuitants.
Max. Annuitization Age	All policies terminate at age 95.
Fixed Expenses	Ignored (i.e., zero). Included in the <i>FE</i> component.
Annual Fee and Waiver	Ignored (i.e., zero). Included in the <i>FE</i> component.
Discount Rate	5.75% pre-tax.
Dynamic Lapse Multiplier (Applies only to policies where GMDB is adjusted “pro-rata by MV” upon withdrawal)	$\lambda = MIN \left[U, MAX \left[L, 1 - M \times \left(\frac{GV}{AV} - D \right) \right] \right]$ <p>$U = 1, L = 0.5, M = 1.25, D = 1.1$</p> <ul style="list-style-type: none"> <input type="checkbox"/> Applied to the “Base Contract Lapse Rate.” <input type="checkbox"/> Does not apply to partial withdrawals.

2. Asset-Based Fund Charges (bps per annum)

Table 7.5: Asset-Based Fund Charges (bps per annum)

Asset Class/Fund	Account Value Charge
Fixed Account	0
Money Market	110
Fixed Income (Bond)	200
Balanced	250
Diversified Equity	250
Diversified International Equity	250
Intermediate Risk Equity	265
Aggressive or Exotic Equity	275

3. Components of Key Used for GC Factor Look-Up

Table 7.6: Components of Key Used for GC Factor Look-Up

(First Digit always “1”)

Contract Attribute	Key: Possible Values and Description	
Product Definition, P	0 : 0	Return-of-premium.
	1 : 1	Roll-up (3% per annum).
	2 : 2	Roll-up (5% per annum).
	3 : 3	Maximum anniversary value (MAV).
	4 : 4	High of MAV and 5% roll-up.
	5 : 5	Enhanced death benefit (excludes the ROP GMDB, which would have to be added separately if the contract in question has an ROP).
GV Adjustment Upon Partial Withdrawal, A	0 : 0	Pro-rata by market value.
	1 : 1	Dollar-for-dollar.
Fund Class, F	0 : 0	Fixed Account.
	1 : 1	Money Market.
	2 : 2	Fixed Income (Bond).
	3 : 3	Balanced Asset Allocation.
	4 : 4	Diversified Equity.
	5 : 5	International Equity.
	6 : 6	Intermediate Risk Equity.
	7 : 7	Aggressive/Exotic Equity.
Attained Age (Last Birthday), X	0 : 35	4 : 65
	1 : 45	5 : 70
	2 : 55	6 : 75
	3 : 60	7 : 80
Contract Duration (years-since-issue), D	0 : 0.5	3 : 9.5
	1 : 3.5	4 : 12.5
	2 : 6.5	
Account Value-to-Guaranteed Value Ratio, ϕ	0 : 0.25	4 : 1.25
	1 : 0.50	5 : 1.50
	2 : 0.75	6 : 2.00
	3 : 1.00	

Annualized Account Charge	0 : -100 bps
Differential from Section 7.E.2	1 : +0
Assumptions	2 : +100

Section 8: Scenario Generation

A. General

1. This section outlines the requirements for the stochastic cash-flow models used to simulate interest rates, fund returns, and implied volatility to be used in the modeled projections. Specifically, it prescribes scenario generators and the associated parameters for interest rates, as well as investment returns for general account equity assets and separate account fund returns. In addition, this section sets certain standards that must be satisfied by fund returns, implied volatility scenarios, and non-prescribed scenario generators. It also discusses general modeling considerations, such as the number of scenarios and projection frequency.

Guidance Note: For more details on the development of these scenario generators, see the Academy recommendations on the development of the Equity Generator (Recommended Approach for Setting Regulator Risk-Based Capital Requirements for Variable Annuities and Similar Products presented to NAIC Capital Adequacy Task Force in June 2005) and the Interest Rate Generator (Report from the American Academy of Actuaries' Economic Scenario Work Group to the NAIC Life Risk-Based Capital (E) Working Group and Life and Health Actuarial (B) Task Force - December 2008).

2. The scenarios discussed in this section are applicable to gross investment returns (before the deduction of any fees or charges). To determine the net returns appropriate for the projections required by these requirements, the company shall reflect applicable fees and contract holder charges in the development of projected account values. The projections also shall include the costs of managing the investments and converting the assets into cash when necessary.
3. As a general rule, funds with higher expected returns should have higher expected volatilities, and in the absence of well-documented mitigating factors (e.g., a highly reliable and favorable correlation to other fund returns), they should lead to higher total asset requirements.

Guidance Note: While the model need not strictly adhere to “mean-variance efficiency,” prudence dictates some form of consistent risk/return relationship between the proxy investment funds. In general, it would be inappropriate to assume consistently “superior” expected returns (i.e., risk/return point above the frontier).

4. For non-prescribed generators, the interest rate, equity, and implied volatility scenarios used to determine reserves must be available in an electronic spreadsheet to facilitate any regulatory review.

B. Prescribed Interest Rate Scenario Generator

1. Treasury Department interest rate curves shall be determined on a stochastic basis using the prescribed interest rate scenario generator with prescribed parameters, or a non-prescribed generator that meets the requirements described in Section 8.E.

2. The prescribed interest rate scenario generator can be found on the SOA's website address, www.soa.org/tables-calcs-tools/research-scenario/. The prescribed parameters for the prescribed interest rate scenario generator shall be those included in the prescribed interest rate scenario generator, and they shall use the mean reversion point for the 20-year Treasury Department bond rate based on the following formula, with the result rounded to the nearest 0.25%:

20% of the median 20-year Treasury Department bond rate over the last 600 months.

+ 30% of the average 20-year Treasury Department bond rate over the last 120 months.

+ 50% of the average 20-year Treasury Department bond rate over the last 36 months.

The mean reversion point for use in the generator changes once per calendar year in January, and it is based on historical rates through the end of the prior calendar year. While the mean reversion point is dynamic depending on the start date of a scenario, it remains constant (rather than dynamic) across all time periods after the scenario start date for the purposes of generating the scenario.

3. For this formula, the historical 20-year Treasury Department bond rate for each month shall be the rate reported for the last business day of the month. Treasury Department interest rates can be found at the website: www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield_historical_main.shtml.

C. Prescribed Total Investment Return Scenario Generator for Equity Assets and Separate Account Funds

1. Total investment return paths for general account equity assets and separate account fund returns shall be determined on a stochastic basis using the prescribed economic scenario generator with prescribed parameters.

Guidance Note: In lieu of the prescribed economic generators, the company may substitute scenarios from a non-prescribed economic generator that meets the requirements described in Section 8.E.

2. The prescribed economic scenario generator can be found on the SOA's website address, www.soa.org/tables-calcs-tools/research-scenario/. The prescribed parameters for the prescribed economic scenario generator shall be those included in the prescribed economic scenario generator. A more complete description of the generator and development of assumptions is contained in the Academy report referenced in the Guidance Note following Section 8.A.1 above.
3. The company shall map each of the proxy funds defined in Section 4.A.2 to the fund returns projected by the prescribed economic scenario generator. This mapping process may involve blending the accumulation factors from two or more of the prescribed fund returns to create the projected returns for each proxy fund. If a proxy fund cannot be appropriately mapped to some combination of the prescribed returns, the company shall determine an appropriate return using a non-prescribed scenario generator and disclose the methodology underlying the non-prescribed scenario generator.
4. In using non-prescribed scenario generators to determine the return for proxy funds that cannot be mapped to the prescribed economic generator, the scenarios so generated must be consistent with the general relationships between risk and return observed in the fund returns from the prescribed scenario generator. This does not imply a strict functional

relationship between the model parameters for various markets/funds, but it would generally be inappropriate to assume that a market or fund consistently “outperforms” (lower risk, higher expected return relative to the efficient frontier) over the long term.

5. When parameters are fit to historic data without consideration of the economic setting in which the historic data emerged, the market price of risk may not be consistent with a reasonable long-term model of market equilibrium. One possibility for establishing “consistent” parameters (or scenarios) across all funds would be to assume that the market price of risk is constant (or nearly constant) and governed by some functional (e.g., linear) relationship. That is, higher expected returns can only be garnered by assuming greater risk.

Guidance Note: As an example, the standard deviation of log returns often is used as a measure of risk. Specifically, two return distributions R_X and R_Y would satisfy the following relationship:

$$\text{Market Price of Risk} = \left(\frac{E[R_X] - r}{\sigma_X} \right) = \left(\frac{E[R_Y] - r}{\sigma_Y} \right)$$

Where $E[R]$ and σ are respectively the (unconditional) expected returns and volatilities, and r is the expected risk-free rate over a suitably long holding period commensurate with the projection horizon. One approach to establish consistent scenarios would set the model parameters to maintain a near-constant market price of risk.

6. A closely related method would assume some form of “mean-variance” efficiency to establish consistent model parameters. Using the historic data, the mean-variance (alternatively, “drift-volatility”) frontier could be constructed from a plot of (mean, variance) pairs from a collection of world market indices. The frontier could be assumed to follow some functional form, with the coefficients determined by standard curve fitting or regression techniques. Recognizing the uncertainty in the data, a “corridor” could be established for the frontier. Model parameters would then be adjusted to move the proxy market (fund) inside the corridor.

Guidance Note: The function forms quadratic polynomials, and logarithmic functions tend to work well.

7. Clearly, there are many other techniques that could be used to establishing consistency between the scenarios. While appealing, the above approaches do have drawbacks, and the company should not be overly optimistic in constructing the model parameters or the scenarios.

Guidance Note: For example, mean-variance measures ignore the asymmetric and fat-tailed profile of most equity market returns.

8. For each proxy fund not within the scope of the prescribed economic generator, the company must consider the following:
 - a. The Market Price of Risk, as defined in the Guidance Note found in Section 8.C.5, implied in the projected fund returns when compared against the Market Price of Risk for all funds generated by the prescribed scenario generator should produce reasonable relationships. In calculating the Market Price of Risk, the company shall use an expected risk-free rate consistent with the long-term risk-free rate used

in determining the Market Price of Risk or equivalent quantities in the calibration of the prescribed scenario generator.

- b. The average correlations, across all scenarios and all time periods, of the projected fund returns with the fund returns generated by the prescribed scenario generator should be in a reasonable range.

The company may also consider any other information that provides assurance that the returns for proxy funds not generated using a prescribed scenario generator do not consistently outperform over the long term if the company believes that the Market Price of Risk and correlations described above are misleading or not relevant.

9. It is not necessary to assume that all markets are perfectly positively correlated, but an assumption of independence (zero correlation) between the equity markets would inappropriately exaggerate the benefits of diversification. An examination of the historic data suggests that correlations are not stationary and that they tend to increase during times of high volatility or negative returns. As such, the company should take care not to underestimate the correlations in those scenarios used for the reserve calculations.

D. Implied Volatility Scenarios

The projection of implied volatility scenarios for interest rates, equities, or other asset classes is left to the judgment of the company, but the scenarios so generated must satisfy the following properties:

1. At each projection time step, all projected implied volatility surfaces must be arbitrage free after considering appropriate transaction costs.
2. Relationships between the projected implied volatility scenarios, the scenarios for the underlying asset investment returns, and the realized volatility of the scenarios for the underlying asset returns should be consistent with relationships observed in historical data.

For instance, projected implied volatility should generally exhibit positive correlation with the realized volatility of the scenarios for the underlying asset returns over the same time period. In addition, it would also be appropriate to assume that projected implied volatility generally exhibits negative correlation with the short-term performance of the underlying asset over the same time period.

3. For a company not using the safe harbor described in Section 9.B.5, any implied volatility scenarios generated using a non-prescribed scenario generator shall not result in a TAR less than that obtained by assuming that the implied volatility level – at all ITM levels – at a given time step in a given scenario is equal to the realized volatility of the underlying asset scenario over the same time period. In other words, the TAR shall not be reduced by assumptions of any realizable spread between implied volatility and realized volatility. For the purposes of demonstrating compliance with this standard, a company may rely on only the values from the stochastic calculations and exclude impacts from the additional standard projection and the alternative methodology.

E. Use of Non-Prescribed Scenario Generators

At the option of the company, interest rates and total investment return scenarios for equity assets and separate account fund returns may be generated in part or in full using non-prescribed scenario generators in lieu of the prescribed economic generators, provided that the scenarios thus generated do not result in a TAR that is materially lower than the TAR resulting from the use of the scenarios from the prescribed economic generators as defined in B. and C. above. For purposes of

demonstrating compliance with this standard, a company may rely on only the values from the stochastic calculations and exclude impacts from the additional standard projection and the alternative methodology

F. Number of Scenarios and Efficiency in Estimation

1. For straight Monte Carlo simulation (with equally probable “paths” of fund returns), the number of scenarios should typically equal or exceed 1000. The appropriate number will depend on how the scenarios will be used and the materiality of the results. The company should use a number of scenarios that will provide an acceptable level of precision.
2. Fewer than 1,000 scenarios may be used provided that the company has determined through prior testing (perhaps on a subset of the portfolio) that the CTE values so obtained materially reproduce the results from running a larger scenario set.
3. Variance reduction and other sampling techniques are intended to improve the accuracy of an estimate more efficiently than simply increasing the number of simulations. Such methods can be used provided the company can demonstrate that they do not lead to a material understatement of results. Many of the techniques are specifically designed for estimating means, not tail measures, and could in fact reduce accuracy (and efficiency) relative to straight Monte Carlo simulation.

Guidance Note: With careful implementation, many variance reduction techniques can work well for CTE estimators. For example, see Manistre, B.J., and Hancock, G. (2003), “Variance of the CTE Estimator,” 2003 Stochastic Modeling Symposium, Toronto, September 2003.

4. The above requirements and warnings are not meant to preclude or discourage the use of valid and appropriate sampling methods, such as Quasi Random Monte Carlo (QRMC), importance sampling or other techniques designed to improve the efficiency of the simulations (relative to pseudo-random Monte Carlo methods).

Section 9: Modeling of Hedges under a Future Non-Index Credit Hedging Strategy

A. Initial Considerations

1. This section applies to modeling of hedges other than situations where the company only hedges index credits.
2. 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 SR, determined in accordance with Section 3.D and Section 4.D.
3. If the company is following one or more future hedging strategies supporting the contracts, 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 SR 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.

4. 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.
5. 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.

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 SR otherwise calculated. Particular attention should be given to VM-21, Section 1.B, Principle 5 for the modeling of future hedging strategies.
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 SR 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 SR 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 SR 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.

<p>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</p>
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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

5. A safe harbor approach is permitted for the reflection of future hedging strategies supporting the contracts 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 SR (Reported)
1. The company shall calculate CTE70 (best efforts)—the results obtained when the CTE70 is based on incorporating the future hedging strategies supporting the contracts (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 future hedging strategies supporting the contracts (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 future hedging strategies supporting the contracts except hedge purchases solely related to strategies to hedge index credits, therefore following the requirements of Section 4.A.4.a and 4.A.4.b.i.

However, for a company with a future hedging strategy supporting the contracts, existing hedging instruments, except hedging instruments solely related to strategies to hedge index credits, that are currently held by the company in support of the contracts falling under the scope of these requirements may be considered in one of two ways for the CTE70 (adjusted):

- a) Include the asset cash flows from any contractual payments and maturity values in the projection model.
- b) 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.

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 SR is given by:

$$SR = \text{CTE70 (best efforts)} + E \times \max[0, \text{CTE70 (adjusted)} - \text{CTE70 (best efforts)}]$$

4. 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.
5. 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 .
6. 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 .
7. 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 less than 12 months of experience and without robust mock testing, E should be 1.0. For a material change in strategy, with less than three months of history, E should be 1.0. However, when a material change in hedging strategy with less than three months of history is the introduction of hedging for a newly introduced product or newly acquired block of business and is supplemented by robust mock testing, E should instead be at least 0.3. Moreover, with prior approval from the domestic regulator, material changes in hedge strategy with less than three months of history but with robust mock testing may have error factors less than 1.0, though still subject to the minimum error factor specified in Section 9.C.4 and with an appropriate prudent estimate to account for additional uncertainty in anticipated hedging experience beyond that of a robust hedging program already in existence. E may also be lower than 1.0 if the change in strategy is a minor refinement rather than a material change in strategy, though still subject to the minimum error factor specified in Section 9.C.4 and with an appropriate prudent estimate to account for any additional uncertainty associated with the refinement.

The following examples are provided as guidance for determining the E factor when there has been a change to the hedge program. These examples are not intended to be exhaustive, and a company must support the determination of whether a hedge methodology change is material based on a review of the company's specific change in methodology.

- The error factor should be temporarily 100% for material changes in hedge methodology (e.g., moving from a fair-value based strategy to a stop-loss strategy) without robust mock testing.

- An increase in the error factor may not always be needed for minor refinements to the hedge strategy (e.g., moving from swaps to Treasury futures).
8. The company shall set the value of E reflecting the extent to which the hedging program is clearly defined. To support a value of E below 1.0, there should be very robust documentation outlining all future hedging strategies. To the extent that documentation outlining any of the future hedging strategies is incomplete, the value of E shall be increased. In particular, the value of E shall be 1.0 if documentation is materially incomplete for any of the individual CDHS attributes (a) through (j), as listed in VM-01.

Any increases required to the value of E to reflect that documentation is not available to support that the future hedging strategies are clearly defined shall be in addition to increases to the value of E to reflect a lack of historical experience or to reflect the back-testing results, subject to an overall ceiling of 1.0 for E .

Guidance Note: Companies must use judgment both in determining an E factor and in applying this requirement in the case where there are multiple future hedging strategies, particularly where some may be CDHS and some may not be CDHS. In this case, the SR should be ensured to be no less than the CTE70, reflecting the future hedging strategies that are CDHS and not reflecting those that are not CDHS. Companies with multiple future hedging strategies with very different levels of effectiveness or with multiple future hedging strategies that include both CDHS and non-CDHS should discuss with their domestic regulator.

D. Additional Considerations for CTE70 (best efforts)

If the company is following one or more future hedging strategies supporting the contracts, 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 SR 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 SR, 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 SR, 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.
5. 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 SR otherwise calculated.
6. 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.
7. The company may also consider historical experience for similar current or past hedging programs on similar products to support the error factor or index credit hedge margin determined for the projection.

Section 10: Contract Holder Behavior Assumptions

A. General

Contract holder behavior assumptions encompass actions such as lapses, withdrawals, transfers, recurring deposits, benefit utilization, option election, etc. Contract holder behavior is difficult to predict accurately, and variance in behavior assumptions can significantly affect the results. In the absence of relevant and fully credible empirical data, the company should set behavior assumptions as guided by Principle 3 in Section 1.B and Section 12.

In setting behavior assumptions, the company should examine, but not be limited by, the following considerations:

1. Behavior can vary by product, market, distribution channel, fund performance, time/product duration, etc.
2. Options embedded in the product may affect behavior.
3. Utilization of options may be elective or non-elective in nature. Living benefits often are elective, and death benefit options are generally non-elective.
4. Elective contract holder options may be more driven by economic conditions than non-elective options.
5. As the value of a product option increases, there is an increased likelihood that contract holders will behave in a manner that maximizes their financial interest (e.g., lower lapses, higher benefit utilization, etc.).
6. Behavior formulas may have both rational and irrational components (irrational behavior is defined as situations where some contract holders may not always act in their best financial interest). The rational component should be dynamic, but the concept of rationality need not be interpreted in strict financial terms and might change over time in response to observed trends in contract holder behavior based on increased or decreased financial efficiency in exercising their contractual options.
7. Options that are ancillary to the primary product features may not be significant drivers of behavior. Whether an option is ancillary to the primary product features depends on many things, such as:
 - a. For what purpose was the product purchased?
 - b. Is the option elective or non-elective?
 - c. Is the value of the option well-known?
8. External influences may affect behavior.

B. Aggregate vs. Individual Margins

1. Prudent estimate assumptions are developed by applying a margin for uncertainty to the anticipated experience assumption. The issue of whether the level of the margin applied to the anticipated experience assumption is determined in aggregate or independently for each and every behavior assumption is discussed in Principle 3 in Section 1.B.

2. Although this principle discusses the concept of determining the level of margins in aggregate, it notes that the application of this concept shall be guided by evolving practice and expanding knowledge. From a practical standpoint, it may not always be possible to completely apply this concept to determine the level of margins in aggregate for all behavior assumptions.
3. Therefore, the company shall determine prudent estimate assumptions independently for each behavior (e.g., mortality lapses and benefit utilization), using the requirements and guidance in this section and throughout these requirements, unless the company can demonstrate that an appropriate method was used to determine the level of margin in aggregate for two or more behaviors.

C. Sensitivity Testing

The impact of behavior can vary by product, time period, etc. Sensitivity testing of assumptions is required and shall be more complex than, for example, base lapse assumption minus 1% across all contracts. A more appropriate sensitivity test in this example might be to devise parameters in a dynamic lapse formula to reflect more out-of-the-money contracts lapsing and/or more holders of in-the-money contracts persisting and eventually using the guarantee. The company should apply more caution in setting assumptions for behaviors where testing suggests that stochastic modeling results are sensitive to small changes in such assumptions. For such sensitive behaviors, the company shall use higher margins when the underlying experience is less than fully relevant and credible.

D. Specific Considerations and Requirements

1. Within materiality considerations, the company should consider all relevant forms of contract holder behavior and persistency, including, but not limited to, the following:
 - a. Mortality (additional guidance and requirements regarding mortality is contained in Section 11).
 - b. Surrenders.
 - c. Partial withdrawals (systematic and elective).
 - d. Fund transfers (switching/exchanges).
 - e. Resets/ratchets of the guaranteed amounts (automatic and elective).
 - f. Future deposits.
2. It may be acceptable to ignore certain items that might otherwise be explicitly modeled in an ideal world, particularly if the inclusion of such items reduces the calculated provisions. For example:
 - a. The impact of fund transfers (intra-contract fund “switching”) might be ignored, unless required under the terms of the contract (e.g., automatic asset re-allocation/rebalancing, dollar cost averaging accounts, etc.).
 - b. Future deposits might be excluded from the model, unless required by the terms of the contracts under consideration and then only in such cases where future premiums can reasonably be anticipated (e.g., with respect to timing and amount).
3. However, the company should exercise caution in assuming that current behavior will be indefinitely maintained. For example, it might be appropriate to test the impact of a shifting

asset mix and/or consider future deposits to the extent they can reasonably be anticipated and increase the calculated amounts.

4. Normally, the underlying model assumptions would differ according to the attributes of the contract being valued. This would typically mean that contract holder behavior and persistency may be expected to vary according to such characteristics as (this is not an exhaustive list):
 - a. Gender.
 - b. Attained age.
 - c. Issue age.
 - d. Contract duration.
 - e. Time to maturity.
 - f. Tax status.
 - g. Fund value.
 - h. Investment option.
 - i. Guaranteed benefit amounts.
 - j. Surrender charges, transaction fees or other contract charges.
 - k. Distribution channel.
5. Unless there is clear evidence to the contrary, behavior assumptions should be no less conservative than past experience. Margins for contract holder behavior assumptions shall assume, without relevant and credible experience or clear evidence to the contrary, that contract holders' efficiency will increase over time.
6. In determining contract holder behavior assumptions, the company shall use actual experience data directly applicable to the business segment (i.e., direct data) if it is available. In the absence of direct data, the company should then look to use data from a segment that is similar to the business segment (i.e., other than direct experience), whether or not the segment is directly written by the company. If data from a similar business segment are used, the assumption shall be adjusted to reflect differences between the two segments. Margins shall reflect the data uncertainty associated with using data from a similar but not identical business segment.
7. Where relevant and fully credible empirical data do not exist for a given contract holder behavior assumption, the company shall set the contract holder behavior assumption to reflect the increased uncertainty such that the contract holder behavior assumption is shifted towards the conservative end of the plausible range of expected experience that serves to increase the SR. If there are no relevant data, the company shall set the contract holder behavior assumption to reflect the increased uncertainty such that the contract holder behavior assumption is at the conservative end of the range. Such adjustments shall be consistent with the definition of prudent estimate, with the principles described in Section 1.B, and with the guidance and requirements in this section.
8. Ideally, contract holder behavior would be modeled dynamically according to the simulated economic environment and/or other conditions. It is important to note, however,

that contract holder behavior should neither assume that all contract holders act with 100% efficiency in a financially rational manner nor assume that contract holders will always act irrationally. These extreme assumptions may be used for modeling efficiency if the result is more conservative.

E. Dynamic Assumptions

1. Consistent with the concept of prudent estimate assumptions described earlier, the liability model should incorporate margins for uncertainty for all risk factors that are not dynamic (i.e., the non-scenario tested assumptions) and are assumed not to vary according to the financial interest of the contract holder.
2. The company should exercise care in using static assumptions when it would be more natural and reasonable to use a dynamic model or other scenario-dependent formulation for behavior. With due regard to considerations of materiality and practicality, the use of dynamic models is encouraged, but not mandatory. Risk factors that are not scenario tested but could reasonably be expected to vary according to a stochastic process, or future states of the world (especially in response to economic drivers) may require higher margins and/or signal a need for higher margins for certain other assumptions.
3. Risk factors that are modeled dynamically should encompass the plausible range of behavior consistent with the economic scenarios and other variables in the model, including the non-scenario tested assumptions. The company shall test the sensitivity of results to understand the materiality of making alternate assumptions and follow the guidance discussed above on setting assumptions for sensitive behaviors.

F. Consistency with the CTE Level

1. All behaviors (i.e., dynamic, formulaic and non-scenario tested) should be consistent with the scenarios used in the CTE calculations (generally, the top 30% of the loss distribution). To maintain such consistency, it is not necessary to iterate (i.e., successive runs of the model) in order to determine exactly which scenario results are included in the CTE measure. Rather, in light of the products being valued, the company should be mindful of the general characteristics of those scenarios likely to represent the tail of the loss distribution and consequently use prudent estimate assumptions for behavior that are reasonable and appropriate in such scenarios. For variable annuities, these “valuation” scenarios would typically display one or more of the following attributes:
 - a. Declining and/or volatile separate account asset values.
 - b. Market index volatility, price gaps and/or liquidity constraints.
 - c. Rapidly changing interest rates.
2. The behavior assumptions should be logical and consistent both individually and in aggregate, especially in the scenarios that govern the results. In other words, the company should not set behavior assumptions in isolation, but give due consideration to other elements of the model. The interdependence of assumptions (particularly those governing customer behaviors) makes this task difficult and by definition requires professional judgment, but it is important that the model risk factors and assumptions:
 - a. Remain logically and internally consistent across the scenarios tested.
 - b. Represent plausible outcomes.

- c. Lead to appropriate, but not excessive, asset requirements.
 - 4. The company should remember that the continuum of “plausibility” should not be confined or constrained to the outcomes and events exhibited by historic experience.
 - 5. Companies should attempt to track experience for all assumptions that materially affect their risk profiles by collecting and maintaining the data required to conduct credible and meaningful studies of contract holder behavior.
- G. Additional Considerations and Requirements for Assumptions Applicable to Guaranteed Living Benefits

Experience for contracts without guaranteed living benefits may be of limited use in setting a lapse assumption for contracts with in-the-money or at-the-money guaranteed living benefits. Such experience may only be used if it is appropriate (e.g., lapse experience on contracts without a living benefit may have relevance to the early durations of contracts with living benefits) and relevant to the business.

Section 11: Guidance and Requirements for Setting Prudent Estimate Mortality Assumptions

A. Overview

1. Intent

The guidance and requirements in this section apply to setting prudent estimate mortality assumptions when determining either the SR or the reserve for any contracts determined using the Alternative Methodology. The intent is for prudent estimate mortality assumptions to be based on facts, circumstances and appropriate actuarial practice, with only a limited role for unsupported actuarial judgment. (Where more than one approach to appropriate actuarial practice exists, the company should select the practice that the company deems most appropriate under the circumstances.)

2. Description

Prudent estimate mortality assumptions shall be determined by first developing expected mortality curves based on either available experience or published tables. Where necessary, margins shall be applied to the experience to reflect data uncertainty. The expected mortality curves shall then be adjusted based on the credibility of the experience used to determine the expected mortality curve. Section 11.B addresses guidance and requirements for determining expected mortality curves, and Section 11.C addresses guidance and requirements for adjusting the expected mortality curves to determine prudent estimate mortality.

Finally, the credibility-adjusted tables shall be adjusted for mortality improvement (where such adjustment is permitted or required) using the guidance and requirements in Section 11.D.

3. Business Segments

For purposes of setting prudent estimate mortality assumptions, the products falling under the scope of these requirements shall be grouped into business segments with different mortality assumptions. The grouping, at a minimum, should differentiate whether the contracts contain VAGLBs, where the no-VAGLB segments would include both contracts with no guaranteed benefits and contracts with only GMDBs. The grouping should also

generally follow the pricing, marketing, management and/or reinsurance programs of the company.

4. Margin for Data Uncertainty

The expected mortality curves that are determined in Section 11.B may need to include a margin for data uncertainty. The margin could be in the form of an increase or a decrease in mortality, depending on the business segment under consideration. The margin shall be applied in a direction (i.e., increase or decrease in mortality) that results in a higher reserve. A sensitivity test may be needed to determine the appropriate direction of the provision for uncertainty to mortality. The test could be a prior year mortality sensitivity analysis of the business segment or an examination of current representative cells of the segment.

For purposes of this section, if mortality must be increased (decreased) to provide for uncertainty, the business segment is referred to as a plus (minus) segment.

It may be necessary, because of a change in the mortality risk profile of the segment, to reclassify a business segment from a plus (minus) segment to a minus (plus) segment to the extent compliance with this section requires such a reclassification.

B. Determination of Expected Mortality Curves

1. Experience Data

In determining expected mortality curves, the company shall use actual experience data directly applicable to the business segment (i.e., direct data) if it is available. In the absence of direct data, the company should then look to use data from a segment that is similar to the business segment (i.e., other than direct experience). See Section 11.B.2. for additional considerations. Finally, if there is no data, the company shall use the applicable table, as required in Section 11.B.3.

2. Data Other Than Direct Experience

Adjustments shall be applied to the data to reflect differences between the business segments, and margins shall be applied to the adjusted expected mortality curves to reflect the data uncertainty associated with using data from a similar but not identical business segment.

To the extent the mortality of a business segment is reinsured, any mortality charges that are consistent with the company's own pricing and applicable to a substantial portion of the mortality risk also may be a reasonable starting point for the determination of the company's expected mortality curves.

3. No Data Requirements

When little or no experience or information is available on a business segment, the company shall use expected mortality curves that would produce expected deaths no less than the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Table with Projection Scale G2 for contracts with no VAGLBs and expected deaths no greater than the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Mortality Table with Projection Scale G2 for contracts with VAGLBs. If mortality experience on the business segment is expected to be atypical (e.g., demographics of target markets are known to have higher [lower] mortality than typical), these "no data" mortality requirements may not be adequate.

$$q_x^{2012+n} = q_x^{2012}(1 - G2_x)^n * F_x$$

Table 11.1

Attained Age (x)	F _x for VA with GLB	F _x for All Other
<=65	80.0%	100.0%
66	81.5%	102.0%
67	83.0%	104.0%
68	84.5%	106.0%
69	86.0%	108.0%
70	87.5%	110.0%
71	89.0%	112.0%
72	90.5%	114.0%
73	92.0%	116.0%
74	93.5%	118.0%
75	95.0%	120.0%
76	96.5%	119.0%
77	98.0%	118.0%
78	99.5%	117.0%
79	101.0%	116.0%
80	102.5%	115.0%
81	104.0%	114.0%
82	105.5%	113.0%
83	107.0%	112.0%
84	108.5%	111.0%
85	110.0%	110.0%
86	110.0%	110.0%
87	110.0%	110.0%
88	110.0%	110.0%
89	110.0%	110.0%
90	110.0%	110.0%
91	110.0%	110.0%
92	110.0%	110.0%
93	110.0%	110.0%
94	110.0%	110.0%
95	110.0%	110.0%
96	109.0%	109.0%
97	108.0%	108.0%
98	107.0%	107.0%
99	106.0%	106.0%
100	105.0%	105.0%
101	104.0%	104.0%
102	103.0%	103.0%
103	102.0%	102.0%
104	101.0%	101.0%

>=105	100.0%	100.0%
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4. Additional Considerations Involving Data

The following considerations shall apply to mortality data specific to the business segment for which assumptions are being determined (i.e., direct data discussed in Section 11.B.1 or other than direct data discussed in Section 11.B.2).

a. Underreporting of Deaths

Mortality data shall be examined for possible underreporting of deaths. Adjustments shall be made to the data if there is any evidence of underreporting. Alternatively, exposure by lives or amounts on contracts for which death benefits were in the money may be used to determine expected mortality curves. Underreporting on such exposures should be minimal; however, this reduced subset of data will have less credibility.

b. Experience by Contract Duration

Experience of a plus segment shall be examined to determine if mortality by contract duration increases materially due to selection at issue. In the absence of information, the company shall assume that expected mortality will increase by contract duration for an appropriate select period. As an alternative, if the company determines that mortality is affected by selection, the company could apply margins to the expected mortality in such a way that the actual mortality modeled does not depend on contract duration.

c. Modification and Relevance of Data

Even for a large company, the quantity of life exposures and deaths are such that a significant amount of smoothing may be required to determine expected mortality curves from mortality experience. Expected mortality curves, when applied to the recent historic exposures (e.g., three to seven years), should not result in an estimate of aggregate number of deaths less (greater) than the actual number deaths during the exposure period for plus (minus) segments.

In determining expected mortality curves (and the credibility of the underlying data), older data may no longer be relevant. The “age” of the experience data used to determine expected mortality curves should be documented.

d. Other Considerations

In determining expected mortality curves, consideration should be given to factors that include, but are not limited to, trends in mortality experience, trends in exposure, volatility in year-to-year A/E mortality ratios, mortality by lives relative to mortality by amounts, changes in the mix of business and product features that could lead to mortality selection.

C. Adjustment for Credibility to Determine Prudent Estimate Mortality

1. Adjustment for Credibility

The expected mortality curves determined in Section 11.B shall be adjusted based on the credibility of the experience used to determine the curves in order to arrive at prudent

estimate mortality. The adjustment for credibility shall result in blending the expected mortality curves with a mortality table consistent with a statutory valuation mortality table. For contracts with no VAGLBs, the table shall be consistent with the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Table with Projection Scale G2; and for contracts with VAGLBs, the table shall be consistent with the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Mortality Table with Projection Scale G2. The approach used to adjust the curves shall suitably account for credibility.

Guidance Note: For example, when credibility is zero, an appropriate approach should result in a mortality assumption consistent with 100% of the statutory valuation mortality table used in the blending.

2. Adjustment of Statutory Valuation Mortality for Improvement

For purposes of the adjustment for credibility, the statutory valuation mortality table for a plus segment may be and the statutory valuation mortality table for a minus segment must be adjusted for mortality improvement. Such adjustment shall reflect Projection Scale G2 from the effective date of the respective statutory valuation mortality table to the experience weighted average date underlying the data used to develop the expected mortality curves (discussed in Section 11.B).

3. Credibility Procedure

The credibility procedure used shall:

- a. Produce results that are reasonable.
- b. Not tend to bias the results in any material way.
- c. Be practical to implement.
- d. Give consideration to the need to balance responsiveness and stability.
- e. Take into account not only the level of aggregate claims but the shape of the mortality curve.
- f. Contain criteria for full credibility and partial credibility that have a sound statistical basis and be appropriately applied.

4. Further Adjustment of the Credibility-Adjusted Table for Mortality Improvement

The credibility-adjusted table used for plus segments may be and the credibility adjusted table used for minus segments must be adjusted for mortality improvement using Projection Scale G2 from the experience weighted average date underlying the company experience used in the credibility process to the valuation date.

Any adjustment for mortality improvement beyond the valuation date is discussed in Section 11.D.

D. Future Mortality Improvement

The mortality assumption resulting from the requirements of Section 11.C shall be adjusted for mortality improvements beyond the valuation date if such an adjustment would serve to increase the resulting SR. If such an adjustment would reduce the SR, such assumptions are permitted, but not required. In either case, the assumption must be based on current relevant data with a margin

for uncertainty (increasing assumed rates of improvement if that results in a higher reserve or reducing them otherwise).

Section 12: Other Guidance and Requirements for Assumptions

A. Overview

This section provides guidance and requirements in general for setting prudent estimate assumptions when determining either the SR or the reserve for any contracts determined using the Alternative Methodology. It also provides specific guidance and requirements for expense assumptions.

B. General Assumption Requirements

1. The company shall use prudent estimate assumptions for risk factors that are not stochastically modeled by applying margins to the anticipated experience assumptions if such risk factors have been categorized as material risks by following Section 1.B, Principle 3 and requirements in Section 12.C.
2. The company shall establish the prudent estimate assumptions for risk factors in compliance with the requirements in Section 12 of Model #820 and must periodically review and update the assumptions, as appropriate, in accordance with these requirements.
3. The company shall model the following risk factors stochastically unless the company elects the Alternative Methodology defined in Section 7:
 - a. Interest rate movements; i.e., Treasury interest rate curves.
 - b. Equity performance (e.g., Standard & Poor's 500 index [S&P 500] returns and returns of other equity investments).
4. If the company elects to stochastically model risk factors in addition to the economic scenarios, the requirements in this section for determining prudent estimate assumptions for these risk factors do not apply.

It is expected that companies will not stochastically model risk factors other than the economic scenarios, such as contract holder behavior or mortality, until VM-21 has more specific guidance and requirements available. Companies shall discuss with domiciliary regulators if they wish to stochastically model other risk factors.

5. The company shall use its own experience, if relevant and credible, to establish an anticipated experience assumption for any risk factor. To the extent that company experience is not available or credible, the company may use industry experience or other data to establish the anticipated experience assumption, making modifications, as needed, to reflect the circumstances of the company.
 - a. For risk factors, such as mortality, to which statistical credibility theory may be appropriately applied, the company shall establish anticipated experience assumptions for the risk factor by combining relevant company experience with industry experience data, tables, or other applicable data in a manner that is consistent with credibility theory and accepted actuarial practice.
 - b. For risk factors, such as utilization of guaranteed living benefits, that do not lend themselves to the use of statistical credibility theory, and for risk factors, such as some of the lapse assumptions, to which statistical credibility theory can be appropriately applied

but cannot currently be applied due to lack of industry data, the company shall establish anticipated experience assumptions in a manner that is consistent with accepted actuarial practice and reflects any available relevant company experience, any available relevant industry experience, or any other experience data that are available and relevant. Such techniques include:

- i. Adopting standard assumptions published by professional, industry, or regulatory organizations to the extent that they reflect any available relevant company experience or reasonable expectations.
 - ii. Applying factors to relevant industry experience tables or other relevant data to reflect any available relevant company experience and differences in expected experience from that underlying the base tables or data due to differences between the risk characteristics of the company experience and the risk characteristics of the experience underlying the base tables or data.
 - iii. Blending any available relevant company experience with any available relevant industry experience and/or other applicable data using weightings established in a manner that is consistent with accepted actuarial practice and that reflects the risk characteristics of the underlying contracts and/or company practices.
 - c. For risk factors that have limited or no experience or other applicable data to draw upon, the assumptions shall be established using sound actuarial judgment and the most relevant data available, if such data exists.
 - d. For any assumption that is set in accordance with the requirements of Section 12.B.5.c, the qualified actuary to whom responsibility for this group of contracts is assigned shall use sensitivity testing and disclose the analysis performed to ensure that the assumption is set at the conservative end of the plausible range.
 - e. The qualified actuary, to whom responsibility for this group of contracts is assigned, shall annually review relevant emerging experience for the purpose of assessing the appropriateness of the anticipated experience assumption. If the results of statistical or other testing indicate that previously anticipated experience for a given factor is inadequate, then the qualified actuary shall set a new, adequate, anticipated experience assumptions for the factor.
6. The company shall sensitivity test material risk factors that are not stochastically modeled and examine the impact on the SR. The company shall update the sensitivity tests periodically, as appropriate. The company may update the tests less frequently, but no less than every three years, when the tests show less sensitivity of the SR to changes in the assumptions being tested or the experience is not changing rapidly. Providing that there is no material impact on the results of the sensitivity testing, the company may perform sensitivity testing:
- a. Using samples of the contracts in force rather than performing the entire valuation for each alternative assumption set.
 - b. Using data from prior periods.

Guidance Note: Sensitivity testing every risk factor on an annual basis is not required. For some risk factors, it may be reasonable, in lieu of testing, to employ statistical measures for margins, such as adding one or more standard deviations to the anticipated experience assumptions.

7. The company shall vary the prudent estimate assumptions from scenario to scenario within the SR calculation in an appropriate manner to reflect the scenario-dependent risks.

C. Assumption Margins

The company shall include margins to provide for adverse deviations and estimation error in the prudent estimate assumptions for all risk factors that are not stochastically modeled or prescribed, subject to the following:

1. The level of margin applied to the anticipated experience assumptions may be determined in aggregate or independently as discussed in Section 1.B, Principle 3. It is not permissible to set a margin less toward the conservative end of the spectrum to recognize, in whole or in part, implicit or prescribed margins that are present, or are believed to be present, in other risk factors.

Risks that are stochastically modeled (e.g., interest rates, equity returns) or have prescribed margins or guardrails (e.g., assets, revenue sharing) shall be considered material risks. Other risks generally considered to be material include, but are not limited to, mortality, contract holder behavior, maintenance and overhead expenses, inflation and implied volatility. In some cases, the list of material risks may also include acquisition expenses, partial withdrawals, policy loans, annuitizations, account transfers and deposits, and/or option elections that contain an element of anti-selection.

2. The greater the uncertainty in the anticipated experience assumption, the larger the required margin, with the margin added or subtracted as needed to produce a larger modeled TAR than would otherwise result. For example, the company shall use a larger margin when:
 - a. The experience data have less relevance or lower credibility.
 - b. The experience data are of lower quality, such as incomplete, internally inconsistent, or not current.
 - c. There is doubt about the reliability of the anticipated experience assumption, such as, but not limited to, recent changes in circumstances or changes in company policies.
 - d. There are constraints in the modeling that limit an effective reflection of the risk factor.
3. In complying with the sensitivity testing requirements in Section 12.B.6 above, greater analysis and more detailed justification are needed to determine the level of uncertainty when establishing margins for risk factors that produce greater sensitivity on the SR.
4. A margin is permitted, but not required, for assumptions that do not represent material risks.
5. A margin should reflect the magnitude of fluctuations in historical experience of the company for the risk factor, as appropriate.
6. The company shall apply the method used to determine the margin consistently on each valuation date, but it is permitted to change the method from the prior year if the rationale for the change and the impact on the SR is disclosed.

D. Expense Assumptions

1. General Prudent Estimate Expense Assumption Requirements

In determining prudent estimate expense assumptions, the company:

- a. May spread certain IT development costs and other capital expenditures over a reasonable number of years in accordance with accepted statutory accounting principles, as defined in the SSAPs.

Guidance Note: Care should be taken regarding the potential interaction with the inflation assumption below.

- b. Shall assume that the company is a going concern.
- c. Shall choose an appropriate expense basis that properly aligns the actual expense to the assumption. If values are not significant, they may be aggregated into a different base assumption.

Guidance Note: For example, death benefit expenses should be modeled with an expense assumption that is per death incurred.

- d. Shall reflect the impact of inflation.
- e. Shall not assume future expense improvements.
- f. Shall not include assumptions for federal income taxes (and expenses paid to provide fraternal benefits in lieu of federal income taxes) and foreign income taxes.
- g. Shall use assumptions that are consistent with other related assumptions.
- h. Shall use fully allocated expenses.

Guidance Note: Expense assumptions should reflect the direct costs associated with the block of contracts being modeled, as well as indirect costs and overhead costs that have been allocated to the modeled contracts.

- i. Shall allocate expenses using an allocation method that is consistent across company lines of business. Such allocation must be determined in a manner that is within the range of actuarial practice and methodology and consistent with applicable ASOPs. Allocations may not be done for the purpose of decreasing the SR.
- j. Shall reflect expense efficiencies that are derived and realized from the combination of blocks of business due to a business acquisition or merger in the expense assumption only when any future costs associated with achieving the efficiencies are also recognized.

Guidance Note: For example, combining two similar blocks of business on the same administrative system may yield some expense savings on a per unit basis, but any future cost of the system conversion should be considered in the final assumption. If all costs for the conversion are in the past, then there would be no future expenses to reflect in the valuation.

- k. Shall reflect the direct costs associated with the contracts being modeled, as well as an appropriate portion of indirect costs and overhead (i.e., expense assumptions representing fully allocated expenses should be used), including expenses categorized in the annual statement as “taxes, licenses and fees” (Exhibit 3 of the annual statement) in the expense assumption.

- l. Shall include acquisition expenses associated with business in force as of the valuation date and significant non-recurring expenses expected to be incurred after the valuation date in the expense assumption.
- m. For contracts sold under a new policy form or due to entry into a new product line, the company shall use expense factors that are consistent with the expense factors used to determine anticipated experience assumptions for contracts from an existing block of mature contracts taking into account:
 - i. Any differences in the expected long-term expense levels between the block of new contracts and the block of mature contracts.
 - ii. That all expenses must be fully allocated, as required under Section 12.D.1.h above.
2. Margins for Prudent Estimate Expense Assumptions

The company shall determine margins for expense assumptions following Section 12.C.

Section 13: Allocation of the Aggregate Reserve to the Contract Level

Section 2.F states that the aggregate reserve shall be allocated to the contracts falling within the scope of these requirements. That allocation should be done for both the pre- and post-reinsurance ceded reserves.

The contract-level reserve for each contract shall be the sum of the following:

- A. The contract's cash surrender value.
- B. An allocated portion of the excess of the aggregate reserve over the aggregate cash surrender value.
 1. For a variable payout annuity or other contracts without a defined cash surrender value, the "cash surrender value" to use in this calculation shall be the amount defined in Section 3.G. which is used to determine the minimum general account reserve.
 2. The excess of the aggregate reserve over the aggregate cash surrender value shall be allocated to each contract based on a measure of the risk of that product relative to its cash surrender value in the context of the company's in force contracts. The measure of risk should consider the impact of risk mitigation programs, including hedge programs and reinsurance, that would affect the risk of the product. The specific method of assessing that risk and how it contributes to the company's aggregate reserve shall be defined by the company. The method should provide for an equitable allocation based on risk analysis. For contracts valued under the alternative methodology, the alternative methodology calculations provide a contract level calculation that may be a reasonable basis for allocation.
 3. As an example, consider a company with the results of the following three contracts:

Table 12.1: Sample Allocation of Aggregate Reserve

Contract (i)	1	2	3	Total
Cash Surrender Value, C	28	40	52	120
Risk adjusted measure, R	38	52	50	

Aggregate Reserve				140
Allocation Basis for the excess of the Aggregate Reserve over the Cash Surrender Value $A_i = \text{Max}(R_i - C_i, 0)$	10	12	0	22
Allocation of the excess of the Aggregate Reserve over the Cash Surrender Value $L_i = (A_i) / \sum A_i * [\text{Aggregate Reserve} - \sum C_i]$	9.09	10.91	0.00	20
Contract-level reserve $C_i + L_i$	37.09	50.91	52.00	140.00

In this example, the Aggregate Reserve exceeds the aggregate Cash Surrender Value by 20. The 20 is allocated proportionally across the three contracts based on the allocation basis of the larger of (i) zero; and (ii) a risk adjusted measure based on reserve principles. Therefore, contracts 1 and 2 receive 45% (9/22) and 55% (11/22), respectively, of the excess Aggregate Reserve. As Contract 3 presents no risk in excess of its cash surrender value, it does not receive an allocation of the excess Aggregate Reserve.

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