AMERICAN ACADEMY *of* ACTUARIES

Report of the American Academy of Actuaries'
Variable Annuity Reserve Work Group

Presented to the National Association of Insurance Commissioners'
Life and Health Actuarial Task Force

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Suggested Revisions submitted by the American Academy of Actuaries' Variable Annuity Reserve Work Group for the June 2005 NAIC meeting

For discussion on June 9, 2005

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The NAIC solicits comments on this draft. Comments should be sent to Mark Peavy, NAIC, at mpeavy@naic.org. Comments are also encouraged on the revised Alternative Methodology factors and the pre-packaged scenarios; they can be found on the American Academy of Actuaries website at http://www.actuary.org/life/phase2.htm.

Please note the page numbers in the Table of Contents do not match the page numbers in the draft document; they will be updated when the final version of the Actuarial Guideline is adopted.

ACTUARIAL GUIDELINE VACARVM – CARVM FOR VARIABLE ANNUITIES REDEFINED

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ACTUARIAL GUIDELINE VACARVM –
CARVM FOR VARIABLE ANNUITIES REDEFINED

I) Background

The purpose of this Actuarial Guideline (Guideline) is to interpret the standards for the valuation of reserves for variable annuity and other contracts involving certain guaranteed benefits similar to those offered with variable annuities. The Guideline codifies the basic interpretation of the Commissioners Annuity Reserve Valuation Method (CARVM) by clarifying the assumptions and methodologies that will comply with the intent of the Standard Valuation Law (SVL). It also applies similar assumptions and methodologies to contracts that contain characteristics similar to those described in the scope, but that are not directly subject to CARVM.

For many years regulators and the industry have struggled with the issue of applying a uniform reserve standard to these contracts and in particular some of the guaranteed benefits referenced above. Current approaches make assumptions about product design, contractholder behavior and economic relationships and conditions. The economic volatility seen over the last few decades, combined with an increase in the complexity of these products, have made attempts to use these approaches for measuring economic-related risk less successful. Actuarial Guideline XXXIX and recent revisions to Actuarial Guideline XXXIV contain what many believe are temporary solutions to address these issues, and many believe more permanent solutions are needed.

The Guideline addresses these issues by including an approach that applies principles of asset adequacy analysis directly to the risks associated with these products and guarantees.

The NAIC is currently considering a similar approach to calculate risk-based capital (RBC) for similar contracts (i.e., the C-3 Phase II project). The methodology in the Guideline is based on that approach, and the intent of the Guideline is to, where possible, facilitate a framework whereby companies may determine both reserve and RBC in a consistent calculation.

In developing the Guideline, two regulatory sources were looked to for guidance. First, the SVL requires that CARVM be based on the greatest present value of future guaranteed benefits. Second, the NAIC Model Variable Annuity Regulation (VAR) states that the "reserve liability for variable annuities shall be established pursuant to the requirements of the Standard Valuation Law in accordance with actuarial procedures that recognize the variable nature of the benefits provided and any mortality guarantees."

The Guideline requires that reserves for contracts falling within its scope be based on the greater of a minimum floor determined using a standard scenario (referred to as the Standard Scenario Amount) and a reserve calculated using a projection of the assets and estimated liabilities supporting these contracts over a broad range of stochastically generated projection scenarios and using prudent best estimate assumptions (referred to as the Conditional Tail Expectation Amount). Within each of these scenarios, the greatest of the present values of accumulated losses ignoring Federal Income Tax is determined. The assumed fund performance for these scenarios must meet the mandated calibration standards contained in the Guideline. The reserve calculated using projections is based on a Conditional Tail Expectation measure of the results for each scenario.

Conditional Tail Expectation (CTE) is a statistical risk measure that provides enhanced information about the tail of a distribution above that provided by the traditional use of percentiles. Instead of only identifying a value at a particular percentile and thus ignoring the possibility of extremely large values in the tail, CTE provides the average over all values in the tail beyond the CTE percentile. Thus for losses that approximate a normal distribution, CTE (65) will approximate the 82.5^{th} percentile. But for distributions with "fat tails" from low probability, high impact events, such as those covered by the Guideline, the use of CTE will provide a more revealing measure than use of a single percentile requirement.

For certain products (e.g., variable annuities with Guaranteed Minimum Death Benefits only), a company can use an Alternative Methodology in place of the modeling approach outlined above to determine the Conditional Tail Expectation Amount.

The projection methodology used to calculate the Conditional Tail Expectation Amount, 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 applying the methodology in the Guideline and analyzing the resulting reserves[1].

[1] Note the following when considering these principles:

Principle 1. The objective of the approach used to determine the Conditional Tail Expectation Amount 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 Conditional Tail Expectation Amount 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 surplus deficiency is calculated. The analysis reflects Prudent Best Estimate (see the definition of Prudent Best Estimate in section III) 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 utilizes a projected total statutory balance sheet approach by including all projected income, benefit and expense items related to the business in the model and sets the Conditional Tail Expectation Amount at a degree of confidence using the conditional tail expectation measure applied to the set of scenario specific greatest present values of accumulated statutory deficiencies that is deemed adequate to cover moderately adverse conditions.

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 actuary's 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 Conditional Tail Expectation Amount 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 Conditional Tail Expectation Amount, the actuary should be guided by evolving practice and expanding knowledge base in the measurement and management of risk.

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 Conditional Tail Expectation Amount 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.

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 Conditional Tail Expectation Amount. 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 Conditional Tail Expectation Amount 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.

The methodology prescribed in the Guideline is applied to a company's entire portfolio of variable annuities (whether or not they contain guaranteed benefits), as well as other affected products that contain guaranteed benefits. Current guaranteed benefits include Guaranteed Minimum Death Benefits, Guaranteed Minimum Accumulation Benefits, Guaranteed Minimum Income Benefits, Guaranteed Minimum Withdrawal Benefits, and Guaranteed Payout Annuity Floors. It is also expected that the methodology in the Guideline can be applied to future variations on these designs and to new guarantee designs.

Since statutory reporting requires companies to report reserves prior to reinsurance, the Guideline clarifies standards for adjusting the various components of the reserve so that the reserve may be reported both prior to and net of reinsurance.

The Guideline also requires an allocation of the total reported reserve between the General and Separate Accounts and prescribes a method for doing this allocation.

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a. The principles should be considered in their entirety.
b. The Guideline requires companies to meet these principles with respect to only those contracts that fall within the scope of the Guideline and are inforce as of the valuation date to which the requirements are applied.

Actuarial certification of the work done to calculate reserves is required by the Guideline. A qualified actuary (referred to throughout the Guideline as "the actuary") shall certify that the work has been done in a way that meets all applicable Actuarial Standards of Practice.

For more details on the development of these requirements, including the development of the calibration criteria, see the American Academy of Actuaries recommendation on C-3 Phase II risk-based capital.

This Guideline and its Appendices require the actuary to make various determinations, verifications and certifications. The company is ~~required~~ expected to provide the actuary with ~~complete and accurate~~the necessary information sufficient to permit the actuary to fulfill the responsibilities set forth in this Guideline and its Appendices and responsibilities arising from applicable Actuarial Standards of Practice, including ASOP No. 23, *Data Quality*.

II) Scope

A) The Guideline applies to contracts, whether directly written or assumed through reinsurance, falling into any of the following categories:

1) Variable deferred annuity contracts subject to the Commissioner's Annuity Reserve Valuation Method (CARVM), whether or not such contracts contain Guaranteed Minimum Death Benefits (GMDBs), or Variable Annuity Guaranteed Living Benefits (VAGLBs);

2) Variable immediate annuity contracts, whether or not such contracts contain GMDBs or VAGLBs;

3) Group annuity contracts that are not subject to CARVM, but contain guarantees similar in nature[2] to GMDBs, VAGLBs, or any combination thereof; and

4) All other products that contain guarantees similar in nature to GMDBs or VAGLBs, even if the insurer does not offer the mutual funds or variable funds to which these guarantees relate, where there is no other explicit reserve requirement[3].

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:

(a) the Guideline shall be applied to the benefit on a standalone basis (i.e., for purposes of the reserve calculation, the benefit shall be treated as a separate contract);

(b) the reserve for the underlying contract is determined according to the explicit reserve requirement; and

(c) the reserve held for the contract shall be the sum of (a) and (b).

B) The Guideline does not apply to contracts falling under the scope of the NAIC Model Modified Guaranteed Annuity Regulation (MGAs); however, it does apply to contracts listed above that include one or more subaccounts containing features similar in nature to those contained in MGAs (e.g., market value adjustments).

C) Separate account products that guarantee an index and do not offer GMDBs or VAGLBs are excluded from the scope of the Guideline.

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[2] The term "similar in nature", as used in sections II)A)3) and II)A)4) is intended to capture both 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 footnote #3 below. 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 and VAGLB in sections III)A)1) and III)A)2) 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).

[3] For example, a group life contract that wraps a GMDB around a mutual fund would generally fall under the scope of the Guideline 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 Guideline would generally apply only to the VAGLB-type benefit, since there is an explicit reserve requirement that applies to the variable life contract and the GMDB.

III) Definitions

A) Definitions of Benefit Guarantees

1) Guaranteed Minimum Death Benefit (GMDB). A GMDB is a guaranteed benefit providing, or resulting in the provision that, an amount payable on the death of a contractholder, annuitant, participant, or insured will be increased and/or will be at least a minimum amount. Only such guarantees having the potential to produce a contractual total amount payable on death that exceeds the account value, or in the case of an annuity providing income payments, an amount payable on death other than continuation of any guaranteed income payments, are included in this definition. GMDBs 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) are also included in this definition.

2) Variable Annuity Guaranteed Living Benefit (VAGLB). A VAGLB is a guaranteed benefit providing, or resulting in the provision that, one or more guaranteed benefit amounts payable or accruing to a living contractholder or living annuitant, under contractually specified conditions (e.g., at the end of a specified waiting period, upon annuitization, or upon withdrawal of premium over a period of time), will increase contractual benefits should the contract value referenced by the guarantee (e.g., account value) fall below a given level or fail to achieve certain performance levels. Only such guarantees having the potential to provide benefits with a present value as of the benefit commencement date that exceeds the contract value referenced by the guarantee are included in this definition.

3) Guaranteed Minimum Income Benefit (GMIB). A GMIB is a VAGLB design for which the benefit is contingent on annuitization of a variable deferred annuity or similar contract. The benefit is typically expressed as a contractholder option, on one or more option dates, to have a minimum amount applied to provide periodic income using a specified purchase basis.

4) Guaranteed Payout Annuity Floor (GPAF). A GPAF is a VAGLB design guaranteeing that one or more of the periodic payments under a variable immediate annuity will not be less than a minimum amount.

B) Definitions of Reserve Methodology Terminology

1) Scenario. A scenario consists of a set of asset growth rates and investment returns from which assets and liabilities supporting a set of contracts may be determined for each year of a projection.

2) Cash Surrender Value. For purposes of the Guideline, the Cash Surrender Value for a contract is the amount available to the contractholder 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. For contracts where all or a portion of the amount available to the contractholder upon surrender is subject to a market value adjustment, however, 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 shall not reflect any market value adjustments where the underlying assets are reported at book value.

3) Scenario Greatest Present Value. For a given scenario, the Scenario Greatest Present Value is the sum of:

a) The greatest of the present values, as of the projection start date, of the projected Accumulated Deficiencies for the scenario; and

b) The Starting Asset Amount, as defined below.

4) Conditional Tail Expectation Amount. The Conditional Tail Expectation Amount is equal to the numerical average of the 35 percent largest values of the Scenario Greatest Present Values.

5) Working Reserve. The Working Reserve is the assumed reserve used in the projections of Accumulated Deficiencies supporting the calculation of the Scenario Greatest Present Values. At any point in the projections, including at the start of the projection, the Working Reserve shall equal the projected Cash Surrender Value.

For a variable payout annuity without a Cash Surrender Value, the Working Reserve shall equal the present value, at the maximum valuation interest rate and the valuation mortality table specified for such a product by the Standard Valuation Law, of future income payments projected using a return based on the valuation interest rate less appropriate asset based charges.

For contracts not covered above, the actuary shall determine the Working Reserve in a manner that is consistent with the above requirements.

6) Accumulated Deficiency. Accumulated Deficiency is an amount measured as of the end of a projection year and equals the projected Working Reserve less the amount of projected assets, both as of the end of the projection year. Accumulated Deficiencies may be positive or negative.[4]

7) Starting Asset Amount. The Starting Asset Amount equals the value of the assets at the start of the projection, as defined in section A1.4)A) of Appendix 1.

8) Prudent Best Estimate. The deterministic assumptions to be used for projections are to be the actuary's Prudent Best Estimate. This means that they are to be set at the conservative end of the actuary's confidence interval as to the true underlying probabilities for the parameter(s) in question, based on the availability of relevant experience and its degree of credibility.

   A Prudent Best Estimate assumption would normally be developed by applying a margin for estimation error to the "best estimate" assumption. "Best estimate" would typically be the actuary's most reasonable estimate of future experience for a risk factor given all available, relevant information pertaining to the contingencies being valued. Recognizing that assumptions are simply assertions of future unknown experience, the margin for error should be directly related to uncertainty in the underlying risk factor. The greater the uncertainty ~~is~~, the larger the margin. Each margin should serve to increase the Aggregate Reserve that would otherwise be held in its absence (i.e., using only the best estimate assumption).

   For example, assumptions for circumstances that have never been observed require more margins for error than those for which abundant and relevant experience data are available. Furthermore, larger margins are typically required for contingencies related to contractholder behavior when a given contractholder action results in the surrender or exercise of a valuable option.

   The actuary shall follow the principles discussed in Appendices 9 and 10 in determining Prudent Best Estimate assumptions.

9) Gross Wealth Ratio. The Gross Wealth Ratio is the cumulative return for the indicated time period and percentile (e.g., 1.0 indicates that the index is at its original level).

10) Clearly Defined Hedging Strategy. The designation of Clearly Defined Hedging Strategy applies to strategies undertaken by a company to manage risks through the future purchase or sale of hedging instruments and the opening and closing of hedging positions. In order to qualify as a Clearly Defined Hedging Strategy, the strategy must meet the principles outlined in the Background section of the Guideline (particularly Principle 5) and shall, at a minimum, identify:

    a) the specific risks being hedged (e.g., delta, rho, vega, etc.),

    b) the hedge objectives,

    c) the risks not being hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.),

    d) the financial instruments that will be used to hedge the risks,

    e) the hedge trading rules including the permitted tolerances from hedging objectives,

    f) the metric(s) for measuring hedging effectiveness,

    g) the criteria that will be used to measure effectiveness,

    h) the frequency of measuring hedging effectiveness,

    i) the conditions under which hedging will not take place, and

    j) the person or persons responsible for implementing the hedging strategy.

    The hedge strategy may be dynamic, static, or a combination thereof.

    It is important to note that strategies involving the offsetting of the risks associated with variable annuity guarantees with other products outside of the scope of the Guideline (e.g., equity-indexed annuities) do not currently qualify as a Clearly Defined Hedging Strategy under the Guideline.

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[4] Note that a positive Accumulated Deficiency means that there is a cumulative loss and a negative Accumulated Deficiency means that there is a cumulative gain.

11) Revenue Sharing. Revenue Sharing, for purposes of the Guideline, means any arrangement or understanding by which an entity responsible for providing investment or other types of services makes payments to the company (or to one of its affiliates). Such payments are typically in exchange for administrative services provided by the company (or its affiliate), such as marketing, distribution and recordkeeping. Only payments that are attributable to charges or fees taken from the underlying variable funds or mutual funds supporting the contracts that fall under the scope of the Guideline shall be included in the definition of Revenue Sharing.

12) Domiciliary Commissioner. For purposes of the Guideline, this term refers to the chief insurance regulatory official of the state of domicile of the company.

IV) Definition of General Reserve Methodology

A) General Description. The Aggregate Reserve for contracts falling within the scope of the Guideline shall equal the greater of:

1) The Standard Scenario Amount; and

2) The Conditional Tail Expectation Amount.

At the option of the company, the Aggregate Reserve may be determined by applying the Guideline to all contracts falling within the scope of the Guideline or to sub-groupings of contracts, with the total reserve held equal to the sum of the reserves computed for each such sub-group.

B) Impact of Reinsurance Ceded. Where reinsurance is ceded for all or a portion of the contracts, both components in the above general description (and thus the Aggregate Reserve) shall be determined net of any reinsurance treaties that meet the requirements of the NAIC Life and Health Reinsurance Agreements Model Regulation.

An Aggregate Reserve before reinsurance shall also be calculated if needed for regulatory reporting or other purposes, using methods described in Appendix 2.

C) The Standard Scenario Amount. The Standard Scenario Amount is the aggregate of the reserves determined by applying the Standard Scenario method to each of the contracts falling within the scope of the Guideline. The Standard Scenario method is outlined in Appendix 3.

D) The Conditional Tail Expectation Amount. The Conditional Tail Expectation Amount shall be determined based on a projection of the contracts falling within the scope of the Guideline, and the assets supporting these contracts, over a broad range of stochastically generated projection scenarios and using Prudent Best Estimate assumptions.

In performing the projections, the contracts may be grouped as described in section A1.1)B) in Appendix 1. The stochastically generated projection scenarios shall meet the Scenario Calibration Criteria described in Appendix 5.

The Conditional Tail Expectation Amount shall be determined using the following steps:

1) For each scenario, projected aggregate Accumulated Deficiencies are determined at the start of the projection (i.e., "time 0") and at the end of each projection year as the sum of the Accumulated Deficiencies for each contract grouping.

2) The Scenario Greatest Present Value is determined for each scenario based on the sum of the aggregate Accumulated Deficiencies[5] and aggregate Starting Asset Amounts for the contracts for which the Aggregate Reserve is being computed.

3) The Scenario Greatest Present Values for all scenarios are then ranked from smallest to largest and the Conditional Tail Expectation Amount is the average of the largest 35 percent of these ranked values.

The projections shall be performed in accordance with Appendix 1. The actuary shall document the assumptions and procedures used for the projections and summarize the results obtained as described in Appendix 2 and Appendix 8.

[5] The Scenario Greatest Present Value is therefore based on the greatest projected Accumulated Deficiency, in aggregate, for all contracts for which the Aggregate Reserve is computed hereunder, rather than based on the sum of the greatest projected Accumulated Deficiency for each grouping of contracts.

E) Alternative Methodology. For variable deferred annuity contracts that contain either no guaranteed benefits or only GMDBs (i.e., no VAGLBs), the Conditional Tail Expectation Amount may be determined using the Alternative Methodology described in Appendix 4 rather than using the approach described in subsection D) above. However, in the event the approach described in subsection D) has been used in prior valuations the Alternative Methodology may not be used without approval from the Domiciliary Commissioner.

The Conditional Tail Expectation Amount 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.

The actuary shall document the assumptions and procedures used for the Alternative Methodology and summarize the results obtained as described in Appendix 2 and Appendix 8.

F) Allocation of Results to Contracts. The Aggregate Reserve shall be allocated to the contracts falling within the scope of the Guideline using the method outlined in Appendix 6.

V) Effective Date

The Guideline affects all contracts issued on or after January 1, 1981. Where the application of the Guideline produces higher reserves than the company had otherwise established by their previously used interpretation, such company shall comply with the Guideline effective December 31, 2005. However, such company may request a grade-in period, of not to exceed three (3) years, from the Domiciliary Commissioner upon satisfactory demonstration of the previous interpretation and that such delay of implementation will not cause a hazardous financial condition or potential harm to its policyholders.

APPENDIX 1 - Determination of Conditional Tail Expectation Amount Based on Projections

A1.1) Projection of Accumulated Deficiencies

A) General Description of Projection. The projection of Accumulated Deficiencies shall be made ignoring Federal Income Tax and reflect the dynamics of the expected cash flows for the entire group of contracts, reflecting all product features, including the 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 shall also be included. Any market value adjustment assessed on projected withdrawals or surrenders shall also be included (whether or not the Cash Surrender Value reflects market value adjustments). Throughout the projection, where estimates are used, such estimates shall be on a Prudent Best Estimate basis.

Federal Income Tax shall not be included in the projection of Accumulated Deficiencies.

B) 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 required calibration points of the S&P 500. The grouping shall reflect characteristics of the efficient frontier (i.e., returns generally cannot be increased without assuming additional risk).

An appropriate proxy 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 actuary must map each variable account to an appropriately crafted proxy fund normally expressed as a linear combination of recognized market indices (or sub-indices).

C) Grouping of Contracts. Projections may be performed for each contract inforce on the date of valuation or by grouping contracts into representative cells of model plans using all characteristics and criteria having a material impact on the size of the reserve. Grouping shall be the responsibility of the actuary but may not be done in a manner that intentionally understates the resulting reserve.

D) Modeling of Hedges. 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 the Guideline shall be included in the projections. If the company is following a Clearly Defined Hedging Strategy and the hedging strategy meets the requirements of Appendix 7, 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 that strategy.

To the degree either the currently held hedge positions or the hedge positions expected to be held in the future introduce basis, gap, price, or assumption risk, a suitable reduction for effectiveness of hedges shall be made. The actuary is responsible for verifying compliance with a Clearly Defined Hedging Strategy and the requirements in Appendix 7 for all hedge instruments included in the projections.

While hedging strategies may change over time, any change in hedging strategy shall be documented and include an effective date of the change in strategy.

The use of products not falling under the scope of the Guideline (e.g., equity-indexed annuities) as a hedge shall not be recognized in the determination of Accumulated Deficiencies.

These requirements 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.

E) Revenue Sharing.

1) Projections of Accumulated Deficiencies may include income from projected future Revenue Sharing, as defined in Section III) net of applicable projected expenses ("Net Revenue Sharing Income") if the following requirements are met:

(a) the Net Revenue Sharing Income is received and controlled by the company[6];

(b) signed contractual agreement or agreements are in place as of the valuation date and support the current payment of the Net Revenue Sharing Income; and

(c) the Net Revenue Sharing Income is not already accounted for directly or indirectly as a company asset.

2) The amount of Net Revenue Sharing Income to be used shall reflect the actuary'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):

(a) 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);

(b) 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;

(c) the benefits and risks to both the company and the entity paying the Net Revenue Sharing Income of continuing the arrangement.

(d) 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;

(e) 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; and

(f) 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.

3) The amount of projected Net Revenue Sharing Income shall also reflect a margin for error (which decreases the assumed Net Revenue Sharing Income) directly related to the uncertainty of the revenue. The greater the uncertainty, the larger the margin[7].

4) To the extent the agreement(s) guarantees[8] the payment of Net Revenue Sharing Income to the company, the net revenue may be included in full over the period for which it is guaranteed[9].

5) 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 subsection 2)(e) above) shall be included in the projections as a company expense under the requirements of section A1.1)A). 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 A1.1)A) and A1.1)E)1) that reduce the Net Revenue Sharing Income.

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[6] As in other sections of the Guideline, the term "the company" is used exclusively as a reference to the insurance company writing the business falling under the scope of the Guideline. The term "entity providing the Net Revenue Sharing Income" is self-explanatory and is used consistently in this subsection.

[7] Because the uncertainty would be expected to increase over time, it may be necessary to decrease the revenue by larger amounts in later projection periods.

[8] Provisions such as one that gives the entity paying the Net 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.

[9] If the agreement allows the company to unilaterally take control of the underlying fund fees that ultimately result in the Net Revenue Sharing Income 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 arrangement at the same expense level, it is presumed that expenses will be higher in this situation. Therefore, the Net Revenue Sharing Income shall be reduced to account for any actual or assumed additional expenses.

6) The actuary is responsible for reviewing the revenue sharing agreements, verifying compliance with these requirements, and documenting the rationale for any source of Net Revenue Sharing Income used in the projections.

F) 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.

G) AVR/IMR. The AVR and the IMR shall be handled consistently with the treatment in the company's cash flow testing.

A1.2) Determination of Scenario Greatest Present Values

A) Scenario Greatest Present Values. For a given scenario, the Scenario Greatest Present Value is the sum of:

1) The greatest present value, as of the projection start date, of the projected Accumulated Deficiencies defined in section III)B)6); and

2) The Starting Asset Amount.

B) Discount Rates. In determining the Scenario Greatest Present Values, Accumulated Deficiencies shall be discounted using the same interest rates ~~used to project General Account Assets~~at which positive cash flows are invested, as determined in section A1.4)D)~~.~~. Such interest rates shall be reduced to reflect expected credit losses. Note that the interest rates used do not include a reduction for Federal Income Taxes.

A1.3) Projection Scenarios

A) Minimum Required Scenarios. The number of scenarios for which projected greatest present values of Accumulated Deficiencies shall be computed shall be the responsibility of the actuary and shall be considered to be sufficient if any resulting understatement in total reserves, as compared with that resulting from running additional scenarios, is not material.

B) Scenario Calibration Criteria. Returns for the groupings of variable funds shall be determined on a stochastic basis such that the resulting distribution of the Gross Wealth Ratios of the scenarios meets the Scenario Calibration Criteria specified in Appendix 5.

A1.4) Projection Assets

A) Starting Asset Amount. 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. 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:

1) all of the Separate Account assets supporting the contracts;

2) an amount of assets held in the General Account equal to the approximate value of statutory reserves as of the start of the projections less the amount in 1), above.

In many instances the initial General Account assets may be negative, resulting in 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.

Any hedge assets meeting the requirements described in section A1.1)D) shall be reflected in the projections and included with other General Account assets under item 2) above. To the extent the sum of the value of such hedge assets and the value of assets in item 1) above is greater than the approximate value of statutory reserves as of the start of the projections, then item 2) above may include enough negative General Account assets or cash such that the sum of items 1) and 2) above equals the approximate value of statutory reserves as of the start of the projections.[10]

[10] Further elaboration on potential practices with regard to this issue may be included in a practice note.

The actuary shall document which assets were used as of the start of the projection, the approach used to determine which assets were chosen and shall verify that the value of the assets equals the approximate value of statutory reserves at the start of the projection.

B) 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.

C) Separate Account Assets. For purposes of determining the Starting Asset Amounts in subsection A) and the valuation of projected assets in subsection B), assets held in a Separate Account shall be summarized into asset categories determined by the actuary as discussed in section A1.1)B).

D) General Account Assets. General Account assets shall be projected 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 at interest rates, which, at the option of the actuary, are one of the following:

1) The forward interest rates implied by the swap curve[11] in effect as of the valuation date,

2) The 200 interest rate scenarios available as prescribed for Phase I, C-3 Risk Based Capital calculation, coupled with the Separate Account return scenarios by mating them up with the first 200 such scenarios and repeating this process until all Separate Account return scenarios have been mated with a Phase I scenario, or

3) Interest rates developed for this purpose from a stochastic model that integrates the development of interest rates and the Separate Account returns.

When the option described in 1) above (the forward interest rates implied by the swap curve) is used, a margin shall be added to the interest rates to reflect the current market expectations about future interest rates using the process described in section A1.5)A).

The actuary may switch from 1) to 2), from 1) to 3) or from 2) to 3) from one valuation date to the next, but may not switch in the other direction without approval from the Domiciliary Commissioner.

A1.5) Projection of Annuitization Benefits (including GMIBs)

A) Assumed Annuitization Purchase Rates at Election. For purposes of projecting annuitization benefits (including annuitizations stemming from the election of a GMIB), 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 A1.4)D). However, where the interest rates used to project General Account Assets are based upon the forward interest rates implied by the swap curve in effect as of the valuation date (i.e., the option described in section A1.4)D)1) is used, herein referred to as a point estimate), the margin between the cost to purchase an annuity using the guaranteed purchase basis and the cost using the interest rates prevailing at the time of annuitization shall be adjusted as discussed below.

If a point estimate is being used, it is important that the margin assumed reflects the current market expectations about future interest rates at the time of annuitization, as described more fully below, and a downward adjustment to the interest rate assumed in the purchase rate basis. The latter adjustment is necessary since a greater proportion of contractholders will select an annuitization benefit when it is worth more than the cash surrender value then when it is not. As a practical matter, this effect can be approximated by using an interest rate assumption in the purchase rate basis that is 0.30 percent below that implied by the forward swap curve, as described below.

To calculate market expectations of future interest rates, the par or current coupon swap curve is used (documented daily in Federal Reserve H.15 with some interpolation needed). Deriving the expected rate curve from this swap curve at a future date involves the following steps:

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[11] The swap curve is based on the Federal Reserve H.15 interest swap rates. The rates are for a Fixed Rate Payer in return for receiving three month LIBOR. One place where these rates can be found is http://www.federalreserve.gov/releases/h15/default.htm.

1) Calculate the implied zero-coupon rates. This is a well documented "bootstrap" process. For this process we use the equation $100=C^n * (v + v^2 + \ldots + v^n) + 100v^n$ where the "v^t" terms are used to stand for the discount factors applicable to cash flows 1,2,…n years hence and C^n is the n-year swap rate. Each of these discount factors are based on the forward curve and therefore are based on different rates, however (i.e. "v^2" does not equal v times v). Given the one year swap rate, one can solve for v. Given v and the two year swap rate one can then back into v^2, and so on.

2) Convert the zero coupon rates to one year forward rates by calculating the discount factor needed to get from v^{t-1} to v^t.

3) Develop the expected rate curve.

   This recognizes that, for example, the five-year forward one-year rate is not the rate the market expects on one year instruments five years from now. The reason is that as the bond gets shorter the "risk premium" in the rate diminishes. This is sometimes characterized as "rolling down" the yield curve. Table A shows the historic average risk premium at various durations. From this table, one can see that to get the rate the market expects a 1 year swap to have five years from now; one must subtract the risk premium associated with six year rates (.95%) and add back that associated with 1 year rates (.50%). This results in a net reduction of .45%.

Table A: Risk Premium by Duration

Duration	Risk Premium	Duration	Risk Premium
1	0.500%	6	0.950%
2	0.750%	7	1.000%
3	0.750%	8	1.100%
4	0.850%	9+	1.150%
5	0.900%		

The Exhibit below combines the three steps. Columns A through D convert the swap curve to the implied forward rate for each future payment date. Columns E through H remove the current risk premium, add the risk premium t years in the future (the Exhibit shows the rate curve five years in the future), and uses that to get the discount factors to apply to the 1 year, 2 year,…5 year cash flows 5 years from now.

Exhibit: Derivation of discount rates expected in the future

	A	B	C	D	E	F	G	H
1								
2	Projection Years	Swap Curve Rate	PV of Zero Coupon	Forward 1 Year Rate	Risk Premium	Risk Premium 5 Years Out	Expected Forward Rate In Five Years	PV of Zero Coupon In 5 Years
3								
4	1	2.57000%	0.97494	2.5700%	0.50000%			
5	2	3.07000%	0.94118	3.5879%	0.75000%			
6	3	3.44000%	0.90307	4.2193%	0.75000%			

7	4	3.74000%	0.86231	4.7268%	0.85000%			
8	5	3.97000%	0.82124	5.0011%	0.90000%			
9	6	4.17000%	0.77972	5.3250%	0.95000%	0.50000%	4.8750%	0.95352
10	7	4.34000%	0.73868	5.5557%	1.00000%	0.75000%	5.3057%	0.90547
11	8	4.48000%	0.69894	5.6861%	1.10000%	0.75000%	5.3361%	0.85961
12	9	4.60000%	0.66049	5.8209%	1.15000%	0.85000%	5.5209%	0.81463
13	10	4.71000%	0.62303	6.0131%	1.15000%	0.90000%	5.7631%	0.77024
14	Cell formulas for Projection Year 10:		=(1-B13*SUM(C4:C12))/(1+B13)	=C12/C13-1		=E8	=D13-E13+F13	=H12/(1+G13)

Where interest rates are projected stochastically using an integrated model, although one would "expect" the interest rate n years hence to be that implied for an appropriate duration asset by the forward swap curve as described above, there is a steadily widening confidence interval about that point estimate with increasing time until the annuitization date. The "expected margin" in the purchase rate is less than that produced by the point estimate based on the expected rate, since a greater proportion of contractholders will have an annuitization benefit whose worth is in excess of cash surrender value when margins are low than when margins are high. As a practical matter, this effect can be approximated by using a purchase rate margin based on an earnings rate .30 percent below that implied by the forward swap curve. If a stochastic model of interest rates is used instead of a point estimate then no such adjustment is needed.

B) Projected Election of Guaranteed Minimum Income Benefit and other Annuitization Options. For contracts projected to elect annuitization options (including annuitizations stemming from the election of a GMIB), the projections may assume one of the following at the actuary's option:

1) The contract is treated as if surrendered at an amount equal to the statutory reserve that would be required at such time for the payout annuity benefits, or

2) The contract is assumed to stay inforce, the projected periodic payments are paid, and the Working Reserve is equal to one of the following:

   a) The statutory reserve required for the payout annuity, if it is a fixed payout annuity, or

   b) If it is a variable payout annuity, the Working Reserve for a variable payout annuity as defined in section III)B)5).

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 2) above shall be used.

Where mortality improvement is used to project future annuitization purchase rates, as discussed in A) above, mortality improvement shall also be reflected on a consistent basis in either the determination of the reserve in 1) above or the projection of the periodic payments in 2) above.

A1.6) Relationship to Risk Based Capital Requirements

A) The Guideline anticipates that the projections described herein may be used for the determination of Risk Based Capital (the "RBC requirements") for some or all of the contracts falling within the scope of the Guideline. There are two major differences between the requirements of the Guideline and the RBC requirements as of the time that the Guideline was drafted. First, the Conditional Tail Expectation level is different (CTE (65) for the Guideline and CTE (90) for the RBC requirements). Second, the projections described in the Guideline are performed on a basis

that ignores Federal Income Tax. That is, under the Guideline, the Accumulated Deficiencies do not include projected Federal Income Tax and the interest rates used to discount the Scenario Greatest Present Value (i.e., the interest rates determined in section A1.4)D)) contain no reduction for Federal Income Tax. Under the RBC requirements, the projections do include projected Federal Income Tax and the discount interest rates used in the RBC requirement do contain a reduction for Federal Income Tax.

B) To further aid the understanding of the Guideline and any instructions relating to the RBC requirement, it is important to note the equivalence in meaning between the following terms, subject to the differences noted above:

1) The amount that is added to the Starting Asset Amount in section III)B)6) of the Guideline is similar to the Additional Asset Requirement referenced in the RBC requirement.

2) The Conditional Tail Expectation Amount referenced in the Guideline is similar to the Total Asset Requirement referenced in the RBC requirement.

A1.7) Compliance with Actuarial Standards of Practice (ASOPs)

When determining the Conditional Tail Expectation Amount using projections, the analysis shall conform to the Actuarial Standards of Practice as promulgated from time to time by the Actuarial Standards Board.

A1.8) Compliance with Principles

When determining the Conditional Tail Expectation Amount using projections, any interpretation and application of the requirements of the Guideline shall follow the principles discussed in the section I) - Background.

APPENDIX 2 - Reinsurance and Statutory Reporting Issues

A2.1) Treatment of Reinsurance Ceded in the Aggregate Reserve

A) Aggregate Reserve Net of and Prior to Reinsurance Ceded. As noted in section IV)B), the Aggregate Reserve is determined net of reinsurance ceded. Therefore, it is necessary to determine the components needed to determine the Aggregate Reserve (i.e., the Standard Scenario Amount, and either the Conditional Tail Expectation Amount determined using projections or the Conditional Tail Expectation Amount determined using the Alternative Methodology) on a net of reinsurance basis. In addition, as noted in section IV)B), it may be necessary to determine the Aggregate Reserve determined on a "direct" basis, or prior to reflection of reinsurance ceded. Where this is needed, each of these components shall be determined prior to reinsurance. Sections B) through D) below discuss methods necessary to determine these components on both a "net of reinsurance" and a "prior to reinsurance" basis. Note that due allowance for reasonable approximations may be used where appropriate.

B) Conditional Tail Expectation Amount Determined using Projections. In order to determine the Aggregate Reserve net of reinsurance ceded, Accumulated Deficiencies, Scenario Greatest Present Values, and the resulting Conditional Tail Expectation Amount shall be determined reflecting the effects of reinsurance within the projections. 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 Conditional Tail Expectation Amount prior to reinsurance ceded, Accumulated Deficiencies, Scenario Greatest Present Values, and the resulting Conditional Tail Expectation Amount shall be determined ignoring the effects of reinsurance within the projections. One acceptable approach involves a projection based on the same Starting Asset Amount as for the Aggregate Reserve net of reinsurance and by ignoring, where appropriate, all anticipated reinsurance premiums or other costs and all reinsurance recoveries in the projections.

C) Conditional Tail Expectation Amount Determined using the Alternative Methodology. If a company chooses to use the Alternative Methodology, as allowed in section IV)E), it is important to note that the methodology produces reserves on a prior to 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 net of reinsurance. In addition, the Alternative Methodology, unadjusted for reinsurance, shall be applied to the contracts falling under the scope of the Guideline to determine the Aggregate Reserve prior to reinsurance.

D) Standard Scenario Amount. Where reinsurance is ceded, the Standard Scenario Amount shall be calculated as described in Appendix 3 to reflect the reinsurance costs and reinsurance recoveries under the reinsurance treaties. If it is necessary, the Standard Scenario Amount shall be calculated prior to reinsurance ceded using the methods described in Appendix 3, but ignoring the effects of the reinsurance ceded.

A2.2) Aggregate Reserve to be held in the General Account

The amount of the reserve held in the General Account shall not be less than the excess of the Aggregate Reserve over the sum of the Basic Reserve, as defined in section A3.2), attributable to the variable portion of all such contracts.

A2.3) Actuarial Certification and Memorandum

A) Actuarial Certification. Actuarial Certification of the work done to determine the Aggregate Reserve shall be required. The actuary shall certify that the work performed has been done in a way that complies with all appropriate Actuarial Standards of Practice. The scope of this certification does not include an opinion on the adequacy of the Aggregate Reserve[12], the company's surplus or the company's future financial condition. The

[12] The adequacy of total company reserves, which includes the Aggregate Reserve, is addressed in the company's Actuarial Opinion as required by the NAIC Model Actuarial Opinion and Memorandum Regulation.

actuary shall also note any material change in the model or assumptions from that used previously and the estimated impact of such changes.

Appendix 8 contains more information on the contents of the required Actuarial Certification.

B) Required Memorandum. An actuarial memorandum shall be constructed documenting the methodology and assumptions upon which the Aggregate Reserve is determined. The memorandum shall also include sensitivity tests that the actuary feels appropriate, given the composition of the company's block of business (i.e., identifying the key assumptions that, if changed, produce the largest changes in the Aggregate Reserve). This memorandum shall have the same confidential status as the actuarial memorandum supporting the actuarial opinion[13] and shall be available to regulators upon request.

Appendix 8 contains more information on the contents of the required memorandum.

C) Conditional Tail Expectation Amount Determined using the Alternative Methodology. Where the Alternative Methodology is used, there is no need to discuss the underlying assumptions and model in the required memorandum. Certification that expense, revenue, fund mapping, and product parameters have been properly reflected, however, shall be required.

Appendix 8 contains more information on the contents of the required Actuarial Certification and memorandum.

D) Material Changes. If there is a material change in results due to a change in assumptions from the previous year, the memorandum shall include a discussion of such change and an estimate of the impact it has on the results.

[13] This is consistent with Section 3D(8) of the Standard Valuation Law, which states: "Except as provided in Paragraphs (12), (13) and (14), documents, materials or other information in the possession or control of the Department of Insurance that are a memorandum in support of the opinion, and any other material provided by the company to the commissioner in connection with the memorandum, shall be confidential by law and privileged, shall not be subject to [insert open records, freedom of information, sunshine or other appropriate phrase], shall not be subject to subpoena, and shall not be subject to discovery or admissible in evidence in any private civil action. However, the commissioner is authorized to use the documents, materials or other information in the furtherance of any regulatory or legal action brought as a part of the commissioner's official duties".

APPENDIX 3 - Standard Scenario Requirements

[Note: This is not part of the Academy VARWG recommendation, but was added at the request of LHATF]

A3.1) Overview

A) Application to Determine Reserves. A Standard Scenario Reserve shall be determined for each of the contracts falling under the scope of the Guideline by applying section A3.3). This includes those contracts to which the Alternative Methodology is applied.

The Standard Scenario Reserve for a contract with guaranteed living benefits or guaranteed death benefits is based on a projection of the account value based on specified returns for supporting assets equal to the account value. An initial drop is applied to the supporting assets and account value on the valuation date. Subsequently, account values are projected at specified rates earned by the supporting assets less contract and fund charges. The assumptions for the projection of account values and margins are prescribed in section A3.3)C). For any contract with guarantees the Standard Scenario Reserve includes the greatest present value of the benefit payments in excess of account values applied over the present value of revenue produced by the margins.

B) The Standard Scenario Amount.

1) The Standard Scenario Amount is defined in section IV)C) of this Guideline as the aggregate of the reserves determined by applying the Standard Scenario Method to each of the contracts falling under the scope of the Guideline. Except as provided in subsection A3.3)B)1) and subject to the Standard Scenario Method limitations in A3.1)B)2), the Standard Scenario Amount equals the sum over all contracts of the Standard Scenario Reserve determined for each contract as of the statement date based on a Discount Rate equal to the applicable federal interest rate (AFIR) as defined in the Internal Revenue Code, Section 807(d)(4)(A)(i), for the contract's year of issue. If the AFIR is no longer available, then a substitute rate determined by the National Association of Insurance Commissioners shall be used. For contracts issued prior to 1988, the statutory valuation interest rate shall be used.

2) The Standard Scenario Method requires the Standard Scenario Amount to not be less than the greater of (a) and (b), where:

(a) is the sum over all contracts of the Basic Reserve, defined in section A3.2)A), determined for each contract as of the statement date; and

(b) is the sum over all contracts of the Standard Scenario Reserve determined for each contract as of the statement date as described in section A3.3), where the Discount Rate is equal to *DR* as defined in the next paragraph.

DR is the annual effective equivalent of the 10-year constant maturity treasury rate reported by the Federal Reserve for the month of valuation plus 50 basis points. However, *DR* shall not be less than three percent or more than nine percent. If the 10-year constant maturity treasury rate is no longer available, then a substitute rate determined by the National Association of Insurance Commissioners shall be used.

In instances where the Standard Scenario Amount in this subsection (2) is greater than that from subsection (1), the Standard Scenario Reserve established for each contract is equal to the amount determined under subsection (2).

3) No modification is allowed for the calculation required by this section as of the statement date unless the Domiciliary Commissioner approves such modification as necessary to produce a reasonable result

C) Illustrative Application of the Standard Scenario to a Projection or Model Office. If the Conditional Tail Expectation Amount is determined based on a projection of an inforce prior to the statement date and/or by the use of a model office, which is a grouping of contracts into representative cells, then additional determinations of A3.1)B)2)(b) shall be performed on the prior inforce and/or model office. The calculations are for illustrative purposes to assist in validating the reasonableness of the projection and/or the model office.

The following table identifies the illustrative additional determinations required by this section using the Discount Rate, *DR*, as defined in A3.1)B)2)(b). The additional determinations required are based on how the Conditional Tail Expectation projection or Alternative Methodology is applied. For completeness, the table also includes the determinations required by sections A3.1)B)1) and A3.1)B)2)(b).

1) Runs A and B in the table are required for all companies by sections A3.1)B)1) and A3.1)B)2)(b) respectively. No additional determinations are required if a company's stochastic or alternative methodology result is calculated on individual contracts as of the statement date.

2) A company that uses a model office as of the statement date to determine its stochastic or alternative methodology result must provide an additional determination for the model office based on the Discount Rate *DR*, run C.

3) A company that uses a contract by contract listing of a prior inforce to determine its stochastic or alternative methodology with result PS and then projects requirements to the statement date with result S must provide an additional determination for the prior inforce based on the Discount Rate *DR*, run D.

4) A company that uses a model office of a prior inforce to determine its stochastic or alternative methodology requirements with result PM and then projects requirements to the statement date with result S must provide an additional determination for the prior model office based on the Discount Rate *DR*, run E.

Standard Scenario Run	Guideline Variations	Validation Measures	
		Model Office Projection	Projection of Prior Inforce
A. Valuation on the statement date on inforce contracts with discount rates equal to AFIR	None	None	None
B. Valuation on the statement date on inforce contracts with discount rate *DR*	None	None	None
C. Valuation on the statement date on the model office with discount rate *DR*	If not material to model office validation	B/C compare to 1.00	None
D. Valuation on a prior inforce date on prior inforce contracts with discount rate *DR*	If not material to projection validation	None	B/D - S/PS compare to 0
E. Valuation on a prior inforce date on a model office with discount rate *DR*	If not material to model office or projection validation.	(B/E – S/PM) compare to 0	

Modification of the requirements in section A3.3) when applied to a prior inforce or a model office is permitted if such modification facilitates validating the projection of inforce or the model office. All such modifications should be documented.

A3.2) Basic and Basic Adjusted Reserve - Application of Actuarial Guideline XXXIII

A) The Basic Reserve for a given contract shall be determined by applying statutory statement valuation requirements applicable immediately prior to adoption of the Guideline to the contract ignoring any guaranteed death benefits in excess of account values or guaranteed living benefits applying proceeds in excess of account values.

B) The calculation of the Basic Reserve shall assume a return on separate account assets based on the year of issue statutory valuation rate less appropriate asset based charges, including charges for any guaranteed death benefits or guaranteed living benefits. It shall also assume a return for any fixed separate account and general account options equal to the rates guaranteed under the contract.

C) The Basic Reserve shall be no less than the Cash Surrender Value on the valuation date, as defined in section III)B) of the Guideline.

D) The Basic Adjusted Reserve shall be that determined based on A3.2)A), A3.2)B) and A3.2)C) except in A3.2)A) free partial withdrawal provisions shall be disregarded when determining surrender charges in applying the statutory statement valuation requirement prior to adoption of the Guideline.

A3.3) Standard Scenario Reserve - Application of the Standard Scenario Method

A) General. Where not inconsistent with the guidance given here, the process and methods used to determine the Standard Scenario Reserve under the Standard Scenario Method shall be the same as required in the calculation of the Conditional Tail Expectation Amount as described in section IV) of the Guideline. Any additional assumptions needed to determine the Standard Scenario Reserve shall be explicitly documented.

B) Results for the Standard Scenario Method. For each contract, the Standard Scenario Reserve is the reserve based on 1) or 2) where:

1) For contracts without any guaranteed benefits, as defined in section III)A) of the Guideline and where not subsequently disapproved by the Domiciliary Commissioner, the Standard Scenario Reserve is the Basic Reserve described in section A3.2)A).

2) For all other contracts the Standard Scenario Reserve is equal to (a) + (b) - (c), where:

(a) is the Basic Adjusted Reserve calculated for the contract, as described in section A3.2)D);

(b) is the greater of zero and the greatest present value at the Discount Rate measured as of the end of each projection year of the negative of the Accumulated Net Revenue described below using the assumptions described in A3.3)C). The Accumulated Net Revenue at the end of a projection year is equal to (i) + (ii) - (iii), where:

(i) is the Accumulated Net Revenue at the end of the prior projection year accumulated at the Discount Rate to the end of the current projection year; the Accumulated Net Revenue at the beginning of the projection (i.e., time 0) is zero;

(ii) are the margins generated during the projection year on account values accumulated at the Discount Rate to the end of the projection year (the factors and assumptions to be used in calculating the margins and account values are in A3.3)C)); and

(iii) are the contract benefits in excess of account values applied, Individual reinsurance premiums and Individual reinsurance benefits payable or receivable during the projection year accumulated at the Discount Rate to the end of the projection year. Individual reinsurance is defined in A3.3)C)2).

(c) is the contract's allocation of the value of hedges and Aggregate reinsurance as described in section A3.3)D). Aggregate reinsurance is defined in section A3.3)C)2).

3) No reinsurance shall be considered in the Standard Scenario Amount if such reinsurance is ineligible for reinsurance credit under the NAIC Life and Health Reinsurance Agreements Model Regulation. The actuary shall determine the projected reinsurance premiums and benefits reflecting all treaty limitations and assuming any options in the treaty to the other party are exercised to decrease the value of reinsurance to the reporting company (e.g., options to increase premiums or terminate coverage). The positive value of any reinsurance treaty that is not guaranteed to the insurer or its successor shall be excluded from the value of reinsurance. The commissioner may require the exclusion of any portion of the value of reinsurance if the terms of the reinsurance treaties are too restrictive (e.g., time or amount limits on benefits correlate to the Standard Scenario Method).

C) Assumptions for use in paragraph A3.3)B)2)(b) for Accumulated Net Revenue and Account Values.

1) **Account Value Return Assumptions.** The bases for return assumptions on assets supporting the Account Value are shown in Table I. The "Initial" returns shall be applied to the account value supported by each asset class on the valuation date as immediate drops, resulting in the Account Value at time 0. The "Year 1" and "Year 2+" returns for the equity, bond and balanced classes are gross annual effective rates of return and are used (along with other decrements and/or increases) to produce the Account Value as of the end of each projection year. For purposes of this section, money market funds supporting Account Value shall be considered part of the Bond class.

The Fixed Fund rate is the greater of the minimum rate guaranteed in the contract or 4% but not greater than the current rates being credited to Fixed Funds on the valuation date.

Account Values shall be projected using the appropriate gross rates from Table I for equity, bond and balanced classes applied to the supporting assets less all fund and contract charges according to the provisions of the funds and contract and applying the Fixed funds rate from Table I as if it were the resulting net rate after deduction for fund or contract charges.

The margins on Account Value are defined as follows:

(a) During the Surrender Charge Period:

(i) 0.10% of Account Value; plus

(ii) The maximum of:

- 0.20% of Account Value; or
- Explicit and optional contract charges for guaranteed living and death benefits.

(b) After the Surrender Charge Period:

(i) The amount determined in (a) above; plus

(ii) The lesser of:

- 0.65% of Account Value; and
- 50% of the excess, if any, of all contract charges over (a) above.

Table I

	Initial	Year 1	Year 2+
Equity Class	-6.25%	0%	6.25%
Bond Class	0%	0%	5.25%
Balanced Class	-3.75%	0%	5.85%
Fixed Separate Accounts and General Account (net)	0%	Fixed Fund Rate	Fixed Fund Rate

2) **Reinsurance Credit.** Individual reinsurance is defined as reinsurance where the total premiums for and benefits of the reinsurance can be determined by applying the terms of the reinsurance to each contract covered without reference to the premiums or benefits of any other contract covered and summing the results over all contracts covered. Reinsurance that is not Individual is Aggregate.

Individual reinsurance premiums projected to be payable on ceded risk and receivable on assumed risk shall be included in the Projected Net Revenue. Similarly, Individual reinsurance benefits projected to be receivable on ceded risk and payable on assumed risk shall be included in the Projected Net Revenue. No Aggregate reinsurance shall be included in Projected Net Revenue.

3) **Lapses, Partial Withdrawals, and Moneyness.** Partial withdrawals elected as guaranteed living benefits, see A3.3)C)7), or required contractually (e.g., a contract operating under an automatic withdrawal provision on the valuation date) are to be deducted from Account Value. No other partial withdrawals, including free partial withdrawals, are to be deducted from Account Value. All lapse rates should be applied as full contract surrenders.

A contract is in the money (ITM) if it includes a guaranteed living benefit and at any time the portion of the projected Account Value under the Standard Scenario Method required to obtain the benefit would be less than the value of the guaranteed benefit at the time of exercise or payment. If the Account Value is 90% of the value of the guaranteed benefit at the time of exercise or payment, the contract is said to be 10% in the money. If the income from applying the Account Value to guaranteed purchase rates exceeds the income from applying the benefit base to GMIB purchase rates for the same type of annuity, then there is no GMIB cost and the GMIB is not in the money. A contract not in the money is out of the money (OTM). If a contract has multiple living

benefit guarantees then the contract is ITM to the extent that any of the living benefit guarantees are ITM. Projected lapses shall be at the annual effective rates given in Table II.

Table II - Lapse Assumptions

	During Surrender Charge Period	After Surrender Charge Period		
Death Benefit Only Contracts	5%	10%		
All Guaranteed Living Benefits OTM	5%	10%		
		ITM < 10%	10%□ITM< 20%	20%□ITM
Any Guaranteed Account Balance Benefits ITM	0%	0%	0%	0%
Any Other Guaranteed Living Benefits ITM	3%	7%	5%	2%

4) **Account Transfers and Future Deposits.** No transfers between funds shall be assumed in the projection used to the determine the greatest present value amount required under section A3.3)B)2)(b) 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.

   Margins generated during a projection year on funds supporting account value are transferred to the Accumulation of Net Revenue and are subsequently accumulated at the Discount Rate. Assets for each class supporting account values are to be reduced in proportion to the amount held in each asset classes at the time of transfer of margins or any portion of Account Value applied to the payment of benefits.

   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.

5) **Mortality.** Mortality at 80% of the 1994 Variable Annuity MGDB Mortality Tables (1994 MGDB tables) through age 95 increasing by 1% each year to 100% of the 1994 MGDB tables at age 115 shall be assumed in the projection used to the determine the greatest present value amount required under section A3.3)B)2)(b).

6) **Projection Frequency.** The projection used to determine the greatest present value amount required under section A3.3)B)2)(b) shall be calculated using an annual or more frequent time step, such as quarterly. For time steps more frequent than annual, assets supporting Account Values at the start of a year may be retained in such funds until year-end (i.e., margin earned during the year will earn the fund rates instead of the Discount Rate until year end) or removed after each time step. However, the same approach shall be applied for all years. Similarly, projected benefits, lapses, elections and other contractholder activity can be assumed to occur annually or at the end of each time step, but the approach shall be consistent for all years.

7) **Contractholder Election Rates.** Contractholder election rates shall be 15% per annum for any elective ITM benefit except guaranteed withdrawal benefits, but only to the extent such election does not terminate a more valuable benefit subject to election. GMDBs are not benefits subject to election. Exception: Contractholder election rates shall be 100% at the last opportunity to elect an ITM benefit, but only to the extent such election does not terminate a more valuable benefit subject to election. A benefit is more valuable if it is more ITM in absolute dollars using the definition of ITM in subsection 5).

   For guaranteed minimum withdrawal benefits, a partial withdrawal equal to the applicable percentage in Table III applied to the contract's maximum allowable partial withdrawal shall be projected. However, if the

contract's minimum allowable partial withdrawal exceeds the partial withdrawal from applying the rate in Table III to the contract's maximum allowable partial withdrawal, then the contract's minimum allowable partial withdrawal shall be projected.

Table III - Guaranteed Withdrawal Assumptions

	Attained Age less than 50	Attained Age 50 to 59	Attained Age 60 or Greater
Withdrawals do not reduce other elective Guarantees that are in the money	50%	75%	100%
Withdrawals reduce elective Guarantees that are in the money	25%	50%	75%

8) **GMIBs.** The projected GMIB cost at the time of annuitization shall be the excess, if positive, of the reserve required for the projected annuitization stream over the Account Value at the time of annuitization. If the reserve required is less than the account value, the GMIB cost shall be zero. The reserve required shall be determined using the 2000 Annuity Mortality Table and a valuation interest rate equal to the Discount Rate. If more than one annuity option is available, choose the option with a reserve closest to the reserve for a life annuity with 10 years of certain payments.

9) **Indices.** If an interest index is required to determine projected benefits or reinsurance obligations, the index must assume interest rates have not changed since the last reported rates before the valuation date. If an equity index is required the index shall be consistent with the last reported index before the valuation date, the initial drop in equity returns and the subsequent equity returns in the standard scenario projection. The sources of information and how they are used to determine the indexes shall be documented and, to the extent possible, consistent from year to year.

D) Assumptions for use in Section A3.3)B)2)(c).

1) **The Value of Aggregate Reinsurance.** The value of Aggregate reinsurance shall be calculated separately from the Accumulated Net Revenue. The value of Aggregate reinsurance is the discounted value, at rate *DR* of the excess of (a) the projected benefit payments from the reinsurance; over (b) the projected gross reinsurance premiums, where (a) and (b) are determined under the assumptions described in section A3.3)C).

2) **The Value of Approved Hedges.** The value of approved hedges shall be calculated separately from the Accumulated Net Revenue. The value of approved hedges is the difference between: a) the discounted value at rate DR of the pre-tax cash flows from the approved hedges; less b) their statement values on the valuation date.

To be an approved hedge, a derivative has to be an actual asset held on the valuation date and be designated as a hedge for one or more contracts subject to the Standard Scenario. The hedge may be part of a dynamic strategy in which the hedge will be adjusted for changes in the contract population, changes in the probability of the risk and changes in the cost if the risk is realized. Also, the hedge may support risks that are not uniform among the contracts because the contracts were issued under different market conditions and or the contracts offer different exposure options to the same risk. In all other respects, the hedge must satisfy the requirements of SSAP 86 for hedge accounting.

If the hedge also supports contracts not subject to the Standard Scenario, then only that portion of the hedge designated for contracts subject to the Standard Scenario shall be included in the value of hedges. Approved hedges must be held in accordance with an investment policy that has been implemented for at least six months and has been approved by the Board of Directors or a subcommittee of Board members. A copy of the investment policy and the resolution approving the policy shall be maintained with the documentation of the Standard Scenario and available on request. Approved hedges must be held in accordance with a written investment strategy developed by management to implement the Board's investment policy. A copy of the investment strategy on the valuation date, the most recent investment strategy presented to the Board if different and the most recent written report on the effectiveness of the strategy shall be maintained with the documentation of the Standard Scenario and available on request.

The Domiciliary Commissioner may require the exclusion of any portion of the value of approved hedges upon a finding that the company's documentation, controls, measurement, execution of strategy or historical results

are not adequate to support a future expectation of risk reduction commensurate with the value of approved hedges.

The item being hedged, the contract guarantees, shall be assumed to be accounted for at market, which will require the statement value of hedges to be held at market value. The cash flow projection for approved hedges that expire in less than one year from the valuation date should be based on holding the hedges to their expiration. For hedges with an expiration of more than 1 year, the value of hedges should be based on liquidation of the hedges one year from the valuation date. Where applicable, the liquidation value of hedges shall be consistent with the assumed returns in the Standard Scenario from the start of the projection to the date of liquidation, Black-Scholes pricing, a risk free rate equal to *DR* and the annual volatility implicit as of the valuation date in the statement value of the hedges when the statement value of hedges are valued with Black-Scholes pricing and a risk-free rate equal to *DR*.

There is no credit in the Standard Scenario for dynamic hedging beyond the credit that results from hedges actually held on the valuation date.

3) **Allocation of the Value of Hedges and the Value of Aggregate Reinsurance.** A contract's allocation of the value of approved hedges and Aggregate reinsurance shall be the lesser of the amount in A3.3)B)2)(b) for the contract or the product of (a) and (b) where:

   (a) is the sum of the value of approved hedges plus the value of the Aggregate reinsurance for all contracts and

   (b) is the ratio of the amount in A3.3)B)2)(b) for the contract to the sum of the amount in A3.3)B)2)(b) for all contracts.

4) **Retention of components**. For the seriatim Standard Scenario Reserve on the statement date under each of Sections A3.1)B)1) and A3.1)B)2)(b), the actuary should have available to the Commissioner the following values for each contract:

   (a) The Standard Scenario Reserve prior to adjustment under paragraph A3.3)D)3)

   (b) The Standard Scenario Reserve net of the adjustment in A3.3)D)3).

APPENDIX 4 - Alternative Methodology

A4.1) General Methodology

A) General Methodology Description. For variable deferred annuity contracts that either contain no guaranteed benefits or only GMDBs[14] (i.e., no VAGLBs), the Conditional Tail Expectation Amount may be determined by using the method outlined below rather than by using the approach described in section IV)D) (i.e., based on projections), provided the approach described in section IV)D) has not been used in prior valuations or else approval has been obtained from the Domiciliary Commissioner.

The Conditional Tail Expectation Amount 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 inforce as of a valuation date and adding this to the contract's Cash Surrender Value[15]. The resulting Conditional Tail Expectation Amount shall not be less than the Cash Surrender Value in aggregate for the group of contracts to which the Alternative Methodology is applied.

The Conditional Tail Expectation Amount determined using the Alternative Methodology for a group of contracts that contain no guaranteed benefits[16] shall be determined using an application of Actuarial Guideline XXXIII, as described below.

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.

B) Definitions of Terms Used in this Appendix.

1) 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.

2) 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.

3) Benchmark. Benchmarks have similar risk characteristics to the entity (e.g., asset class, index, or fund) to be modeled.

4) Deterministic Calculations. In a Deterministic Calculation, a given event (e.g., asset returns going up by 7% then down by 5%) is assumed to occur with certainty. In a stochastic calculation, events are assigned probabilities.

5) Foreign Securities. Securities issued by entities outside the United States and Canada.

6) 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.

7) 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.

8) 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

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[14] This includes "earnings enhanced death benefits", as discussed in section III)A)1).

[15] The amount that is added to a 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.

[16] 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).

containing securities predominately containing securities that are not NAIC rated as 1 or 2 (or similar agency ratings) are considered to be High-Yield.

9) 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.

10) 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.

11) Margin Offset. Margin Offset is the portion of charges available to fund claims and amortization of the unamortized surrender charges allowance.

12) 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.

13) Model Office. A Model Office converts many contracts with similar features into one contract with specific features for modeling purposes.

14) Pre-Packaged Scenarios. The Pre-Packaged Scenarios are the year-by-year asset returns that may be used (but are not mandated) in projections related to the alternative methodology. This data is available on an American Academy of Actuaries website.

15) 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.

16) 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.

17) Risk Mitigation Strategy. A Risk Mitigation Strategy is a device to reduce the probability and/or impact of a risk below an acceptable threshold.

18) Risk Profile. Risk Profile in the Guideline relates to the prescribed asset class categorized by the volatility of returns associated with that class.

19) 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.

20) Roll-Up. A Roll-Up benefit results in the guaranteed value associated with a minimum contractual guarantee increasing at a contractually defined interest rate.

21) Volatility. Volatility refers to the annualized standard deviation of asset returns.

C) 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 Actuarial Guideline XXXIII. The application shall assume a return on separate account assets equal to the year of issue valuation interest rate less appropriate asset based charges. It shall also assume a return for any fixed separate account and general account options equal to the rates guaranteed under the contract.

The reserve for such contracts shall be no less than the Cash Surrender Value on the valuation date, as defined in section III)B).

D) 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:

1) the contractual features of the variable annuity product,

2) the actual issue age, period since issue, attained age, years-to-maturity, and gender applicable to the contract,

3) the account value and composition by type of underlying variable or fixed fund,

4) any surrender charges,

5) the GMDB and the type of adjustment made to the GMDB for partial withdrawals (e.g., proportional or dollar-for-dollar adjustment), and

6) expenses to be incurred and revenues to be received by the company as estimated on a Prudent Best Estimate basis as described in section III)B)8) and complying with the requirements for Revenue Sharing as described in section A1.1)E).

E) Factor Components. Factors shall be applied to determine each of the following components[17]:

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 for lapse rates that are based on the insurer's own anticipated experience 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 Best 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 A4.3)A);

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 $R(\beta_0, \beta_1) = \beta_0 + \beta_1 \times W$. The intercept and slope factors for this linear function vary according to:

a) product type,

b) pro-rata or dollar-for-dollar reductions in guaranteed value following partial withdrawals,

c) fund class,

d) attained age,

e) contract duration,

f) asset-based charges, and

g) 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_0, and β_1 values, reflecting a 65% confidence level and ignoring Federal Income Tax, are available from the National Association of Insurance Commissioners. In calculating $R(\beta_0, \beta_1)$ 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:

1) attained age,

2) contract duration,

3) ratio of account value to GMDB, and

[17] Material to assist in the calculation of the components is available on the American Academy of Actuaries' website, at http://www.actuary.org/life/phase2.htm (this is the address as of April, 2005).

4) 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 by complying with the requirements for Prudent Best Estimate described in section III)B)8) and Revenue Sharing described in section A1.1)E). 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 the Conditional Tail Expectation Amount were being computed as described in section A1.1)A) 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 Conditional Tail Expectation Amount using the Alternative Methodology, any interpretation and application of the requirements of the Guideline shall follow the principles discussed in the section I) - Background.

A4.2) Calculation of *CA* and *FE*

A) 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 Best Estimate basis as described in section III)B)8). Lapse rates shall be adjusted by the formula shown below (the Dynamic Lapse Multiplier, λ), 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.

$$\lambda = MIN\left[U, MAX\left[L, 1 - M \times \left(\frac{GV}{AV} - D\right)\right]\right],$$

where U=1, L=0.5, M=1.25, 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 A4.4, to a single “equivalent” asset class (as described in A4.4)C)), the *CA* and *FE* calculation separately projects each variable subaccount (as mapped to the 8 prescribed categories shown in section A4.4)) 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.

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%

B) 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 basis points 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, λ, 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 Best Estimate basis, and may vary according to the attributes of the business being valued, including, but not limited to, attained age, contract duration, etc.

C) 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.

A4.3) Calculation of the *GC* Component

A) *GC* Factors. *GC* is calculated as $F \times GV - G \times AV \times R$, where *GV* is the amount of 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_0 and β_1) are pre-calculated factors available from the National Association of Insurance Commissioners and known herein as the "Pre-Calculated Factors". These factors shall be interpolated as described in subsection F), below, and modified as necessary as described in sections A4.3)G) and A4.3)H).

B) Five Steps. There are five major steps in determining the *GC* component for a given contract:

1) classifying the asset exposure (as specified in subparagraph C), below);

2) determining the risk attributes (as specified in subparagraphs D) and E), below);

3) retrieving the appropriate nodal factors from the factor grid (as described in subparagraph F) below;

4) interpolating the nodal factors, where applicable (optional) also as described in subparagraph F), below; and

5) applying the factors to the contract values.

C) 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 A4.4), using the Fund Categorization rules in section A4.4).

D) Product Designs. Factors *F*, *G* and $R(\beta_1, \beta_2)$ are available within the Pre-Calculated Factors for the following GMDB product designs:

1) Return of Premium ("ROP"),

2) Premiums less withdrawals accumulated at 3% per annum, capped at 2.5 times premiums less withdrawals, with no further increase beyond age 80 ("ROLL3"),

3) Premiums less withdrawals accumulated at 5% per annum, capped at 2.5 times premiums less withdrawals, with no further increase beyond age 80 ("ROLL5"),

4) 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"),

5) A design having a guaranteed benefit equal to the larger of the benefits in designs 3 and 4, above ("HIGH"),

6) 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 ("EDB"),

E) Other Attributes. Factors *F*, *G* and $R(\beta_1, \beta_2)$ are available within the Pre-Calculated Factors for the following set of attributes:

1. 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,
2. The eight asset classes described in section A4.4)B),
3. Eight attained ages, with a 5-year age setback for females,
4. Five contract durations,
5. Seven values of GV/AV, and
6. Three levels of asset-based income,

F) Interpolation of *F*, *G* and $R(\beta_1,\beta_2)$.

1) Values of *F*, *G* and $R(\beta_1, \beta_2)$ apply to a contract having the product characteristics listed in section A4.5)A) and shall be determined by selecting values for the appropriate partial withdrawal rule and asset class and then using multi-point linear interpolation among published values for the last four attributes shown in section A4.3)E).

2) 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* ÷ *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 A4.5)C) (i.e., capped at +100 and floored at –100 bps).

3) 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.

4) An Excel® workbook, Excel® add-in and companion dynamic link library (.dll) program is available from the National Association of Insurance Commissioners that can be used to determine the correct values and perform the multi-point linear interpolation.

5) Alternatively, published documentation can be referenced on performing multi-point linear interpolation and the required sixteen values determined using a key that is documented in the table "*Components of Key Used for GC Factor Look-Up*" located in section A4.5)C).

G) Adjustments to *GC* for Product Variations & Risk Mitigation/Transfer. In some cases, it may be necessary to make adjustments to the published factors due to:

1) A variation in product form wherein the definition of the guaranteed benefit is materially different from those for which factors are available (see section A4.3)H)); and/or

2) 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 inforce 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 non-linear in its impact on the Conditional Tail Expectation Amount, 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.

H) 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.

1) Select a contract design among those described in section A4.3)D) 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 A4.5)A) and table of *Asset Based Fund Charges* in section A4.5)B)) and the pre-packaged scenarios 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 pre-calculated factors. Rank (order) the sample distribution of results for the present value of net cost[18]. Determine those scenarios that comprise CTE (65).

2) 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 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.

3) Extract the corresponding pre-calculated 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:

[18] 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).

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

4) Execute "product specific" cash flow projections using the documented assumptions and pre-packaged scenarios 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).

5) Using the results from step 4, 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 $\overline{F}_J$. 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 $\overline{G}_J$.

6) To calculate the Conditional Tail Expectation Amount for the specific product in question, the company should implement the Alternative Methodology as documented, but use $\overline{F}_J \times F_J^*$ in place of *F* and $\overline{G}_J \times G_J^*$ 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).

I) 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. Companies electing to use the Alternative Methodology that have not conducted an evaluation of their mortality experience shall use these factors. Other companies should use the procedure described below to adjust for the actuary's Prudent Best Estimate of mortality. The development of Prudent Best Estimate mortality shall follow the requirements and guidance of Appendix 10. 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 inforce business, a 5-year age setback should be used for female annuitants.

1) Develop a set of mortality assumptions based on Prudent Best Estimate. In setting these assumptions, the actuary shall be guided by the definition of Prudent Best Estimate and the principles discussed in Appendices 9 and 10 of the Guideline.

2) Calculate two sets of net single premiums (NSP) at each attained age: one valued using 100% of the 1994 Variable Annuity MGDB ALB Mortality Table (with the aforementioned 5-year age setback for females) and the other using Prudent Best Estimate mortality. These calculations shall assume an interest rate of 3.75% and a lapse rate of 7% per year.

3) The *GC* factor is multiplied by the ratio, for the specific attained age being valued, of the NSP calculated using the Prudent Best Estimate mortality to the NSP calculated using the 1994 Variable Annuity MGDB ALB Mortality Table (with the aforementioned 5-year age setback for females).

A4.4) Fund Categorization

A) 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.

B) Asset Classes. Variable subaccounts must be categorized into one of the following eight (8) 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.

1) **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.

2) **Money Market/Short-Term.** This class is invested in money market instruments with an average remaining term-to-maturity of less than 365 days.

3) **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.

4) **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 'specialized' 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%.

5) **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&P500. These funds should usually have a long-term volatility in the range of 13% – 18%.

6) **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%.

7) **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%.

8) **Aggressive or Exotic Equity.** This class comprises more volatile funds where risk can arise from: (a) underdeveloped markets, (b) uncertain markets, (c) high volatility of returns, (d) 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%.

C) 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 multi-step process:

1) 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.

2) 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 A4.4)D).

3) Evaluate the asset composition and expected volatility (as calculated in step 2) 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.

In step 1, 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.

In step 2, 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 the table.

D) 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**

E) 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.

	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	6,000	-
MV Fund Z (Aggressive Equity):	1,000	4,000	-	4,000	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 % (*A*):	33%	27%	80%	0%	50%
Fixed Income Test (*A*>75%):	No	No	Yes	No	No
Aggressive % of Equity (B):	10%	36%	n/a	40%	100%
Balanced Test (*A*>25% & *B*<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*[19]**	**Fixed Income**	**Intermediate**	**Diversified**

As an example, the "Volatility of Current Fund Holdings" for contract #1 is calculated as $\sqrt{A+B}$ where:

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

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

So the volatility for contract #1 = $\sqrt{0.0092+0.0026}$ = 0.109 or 10.9%.

[19] 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".

A4.5) Tables

A) Liability Modeling Assumptions & Product Characteristics used for *GC* Factors.

Asset Based Charges (MER)	Vary by fund class. See section A4.5)B).
Base Margin Offset	100 basis points per annum.
GMDB Description	1. ROP = return of premium ROP. 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. 6. 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 5 are solely for the Enhanced Death Benefit.
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 *CA* 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 contact 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 that section A4.3)I) allows modification to this assumption.
Gender /Age Distribution	100% male. Methodology accommodates different attained ages. A 5-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 *FE* component.
Annual Fee and Waiver	Ignored (i.e., zero). Included in the *FE* component.
Discount Rate	5.75% pre-tax.

Dynamic Lapse Multiplier (Applies only to policies where GMDB is adjusted "pro-rata by MV" upon withdrawal)	$\lambda = MIN\left[U, MAX\left[L, 1 - M \times \left(\frac{GV}{AV} - D\right)\right]\right]$ U=1, L=0.5, M=1.25, D=1.1 ▪ Applied to the 'Base Contract Lapse Rate' ▪ Does not apply to partial withdrawals.

B) 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

C) Components of Key Used for *GC* Factor Look-Up.

(First Digit Always "1")

Contract Attribute	Key : Possible Values & 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 benefit.)
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	1 : 3.5
	2 : 6.5	3 : 9.5
	4 : 12.5	
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 Differential from A4.5)B) Assumptions	0 : –100 bps	
	1 : +0	
	2 : +100	

APPENDIX 5 - Scenario Calibration Criteria

A5.1) General

This Appendix outlines the requirements for the stochastic models used to simulate fund performance[20]. Specifically, it sets certain standards that must be satisfied and offers guidance to the actuary in the development and validation of the scenario models. Background material and analysis are presented to support the recommendation. The Appendix focuses on the S&P 500 as a proxy for returns on a broadly diversified U.S. equity fund, but there is also advice on how the techniques and requirements would apply to other types of funds. General modeling considerations such as the number of scenarios and projection frequency are also discussed.

The calibration points given in this appendix are applicable to gross returns (before the deduction of any fees or charges). To determine the net returns appropriate for the projections required by the Guideline, the actuary shall reflect applicable fees and contractholder charges in the development of projected account values. The projections shall also include the costs of managing the investments and converting the assets into cash when necessary.

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), should lead to higher reserve requirements[21].

State or path dependent models are not prohibited, but must be justified by the historic data and meet the calibration criteria. To the degree that the model uses mean-reversion or path-dependent dynamics, this must be well supported by research and clearly documented in the Memorandum supporting the required actuarial certification.

The equity scenarios used to determine reserves must be available in an electronic format to facilitate any regulatory review.

A5.2) Gross Wealth Ratios

Gross Wealth Ratios derived from the stochastic return scenarios for use with a Separate Account variable fund category for diversified U.S. equities must satisfy calibration criteria consistent with that for the S&P 500 shown in the following table. Under these calibration criteria, Gross Wealth Ratios for quantiles less than 50 percent may not exceed the value from the table corresponding to the quantile, while at quantiles greater than 50 percent; Gross Wealth Ratios may not be less than the corresponding value for the quantile from the table. Gross Wealth Ratios must be tested for holding period 1, 5, 10 and 20 years throughout the projections, except as noted in section A5.3).

The "wealth factors" are defined as gross accumulated values (i.e., before the deduction of fees and charges) with complete reinvestment of income and maturities, starting with a unit investment. These can be less than 1, with "1" meaning a zero return over the holding period.

S&P 500 Total Return Gross Wealth Ratios at the Calibration Points

Calibration Point	One Year	Five Year	Ten Year	Twenty Year
2.5%	0.78	0.72	0.79	
5.0%	0.84	0.81	0.94	1.51
10.0%	0.90	0.94	1.16	2.10
90.0%	1.28	2.17	3.63	9.02

[20] For more details on the development of these requirements, including the development of the calibration points, see the American Academy of Actuaries recommendation on C-3 Phase II risk-based capital.

[21] 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).

95.0%	1.35	2.45	4.36	11.70
97.5%	1.42	2.72	5.12	

The scenarios need not strictly satisfy all calibration points, but the actuary should be satisfied that any differences do not materially reduce the resulting reserves[22]. In particular, the actuary should be mindful of which tail most affects the business being valued. If reserves are less dependent on the right (left) tail for all products under consideration (e.g., a return of premium guarantee would primarily depend on the left tail, an enhanced death benefit equal to a percentage of the gain would be most sensitive to the right tail, etc.), it is not necessary to meet the right (left) calibration points.

For models that require starting values for certain state variables[23], long-term ('average' or 'neutral') values should be used for calibration. The same values should normally be used to initialize the models for generating the actual projection scenarios unless an alternative assumption can be clearly justified[24]. It should be noted that a different set of initialization parameters might produce scenarios that do not satisfy all the calibration points shown in the above table. However, the S&P 500 scenarios used to determine reserves must meet the calibration criteria.

A5.3) Calibration Requirements Beyond Twenty Years

It is possible to parameterize some path and/or state dependent models to produce higher volatility (and/or lower expected returns) in the first 20 years in order to meet the calibration criteria, but with lower volatility (and/or higher expected returns) for other periods during the forecast horizon. While this property may occur for certain scenarios (e.g., the state variables would evolve over the course of the projection and thereby affect future returns), it would be inappropriate and unacceptable for a company to alter the model parameters and/or its characteristics for periods beyond year 20 in a fashion not contemplated at the start of the projection and primarily for the purpose(s) of reducing the volatility and/or severity of ultimate returns[25].

A5.4) Other Funds

Calibration of other markets (funds) is left to the judgment of the actuary, but the scenarios so generated must be consistent with the calibration points in the table in section A5.2). 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.

The actuary shall document the actual 1-, 5-, 10- and 20-year wealth factors of the scenarios at the same frequencies as in the "S&P 500 Total Return Gross Wealth Ratios at the Calibration Points" table in section A5.2). The annualized mean and standard deviation of the wealth factors for the 1-, 5-, 10- and 20-year holding periods must also be provided. For equity funds, the actuary shall explain the reasonableness of any significant differences from the S&P500 calibration points.

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[26].

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[22] See the Preamble to the Accounting Practices and Procedures Manual for an explanation of materiality.

[23] For example, a stochastic log volatility ("SLV") model requires the starting volatility. Also, the regime-switching lognormal model requires an assumption about the starting regime.

[24] A clear justification exists when state variables are observable or "known" to a high degree of certainty and not merely estimated or inferred based on a "balance of probabilities".

[25] Such adjustments must be clearly documented and justified by the historic data.

[26] As an example, the standard deviation of log returns is often used as a measure of risk.

Specifically, two return distributions *X* and *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.

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 a 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[27], 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.

Clearly, there are many other techniques that could be used to establishing consistency between the scenarios. While appealing, the above approaches do have drawbacks[28] and the actuary should not be overly optimistic in constructing the model parameters or the scenarios.

Funds can be grouped and projected as a single fund if such grouping is not anticipated to materially reduce reserves. However, care should be taken to avoid exaggerating the benefits of diversification. The actuary must document the development of the investment return scenarios and be able to justify the mapping of the company's variable accounts to the proxy funds used in the modeling.

A5.5) Correlation of Fund Returns

In constructing the scenarios for the proxy funds, the company may require parameter estimates for a number of different market indices. When more than one index is projected, it is generally necessary to allow for correlations in the simulations. 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 actuary should take care not to underestimate the correlations in those scenarios used for the reserve calculations.

If the projections include the simulation of interest rates (other than for discounting surplus strain) as well as equity returns, the processes may be independent provided that the actuary can demonstrate that this assumption (i.e., zero correlation) does not materially underestimate the resulting reserves.

A5.6) Number of Scenarios and Efficiency in Estimation

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 actuary should use a number of scenarios that will provide an acceptable level of precision.

Fewer than 1000 scenarios may be used provided that the actuary 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.

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 actuary can demonstrate that

[27] Quadratic polynomials and logarithmic functions tend to work well.

[28] For example, mean-variance measures ignore the asymmetric and fat-tailed profile of most equity market returns.

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[29].

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). However, the actuary should maintain documentation that adequately describes any such techniques used in the projections. Specifically, the documentation should include the reasons why such methods can be expected not to result in systematic or material under-statement of the resulting reserves compared to using pseudo-random Monte Carlo numbers.

A5.7) Frequency of Projection and Time Horizon

Use of an annual cashflow 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 actuary 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.

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[30].

A5.8) Pre-Packaged Scenarios

The American Academy of Actuaries has provided 10,000 scenarios on a website[31] for the following nineteen asset classes[32]:

1. 3-month U.S. Treasury yields
2. 6-month U.S. Treasury yields
3. 1-year U.S. Treasury yields
4. 2-year U.S. Treasury yields
5. 3-year U.S. Treasury yields
6. 5-year U.S. Treasury yields
7. 7-year U.S. Treasury yields
8. 10-year U.S. Treasury yields
9. 20-year U.S. Treasury yields
10. 30-year U.S. Treasury yields
11. Money Market / Short-Term
12. U.S. Intermediate Term Government Bonds
13. U.S. Long Term Corporate Bonds
14. Diversified Fixed Income
15. Diversified Balanced Allocation

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[29] However, 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, ON, September 2003.

[30] As a general guide, the forecast horizon should not be less than 20 years.

[31] The pre-packaged scenarios can be found at http://www.actuary.org/life/phase2.htm and are fully documented at http://www.actuary.org/pdf/life/c3supp_march05.pdf (these are the addresses as of April 2005).

[32] Because the reserves calculated using projections involve cash flow projections, the pre-packaged scenarios were developed on a "real world" basis (as opposed to a "risk-neutral" basis). Therefore, the pre-packaged scenarios may not be appropriate for purposes of projecting the market value of future hedge instruments within a projection (to the extent such instruments are used in the projections). For this purpose, it may be more appropriate to use risk neutral scenarios to determine the market value of hedge instruments in the cash flow projections that are based on real world scenarios.

16. Diversified Large Capitalized U.S. Equity
17. Diversified International Equity
18. Intermediate Risk Equity
19. Aggressive or Specialized Equity

The scenarios are available as gross monthly accumulation factors over a 30-year horizon (i.e., a 10000 × 361 matrix for each asset class, where the first column is composed entirely of ones) in comma-separated value format (**.csv*). These scenarios have been appropriately correlated so that the K^{th} scenario for each asset class must be used together and considered one 'future investment return scenario'[33]. Hence, the scenarios can be combined (by blending the accumulation factors[34]) to create additional 'proxy' scenarios for the company's funds.

For example, suppose the actuary wanted to construct scenarios for a 'balanced fund' that targets a 60/40 allocation between bonds and U.S. equities. If we denote $[\ AF^{X}\ ]$ as the matrix of accumulation factors for asset class X, then the balanced scenarios would be defined by $[\ AF^{BAL}\ ] = 0.60 \times [\ AF^{BOND}\ ] + 0.40 \times [\ AF^{S\&P500}\ ]$. Care should be taken to avoid exaggerating the benefits of diversification. The actuary shall document the development of the investment return scenarios and be able to justify the mapping of the company's variable accounts to the proxy funds used in the modeling.

The U.S. Treasury yields are expressed as nominal semi-annual bond equivalent yields in decimal format. All other returns are expressed as periodic (not cumulative) market accumulation factors (i.e., monthly "gross wealth ratios"). Interest rates are assumed to change at the start of each month, hence the value in column T applies for month T-1. The market accumulation factor in column T represents the growth in month T-1.

If all or a portion of these scenarios are used, then the actuary shall verify that the scenario calibration criteria are met.

[33] It is inappropriate to misalign the ordering of scenarios (e.g., scenario J for "Diversified U.S. Equity" cannot be combined with scenario K for "Diversified International Equity", where $J \neq K$).

[34] It is important to blend the accumulation factors (not the returns) in order to achieve the desired asset mix.

APPENDIX 6 - Allocation of the Aggregate Reserves to the Contract Level

A6.1) Allocation of Aggregate Reserve Determined using the Alternative Methodology

The Alternative Methodology, as allowed in section IV)E), is based on the sum of reserves calculated on a contract-by-contract basis, as described in Appendix 4. Therefore, where the Aggregate Reserve is equal to the Conditional Tail Expectation Amount determined using the Alternative Methodology, the reserve allocated to each contract shall be the reserve calculated for each contract under the Alternative Methodology.

A6.2) Allocation of Aggregate Reserve Determined using the Standard Scenario Amount

The Standard Scenario Amount, as required by section IV)C), is calculated on a contract-by-contract basis, as described in Appendix 3. Therefore, where the Aggregate Reserve is equal to the Standard Scenario Amount, the reserve allocated to each contract shall be the reserve calculated for each contract under the Standard Scenario method.

A6.3) Allocation of Aggregate Reserve Determined using Projections

Where the Aggregate Reserve is equal to the Conditional Tail Expectation Amount determined using projections, the reserve allocated to each contract shall be the reserve calculated for each contract under the Standard Scenario method, as described in Appendix 3, plus an allocation of the excess of the Aggregate Reserve over the Standard Scenario Amount. Such allocation shall be made in proportion to the reserve for each contract under the Standard Scenario method.

APPENDIX 7 – Modeling of Hedges

A7.1) Initial Considerations

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 the Guideline (excluding those that involve the offsetting of the risks associated with variable annuity guarantees with other products outside of the scope of the Guideline, such as equity-indexed annuities) shall be included in the calculation of the Conditional Tail Expectation Amount, determined in accordance with section IV)D) of the Guideline (i.e., Conditional Tail Expectation Amount using projections). If the company is following a Clearly Defined Hedging Strategy ("hedging strategy"), as defined in section III, in accordance with an investment policy adopted by the Board of Directors or a committee ~~of~~ authorized by the Board ~~members~~of Directors, the company is eligible to reduce the amount of the Conditional Tail Expectation Amount 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.

For this purpose, the investment assets refer to all the assets including derivatives supporting covered products and guarantees. This is also referred to as the investment portfolio. The investment strategy is the set of all asset holdings at all points in all time in all scenarios. The hedging portfolio, which is also 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. The distinction of what is the hedging portfolio and what is the investment portfolio is something that is not attempted to be made in this Appendix. Nor is the distinction between investment strategy and hedging strategy formally made here. Where necessary to give effect to the intent of this Appendix, the requirements applicable to the hedging portfolio or the hedging strategy are to apply to the overall investment portfolio and investment strategy.

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.

The cost and benefits of hedging instruments that are currently held by the company in support of the contracts falling under the scope of the Guideline shall be included in the stochastic cash flow model used to calculate the Conditional Tail Expectation Amount in accordance with section IV)D) (the "model"). If the company is following a Clearly Defined Hedging Strategy, the model shall take into account the cost and benefits of hedge positions expected to be held by the company in the future based on the operation of the hedging strategy.

Before either a new or revised hedging strategy can be used to reduce the amount of the Conditional Tail Expectation Amount otherwise calculated, the hedging strategy should be in place (i.e., effectively implemented by the company) for at least three months. The company may meet the time requirement by having evaluated the effective implementation of the hedging strategy for at least three months without actually having executed the trades indicated by the hedging strategy (e.g., mock testing or by having effectively implemented the strategy with similar annuity products for at least three months).

These requirements 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.

A7.2) Background

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

The fundamental characteristic of the first method is that all hedging positions, both the currently held positions and those expected to be held in the future, are included in the stochastic cash flow model used to determine the Scenario Greatest Present Value, as discussed in section IV)D), for each scenario.

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

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

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

A7.3) Calculation of CTE Amount(reported)

The company should begin by calculating "CTE Amount(best efforts)" – the results obtained when the Conditional Tail Expectation Amount (or "CTE Amount") is based on ~~the actuary's best efforts to~~ incorporating~~e~~ the hedging strategy (including currently held hedge positions) into the stochastic cash flow model, including all of the factors and assumptions needed to execute the hedging strategy (e.g., stochastic implied volatility) and to measure the projected impact of hedge positions based on a hedging strategy that may fail to hedge some risks or include some of the costs of implementing the strategy or may include imperfections in the quantification of the impact of the hedging strategy.

Because most models will include at least some approximations or idealistic assumptions, CTE Amount(best efforts) may overstate the impact of the hedging strategy. To compensate for potential overstatement of the impact of the hedging strategy, the company must recalculate the Conditional Tail Expectation Amount reflecting the impact of risks not completely reduced, eliminated or contemplated by the hedging strategy, all of the costs associated with the hedging strategy, the imperfections in the hedging strategy, and any uncertainty over the effectiveness of the hedging strategy. The result so obtained is called "CTE Amount(adjusted)". In some situations the determination of CTE Amount(adjusted) may include both direct and indirect techniques.

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

CTE Amount(reported) = CTE Amount(best efforts) +
E × MAX[0,CTE Amount(adjusted) – CTE Amount(best efforts)]

The value for *E* (an "error factor") reflects the actuary's view as to the level of sophistication of the stochastic cash flow model. As the sophistication of the stochastic cash flow model increases, the value for *E* decreases, subject to minimum of 0.05 (i.e., the greater the ability of the CTE Amount(best efforts) model to capture all risks and uncertainties, the lower the value of *E*). If the ~~actuary's "best efforts"~~ model used to determine the "CTE Amount(best efforts)" is "state of art", the value "CTE Amount(adjusted) – CTE Amount(best efforts)" may be nominal. On the other hand, if the ~~actuary's best efforts~~ model used to determine the "CTE Amount(best efforts)" is simplistic, the value "CTE Amount(adjusted) – CTE Amount(best efforts)" may be significant.

A7.4) Specific Considerations and Requirements

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 Conditional Tail Expectation Amount, the actuary should review actual historical hedging effectiveness. The actuary must evaluate the appropriateness of the assumptions on future trading, transaction costs, and other elements of the model, the strategy, the mix of business, and other items that could result in materially adverse results. This includes an analysis of model assumptions that, when combined with the reliance on the hedging strategy, may result in adverse results relative to those

modeled. The parameters and assumptions must 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 must be modified to reflect them at either best estimates or adverse estimates of the parameters.

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 contractholder 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 contractholder 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 Conditional Tail Expectation Amount, the actuary 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.

Implementing 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.

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 actuary 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; or

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.

If the stochastic cash flow model allows for such situations, the actuary should be satisfied that the results do not materially rely directly or indirectly on the use of such strategies. In addition, the actuary should disclose the situations and provide supporting documentation at to why the actuary believes the situations are not material for determining the Conditional Tail Expectation Amount. If the results do materially rely directly or indirectly on the use of such strategies, the strategies may not be used to reduce the Conditional Tail Expectation Amount otherwise calculated.

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. If there are substantial discrepancies, the actuary should disclose the material discrepancies and provide supporting documentation as to why the model-based prices are appropriate for determining the Conditional Tail Expectation Amount. 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.

A7.5) Certification and Documentation

The actuary must provide a certification that the values for *E*, CTE Amount(adjusted) and CTE Amount(best efforts) were calculated using the process discussed above and the assumptions used in the calculations were reasonable for the purpose of determining the Conditional Tail Expectation Amount. The actuary must document the method(s) and assumptions (including data) used to determine CTE Amount(adjusted) and CTE Amount(best efforts) and maintain adequate documentation as to the methods, procedures and assumptions used to determine the value of *E*.

The actuary must provide a certification as to whether the Clearly Defined Hedging Strategy is fully incorporated into the stochastic cash flow model and any supplementary analysis of the impact of the hedging strategy on the Conditional Tail Expectation Amount. The actuary must document the extent to which elements of the hedging strategy (e.g., time

between portfolio rebalancing) are not fully incorporated into the stochastic cash flow model and any supplementary analysis to determine the impact, if any. In addition, the actuary must provide a certification and maintain documentation to support the certification that the hedging strategy designated as the Clearly Defined Hedging Strategy meets the requirements of a Clearly Defined Hedging Strategy including that the implementation of the hedging strategy in the stochastic cash flow model and any supplementary analysis does not include knowledge of events that occur after any action dictated by the hedging strategy (i.e. the model cannot use information about the future that would not be known in actual practice.).

A financial officer of the company (e.g., Chief Financial Officer, Treasurer or Chief Investment Officer) or a person designated by them who has direct or indirect supervisory authority over the actual trading of assets and derivatives must certify that the hedging strategy meets the definition of a Clearly Defined Hedging Strategy and that the Clearly Defined Hedging Strategy is the hedging strategy being used by the company in its actual day to day risk mitigation efforts.

APPENDIX 8 – Certification Requirements

A8.1) General Requirements

A) Compliance with this Guideline

B) Submission of Certification

C) Creation of Supporting Memorandum

A8.2) Certification

A) General Description. The certification shall be provided by a qualified actuary and consist of at least the following:

1) a paragraph identifying the actuary and his or her qualifications;

2) a scope paragraph identifying the reserves as of the valuation date for contracts included in the certification categorized by the approaches used to determine the reserves (e.g., Alternative Methodology, Projections, Standard Scenario);

3) a reliance paragraph describing those areas, if any, where the certifying actuary has relied on other experts;

(a) a reliance statement from each of those relied on should accompany the certification.

(b) the reliance statements should note the information being provided and a statement as to the accuracy, completeness or reasonableness, as applicable, of the information.

4) a paragraph certifying that the reserve was calculated in accordance with the principles and requirements of the Guideline.

5) a paragraph disclosing all material changes in the model or assumptions from that used previously and the estimated impact of such changes; and

6) a paragraph stating that the qualified actuary is not opining on the adequacy of the company's surplus or its future financial condition.

A8.3) Supporting Memorandum

A) General Description. A supporting memorandum shall be created to document the methodology and assumptions used to determine the Aggregate Reserve. The information shall include the comparison of the Standard Scenario Amount to the Conditional Tail Expectation Amount required by section IV)A) in the determination of the Aggregate Reserve.

B) Alternative Methodology using Published Factors.

1) If a seriatim approach was not used, disclose how contracts were grouped.

2) Disclosure of assumptions to include:

(a) Component *CA*

(i) mapping to prescribed asset categories

(ii) lapse and withdrawal rates

(b) Component *FE*

(i) determination of fixed dollar costs and revenues

(ii) lapse and withdrawal rates

(iii) inflation rates

(c) Component *GC*

(i) Disclosure of contract features and how the company mapped the contract form to those forms covered by the Alternative Methodology factors

⇒ Product Definition - If not conservatively assigned to a published factor, company specific factors

or stochastic modeling is required

⇒ Partial Withdrawal Provision

⇒ Fund Class - Disclose the process used to determine the single asset class that best represents the exposure for a contract. If individual funds are mapped into prescribed categories, the process used to map the individual funds should be disclosed.

⇒ Attained Age

⇒ Contract Duration

⇒ Ratio of Account Value to Guaranteed Value

⇒ Annualized Account Charge Differential from Base Assumptions

(ii) Derivation of Equivalent Account Charges

(iii) Derivation of margin offset

(iv) Disclosure of interpolation procedures and confirmation of node determination

3) Disclosure, if applicable, of reinsurance that exists and how it was handled in applying published factors (For some reinsurance, creation of company-specific factors or stochastic modeling may be required.)

(a) Discuss how reserves before reinsurance were determined.

C) Alternative Factors based on Company-Specific Factors.

1) Disclosure of requirements consistent with Published Factors, as noted in subsection B) above.

2) Additional Requirements

(a) Stochastic analysis supporting adjustments to published factors should be fully documented. This analysis needs to be submitted when initially used and be available upon request in subsequent years. Adjustments may include:

(i) Contract design;

(ii) Risk mitigation strategy (excluding hedging); and

(iii) Reinsurance.

D) Stochastic Modeling.

1) Assets

(a) Description including type and quality

(b) Investment & disinvestment assumptions

(c) Describe assets used at the start of the projection

(d) Source of asset data

(e) Asset valuation basis

(f) Documentation of assumptions

(i) Default costs

(ii) Prepayment functions

(iii) Market value determination

(iv) Yield on assets acquired

(v) Mapping and grouping of funds to modeled asset classes

(g) Hedging Strategy

(i) Documentation of strategy

(ii) Identification of current positions

(iii) Description on how strategy was incorporated into modeling

⇒ basis risk, gap risk, price risk, assumption risk

⇒ Document the methods and criterion used to estimate the apriori effectiveness of the hedging strategy

(iv) Documentation required for specific consideration raised in section A7.4).

(v) Documentation and certification required by section A7.5).

2) Liabilities

(a) Product descriptions

(b) Source of Liabilities

(c) Grouping of contracts

(d) Reserve method and modeling (e.g., Working Reserves were set to CSV)

(e) Investment Reserves

(f) Describe how reinsurance was handled in the models, including how reserves gross of reinsurance were modeled.

(g) Documentation of assumptions (i.e., list assumptions, discuss the sources and the rationale for using the assumptions).

(i) Premiums and subsequent deposits

(ii) Withdrawal, Lapse and Termination Rates

⇒ Partial Withdrawal (including treatment of dollar-for-dollar offsets on GMDBs and VAGLBs, and Required Minimum Distributions)

⇒ Lapses / Surrenders

(iii) Crediting Strategy

(iv) Mortality

(v) Annuitization rates

(vi) Income Purchase rates

(vii) GMIB and GMWB Utilization rates

(viii) Commissions

(ix) Expenses

(x) Persistency Bonuses

(xi) Investment / Fund Choice

(xii) Revenue Sharing

(xiii) Asset Allocation, Rebalancing and Transfer Assumptions

⇒ Dollar Cost Averaging

3) Scenarios

(a) Description of scenario generation for interest rates and equity returns

(i) Disclose the number "n" of scenarios used and the methods used to determine the sampling error of the CTE(65) statistic when using "n" scenarios.

(ii) Time step of model (e.g., monthly, quarterly, annual)

(iii) Correlation of fund returns

(b) Calibration

(i) Gross Wealth Ratios for equity funds

⇒ Disclosure of adjustments to model parameters, if any.

⇒ Disclosure of 1-year, 5-year and 10-year wealth factors, as well as mean and standard deviation.

(ii) Consistency of other funds to equity funds

(iii) Correlation between all funds

(c) Extent of use of pre-packaged scenarios and support for mapping variable accounts to proxy funds

4) Description and results of sensitivity tests performed.

E) Standard Scenario.

1) For the amounts in 2), 3) and 4) below report the Basic Reserve in A3.3)B)2)(a), the projection requirements in A3.3)B)2)(b), the value of Aggregate reinsurance in A3.3)D)1), the value of hedges in A3.3)D)2), the total allocation of the value of hedges and Aggregate reinsurance in A3.3)B)2)(c) and the Standard Scenario Reserve.

2) Report the Standard Scenario Amount as of the valuation date.

3) If applicable, report the Standard Scenario Amount on the inforce prior to the valuation date that was used to project the reserve requirements to the valuation date.

4) If applicable, report the Standard Scenario Amount on the model office used to represent the inforce.

5) Discuss modifications, if any, in the application of the standard scenario requirements to produce the amounts in 2), 3) and 4) above.

6) Document any assumptions, judgements or procedures not prescribed in the Standard Scenario Method or in the Guideline that are used to produce the Standard Scenario Amount.

7) If applicable, documentation of approval by the commissioner to use the Basic Reserve as the Standard Scenario reserve.

8) Document the company's calculation of *DR*.

9) Document the allocation of funds to Equity, Bond, Balanced and Fixed classes.

APPENDIX 9 – Contractholder Behavior

Contractholder behavior assumptions encompass actions such as lapses, withdrawals, transfers, recurring deposits, benefit utilization, option election, etc. Contractholder behavior is difficult to predict and behavior assumptions can significantly impact the results. In the absence of relevant and fully credible empirical data, the actuary should set behavior assumptions on the conservative end of the plausible spectrum (consistent with the definition of Prudent Best Estimate).

In setting behavior assumptions, the actuary 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 impact behavior.
3. Options may be elective or non-elective in nature. Living benefits are often elective and death benefit options are generally non-elective.
4. Elective contractholder 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 contractholders 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 contractholders 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.
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:
   - For what purpose was the product purchased?
   - Is the option elective or non-elective?
   - Is the value of the option well known?

The impact of behavior can vary by product, time period, etc. Sensitivity testing of assumptions is recommended.

Within materiality considerations, the actuary should consider all relevant forms of contractholder behavior and persistency, including but not limited to the following:

- Mortality (additional guidance and requirements regarding mortality is contained in Appendix 10)
- Surrenders
- Partial Withdrawals (Systematic and Elective)
- Fund Transfers (Switching/Exchanges)
- Resets/Ratchets of the Guaranteed Amounts (Automatic and Elective)
- Future Deposits

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:

- 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.)
- 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).

However, the actuary 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.

Normally, the underlying model assumptions would differ according to the attributes of the contract being valued. This would typically mean that contractholder behavior and persistency may be expected to vary according to such characteristics as (this is not an exhaustive list):

- Gender
- Attained age
- Issue age
- Contract duration
- Time to maturity
- Tax status
- Fund value
- Investment option
- Guaranteed benefit amounts
- Surrender charges, transaction fees or other contract charges
- Distribution channel

Unless there is clear evidence to the contrary, behavior should be consistent with past experience and reasonable future expectations. Ideally, contractholder behavior would be modeled dynamically according to the simulated economic environment and/or other conditions. However, it is reasonable to assume a certain level of non-financially motivated behavior. The actuary need not assume that all contractholders act with 100% efficiency in a financially rational manner. Neither should the actuary assume that contractholders will always act irrationally.

Consistent with the concept of Prudent Best Estimate assumptions described earlier, the liability model should incorporate "margins" for uncertainty for all risk factors which are not dynamic (i.e., the non-scenario tested assumptions) and are assumed not to vary according to the financial interest of the contractholder.

The actuary 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 which are not scenario tested, but could reasonably be expected to vary according to (a) a stochastic process, or (b) future states of the world (especially in response to economic drivers) may require additional margins and/or signal a need for higher margins for certain other assumptions.

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 actuary is encouraged to test the sensitivity of results to understand the materiality of making alternate assumptions.

All behaviors (i.e., dynamic, formulaic and non-scenario tested) should be consistent with the scenarios used in the CTE calculations (generally, the top 1/3 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 actuary should be mindful of the general characteristics of those scenarios likely to represent the tail of the loss distribution and consequently use Prudent Best 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:

- Declining and/or volatile separate account asset values;
- Market index volatility, price gaps and/or liquidity constraints;
- Rapidly changing interest rates.

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 actuary 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:

- Remain logically and internally consistent across the scenarios tested;
- Represent plausible outcomes; and

- Lead to appropriate, but not excessive, asset requirements.

The actuary should remember that the continuum of "plausibility" should not be confined or constrained to the outcomes and events exhibited by historic experience.

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 contractholder behavior.

APPENDIX 10 – Specific Guidance and Requirements for Setting Prudent Best Estimate Mortality Assumptions

A10.1) Overview

A) Intent. The guidance and requirements in this appendix apply for setting Prudent Best Estimate mortality assumptions when determining the Conditional Tail Expectation Amount (whether using projections or the Alternative Methodology). The intent is for Prudent Best Estimate mortality assumptions to be based on facts, circumstances and appropriate actuarial practice (where more than one approach to appropriate actuarial practice exists, the actuary should select the practice that the actuary deems most appropriate under the circumstances) with only a limited role for unsupported actuarial judgment.

B) Description. Prudent Best Estimate mortality assumptions are determined by first developing expected mortality curves based on either available experience or published tables. Where necessary, margins are applied to the experience to reflect data uncertainty. The expected mortality curves are then adjusted based on the credibility of the experience used to determine the expected mortality curve. Section A10.2) addresses guidance and requirements for determining expected mortality curves and section A10.3) addresses guidance and requirements for adjusting the expected mortality curves to determine Prudent Best 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 A10.4).

C) Business Segments. For purposes of setting Prudent Best Estimate mortality assumptions, the products falling under the scope of the Guideline shall be grouped into business segments with different mortality assumptions. The grouping should generally follow the pricing, marketing, management and/or reinsurance programs of the company. Where less refined segments are used for setting the mortality assumption than is used in business management the documentation should address the impact, if material, of the less refined segmentation on the resulting reserves.

D) Margin for Data Uncertainty. The expected mortality curves that are determined in section A10.2) 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 appendix, 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 subsection requires such a reclassification.

A10.2) Determination of Expected Mortality Curves

A) 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 B) below for additional considerations. Finally, if there is no data, the company shall use the applicable table, as required in subsection C) below.

B) Data Other than Direct Experience. If expected mortality curves for a segment are being determined using data from a similar business segment (whether or not directly written by the company), the actuary shall document any similarities or differences between the two business segments (e.g., type of underwriting, marketing channel, average policy size, etc.). The actuary shall also document the data quality of the mortality experience of the similar business. 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. The actuary shall document the adjustments and the margins applied.

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 may also be a reasonable starting

point for the determination of the company's expected mortality curves. The actuary shall document the application of such reinsurance charges and how they were used to set the company's expected mortality curves for the segment.

C) 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 using 100% of the 1994 Variable Annuity MGDB mortality table for a plus segment and expected deaths no greater than 100% of the Annuity 2000 table for a minus segment[35]. 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.

D) 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 subsection A) above or other than direct data discussed in subsection B) above).

1) **Underreporting of deaths.** Mortality data shall be examined for possible underreporting of deaths[36]. 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.

2) **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 actuary shall assume that expected mortality will increase by contract duration for an appropriate select period[37]. As an alternative, if the actuary determines that mortality is impacted by selection, the actuary could apply margins to the expected mortality in such a way that the actual mortality modeled does not depend on contract duration.

3) **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., 3 to 7 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. If this condition is not satisfied, the actuary must document the rationale in support of using expected mortality that differs from recent mortality experience.

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. There should be commentary in the documentation on the relevance of the data (e.g., any actual and expected changes in markets, products and economic conditions over the historic and projected experience).

4) **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.

E) Documentation Requirements.

1) **All Segments.** The documentation should include any material considerations necessary to understand the development of mortality assumptions for the statutory valuation even if such considerations are not explicitly mentioned in this section. The documentation should be explicit when material judgments were required and such judgments had to be made without supporting historic experience.

The documentation shall:

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[35] The NAIC should verify whether the tables chosen and the 100% level are appropriate for this purpose.

[36] The NAIC should consider if it wants to specify a required minimum load in the situation where no effort has been made to adjust the data for under-reporting of deaths since such a load is completely subjective. The NAIC could require documentation to support any reduction from the minimum load for the underreporting of deaths.

[37] The NAIC should consider if it wants to specify a required minimum load by duration for a minimum select period in the case of no information since such a load is completely subjective. The NAIC could require documentation to support and reduction from the minimum load for selection.

(a) Explain the rationale for the grouping of contracts into different segments for the determination of mortality assumptions and characterize the type and quantity of business that constitute each segment.

(b) Describe how each segment was determined to be a plus or minus segment.

(c) Summarize any mortality studies used to support mortality assumptions, quantify the exposures and corresponding deaths, describe the important characteristics of the exposures and comment on unusual data points or trends.

(d) Document the age of the experience data used to determine expected mortality curves and comment on the relevance of the data.

(e) Document the mathematics used to adjust mortality based on credibility and summarize the result of applying credibility to the mortality segments.

(f) Discuss any assumptions made on mortality improvements, the support for such assumptions and how such assumptions adjusted the modeled mortality.

(g) Describe how the expected mortality curves compare to recent historic experience and comment on any differences.

(h) Discuss how the mortality assumptions are consistent with the goal of achieving the required CTE level over the joint distribution of all future outcomes, in keeping with Principle #3 and Appendix 9.

If the study was done on a similar business segment, identify the differences in the business segment on which the data was gathered and the business segment on which the data was used to determine mortality assumptions for the statutory valuation. Describe how these differences were reflected in the mortality used in modeling.

If mortality assumptions for the statutory valuation were based in part on reinsurance rates, document how the rates were used to set expected mortality (e.g., assumptions made on loadings in the rates and/or whether the assuming company provided their expected mortality and the rationale for their assumptions).

2) **Plus Segments.** For a plus segment, the documentation shall also discuss the examination of the mortality data for the underreporting of deaths and experience by duration, and describe any adjustments that were made as a result of the examination.

3) **Minus Segments.** For a minus segment the documentation shall also discuss how the mortality deviations on minus segments compare to those on any plus segments. To the extent the overall margin is reduced, the documentation should include support for this assumption.

A10.3) Adjustment for Credibility to Determine Prudent Best Estimate Mortality

A) Adjustment for Credibility. The expected mortality curves determined in section A10.2) shall be adjusted based on the credibility of the experience used to determine the curves in order to arrive at Prudent Best 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 a plus segment, the table shall be consistent with 100% of the 1994 Variable Annuity MGDB table (or a more recent mortality table adopted by the NAIC to replace this table). For a minus segment, the table shall be consistent with 100% of the 2000 Annuity table (or a more recent mortality table adopted by the NAIC to replace that table). The approach used to adjust the curves shall suitably account for credibility[38].

B) 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 applicable published industrywide experience 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 A10.2)).

C) Credibility Procedure. The credibility procedure used shall:

[38] 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.

1) produce results that are reasonable in the professional judgment of the actuary,

2) not tend to bias the results in any material way,

3) be practical to implement,

4) give consideration to the need to balance responsiveness and stability,

5) take into account not only the level of aggregate claims but the shape of the mortality curve, and

6) contain criteria for full credibility and partial credibility that have a sound statistical basis and be appropriately applied.

Documentation of the credibility procedure used shall include a description of the procedure, the statistical basis for the specific elements of the credibility procedure, and any material changes from prior credibility procedures.

D) Further Adjustment of the Credibility-adjusted Table for Mortality Improvement. The credibility-adjusted table used for plus segments may be and the credibility adjusted date used for minus segments must be adjusted for applicable published industrywide experience 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 A10.4).

A10.4) Future Mortality Improvement

The mortality assumption resulting from the requirements of section A10.3) shall be adjusted for mortality improvements beyond the valuation date if such an adjustment would serve to increase the resulting Conditional Tail Expectation Amount. If such an adjustment would reduce the Conditional Tail Expectation Amount, such assumptions are permitted, but not required. In either case, the assumption must be based on current relevant data with a margin for error (increasing assumed rates of improvement if that results in a higher reserve, reducing them otherwise).

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