AMERICAN ACADEMY of ACTUARIES

MEMORANDUM

TO: Philip Barlow, Chair, NAIC Life RBC Working Group

FROM: Peter Boyko, Chair, American Academy of Actuaries'[1] C3 Work Group

RE: Draft C3 RBC Instructions and Appendices

DATE: November 24, 2009

Per your request at the Life RBC Working Group meeting held during the NAIC's Fall National Meeting in September, the Academy's C3 Life and Annuity Capital Work Group (C3WG) has drafted the attached proposed changes to the RBC instructions, along with two appendices. The changes to the RBC instructions are to appropriately reference the new Appendices 2 and 3.

Appendix 2 would directly incorporate the Academy's June 2005 "Recommended Approach for Setting Risk-Based Capital Requirements for Variable Annuities and Similar Products Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee" (C3 Phase II Report) into the RBC instructions along with existing requirements language in the RBC instructions. Appendix 3 would directly incorporate the September 2009 "Report of the American Academy of Actuaries' C3 Life and Annuity Capital Work Group On RBC C3 Requirements for Life Products" (C3 Phase III Report) into the RBC instructions.

Please note that Appendix 2 describes C3 requirements for variable annuities and similar products utilizing the existing text of the C3 Phase II Report. It should be noted that certain text from the C3 Phase III Report has also been included in Appendix 2 for consistency with the proposed C3 Phase III requirements, where it was considered appropriate and not in conflict with existing requirements. For instance, Section 1 includes definitions of a number of terms that were not specifically defined in the C3 Phase II Report but are defined in the C3 Phase III Report. In such cases the definitions from the C3 Phase III Report have been added for consistency and completeness. The C3WG does not intend for the merging of the text to result in a change in existing requirements.

If you have any questions, please do not hesitate to contact Dianna Pell, Life Policy Analyst, at (202) 785-6924 or email pell@actuary.org.

[1] The American Academy of Actuaries is a 16,000-member professional association whose mission is to serve the public on behalf of the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

UNAFFILIATED PREFERRED AND COMMON STOCK

LR005

Basis of Factors

Unaffiliated Preferred Stock

Starting with year-end 2004 RBC, the preferred stock factors were changed to be the same as for bonds.

Unaffiliated Common Stock

Non-government money market mutual funds are more like cash than common stock; therefore, it is appropriate to use the same factor as for cash. Federal Home Loan Bank Stock has characteristics more like a fixed-income instrument rather than common stock. A 1.1 percent pre-tax factor was chosen. The factor for other unaffiliated common stock is based on studies conducted at two large life insurance companies. Both of these studies focused on well-diversified portfolios with characteristics similar to the Standard and Poor's 500 and indicate that a 30 percent pre-tax factor is needed to provide capital to cover approximately 95 percent of the greatest losses in common stock value over a two-year future period. This factor assumes capital losses are unrealized and not subject to favorable tax treatment at the time loss in fair value occurs.

Two adjustments are made to the 30 percent pre-tax factor to account for differences between the insurer's portfolio and the Standard and Poor's 500: first, the factor for publicly traded unaffiliated common stock is adjusted up or down by the weighted average beta of the insurer's portfolio subject to a maximum of 45 percent and a minimum of 22.5 percent; and second, a common stock concentration component is calculated, adding an additional requirement equal to 50 percent of the beta adjusted basic requirement for the five largest holdings of common stock in the insurer's portfolio.

Specific Instructions for Application of the Formula

Lines (1) through (6)

Column (1) amounts are from the Asset Valuation Reserve Default Component, Page 30, Column 1, Lines 10 through 15 of the annual statement. Since affiliated amounts are included for affiliated companies without an AVR in the Asset Valuation Reserve Default Component, Lines 10 through 15, these affiliated amounts should be deducted in Column (2). Affiliated companies with an AVR are reported on the Asset Valuation Reserve Default Component, Line 16 and should not be included in Column (2).

Line (7)

Column (1) should equal Annual Statement Assets, Page 2, Column 3, Line 2.1 less Asset Valuation Reserve Default Component, Column 1, Line 16. Column (2) should equal Schedule D Summary by Country, Column 1, Line 18 less Asset Valuation Reserve Default Component, Column 1, Line 16.

Line (21)

Amount should reflect any non-admitted unaffiliated common stock that was included in the book/adjusted carrying value of Schedule D Summary by Country, Line 24, Column 1 (Line (19) of this page).

Line (22)
Amounts should reflect only those money market mutual funds reported on Schedule D, Part 2, Section 2. Money market funds qualifying for Schedule DA treatment or reported on Schedule D, Part 1 should not be included on this line. Refer to the *Purposes and Procedures Manual of the NAIC Securities Valuation Office* for a discussion on those money market funds that qualify for Schedule DA treatment.

Line (23)
Federal Home Loan Bank common stock reported on Schedule D, Part 2, Section 2 of the annual statement should be reflected on this line.

Line (25)
The pre-tax factor for other unaffiliated common stock should be equal to 30 percent adjusted in the case of publicly traded stock by the weighted average beta for the insurer's portfolio of common stock, subject to a minimum factor of 22.5 percent and a maximum factor of 45 percent. The calculation of the beta adjustment should follow the procedures laid out for the similar adjustment in the asset valuation reserve calculation. Insurers that choose not to calculate a beta for their portfolio should use the maximum factor of 45 percent.

Line (26)
Column (1) should equal Annual Statement Schedule D Summary by Country, Column 1, Line 24 less Schedule D Summary by Country, Column 1, Line 23.

Lines (27) and (28)
To the extent that a modco or funds withheld transaction is backed by common stock included in Line (26) of the ceding company's RBC calculation, the ceding company's credit and assuming reinsurer's charge should include a beta adjustment that is calculated in a manner consistent with the Line (26) calculation of the ceding insurer.

SEPARATE ACCOUNTS
LR006

Basis of Factors

Separate Accounts with Guarantees
Guaranteed separate accounts are divided into two categories: indexed and non-indexed.

Guaranteed indexed separate accounts may invest using various approaches that are grouped into Class I or Class II strategies. Additional information on these types of accounts is provided in the "AAA Report on Separate Accounts that Guarantee an Index" adopted by the NAIC Life Risk Based Capital Working Group in New York, NY, June 2003.

Indexed Class I Strategies:

A company using a Class I strategy invests separate account assets in much the same way it would for its general account. If the guaranteed index obligation is not similar in nature to a traditional general account fixed annuity, the company may transform the financial characteristics of the obligation, using an overlay strategy, to those characteristics that are similar to a traditional general account fixed annuity (e.g., the company swaps the guaranteed index return to an interest rate). General account C-1 factors apply to assets invested using a Class I strategy. If a company uses an overlay strategy, there is an additional charge for operational and other residual financial risk attributable to the use of the overlay strategy. Also, a Class I strategy is subject to a C-3 interest rate risk charge as described in LR025, Interest Rate Risk and Market Risk.

Indexed Class II Strategies:

A company using a Class II strategy does not follow a traditional general account investment strategy when investing deposits. Under this strategy, the company is buying securities that are either included in the underlying index or are highly correlated with these underlying securities. Alternatively, a mix of strategies that are market neutral in aggregate or that are not normally associated with general account investing could form the core investment strategy. This strategy may be combined with an overlay strategy that transforms the returns to the guaranteed index. The RBC factor derivation is described below. The factor determined in the calculation includes both C-1 and C-3 risk. A spreadsheet at http://www.naic.org/documents/committees_e_capad_lrbc_rbc_june03.xls is available to do the calculation.

Non-Indexed Separate Accounts:

Non-indexed separate accounts with guarantees are subject to the risk of the underlying assets; therefore, 100 percent of the calculated risk-based capital of these accounts is appropriate. Contracts reserved at book value are reported for the RBC calculation exactly as if they were general account funded.

For contracts valued using the fair value of assets and the fair value (at current interest rates) of liabilities, risk-based capital is calculated as the excess of the regular C-1 and C-3 standards over the applicable reserve margins. New York Regulation 128 and California CIC 10506 are two examples of state valuation laws regulating such business. The reserve margin is calculated as the excess of the book/adjusted carrying value of the assets supporting the reserve (including any supplemental general account reserves) over the present value of the guaranteed payments. The present value of guaranteed payments is calculated using the expected net portfolio rate of return, and is not to exceed 105 percent of U.S. Treasury spot rates. The excess, if any, of the asset value over the present value of guaranteed payments is first applied to reduce the C-3 requirement. The remainder is used to reduce the C-1 requirement. The risk-based capital amount to be entered in the worksheet is the C-1 and C-3 requirements for these contracts after these credits. Excess margins may not be applied to contracts for which these amounts are not available.

Synthetic GICs

Synthetic GICs are contracts with provisions similar to separate accounts with guarantees, except that the insurance company does not own the assets. For business of this type, the C-1 and C-3 risk-based capital is determined to be the same as if the insurance company owned the assets and provided the same guarantees as in a guaranteed separate account.

Surplus in Non-Guaranteed Separate Accounts

There are a variety of reasons why surplus appears in non-guaranteed separate accounts; e.g., remaining seed money, or as a margin for certain risks assumed by the insurance company. The risk-based capital for such separate accounts is 11 percent of surplus held in such separate accounts before taxes plus 11 percent of the Commissioners Reserve Valuation Method (CRVM) or the Commissioners Annuity Reserve Valuation Method (CARVM) expense allowance transfers before taxes if the current surrender charge is based on the fund balance. If the current surrender charge is based on fund contributions, then the risk-based capital charge for the expense allowance component is 2.4 percent of the CRVM or CARVM expense allowance before taxes for each contract for which the fund balance exceeds the sum of the premiums less withdrawals; otherwise, it is an 11 percent factor pre-tax.

Specific Instructions for Application of the Formula

Line (1)
The amounts reported for Guaranteed Indexed Separate Accounts must be calculated manually.

Component 1 is calculated by applying the NAIC RBC C-1 factors to the assets supporting the Class I indexed separate accounts. However, this calculation does not include the size factor for bonds, the experience adjustments for mortgages or the concentration factor.

Component 2 is calculated if an overlay strategy is used with all or a portion of the Class 1 indexed separate accounts. It is calculated as the product of 0.004 times that portion of the assets using an overlay strategy.

Component 3 is the amount of RBC calculated for Class II indexed separate accounts using the procedure described below.

Class II indexed separate accounts base the RBC requirement on a factor from a prescribed calculation that is described below. The factor times the net separate account assets is the RBC Requirement.

1. Determine the series {X(t)} as actual net tracking error (fund performance minus guaranteed performance) for the most recent 60 months.

2. Convert each value X(t) to a value Y(t) using the formula, Y = (X -m)*K*(1+.15)+24*m

   Where m is the mean of the series {X(t)} and K is an adjustment factor to account for the variance of the distribution Y including serial correlation. More information on the K adjustment factor is described in the "AAA Report on Separate Accounts That Guarantee an Index" and is calculated in the associated supporting spreadsheet at http://www.naic.org/documents/committees_e_capad_lrbc_rbc_june03.xls. Covariance is set to 0 if the corresponding serial correlation is less than 0.20. The sample standard deviation in the terms above is increased 15 percent to allow for sampling error in the data series and to allow for the possibility of a shortfall during the first two years. The sample standard deviation is constrained so that it is not less than 50 percent or greater than 150 percent of the standard deviation calculated without correlation.

3. Order the series {Y(t)} in ascending order. Set any positive values to zero. Average the first six values. Change the sign and the result is the 90 CTE capital for C-1 and C-3.

4. Where there is less than 30 months of tracking error history the capital charge for C1 and C3 is 4 percent. If there is 30 months or more of history, the 4 percent factor is gradually phased out. For 30 months, actual experience is weighted by the square root of 30/60 and the 4 percent factor is weighted by one minus the square root of 30/60. For 31 months, experience is weighted by the square root of 31/60 and the 4 percent factor is weighted by one minus the square root of 31/60. This pattern continues up to month 59 when experience is weighted by the square root of 59/60 and the 4 percent factor is weighted by one minus the square root of 59/60.

5. The actual experience-based calculation, under step (3) above, needs to be adjusted when there are fewer than 60 months of experience to gauge the 90 CTE. If the number of months divided by 10 is an integral number n, take the average of the first n values after the series is put in ascending order with positive values set to zero. If n is non-integral, then set n to the next highest integral number and interpolate, using each average of the of the first n-1 and n values after the series is set in ascending order and positive values are set to zero. For example, if there are 37 values, the idea is to identify the worst 3.7 of them. This is done by interpolating, taking 30 percent of the average of the first three values and 70 percent of the average of the first four values.

6. The resulting RBC factor is subject to a minimum 0.4 percent.

Lines (2) and (3)
The amounts to be reported for non-indexed separate accounts with guarantees [Line (2) and Line (3), Column (2)] must be calculated manually. Risk-based capital for these amounts should be calculated using the life company formula; however, the RBC calculation for non-indexed separate accounts should not include the size factor for bonds, the experience adjustment for mortgages or the concentration factor.

Line (11)
Report the CRVM or CARVM expense allowance transfers where the current surrender charge is based on the fund balance or all other expense allowance transfers. Exclude expense allowance transfers for contracts subject to the LR025 Line (37) market risk requirements.

Line (12)
Report the CRVM or CARVM expense allowance transfers where the current surrender charge is based on fund contributions for each contract for which the fund balance exceeds the sum of the premiums less withdrawals. Exclude expense allowance transfers for contracts subject to the LR025 Line (37) market risk requirements.

Line (14)
The total assets of separate accounts with guarantees and separate accounts without guarantees of the formula should be equal to total separate account assets on Page 2, Line 25, Column 3 of the annual statement.

INTEREST RATE RISK AND MARKET RISK

LR025

Basis of Factors

The interest rate risk is the risk of losses due to changes in interest rate levels. The factors chosen represent the surplus necessary to provide for a lack of synchronization of asset and liability cash flows.

The impact of interest rate changes will be greatest on those products where the guarantees are most in favor of the policyholder and where the policyholder is most likely to be responsive to changes in interest rates. Therefore, risk categories vary by withdrawal provision. Factors for each risk category were developed based on the assumption of well matched asset and liability durations. A loading of 50 percent was then added on to represent the extra risk of less well-matched portfolios. Companies must submit an unqualified actuarial opinion based on asset adequacy testing to be eligible for a credit of one-third of the RBC otherwise needed.

Consideration is needed for products with credited rates tied to an index, as the risk of synchronization of asset and liability cash flows is tied not only to changes in interest rates but also to changes in the underlying index. In particular, equity-indexed products have recently grown in popularity with many new product variations evolving. The same C-3 factors are to be applied for equity-indexed products as for their non-indexed counterparts; i.e., based on guaranteed values ignoring those related to the index.

In addition, some companies may choose to or be required to calculate part of the RBC on Certain Annuities ~~and Single Premium Life Insurance~~ under a method using cash flow testing techniques. Refer to LR044 Exemption Test: Cash Flow Testing for C-3 RBC for determination of exemption from this cash flow testing requirement.

Reserves on Certain Annuities ~~and Single Premium Life Insurance~~ that were Cash Flow Tested for Asset Adequacy – Factor-Based RBC
See Appendix 1 of the instructions for more details.

The risk categories are:

(a) Low-Risk Category

The basic risk-based capital developed for annuities and life insurance in the low-risk category was based on an assumed asset/liability duration mismatch of 0.125 (i.e., a well matched portfolio). This durational gap was combined with a possible 4 percent one-year swing in interest rates (the maximum historical interest rate swing 95 percent of the time) to produce a pre-tax factor of 0.0077. In addition to the 50 percent loading discussed above, the risk-based capital pre-tax factor is 0.0115.

(b) Medium and High-Risk Category

The factors for the medium and high-risk categories were determined by measuring the value of the additional risk from the more discretionary withdrawal provisions based on assumptions of policyholder behavior and 1,000 random interest rate scenarios. Supplementary contracts not involving life contingencies and dividend accumulations are included in the medium-risk category due to the historical tendency of these policyholders to be relatively insensitive to interest rate changes.

Additional Component for Callable/Pre-Payable Assets

Identify the amount of callable/pre-payable assets (including IOs and similar investments) supporting reserves classified in this section. The C-3 requirement after taxes is 50 percent of the excess, if any, of book/adjusted carrying value above current call price. The calculation is done on an asset-by-asset basis. NOTE: If a company is required to calculate part of the RBC based on cash flow testing for C-3 RBC, the callable/pre-payable assets adjustment for any such assets used in that testing is reversed in a later step of the calculation.

All Other Reserves

This captures all reserves not included in Reserves on Certain Annuities ~~and Single Premium Life Insurance~~ that were Cash Flow Tested or products included under the "~~Recommended~~ Approach ~~for Setting~~to Determining ~~Risk-Based Capital~~C3 Requirements for Variable Annuities and Similar Products~~.~~" detailed in Appendix 2 or products included under the "Approach to Determining C3 Requirements for Life Insurance Products" detailed in Appendix 3.

The risk categories are:

(a) Low-Risk Category

The basic risk-based capital developed for annuities and life insurance in the low-risk category was based on an assumed asset/liability duration mismatch of 0.125 (i.e., a well-matched portfolio). This durational gap was combined with a possible 4 percent one-year swing in interest rates (the maximum historical interest rate swing 95 percent of the time) to produce a pre-tax factor of 0.0077. In addition to the 50 percent loading discussed above, the risk-based capital pre-tax factor is 0.0115.

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The factors for the medium and high-risk categories were determined by measuring the value of the additional risk from the more discretionary withdrawal provisions based on assumptions of policyholder behavior and 1,000 random interest rate scenarios. Supplementary contracts not involving life contingencies and dividend accumulations are included in the medium-risk category due to the historical tendency of these policyholders to be relatively insensitive to interest rate changes.

Additional Component for Callable/Pre-Payable Assets

Identify the amount of callable/pre-payable assets (including IOs and similar investments) not reported for Reserves on Certain Annuities ~~and Single Premium Life Insurance~~ that were Cash Flow Tested or the Interest Rate Risk Component for products included under the "~~Recommended~~ Approach to ~~for Setting Risk-Based~~Determining C3 Capital Requirements for Variable Annuities and Similar Products~~.~~" detailed in Appendix 2 or the Interest Rate Risk Component for products included under the "Approach to Determining C3 Requirements for Life Insurance Products" detailed in Appendix 3. This includes callable/pre-payable assets supporting other reserves and capital and surplus. The C-3 requirement after taxes is 50 percent of the excess, if any, of book/adjusted carrying value above current call price. The calculation is done on an asset-by-asset basis and reported in aggregate.

Cash Flow Testing of Certain Annuities for C-3 RBC

A company may be required or choose to perform cash flow testing to determine its RBC requirement on Certain Annuities. Because of the widespread use of increasingly well-disciplined scenario testing for actuarial opinions based upon an asset adequacy analysis involving cash flow testing, it was determined that a practical method of measuring the degree of asset/liability mismatch existed. It involves further cash flow testing. See Appendix 1 – Cash Flow Testing for C-3 RBC for details.

Specific Instructions for Application of the Formula

Lines (2) through (16)

These lines deal with Certain Annuities ~~and Single Premium Life Insurance~~ for which reserves were cash flow tested for asset adequacy. The fixed portion of equity-based variable products should not be included. Guaranteed indexed separate accounts following a Class I investment strategy are reported as low-risk Line 2 and those following a Class II investment strategy are excluded. Company source records entered in Column (3) of Lines (13), (15) and (16) should be adjusted to a pre-tax basis.

Line (17)

Should equal the sum of Lines (6) + (11) + (14) + (15). Line (16) is not included in the Line (17) total. Instead, it is included in the Line (32) total.

Lines (18) through (31)

These lines cover:

(a) The remaining company business that was not cash flow tested for asset adequacy (see Appendix 1 for details) excluding products included under the "Recommended Approach for Setting Risk-Based Capital Requirements for Variable Annuities and Similar Products" and
(b) Business in companies that did not cash flow test for asset adequacy.

The calculation for risk-based capital should not include unitized separate accounts without guarantees even though they may be included in Item 32 of the Notes to Financial Statements. Separate accounts with guarantees should be included, except for those separate accounts that guarantee an index and follow a Class II investment strategy and certain other guaranteed separate accounts as defined below. Synthetic GICs net of certain credits should be included in this section. The provisions for these credits to C-3 requirements is provided in the Separate Accounts section of the risk-based capital instructions. Experience-rated pension contracts defined below should be excluded from "annuity reserves with fair value adjustment" and "annuity reserves not withdrawable." All amounts should be reported net of reinsurance, net of policy loans and adjusted for assumed and ceded modified coinsurance.

Experience-rated group and individual pension business that meets all of the following four conditions is excluded from C–3 factor-based risk:

(a) General account funded;
(b) Reserve interest rate is carried at no greater than 4 percent and/or fund long-term interest guarantee (in excess of a year) does not exceed 4 percent;
(c) Experience rating mechanism is immediate participation, retroactive credits, or other technique other than participating dividends; and
(d) Either is not subject to discretionary withdrawal or is subject to fair value adjustment, but only if the contractually defined lump sum fair value adjustment reflects portfolio experience as well as current interest rates and is expected to pass both credit risk and rate risk to the policyholder at withdrawal. (A lump sum settlement based only on changes in prevailing rates does not meet this test. Book value cash out options meet this test as long as the present value of payments using U.S. Treasury spot rates is less than or equal to the lump sum fair value on the valuation date and the policyholder does not have an option to change the payment period once payments begin.)

For companies not exempt from cash flow testing for C-3 RBC, such testing is to include those experience-rated products exempted from the formula factors, but for which cash flow testing is done as a part of the asset adequacy testing.

Non-indexed separate account business with guarantees that satisfy both conditions (b) and (d) above is excluded from C–3 factor-based risk.

Guaranteed indexed separate account business following a Class I investment strategy is reported on Line (18). Note that in the AAA Report "Proposed New Risk-Based Capital Method for Separate Accounts That Guarantee an Index (adopted by the NAIC Life Risk-Based Capital Working Group in New York, NY, June 2003), there is a stress test applicable to Class I investment strategies for a company that is not subject to scenario testing requirements.

Company source records entered in Column (3) of Lines (30) and (31) should be adjusted to a pre-tax basis.

Line (33)

Enter in Column (3) the pre-tax interest rate risk results of cash flow testing per the Appendix 1a methodology. Line (33) should be completed by all companies who do cash flow testing of Certain Annuities ~~and Single Premium Life Insurance~~ for asset adequacy (see Appendix 1) except those with less than $100 million in admitted assets at year-end, unless the answer to Line (14) or Line (22) of LR044 Exemption Test: Cash Flow Testing for C-3 RBC is "Yes" or if the company chooses to do C-3 RBC cash flow testing on a continuing basis. Once a company chooses to use the C-3 RBC cash flow testing method to calculate RBC it must continue to do so unless regulatory approval from the domiciliary jurisdiction is received to go back to the factor-based method. The interest rate risk component for Variable Annuities and Similar Products under the "Approach to Determining C3 Requirements for Variable Annuity and Similar Products and Life Insurance Products included under the "Approach to Determining C3 Requirements for Life Insurance Products" should be entered into Line (35).

Line (34)

If Line (33) is equal to zero, then Line (34) should equal Line (32). Otherwise, Line (34) should equal Line (32) plus Line (33) less Line (16) less Line (17) subject to a minimum of 0.5 times Line (32).

Line (35)

Line (35) is the sum of the interest rate risk component for Variable Annuities and Similar Products~~,~~ and the interest rate risk component for Life Insurance Products.

Specifications for the calculation of the interest rate risk component for Variable Annuities and Similar Products are given in Appendix 2.

Specifications for the calculation of the interest rate risk component for Life Insurance Products are given in Appendix 3

Life Insurance Products

The amount reported on Line (35) relating to Life Insurance Products is calculated using a four step process:

(1) The first step is to calculate the C-3 amount by applying the methodology described in Appendix 3.

(2) The second step is to determine the market risk portion of the risk as described in section 6.I.7 of Appendix 3.

(3) The second step is to reduce the amount in step (1) above by the market risk portion of the risk (i.e., only the interest rate risk is included in this step). The reduced amount may not be less than zero.

(4) Divide the result from step (2) by .65 to arrive at a pre-tax amount.

The result in step 4 above is added to the amount on line (35), if any, relating to Variable Annuities and Similar Products.

Line (36)
Total interest rate risk. Equals Line (34) plus Line (35).

Line (37)

Line (37) is the sum of the market risk component for Variable Annuities and Similar Products~~,~~ and.the market risk component for Life Insurance Products.

Specifications for the calculation of the market risk component for Variable Annuities and Similar Products are given in Appendix 2.

Specifications for the calculation of the market risk component for Life Insurance Products are given in Appendix 3.

Life Insurance Products

The amount reported on Line (37) relating to Life Insurance Products is calculated using a two step process:

(1) The first step is to determine the market risk component relating to Life Insurance Products (step 2 of the determination of line 35 amount for Life Insurance Products).

(2) Divide the result from step (1) by .65 to arrive at a pre-tax amount.

The result in step 2 above is added to the amount on line (37), if any, relating to Variable Annuities and Similar Products.

~~*Overview* *Variable Annuities and Similar Products*~~

~~The amount reported on Line (37)) relating to Variable Annuities and Similar Products is calculated using a nine-step process.~~

~~(1) The first step is determined by applying the methodology described in the report "Recommended Approach for Setting Risk Based Capital Requirements for Variable Annuities and Similar Products Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee to the National Association of Insurance Commissioners' Capital Adequacy Task Force (June 2005)" to calculate the total asset requirement. Although Appendix 2 in the Report notes path dependent models under a different set of initialization parameters might produce scenarios that do not satisfy all the calibration points shown in Table 1, to be in compliance with the requirements in this first step, the actual scenarios used for diversified U.S. equity funds must meet the calibration criteria. The scenarios need not strictly satisfy all calibration points in Table 1 of Appendix 2, but the actuary should be satisfied that any differences do not materially reduce the resulting capital requirements. See the Preamble to the *Accounting Practices and Procedures Manual* for an explanation of materiality. Include the Tax Adjustment as described in the report.~~

~~(2) The second step is to reduce the amount calculated in (1) above by the interest rate portion of the risk (i.e., only the separate account market risk is included in this step).~~

~~(3) The third step is to calculate the Standard Scenario Amount.~~

~~(4) Take the greater of the amounts from steps (2) and (3).~~

~~(5) Apply the smoothing and transition rules (if applicable) to the amount in step (4).~~

~~(6) Add the general account interest rate portion of the risk to the amount in step (5).~~

~~(7) Subtract the reported statutory reserves for the business subject to the Report from the amount calculated in step (6). Floor this amount at $0.~~

~~(8) Divide the result from step (7) by 0.65 to arrive at a pre-tax amount.~~

~~(9) Split the result from step (8) into an interest rate risk portion and a market risk portion. Note that the interest rate portion may not equal the interest rate portion of the risk used in steps (2) and (6) above even after adjusting these to a pre-tax basis. The interest rate portion of the risk should be included in Line (35) and the market risk portion in Line (37).~~

Calculation of the Total Asset Requirement

The method of calculating the Total Asset Requirement is explained in detail in the AAA's June 2005 report, referenced above. In summary, it is as follows:

A. Aggregate the results of running stochastic scenarios using prudent best estimate assumptions (the more reliable the underlying data is, the smaller the need for margins for conservatism) and calibrated fund performance distribution functions. If utilizing prepackaged scenarios as outlined in the American Academy of Actuaries' report, *Construction and Use of Pre-Packaged Scenarios to Support the Determination of Regulatory Risk Based Capital Requirements for Variable Annuities and Similar Products*, Jan. 13, 2006, the Enhanced C-3 Phase I Interest Rate Generator should be used in generating any interest rate scenarios or regenerating pre-packaged fund scenarios for funds that include the impact of bond yields. Details concerning the Enhanced C-3 Phase I Interest Rate Generator can be found on the American Academy of Actuaries webpage at the following address http://www.actuary.org/pdf/life/c3supp_jan06.pdf. The Enhanced C3 Phase 1 Interest Rate Generator with its ability to use the yield curve as of the run date and to regenerate pre-packaged fund returns using interest rates scenarios based on the current yield curve replaces the usage of the March 2005 pre-packaged scenarios.

B. Calculate required capital for each scenario by calculating accumulated statutory surplus, including the effect of federal income taxes at a rate of 35 percent, for each calendar year-end and its present value. The negative of the lowest of these present values is the asset requirement for that scenario. These values are recorded for each scenario and the scenarios are then sorted on this measure. For this purpose, statutory surplus is modeled as if the statutory reserve were equal to the working reserve.

C. The Total Asset Requirement is set at the 90 Conditional Tail Expectation by taking the average of the worst 10 percent of all the scenarios' asset requirements (capital plus starting reserve). Risk-based capital is calculated as the excess of the Total Asset Requirement above the statutory reserves. For products with no guaranteed living benefit, or just a guaranteed death benefit, an alternative method is allowed, as described in the AAA report.

D. Risk-based capital is calculated as the excess of the Total Asset Requirement above the statutory reserves. Except for the effect of the Standard Scenario and the Smoothing and Transition Rules (see below), this RBC is to be combined with the $C1_{CS}$ component for covariance purposes.

E. A provision for the interest rate risk of the guaranteed fixed fund option, if any, is to be calculated and combined with the current C3 component of the formula.

F. The way grouping (of funds and of contracts), sampling, number of scenarios, and simplification methods are handled is the responsibility of the actuary. However, all these methods are subject to Actuarial Standards of Practice, supporting documentation and justification.

G. Certification of the work done to set the RBC level will be required to be submitted with the RBC filing. Refer to Appendices 10 and 11 of the AAA LCAS C-3 Phase II RBC Report (June 2005) for further details of the certification requirements. The certification should specify that the actuary is not opining on the adequacy of the company's surplus or its future financial condition. The actuary will also note any material change in the model or assumptions from that used previously and the impact of such changes (excluding changes due to a change in these NAIC instructions). Changes will require regulatory disclosure and may be subject to regulatory review and approval. Additionally, if hedging is reflected in the stochastic modeling, additional certifications are required from an actuary and financial officer of the company.

The certification(s) should be submitted by hard copy with any state requiring an RBC hard copy.

H. An actuarial memorandum should be constructed documenting the methodology and assumptions upon which the required capital is determined. The memorandum should also include sensitivity tests that the actuary feels appropriate, given the composition of their block of business (i.e., identifying the key assumptions that, if changed, produce the largest changes in the RBC amount.). This memorandum will be confidential and available to regulators upon request.

Application of the Tax Adjustment

Tax Adjustment: Under the U.S. IRC the tax reserve is defined. It can never exceed the statutory reserve nor be less than the cash surrender value. If tax reserves assumed in the projection are set equal to Working Reserves and if tax reserves actually exceed Working Reserves at the beginning of the projection, a tax adjustment is required.

A tax adjustment is not required in the following situations:

- Tax reserves are projected directly; that is, it is not assumed that projected tax reserves are equal to Working Reserves, whether these are cash values or other approximations.
- Tax reserves at the beginning of the projection period are equal to Working Reserves.
- Tax reserves at the beginning of the projection period are lower than Working Reserves. This situation is only possible for contracts without cash surrender values and when these contracts are significant enough to dominate other contracts where tax reserves exceed Working Reserves. In this case the modeled tax results are overstated each year for reserves in the projection, as well as the projected tax results reversed at the time of claim.

If a tax adjustment is required the Total Asset Requirement (TAR) must be increased on an approximate basis to correct for the understatement of modeled tax expense. The additional taxable income at the time of claim will be realized over the projection and will be measured approximately using the duration to worst, i.e., the duration producing the lowest present value for each scenario. The method of developing the approximate tax adjustment is described below.

The increase to TAR may be approximated as the corporate tax rate (i.e., 35 percent) times f times the difference between tax reserves and Working Reserves at the start of the projections. For this calculation, f is calculated as follows. For the scenarios reflected in calculating 90 CTE, the lowest of these present values of accumulated statutory surplus is determined for each calendar year-end and its associated projection duration is tabulated. At each such duration, the ratio of the number of contracts in force (or covered lives for group contracts) to the number of contracts in force (or covered lives) at the start of the modeling projection is calculated. The average ratio is then calculated, over all 90 CTE scenarios, and f is one minus this average ratio. If instead, RBC is determined under the standard scenario method then f is based on the ratio at the worst duration under that scenario. If the Alternative Method is used, f is approximated as 0.5.

Calculation of the Standard Scenario Amount

Standard Scenario for C-3 Phase II Risk Based Capital (RBC) Determination

I)Overview

A)Application to Determine RBC. A Standard Scenario Amount shall be determined for all of the contracts under the scope described in the June 2005 report, "Recommended Approach for Setting Risk-Based Capital Requirements for Variable Annuities and Similar products". If the Standard Scenario Amount is greater than the Total Asset Requirement less any amount included in the TAR but attributable to and allocated to C-3 (Interest Rate Risk) otherwise determined based on the Report, then the Total Asset Requirement before tax adjustment used to determine C-3 Phase 2 (Market Risk) RBC shall be the Standard Scenario Amount.

The Standard Scenario Amount shall be the sum of the following:

1.For contracts for which RBC is based on the Alternative Methodology applied without a model office using 100 percent of the MGDB mortality table, the Standard Scenario Amount shall be the sum of the total asset requirement before tax adjustment from the Alternative Methodology applied to such contracts.

2.For contracts without guaranteed death benefits for which RBC is based on the Alternative Methodology applied without a model office, the Standard Scenario Amount shall be the sum of the total asset requirements before tax adjustment from the Alternative Methodology applied to such contracts.

3.For contracts under the scope of the Report other than contracts for which paragraphs 1 and 2 apply, the Standard Scenario Amount is determined by use of The Standard Scenario Method described in Section III. The Standard Scenario Method requires a single projection of account values based on specified returns on the assets supporting the account values. On the valuation date an initial drop is applied to the account values based on the supporting assets. Subsequently, account values are projected at the rate earned on supporting assets less a margin. Additionally, the projection includes the cash flows for certain contract provisions, including any guaranteed living and death benefits using the assumptions in Section III. Thus the calculation of the Standard Scenario Amount will reflect the greatest present value of the accumulated projected cost of guaranteed benefits less the accumulated projected revenue produced by the margins in accordance with Subsection III (D).

B)The Standard Scenario Amount under the Standard Scenario Method.

The Standard Scenario Amount for all contracts subject to the Standard Scenario Method is determined as of the valuation date under the Standard Scenario Method described in Section III based on a rate, DR. 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 3 percent or more than 9 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. The accumulation rate, AR, is the product of DR and one minus the tax rate defined in paragraph III(D)(10).

No modification is allowed from the requirements in Section III unless the Domiciliary Commissioner approves such modification as necessary to produce a reasonable result

C)Illustrative Application of the Standard Scenario Method to a Projection, Model Office and Contract by Contract. To provide information on the significance of aggregation, a determination of the Standard Scenario Amount based on paragraphs III(B)(1) and III(B)(2) is required for each contract subject to paragraph I(A)(3). The sum of all such Standard Scenario Amounts is described as row B in Table A. In addition, if the Conditional Tail Expectation Amount in the Report 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 the Standard Scenario Amount 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 and to determine the significance of aggregation.

Table A identifies the Standard Scenario Amounts required by this section. The Standard Scenario Amounts required are based on how the Conditional Tail Expectation projection or Alternative Methodology is applied. For completeness, the table also includes the Standard Scenario Amount required by paragraph I(A)(3). The amounts in Table A should be included as part of the certifying actuary's annual supporting memorandum specified in paragraph (H) of the "Calculation of the Total Asset Requirement" section of the RBC instructions.

- Standard Scenario Amounts in rows A and B in Table A are required of all companies subject to paragraph I(A)(3). No additional Standard Scenario Amounts are required if a company's stochastic or alternative methodology result is calculated on the statement date using individual contracts (i.e., without a model office).
- A company that uses a model office as of the statement date to determine its stochastic or alternative methodology result must provide the Standard Scenario Amount for the model office. This is row C.
- A company that uses an aggregation by duration of contract by contract projection 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 the Standard Scenario Amount for the prior inforce, row D.
- 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 the Standard Scenario Amount for the model office on the prior inforce date, row E.

Table A

Standard Scenario Amounts	Guideline Variations	Validation Measures	
		Model Office Projection	Projection of Prior Inforce
A.Aggregate valuation on the statement date on inforce contracts required in I(A)(3)	None	None	None
B.Seriatim valuation on the statement date on inforce contracts	None: Compare to A	None	None
C.Aggregate valuation on the statement date on the model office	If not material to model office validation	A/C compare to 1.00	None
D.Aggregate valuation on a prior inforce date on prior inforce contracts	If not material to projection validation	None	A/D - S/PS Compare to 0
E.Aggregate valuation on a prior inforce date of a model office	If not material to model office or projection validation.	(A/E - S/PM) compare to 0	

Modification of the requirements in Section III 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. No modification is allowed for row B as of the statement date unless the Domiciliary Commissioner approved such modification as necessary to produce a reasonable result under the corresponding amount in row A.

II)Basic Adjusted Reserve

For purposes of determining the Standard Scenario Amount for Risk-Based Capital, the Basic Adjusted Reserve for a contract shall be the Working Reserve, as described in the Report, as of the valuation date.

III)Standard Scenario Amount - Application of the Standard Scenario Method

A)General

Where not inconsistent with the guidance given here, the process and methods used to determine results under the Standard Scenario Method shall be the same as required in the calculation under the modeling methodology required by the Report. Any additional assumptions needed to apply the Standard Scenario Method to the inforce shall be explicitly documented.

B)Results for the Standard Scenario Method.

The Standard Scenario Amount is equal to (1) + (2) – (3) where:

1)Is the sum of the Basic Adjusted Reserve as described in Section II for all contracts for which the Standard Scenario Amount is being determined,

2)Is zero or if greater the aggregate greatest present value for all contracts measured as of the end of each projection year of the negative of the Accumulated Net Revenue described below using the assumptions described in Subsection III(D) and a discount rate equal to the Accumulation Rate, AR. The Accumulated Net Revenue at the end of a projection year equals (i) + (ii) – (iii) where:

(i)Is the Accumulated Net Revenue at the end of the prior projection year accumulated at the rate AR 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 as defined in paragraph III(D)(1) multiplied by one minus the tax rate and accumulated at rate AR to the end of current projection year, and

(iii)Are the contract benefits paid in excess of account value applied plus the Individual reinsurance premiums (ceded less assumed) less the Individual reinsurance benefits (ceded less assumed) payable or receivable during the projection year multiplied by one minus the tax rate and accumulated at rate AR to the end of current projection year. Individual reinsurance is defined in paragraph III(D)(2).

3) – Is the value of approved hedges and Aggregate reinsurance as described in paragraph III(E)(2). Aggregate reinsurance is defined in paragraph III(D)(2).

C)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).

D)Assumptions for Paragraph III (B) (2) Margins and Account Values.

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

The Fixed Fund rate is the greater of the minimum rate guaranteed in the contract or 3.5 percent but not greater than the current rates being credited to Fixed Funds on the valuation date.

Account Values shall be accumulated after the initial drop using the rates from Table I with appropriate reductions applied to the supporting assets. The appropriate reductions for account values supported by assets in the Equity, Bond or Balance Classes are all fund and contract charges according to the provisions of the funds and contracts. The appropriate reduction for Account Values supported by Fixed Funds is zero.

The margins on Account Values 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 Values; and
- 50% of the excess, if any, of all contract charges over (a) above.

However, on fixed funds after the surrender charge period, a margin of up to the amount in (a) above plus 0.4%. may be used.

Table I

	Initial	Year 1	Year 2+
Equity Class	20%	0%	3%
Bond Class	0	0	4.85%
Balanced Class	12%	0%	3.74%
Fixed Separate Accounts and General Account		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 reinsurance is Aggregate reinsurance.

Individual reinsurance premiums projected to be payable on ceded risk and receivable on assumed risk shall be included in the subparagraph III(B)(2)(iii). Similarly, Individual reinsurance benefits projected to be receivable on ceded risk and payable on assumed risk shall be included in subparagraph III(B)(2)(iii). No Aggregate reinsurance shall be included in subparagraph III(B)(2)(iii).

3)Lapses, Partial Withdrawals, and Moneyness. Partial withdrawals elected as guaranteed living benefits or required contractually (e.g., a contract operating under an automatic withdrawal provision on the valuation date) are to be included in subparagraph III(B)(2)(iii). No other partial withdrawals, including free partial withdrawals, are to be included. All lapse rates shall 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 future 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 projected account value is 90 percent of the value of the guaranteed benefit at the time of exercise or payment, the contract is said to be 10 percent in the money. If the income from applying the projected account value to guaranteed purchase rates exceeds the income from applying the projected 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. 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 to determine the greatest present value amount required under paragraph III(B)(2) 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 values are transferred to the Accumulation of Net Revenue at year end and are subsequently accumulated at the Accumulation 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 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 funds.

5) Mortality. Mortality at 80 percent of the 1994 MGDB tables through age 95 increasing by 1 percent each year to 100 percent of the 1994 MGDB table at age 115 shall be assumed in the projection used to the determine the greatest present value amount required under paragraph III(B)(2).

6) Projection Frequency. The projection used to determine the greatest present value amount required under paragraph III(B)(2) 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 each projection year may be retained in such funds until year-end (i.e., pre-tax 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. Subsequent to each projection year end, Accumulated Net Revenues for the year shall earn the Accumulation Rate. Similarly, projected benefits, lapses, elections and other contract 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) Surrender Charge Period. If the surrender charge for the contract is determined based on individual contributions or deposits to the contracts, the surrender charge amortization period may be estimated for projection purposes. Such estimated period shall not be less than the remaining duration based on the normal amortization pattern for the remaining total contract charge assuming it resulted from a single deposit, plus one year.

8) Contract Holder Election Rates. Contract holder election rates to determine amounts in subparagraph III(B)(2)(iii) shall be 15 percent 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. Guaranteed Minimum Death Benefits are not benefits subject to election. Exception: Contract holder election rates shall be 100 percent 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 paragraph III(D)(3).

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 assumed in subparagraph III(B)(2)(iii). 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 assumed in subparagraph III(B)(2)(iii).

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%

9) GMIBs. For subparagraph III(B)(2)(iii), GMIB cost at the time of election shall be the excess, if positive, of the reserve required for the projected annuitization stream over the available account value. If the reserve required is less than the account value, the GMIB cost shall be zero. The reserve required shall be determined using the Annuity 2000 Mortality Table and a valuation interest rate equal to the Discount Rate. If more than one annuity option is available, chose the option with a reserve closest to the reserve for a life annuity with 10 years of certain payments.

10) 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 up to the time the index is used. The sources of information and how the information is used to determine indexes shall be documented and, to the extent possible, consistent from year to year.

11) Taxes. All taxes shall be based on a tax rate of 35 percent.

E)Assumptions for use in paragraph III (B) (3).

1)The Value of Aggregate Reinsurance. The value of Aggregate reinsurance is the discounted value, at rate AR of the excess of: a) the benefit payments from the reinsurance, over b) the reinsurance premiums, where (a) and (b) are determined under the assumptions described in Subsection III(D).

2)The Value of Approved Hedges. The value of approved hedges shall be calculated separately from the calculation in paragraph III(B)(2). The value of approved hedges is the difference between: a) the discounted value at rate AR of the after-tax cash flows from the approved hedges; less b) their statement values on the valuation date.

To be an approved hedge, a derivative or other investment has to be an actual asset held on the valuation date, be designated as a hedge for one or more contracts subject to the Standard Scenario, and be part of a clearly defined hedging strategy as described in the Report. If the approved 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 approved 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 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, and the approved hedges are assumed to be accounted for at the average present value of the tail scenarios. The value of approved hedges for the standard scenario is the difference between an estimate of this "tail value" and the "fair value" of approved hedges. For this valuation to be consistent with the statement value of approved hedges, the statement value of approved hedges will need to be held at fair value with the immediate recognition of gains and losses. Accordingly, it is assumed that approved hedges are not subject to the IMR or the equity component of the AVR. Approved hedges need not satisfy SSAP No. 86. In particular, as gains and loses of approved hedges are recognized immediately, approved hedges need not satisfy the requirements for hedge accounting of fair value hedges.

It is the combination of hedges and liabilities that determine which scenarios are the tail scenarios. In particular, scenarios where the hedging is least effective are likely to be tail scenarios and liabilities that are a left tail risk could in combination with hedges become a right tail risk.

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 one 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 Black-Scholes pricing, a risk-free rate of DR, annual volatility implicit as of the valuation date in the statement value of the hedges under Black-Scholes pricing and a risk-free rate of DR and the assumed returns in the Standard Scenario from the valuation date to the date of liquidation.

There is no credit in the Standard Scenario for dynamic hedging beyond the credit that results from hedges actually held on the valuation date. There is no credit for hedges actually held on the valuation date that are not approved hedges as the commitment to maintain the level of risk reduction derived from such hedges is not adequate.

3)Retention of Components. For the Standard Scenario Amounts on the statement date the company should have available to the Commissioner the following values:

a)For runs A and B as defined in I(C) by contract and in aggregate the amounts determined in III(B)(1) and III(B)(2).

b)For run A the aggregate amounts determined in III(E)(1) and III(E)(2).

Smoothing and Transition Rules

If a company is following a Clearly Defined Hedging Strategy (See "Recommended Approach for Setting Risk Based Capital Requirements for Variable Annuities and Similar Products Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee to the National Association of Insurance Commissioner's Capital Adequacy Task Force (June 2005)" for the definition of this phrase) on some or all of its business, a decision should be made whether or not to smooth the TAR. In all cases where 'cash value' is to be used, the values used must be computed on a consistent basis for each block of business at successive year-ends. For deferred annuities with a cash value option, direct writers will use the cash value. For deferred annuities with no cash value option, or for reinsurance assumed through a treaty other than coinsurance, use the policyholder account value of the underlying contract. For payout annuities, or other annuities with no account value or cash value, use the amount as defined for variable payout annuities in the definition of Working Reserve. For any business reinsured under a coinsurance agreement that complies with all applicable reinsurance reserve credit "transfer of risk" requirements, the ceding company shall reduce the value in proportion to the business ceded while the assuming company shall use an amount consistent with the business assumed.

A company who reported an amount in Line (37) last year may choose to smooth the Total Asset Requirement. A company is required to get approval from its domestic regulator prior to changing its decision about smoothing from the prior year. To implement smoothing, use the following steps. If a company does not qualify to smooth or a decision has been made not to smooth, go to the step "Reduction for reported Statutory Reserves."

Instructions – 2007 and Later

1.Determine the Total Asset Requirement as the greater of that produced by the "Recommended Approach for Setting Risk Based Capital Requirements for Variable Annuities and Similar Products Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee to the National Association of Insurance Commissioner's Capital Adequacy Task Force (June 2005)" or the value produced by the "Standard Scenario" as outlined above.
2.Determine the aggregate cash value for the contracts covered by the Stochastic modeling requirements.
3.Determine the ratio of TAR / CV for current year.
4.Determine the Total Asset Requirement as actually reported for the prior year Line (37).
5.Determine the aggregate cash value for the same contracts for the prior year-end.
6.Determine the ratio of TAR / CV for prior year
7.Determine a ratio as 0.4*(6) plus 0.6*(3) {40% prior year ratio and 60% current year ratio}
8.Determine TAR for current year as the product of (7) and (2) {adjust (2) to be actual 12/31 cash value}

Reduction for reported statutory reserves

The amount of the TAR (post-Federal Income Tax) determined using the instructions for the applicable year is reduced by the reserve, net of reinsurance, for the business subject to this instruction reported in the current statutory annual statement.

Allocation of Results to Line (35) and Line (37)

See step (9) located in the overview section at the beginning of the instructions for this line

The total of all annual statement reserves representing exposure to C–3 risk on Line (36) should equal the following:

Exhibit 5, Column 2, Line 0199999
– Page 2, Column 3, Line 6
+ Exhibit 5, Column 2, Line 0299999
+ Exhibit 5, Column 2, Line 0399999
+ Exhibit 7, Column 1, Line 14
+ Separate Accounts Page 3, Column 3, Line 1 plus Line 2 after deducting (a) funds in unitized separate accounts with no underlying guaranteed minimum return and no unreinsured guaranteed living benefits; (b) non-indexed separate accounts that are not cash flow tested with guarantees less than 4 percent; (c) non-cash-flow-tested experience rated pension reserves/liabilities; and (d) guaranteed indexed separate accounts using a Class II investment strategy.
– Non policyholder reserves reported on Exhibit 7
+ Exhibit 5, Column 2, Line 0799997
+ Schedule S, Part 1, Section 1, Column 11
– Schedule S, Part 3, Section 1, Column 13

EXEMPTION TEST: CASH FLOW TESTING FOR C-3 RBC
LR044

Specific Instructions for Application of the Formula

Line (5)
Column (1) Line (5) will need to be manual entry if the company has any equity-indexed product amounts included in the totals from LR025 Interest Rate Risk and Market Risk. Line (5) is calculated as LR025 Interest Rate Risk and Market Risk Column (3) Line (17) times 0.65 plus LR025 Interest Rate Risk and Market Risk Column (3) Line (16) times 0.65 minus any equity indexed product amounts included in these totals times 0.65.

Line (6)
Column (1) Line (6) will also be manual entry if the company has any equity-indexed product amounts subtracted from Line (5) above. Line (6) is calculated as LR025 Interest Rate Risk and Market Risk Column (3) (Line (22) + (27) + (29) + (30) + (31)) x 0.65 plus any equity-indexed amounts subtracted in the Line (5) calculation.

Line (16)
Column (1) Line (16) will need to be manual entry if the company has any equity-indexed product amounts included in the totals from LR025 Interest Rate Risk and Market Risk. Line (16) is calculated as LR025 Interest Rate Risk and Market Risk Column (3) Line (17) times 0.65 plus LR025 Interest Rate Risk Column (3) Line (16) times 0.65 minus any equity-indexed product amounts included in these totals times 0.65.

Line (17)
Column (1) Line (17) will need to be manual entry if the company has any equity indexed product amounts included in the totals from LR025 Interest Rate Risk and Market Risk. Line (17) is calculated as LR025 Interest Rate Risk and Market Risk Column (3) Line (17) times 6.5 times 0.65 minus any equity-indexed product amounts included in these totals times 6.5 times 0.65.

Line (18)
Column (1) Line (18) will also be manual entry if the company has any equity-indexed product amounts subtracted from Line (16) above. Line (18) is calculated as LR025 Interest Rate Risk and Market Risk Column (3) (Line (22) + (27) + (29) + (30) + (31)) x 0.65 plus any equity-indexed amounts subtracted in the Line (5) calculation.

Appendix 1 – Cash Flow Testing for C-3 RBC

This appendix is applicable for all companies who do Cash Flow Testing for C-3 RBC.

The method of developing the C-3 component is building on the work of the asset adequacy modeling, but using interest scenarios designed to help approximate the 95th percentile C-3 risk.

The C-3 component is to be calculated as the sum of four amounts, but subject to a minimum. The calculation is:

(a) For Certain Annuities or Single Premium Life Insurance products other than equity-indexed products, whether written directly or assumed through reinsurance, that the company tests for asset adequacy analysis using cash flow testing, an actuary should calculate the C-3 requirement based on the same cash flow models and assumptions used and same "as-of" date as for asset adequacy, but with a different set of interest scenarios and a different measurement of results. A weighted average of a subset of the scenario-specific results is used to determine the C-3 requirement. The result is to be divided by 0.65 to put it on a pre-tax basis for LR025 Interest Rate Risk and Market Risk Column (2) Line (33).

If the "as-of" date of this testing is not Dec. 31, the ratio of the C-3 requirement to reserves on the "as-of" date is applied to the year-end reserves, similarly grouped, to determine the year-end C-3 requirement for this category.

(b) Equity-indexed products are to use the existing C-3 RBC factors, not the results of cash flow testing.

(c) For all other products (either non-cash-flow-tested or those outside the product scope defined above) the C-3 requirements are calculated using current existing C-3 RBC factors and instructions.

(d) For callable/pre-payable assets (including IOs and similar investments other than those used for testing in component a) above, the C-3 requirement is 76.9 percent of the excess, if any, of book/adjusted carrying value above current call price. The calculation is to be done on an asset-by-asset basis.

The total C-3 component is the sum of (a), (b), (c) and (d), but not less than half the C-3 component based on current factors and instructions.

- For this C-3 calculation, "Certain Annuities" means products with the characteristics of deferred and immediate annuities, structured settlements, guaranteed separate accounts (excluding guaranteed indexed separate accounts following a Class II investment strategy) and GICs (including synthetic GICs and funding agreements). Debt incurred for funding an investment account is included if cash flow testing of the arrangement is required by the insurer's state of domicile for asset adequacy analysis. The equity-based portions of variable products are not to be included, but guaranteed fixed options within such products are. See Appendix 1b for further discussion.

- The company may use either a standard 50 scenario set of interest rates or an alternative, but more conservative, 12 scenario set (for part a, above). It may use the smaller set for some products and the larger one for others. Details of the cash flow testing for C-3 RBC methodology are contained in Appendix 1a.

- In order to allow time for the additional work effort, an estimated value is permitted for the year-end annual statement. For the RBC electronic filing, the actual results of the cash flow testing for C-3 RBC will be required. If the actual RBC value exceeds that estimated earlier in the blanks filing by more than 5 percent, or if the actual value triggers regulatory action, a revised filing with the NAIC and the state of domicile is required by June 15; otherwise, re-filing is permitted but not required.

- The risk-based capital submission is to be accompanied by a statement from the appointed actuary certifying that in his or her opinion the assumptions used for these calculations are not unreasonable for the products, scenarios and purpose being tested. This C-3 Assumption Statement is required from the appointed actuary even if the cash flow testing for C-3 RBC is done by a different actuary.

- The cash flow testing used for this purpose will use assumptions as to cash flows, assets associated with tested liabilities, future investment strategy, rate spreads, "as-of" date and how negative cash flow is reflected consistent with those used for cash flow testing for asset adequacy purposes (except that if negative cash flow is modeled by borrowing, the actuary needs to make sure that the amount and cost of borrowing are reasonable for that particular scenario of the C-3 testing). The other differences are the interest scenarios assumptions and how the results are used.

  It is important that assumptions be reviewed for reasonableness under the severe scenarios used for C-3 RBC cash flow testing. The assumptions used for cash flow testing may need to be modified so as to produce reasonable results in severe scenarios.

- The actuary must also ensure that the cash flow testing used for the 50 or 12 scenarios does not double-count cash flow offsets to the interest rate risks. That is, that the calculations do not reduce C-3 and another RBC component for the same margins. For example, certain reserve margins on some guaranteed separate account products serve an AVR role and are credited against the C-1o requirement. To that degree, these margins should be removed from the reserve used for C-3 RBC cash flow testing.

Appendix 1a – Cash Flow Testing for C-3 RBC Methodology

General Approach

1. The underlying asset and liability model(s) are those used for year-end Asset Adequacy Analysis cash flow testing, or a consistent model.

2. Run the scenarios (12 or 50) produced from the interest-rate scenario generator.

3. The statutory capital and surplus position, S(t), should be captured for every scenario for each calendar year-end of the testing horizon. The capital and surplus position is equal to statutory assets less statutory liabilities for the portfolio.

4. For each scenario, the C-3 measure is the most negative of the series of present values S(t)*pv(t), where pv(t) is the accumulated discount factor for t years using 105 percent of the after-tax one-year Treasury rates for that scenario. In other words:

$$pv(t) = \prod_{1}^{t} 1/(1+i_t)$$

5. Rank the scenario-specific C-3 measures in descending order, with scenario number 1's measure being the positive capital amount needed to equal the very worst present value measure.

6. Taking the weighted average of a subset of the scenario specific C-3 scores derives the final C-3 after-tax factor.

   (a) For the 50 scenario set, the C-3 scores are multiplied by the following series of weights:

   ---------- Weighting Table ----------

Scenario Rank:	17	16	15	14	13	12	11	10	9	8	7	6	5
Weight:	0.02	0.04	0.06	0.08	0.10	0.12	0.16	0.12	0.10	0.08	0.06	0.04	0.02

   The sum of these products is the C-3 charge for the product.

   (b) For the 12 scenario set, the charge is calculated as the average of the C-3 scores ranked 2 and 3, but cannot be less than half the worst scenario score.

7. If multiple asset/liability portfolios are tested and aggregated, an aggregate C-3 charge can be derived by first summing the S(t)'s from all the portfolios (by scenario) and then following Steps 2 through 6 above. An alternative method is to calculate the C-3 score by scenario for each product, sum them by scenario, then order them by rank and apply the above weights.

Single Scenario C-3 Measurement Considerations

1. GENERAL METHOD - This approach incorporates interim values, consistent with the approach used for bond, mortgage and mortality RBC factor quantification. The approach establishes the risk measure in terms of an absolute level of risk (e.g., solvency) rather than volatility around an expected level of risk. It also recognizes reserve conservatism, to the degree that such conservatism hasn't been used elsewhere.

2. INITIAL ASSETS = RESERVES - Consistent with appointed actuary practice, the cash flow models are run with initial assets equal to reserves; that is, no surplus assets are used.

3. AVR - Existing AVR-related assets should not be included in the initial assets used in the C-3 modeling. These assets are available for future credit loss deviations over and above expected credit losses. These deviations are covered by C-1 risk capital. Similarly, future AVR contributions should not be modeled. However, the expected credit losses should be in the cash flow modeling. (Deviations from expected are covered by both the AVR and the C-1 risk capital.)

4. IMR - IMR assets should be used for C-3 modeling. (Also see #9 – Disinvestment Strategy.)

5. INTERIM MEASURE - Retained statutory surplus (i.e., statutory assets less statutory liabilities) is used as the year-to-year interim measure.

6. TESTING HORIZONS - Surplus adequacy should be tested over a period that extends to a point at which contributions to surplus on a closed block are immaterial in relationship to the analysis. If some products are being cash flow tested for Asset Adequacy Analysis over a longer period than the 30 years generated by the interest-rate scenario generator, the scenario rates should be held constant at the year 30 level for all future years. A consistent testing horizon is important for all lines if the C-3 results from different lines of business are aggregated.

7. TAX TREATMENT - The tax treatment should be consistent with that used in Asset Adequacy Analysis. Appropriate disclosure of tax assumptions may be required.

8. REINVESTMENT STRATEGY - The reinvestment strategy should be that used in Asset Adequacy Analysis modeling.

9. DISINVESTMENT STRATEGY - In general, negative cash flows should be handled just as they are in the Asset Adequacy Analysis. The one caveat is, since the RBC scenarios are more severe, models that depend on borrowing need to be reviewed to be confident that loans in the necessary volume are likely to be available under these circumstances at a rate consistent with the model's assumptions. If not, adjustments need to be made.

   If negative cash flows are handled by selling assets, then appropriate modeling of contributions and withdrawals to the IMR need to be reflected in the modeling.

10. STATUTORY PROFITS RETAINED - The measure is based on a profits retained model, anticipating that statutory net income earned one period is retained to support capital requirements in future periods. In other words, no stockholder dividends are withdrawn, but policyholder dividends, excess interest, declared rates, etc., are modeled realistically and assumed, paid or credited.

11. LIABILITY and ASSET ASSUMPTIONS - The liability and asset assumptions should be those used in Asset Adequacy Analysis modeling. Disclosure of these assumptions may be required.

12. SENSITIVITY TESTING - Key assumptions shall be stress tested (e.g., lapses increased by 50 percent) to evaluate sensitivity of the resulting C-3 requirement to the various assumptions made by the actuary. Disclosure of these results may be required.

Appendix 1b - Frequently Asked Questions for Cash Flow Testing for C-3 RBC

1. Where can the scenario generator be found? What is needed to run it?

   The scenario generator is a Microsoft Excel spreadsheet. By entering the Treasury yield curve at the date for which the testing is done, it will generate the sets of 50 or 12 scenarios. It requires Windows 95 or higher. This spreadsheet and instructions are available on the NAIC Web site at (http://www.naic.org/committees_e_capad_lrbc.htm). It is also available on diskette from the American Academy of Actuaries.

2. The results may include sensitive information in some instances. How can it be kept confidential?

   As provided for in Section 8 of the Risk-Based Capital (RBC) For Insurers Model Act, all information in support of and provided in the RBC reports (to the extent the information therein is not required to be set forth in a publicly available annual statement schedule), with respect to any domestic or foreign insurer, which is filed with the commissioner constitute information that might be damaging to the insurer if made available to its competitors, and therefore shall be kept confidential by the commissioner. This information shall not be made public or be subject to subpoena, other than by the commissioner and then only for the purpose of enforcement actions taken by the commissioner under the Risk-Based Capital (RBC) For Insurers Model Act or any other provision of the insurance laws of the state.

3. The definition of the annuities category talks about “debt incurred for funding an investment account…” Could you give a specific description of what is intended?

   One example is a situation where an insurer is borrowing under an advance agreement with a federal home loan bank, under which agreement collateral, on a current fair value basis, is required to be maintained with the bank. This arrangement has many of the characteristics of a GIC, but is classified as debt.

4. The instructions specify that assumptions consistent with those used for Asset Adequacy Analysis testing be used for C-3 RBC, but my company cash flow tests a combination of universal life and annuities for that analysis and using the same assumptions will produce incorrect results. What was intended in this situation?

   Where this situation exists, assumptions should be used for the risk-based capital work that are consistent with those used for the Asset Adequacy Cash Flow Testing. In other words, the assumptions used should be appropriate to the annuity component being evaluated for RBC and consistent with the overall assumption set used for Asset Adequacy Analysis.

Appendix 2
Approach to Determining C3 Requirements for Variable Annuities and Similar Products

Introduction

This Appendix details a principle-based approach (PBA) to the determination of the C3 component of Risk-Based Capital for variable annuities and similar products.

The C3 amount is established to address the equity risk, the interest rate risk, and the expense recovery risk associated with variable annuities, with group annuities that contain death benefit or living benefit guarantees for their equity funds, and for insurance contracts that provide death benefit floors for equity fund performance.

Covered products consist of:
--all variable annuities except for Modified Guaranteed Annuities;
--group annuities containing guarantees similar in nature to VAGLBs or GMDBs; and
--all other products that contain guarantees similar in nature[1] to GMDBs or VAGLBs, even if the company does not offer the funds to which these guarantees relate, where there is no explicit reserve requirement (other than AG VACARVM) for such guarantees. If such a benefit is offered as a part of a contract that has an explicit reserve requirement other than AG CARVM[2], the methods of this capital requirement shall be applied to the benefit on a standalone basis.
-- Equity indexed products are excluded from this requirement
--Separate account products that guarantee an index and do not offer GMDBs or VAGLBs are excluded from the scope of this requirement.

The RBC formula has a charge for the expense allowance in reserves of 2.4 percent (pre-tax) if the surrender charges are based on fund contributions and the fund balance exceeds the sum of premium less withdrawals; otherwise the charge is 11 percent. This amount provides for the possible non-recovery of the full "CARVM Allowance," if the stock market performs poorly. Since this impact will be captured directly in the scenario modeling or in the Alternative Method, this separate requirement is no longer necessary for products covered by C-3 Phase II. For variable annuities with no living or death benefit guarantees, the Alternative Method continues to use this calculated amount.

The projection methodology used to calculate the Total Asset Requirement ("TAR"), as well as the approach used to determine the Alternative Methodology, is based on the following set of principles. These principles should be followed when applying the methodology in these recommendations and analyzing the resulting TAR[3].

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[1] The term "similar in nature", as used above is intended to capture both current products and benefits as well as products and benefit designs that may emerge in the future. Examples of the currently known designs are listed in footnote #2 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 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).

[2] For example, a group life contract that wraps a GMDB around a mutual fund would generally fall under the scope of the this requirement 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, this requirement 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.

[3] Note the following when considering these principles:

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.

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

Principle 2. The calculation of TAR 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 statutory deficiencies is calculated. The analysis reflects Prudent Best Estimate (see the definition of Prudent Best Estimate in the Glossary of this Report) assumptions for deterministic variables and is performed in aggregate (subject to limitations related to contractual provisions)[4] 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 TAR 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 consistent with the quantification of other risks in the NAIC Life RBC formula.

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 TAR is based on the results derived from the application of the stochastic cash flow model to scenarios while the actual capital 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 an insurer'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 quantifying the TAR using the AAA recommendations. 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 TAR 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 method defined in this Appendix applies to all variable annuities and similar products, supplemental benefits, and riders on those policies, whether directly written or assumed through reinsurance.

[4] Examples where full aggregation between contracts may not be possible include experience rated group contracts and the operation of reinsurance treaties.

Appendix 2
Approach to Determining C3 Requirements for Variable Annuities and Similar Products

The C3 RBC amount to be calculated is based on a prospective valuation method that appropriately captures all material C3 risks underlying the product being valued, the revenue to fund those risks, and the effect of any risk mitigation techniques.

While the method contemplates a stochastic approach to the determination of appropriate values, a deterministic approach may be sufficient for certain products, depending on the nature of the risks. A stochastic approach may be necessary for other products.

The only assumptions for which stochastic processes were considered are those for equity returns. All other assumptions which are neither stochastically determined nor prescribed should incorporate appropriate margins for uncertainty.

Assumptions should be updated as experience data emerges and expectations of future experience and economic conditions change. In other words, assumptions are not locked in at issue.

Finally, it is recognized that 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. 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 and hence, uncertainty in future experience is an important consideration when determining the amount being valued. As such:

1. The actuary must take the model's limitations into consideration when setting assumptions, applying the methodology and determining the appropriateness of the resulting amounts.
2. 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. Therefore, the use of assumptions, methods, models, risk management strategies (e.g., hedging), other Derivative Programs, structured investments or any other risk transfer arrangements (such as reinsurance) that serve to materially reduce the calculated amounts without also reducing risk on scenarios similar to those used in the actual cash flow modeling are inconsistent with these principles.

The amount reported on Lines (35) and (37) relating to Variable Annuities and Similar Products is calculated using a nine-step process. Terms that are capitalized defined in Section 1.

(1). The first step is to determine the Total Asset Requirement for Variable Annuities and Similar Products by applying the methodology described in Sections 1 - 10.

(2). The second step is to reduce the amount calculated in (1) above by the interest rate portion of the risk as determined per Section 8 (i.e., only the separate account market risk is included in this step).

(3). The third step is to calculate the Standard Scenario Amount. This step is summarized in Section 11.

(4). Take the greater of the amounts from steps (2) and (3).

(5). Apply the smoothing and transition rules (if applicable) to the amount in step (4). This step is summarized in Section 12.

(6). Add the general account interest rate portion of the risk to the amount in step (5).

(7). Subtract the reported statutory reserves for the business subject to the Report from the amount calculated in step (6). Floor this amount at $0. See Section 13 for reference.

(8). Divide the result from step (7) by 0.65 to arrive at a pre-tax amount.

(9). Split the result from step (8) into an interest rate risk portion and a market risk portion. Note that the interest rate portion may not equal the interest rate portion of the risk used in steps (2) and (6) above even after adjusting these to a pre-tax basis. The interest rate portion of the risk should be included in Line (35) and the market risk portion in Line (37). See Section 14 for reference.

Appendix 2
Approach to Determining C3 Requirements for Variable Annuities and Similar Products

Section 1. Definitions

The following terms shall have the indicated meanings for purposes of this Appendix:

A. Accumulated Deficiency. The projected working reserve, if any, less the annual statement value of projected assets and measured as of the projection start date and as of the end of each projection year.

B. Actuarial Report. A document prepared by the company that summarizes all of the material decisions supporting the calculation of the Reported Amount, including assumptions, margins and methodologies used to calculate the Reported Amount.

C. Cash Flow Model. A model designed to simulate asset and liability cash flows.

D. Cash Surrender Value. The amount available to the contract/policyholder, if any, due to surrender of the contract/policy, prior to any outstanding contract/policy indebtedness and net of any applicable surrender charges. The cash surrender value shall reflect any applicable 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 not reported at market value. (Note: where there is a group certificate and it has a cash value, this applies to the certificate within the group contract/policy).

E. 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 this Appendix (particularly Principle 5) and shall, at a minimum, identify:

1) the specific risks being hedged (e.g., delta, rho, vega, etc.),
2) the hedge objectives,
3) the risks not being hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.),
4) the financial instruments that will be used to hedge the risks,
5) the hedge trading rules including the permitted tolerances from hedging objectives,
6) the metric(s) for measuring hedge effectiveness,
7) the criteria that will be used to measure effectiveness,
8) the frequency of measuring hedging effectiveness ,
9) the conditions under which hedging will not take place, and
10) 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 these recommendations (e.g., equity indexed annuities) do not currently qualify as a Clearly Defined Hedging Strategy under these recommendations.

F. Conditional Tail Expectation (CTE). A risk measure that is calculated as the average of all modeled outcomes (ranked from lowest to highest) above a prescribed percentile.

G. Contractholder Behavior. Any action a policyholder, contract holder or any other person with the right to elect options, such as a certificate holder, may take under a policy or contract subject to this Act including, but not limited to, lapse, withdrawal, transfer, deposit, premium payment, loan, annuitization, or benefit elections prescribed by the policy or contract but

excluding events of mortality or morbidity that result in benefits prescribed in their essential aspects by the terms of the policy or contract.

H. Derivative Instrument. An agreement, option, instrument or a series or combination thereof:

a. To make or take delivery of, or assume or relinquish, a specified amount of one or more underlying interests, or to make a cash settlement in lieu thereof; or

b. That has a price, performance, value or cash flow based primarily upon the actual or expected price, level, performance, value or cash flow of one or more underlying interests.

This includes, but is not limited to, an option, warrant, cap, floor, collar, swap, forward or future, or any other agreement or instrument substantially similar thereto or any series or combination thereof. Each Derivative Instrument shall be viewed as part of a specific Derivative Program.

I. Derivative Program. A program to buy or sell one or more Derivative Instruments or open or close hedging positions to achieve a specific objective. Both hedging and non-hedging programs (e.g., for replication or income generation objectives) are included in this definition.

J. Discount Rates. The path of rates used to derive the present value.

K. Duration. The period of time elapsed from the Projection Start Date to a future date within the Projection Period.

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

M. Guaranteed Minimum Death Benefit (GMDB) - The 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.

N. Guaranteed Minimum Income Benefit (GMIB) – The GMIB is a VAGLB design for which the benefit is contingent on annuitization of a variable deferred annuity contract 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.

O. Net Revenue Sharing Income. The amount of Revenue Sharing to be included in cashflow projections.

P. Non-Guaranteed Elements (NGE). Either: (a) dividends under participating policies or contracts; or (b) other elements affecting life insurance or annuity policyholder/contract holder costs or values that are both established and subject to change at the discretion of the insurer.

Q. Policy. A policy included in the scope of this appendix.

R. Projection Start Date. The date on which the Projection Period begins.

S. Projection Year. A 12-month period starting on the Projection Start Date or an anniversary of the Projection Start Date.

T. Projection Interval. The time interval used in the Cash Flow Model to project the cash flow amounts (e.g. monthly, quarterly, annually).

U. Projection Period. The period over which the Cash Flow Model is run.

V. Prudent Best Estimate - The deterministic assumptions to be used for modeling 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. The actuary shall follow the principles discussed in this appendix in determining "prudent best estimate" assumptions. A "prudent best estimate" assumption would normally be defined 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, the larger the margin. Each margin should serve to increase the liability or provision 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 margin 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.

W. Qualified Actuary. An actuary who meets the qualifications as defined in Section 7 (Certification and Documentation Requirements) to certify that the amounts for the policies subject to this report have been calculated following all applicable laws, regulations, actuarial guidelines (AGs) and Actuarial Standards of Practice. The Qualified Actuary shall be referred to throughout this appendix as "the actuary."

X. Risk Factor. An aspect of future experience that is not fully predictable on the Valuation Date.

Y. Revenue Sharing. Revenue Sharing, for purposes of these requirements, 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/or 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 these requirements shall be included in the definition of Revenue Sharing.

Z. Scenario. A sequence of outcomes used in the cash flow model, such as a path of future interest rates, equity performance, or separate account fund performance.

AA. 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 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. Payout annuities without minimum payout or performance guarantees are neither considered to contain nor to be VAGLBs.

BB. Working Reserve - For doing the necessary projections, the concept of a Working Reserve is introduced in order to simplify the calculations. 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 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 annuitizations that occur during the projection, the valuation interest rate as of the current valuation date may be used in determining the Working Reserve. Alternatively, if an integrated model of equity returns and interest rates is used, a future estimate of valuation interest rates may be incorporated into the Working Reserve. For contracts not covered above including variable payout annuities with liquidity options or variable payout annuities that provide alternative benefit designs, e.g., joint and last survivor, life with period certain, etc., the actuary shall determine the Working Reserve in a manner that is consistent with the above requirements. For example, for many reinsurance contracts and group insurance contracts the working reserve is zero.

Section 2. Definition of General Methodology

All covered products that contain any living benefit guarantees, whether written directly or assumed through reinsurance, must utilize scenario testing to establish capital requirements. Variable annuities with no such guarantees may use scenario testing or the "Alternative Method" described below. Other covered products must utilize scenario testing, unless sufficient modeling is done to allow adjustment of the Alternative Method factors.

The methodology involves running a cash flow testing model over a number of scenarios, calculating a value for each and basing the total asset requirement (including reserves) on the distribution of those results. The RBC requirement is the difference between the total asset requirement and the reserve with an adjustment for differences between tax reserves and statutory reserves.

Projections using stochastic market scenarios are run for the book of business (in aggregate) for all contracts falling under the scope of this requirement, reflecting product features, anticipated cash flows, the parameters associated with the funds being used, expenses, fees, Federal Income Tax, hedging, and reinsurance. Cash flows from any fixed account options should also be included.

For each scenario, the C-3 asset increase needed is the smallest of the series of present values S(t)*pv(t), where S(t) is statutory assets less liabilities for the products in question at the end of year t, and pv(t) is the accumulated discount factor for t years using the after-tax swap rates (or post-tax one year Treasury rates for that scenario, if applicable). For this purpose, t should range from 0 (i.e. the valuation date) to a point such that the effect of further extension is not material.

1. Scenarios

Scenarios will consist of a sufficient number of equity scenarios, adequate for the purpose, created by the company. The equity scenarios will need to meet the calibration methodology and requirements outlined in Section 3. Guaranteed Fund results need to reflect the risk of interest rate shocks and several alternatives for doing so are available (see Section 9). If stochastic interest rate scenarios are not part of the model being used, the GMIB results need to reflect the impact of the uncertainty in interest margins (see Section 7).

2. Asset/Liability Model

Asset/Liability models are to be run that reflect the dynamics of the expected cash flows for the entire contract, given the guarantees provided under the contract. Federal Income Tax, 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 should 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).

For large blocks of business, the actuary may employ grouping methods to in-force seriatim data in order to improve model run times. Care needs to be exercised when aggregating data for RBC purposes. Grouping methods must retain the characteristics needed to model all material risks and options embedded in the liabilities. RBC needs to cover "tail scenarios" and these are impacted by low probability, high impact scenarios. This may require more granularity (i.e., model points) in the grouping of data than what is needed for other purposes. Testing indicates that, typically, if each "cell" is assumed to have parameters equal to its mean or midpoint, the capital requirements are understated. This implies the need for either fine subdivision of the book of business, use of a value other than the mean, or an appropriate error adjustment.

Actuaries may want to consider the following when grouping data;

- Various breakpoints for "in-the-moneyness".
- Grouping funds that have similar risk/return characteristics.
- Product variations (e.g., various types of living and/or death benefit options).
- Annuitant and/or owner age.
- Duration of contract.
- Market
- Distribution channel.
- Other factors which could significantly impact the results.

It is important that adequate testing be done to validate models on both a static and dynamic basis. The model used must fit the purpose. The input data, assumptions, and formulas/calculations should all be validated. Peer review is recommended.

3. Assets

For the projections of accumulated statutory surplus, 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. The mix of assets between separate account and general account assets should be consistent with that used for cash flow testing. 100% of separate account assets held in support of these products should be included in the modeling. If specific "hedge assets," such as equity put options, are being held for the benefit of these products, these are reflected in the model in full and other general account assets assigned are reduced accordingly. In many instances the initial general account assets may be negative, resulting in an interest expense. Since the capital definition depends on statutory surplus projections, assets should be valued at their annual statement value.

4. Fund categorization

The funds offered in the product may be grouped for modeling. Various grouping practices are provided below. Regardless of the method chosen, fundamental characteristics of the fund should be reflected and the parameters should have the appropriate relationship to the required calibration points of the S&P 500. The modeling should reflect characteristics of the efficient frontier (i.e., returns generally cannot be increased without assuming additional risk).

An appropriate proxy for each variable account must be designed in order to develop the investment return paths. This does not mean that unique scenarios need to be developed for each individual variable fund. In most applications, this would be impractical and therefore, some grouping will be necessary. However, the development of the proxy scenarios 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. As noted, this 'mapping' is typically not 'one-to-one', but 'many-to-several'.

It would rarely be appropriate to estimate the stochastic model parameters (for the proxy) directly from actual company data. Rather, the proxy would normally be expressed as a linear combination of recognized market indices (or sub-indices). This approach has several distinct advantages:

- A small number of well-developed data series can be used to model a wide range of funds.
- It promotes consistency in practice.
- Historic data is generally available over long time periods. This enhances the reliability of any model parameters estimated from the empirical data.

The proxy construction process should include an analysis that establishes a firm relationship between the investment return proxy and the specific variable funds. Such an analysis can include, but would not be limited to the following:

- Portfolio objectives
- MorningStar classification
- Asset composition
- Historical returns
- Performance benchmark
- Market beta
- AG 34 classifications

When sufficient fund performance information exists, the analysis should examine the relationship of these data to the market/sector indices. Due to shifts in investment objectives, fund manager changes and tactical allocation (e.g., market timing), this comparison may not be straightforward, but would ideally include a study of serial correlations, tracking error and asset composition.

If credible historical fund data is not available, the proxy should be constructed by combining asset classes and/or employing allocation rules that most closely reflect the expected long-term composition of the specific fund given the investment objectives and management strategy. The relevant historic market data can then be used to estimate parameters. If sufficient historical market (or sub-sector) data does not exist, the return-generating process should reflect the contribution of each component by reference to some 'efficient markets' hypothesis.

However defined, efficient market theory generally posits that higher expected returns can only be attained by assuming greater risk. While the historic market data does not indicate a clearly defined 'risk-return' relationship, it would be imprudent to ignore the concept of market efficiency in establishing the proxy funds and the associated model parameters used to generate the investment return scenarios.

5. Prudent Best Estimate Mortality Assumptions

Specific Guidance and Requirements for Setting Prudent Best Estimate Mortality Assumptions is given in Section 4.

Specific Guidance and Requirements for reflecting Prudent Best Estimate Mortality Assumptions under the Alternative Method is given in Section 5.

6. Contractholder Behavior

Specific Guidance and Requirements for setting contractholder behavior assumptions is given in Section 6.

7. 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 these requirements shall be included in the projections. If the company is following a clearly defined hedging strategy and the modeling method is used, the stochastic modeling should take into account the appropriate costs and benefits of hedge positions expected to be held in the future through the execution of that strategy. This recognizes that a hedging strategy may not require hedge positions to be held at a particular point in time; however, allowance for the impact of hedge positions not currently held, is only permitted if the insurer is following a clearly defined hedging strategy that is in accordance with the investment policy adopted by the Board of Directors, or an authorized committee. 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 should be made. Section 8 details the standards for this modeling.

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.

8. Revenue Sharing

Projections of Accumulated Deficiencies may include income from projected future Revenue Sharing, as defined in the glossary, 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[5];

(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.

The amount of Net Revenue Sharing Income to be used shall reflect the actuary's assessment 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.

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.[6]

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

[6] Because the uncertainty would be expected to increase over time, it may be necessary to decrease the portion for later periods.

To the extent the agreement(s) guarantees[7] 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[8].

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 above) shall be included in the projections as a company expense under the requirements of section 2 (Asset/Liability Model), above. 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 that reduce the Net Revenue Sharing Income.

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.

9. Expected Interest Rates

For discounting future surplus needs and for earnings on projected general account investments (beyond the maturity of the current assets), companies that do not use an integrated model are to use the implied forward rates from the swap curve. Companies that do have an integrated model may use the rates generated by that model or the swap curve, but must use the method chosen consistently from year to year. Whether from a model or from the swap curve, the discount rates need to be reduced for Federal Income Tax. Interest earnings on existing fixed assets should be reduced to reflect expected credit losses.

Assumptions for GMIB purchase rate margins are discussed in Section 7.

10. Interest Rate Risk

C3 interest rate risk is to be recognized for all variable annuities in calculating RBC according to methods outlined in this report. There are a number of ways in which this may be accomplished (see Section 9). In reflecting this risk:

i) Companies may combine the guaranteed fund portions of variable annuities and similar contracts with the other interest sensitive products included in C3 interest risk or may handle them separately, and differently.

ii) If the company is "exempt" from regular C-3 Phase 1 scenario testing, it may elect to be non-exempt for the variable annuity portion or for all C3 interest rate testing. However, a company that makes such a choice may not revert to the factor method without regulatory approval.

[7] 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.

[8] 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.

8. Liabilities

For the purposes of capital determination, "statutory surplus" is based on a liability value at time t equal to the Working Reserve. This will result in a surplus at the start of the projections equal to the excess of the starting value of assets included in the model over the Working Reserve.

9. Asset Requirements for a Specific Scenario

The Additional Asset Requirement (AAR) for a particular scenario is the negative of the lowest present value of statutory surplus at any year-end, including the current one. This value may be negative (sufficient) or positive (deficient). The Scenario Specific Total Asset Requirement for that scenario is the sum of the AAR plus the starting assets.

10. Determination of Total Asset Requirement and Risk Based Capital using CTE in the NAIC RBC framework

Having determined the Total Asset Requirement for each scenario, the values are sorted by amount and the average of the highest 10% is taken. This is the Total Asset Requirement for the business being evaluated.

The Risk Based Capital requirement is the Total Asset Requirement adjusted for taxes, minus the statutory reserve actually held.

Tax Adjustment: Under the U.S. IRC the tax reserve is defined. It can never exceed the statutory reserve nor be less than the cash surrender value. If tax reserves assumed in the projection are set equal to Working Reserves and if tax reserves actually exceed Working Reserves at the beginning of the projection, a tax adjustment is required.

A tax adjustment is not required in the following situations:

- Tax reserves are projected directly; that is, it is not assumed that projected tax reserves are equal to Working Reserves, whether these are cash values or other approximations.
- Tax reserves at the beginning of the projection period are equal to Working Reserves.
- Tax reserves at the beginning of the projection period are lower than Working Reserves. This situation is only possible for contracts without cash surrender values and when these contracts are significant enough to dominate other contracts where tax reserves exceed Working Reserves. In this case the modeled tax results are overstated each year for reserves in the projection, as well as the projected tax results reversed at the time of claim.

If a tax adjustment is required the Total Asset Requirement (TAR) must be increased on an approximate basis to correct for the understatement of modeled tax expense. The additional taxable income at the time of claim will be realized over the projection and will be measured approximately using the "duration to worst", i.e. the duration producing the lowest present value for each scenario. The method of developing the approximate tax adjustment is described below.

The increase to TAR may be approximated as the corporate tax rate (i.e., 35%) times "f" times the difference between tax reserves and Working Reserves at the start of the projections. For this calculation, f is calculated as follows. For the scenarios reflected in calculating CTE(90), the lowest of these present values of accumulated statutory surplus is determined for each calendar year-end and its associated projection duration is tabulated. At each such duration, the ratio of the number of contracts in force (or covered lives for group contracts) to the number of contracts in force (or covered lives) at the start of the modeling projection is calculated. The average ratio is then calculated, over all CTE(90) scenarios, and f is one minus this average ratio. If instead, RBC is determined under the standard scenario method then f is

based on the ratio at the worst duration under that scenario. If the Alternative Method is used, f is approximated as .5.

11. Timing of Calculations

In order to allow time for the work required to develop the capital requirements, an estimated value is permitted for the year-end annual statement. For the electronic filing of risk-based capital the reported Authorized Control Level Risk-Based Capital should be no less than the amount required, using year-end data but not necessarily requiring a complete recalculation as of year-end using the NAIC Instructions which include this methodology for Variable Annuities and Similar Products. If the reported Authorized Control Level Risk-Based Capital for a company exceeds that printed in the annual statement by more than 5 percent, or if the reported Risk-Based Capital triggers regulatory action, a revised filing of the annual statement with the reported results is required to be made to the NAIC and the state of domicile by June 15; otherwise re-filing is permitted but not required.

12. C-1 Expense Allowance Elimination for Covered Products

The current RBC formula has a charge for the expense allowance in reserves of 2.4 percent (pre-tax) if the surrender charges are based on fund contributions and the fund balance exceeds the sum of premium less withdrawals; otherwise the charge is 11 percent. This amount provides for the possible non-recovery of the full "CARVM Allowance", if the stock market performs poorly. Since this impact will be captured directly in the scenario modeling or in the Alternative Method, this separate requirement is no longer necessary for products covered by C-3, Phase II. For variable annuities with no living or death benefit guarantees, the Alternative Method continues to use this calculated amount.

Alternative Method

A company may choose to develop capital requirements for Variable Annuity contracts with no VAGLBs, by using the Alternative Method, as defined in Section 10 of this report instead of using scenario testing if it hasn't used scenario testing for this purpose in previous years. Companies are encouraged to develop models to allow scenario testing for this purpose. Once a company uses the stochastic modeling methodology for a block of business, the option to use the Alternative Method is no longer available for that part of its business. Contracts containing VAGLBs must be evaluated by scenario testing. Contracts not containing VAGLBs, but that differ from those for which Alternative Method factors are provided, may use a modified set of factors as described in Section 11.

Section 3. Scenario Requirements

This section outlines the requirements for the stochastic models used to simulate fund performance. 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 section focuses on the S&P500 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 financial projections, the actuary must consider the costs of managing the investments and converting the assets into cash when necessary.[9] Specifically, the simulations must reflect applicable fees and policyholder charges in the development of projected account values.

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 capital requirements.[10]

State 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 capital levels must be available in an electronic format to facilitate any regulatory review.

Calibration Criteria for Equity Returns

Table 1 provides the proposed standard for the calibration of equity return models.

Table 1: Calibration Standard for Total Return Wealth Ratios

Percentile	1 Year	5 Years	10 Years	20 Years
2.5%	0.78	0.72	0.79	n/a
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
95.0%	1.35	2.45	4.36	11.70
97.5%	1.42	2.72	5.12	n/a

[9] Ibid., section 3.4.1(d)

[10] 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) for long-term capital modeling.

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.

To interpret the above values, consider the 5-year point of 0.72 at the $\alpha = 2.5^{th}$ percentile. This value implies that there is a 2.5 percent probability of the accumulated value of a unit investment being less than 0.72 in 5-years time, ignoring fees and expenses and without knowing the initial state of the process (i.e., this is an unconditional[11] probability). For left-tail calibration points (i.e., those quantiles less than 50%), lower factors after model calibration are required. For right-tail calibration points (quantiles above 50%), the model must produce higher factors.

The historic data do not permit credible inferences about long-term equity returns in the tails of the distribution. As such, factors for the 20-year horizon at the 2.5% and 97.5% points are deliberately excluded from the calibration.

Using the Calibration Points

The actuary may need to adjust the model parameters in order to satisfy the calibration criteria in Table 1. This can be accomplished in a variety of ways, but a straightforward approach would modify the parameters controlling 'drift' (expected continuous return) and 'volatility' (standard deviation of returns). This might be accomplished analytically, but in most practical applications would require simulation.

As a first step, the actuary should determine which tail (left, right or both) is most relevant for the business being valued and then identify those calibration points not satisfied by the current scenario set. All else being equal, lowering drift will decrease the resulting wealth factors, while raising volatility will decrease the left-tail factors (i.e., those quantiles < 50%) and increase the right. Changes to both drift[12] and volatility parameters can obviously affect the entire shape of the curve, but as a general rule the 'drift' terms have less impact over the shorter holding periods (i.e., the 1-year 'tail factors' are more affected by volatility).

As an example, suppose the company is using the independent lognormal ("ILN") model for equity returns. This is a two-parameter model whereby the log (i.e., continuous) returns are normally distributed with constant mean μ and variance σ^2. From the historic monthly S&P500TR data (December 1955 to December 2003, inclusive) we obtain the monthly maximum likelihood estimators of $\mu = 0.008356$ (10.03% annualized) and $\sigma = 0.042558$ (14.74 % annualized).[13]

Without adjustment, ILN scenarios generated from these parameters would not satisfy the calibration requirements. Nevertheless, lowering the drift to $\mu = 0.006667$ (8% annualized) and increasing the standard deviation to $\sigma = 0.050518$ (17.5% annualized) would satisfy Table 1. This ILN model has an expected total return of 10% per annum. However, the resulting wealth factors would be too fat-tailed over the longer holding periods (relative to the criteria imposed by Table 1), indicating more conservatism than

[11] In this context, the term "unconditional" should be interpreted to mean that the resulting values would be obtained "on average over the long term". This can be determined by using long-run or neutral values (e.g., median) for the initial state variables or by running the model with "current" state parameters over a longer period and ignoring the returns for the first 10 years.

[12] The term "drift" generically refers to those parameters which control the trend in the return process. The term volatility is reserved for the model components which affect the standard deviation of returns. For some models, such a fine distinction is not possible.

[13] Here, the parameters μ and σ are respectively the annualized mean and standard deviation of the associated normal distribution for the log (i.e., continuous) returns. μ is sometimes called the "drift" or "trend" parameter and is the expected log return over a 1 year horizon. The volatility parameter σ is the annualized standard deviation of the log returns.

would strictly be necessary. As such, it should be clear that a two-parameter model (such as the ILN) does not offer much flexibility – to obtain a 'better fit', it would be necessary to introduce more parameters.[14]

The scenarios need not strictly satisfy all calibration points, but the actuary should be satisfied that any differences do not materially reduce the resulting capital requirements. In particular, the actuary should be mindful of which tail most affects the business being valued. If capital is 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 benefit equal to a percentage of the gain would be most sensitive to the right tail, etc.), it is not absolutely necessary to meet the right (left) calibration points.

If the scenarios are 'close' to the calibration points, an acceptable method to true up the scenarios is to start with the lowest bucket not meeting the calibration criteria (e.g., one year factor at $\alpha = 2.5\%$) and randomly duplicate (or re-generate) a scenario meeting this criteria until the set of scenarios meets this calibration point. If a fixed number of scenarios are required, a scenario can be eliminated at random in the first higher bucket that satisfies the calibration criteria. The process would continue until all one-year calibration points are achieved and then be repeated for the 5, 10 and 20-year criteria. However, on completing the 'bucket' for a given holding period, it may be necessary to redo the tests for the other horizons to ensure they still meet the calibration points. It is acknowledged that this method is not statistically correct, but it is not anticipated that the process would introduce any material bias in the calculated capital requirements.

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.[15]

For models that require starting quantities for certain state variables[16], 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 alternative values can be clearly justified[17]. It should be noted that a different set of initialization parameters might produce scenarios that do not satisfy all the calibration points shown in Table 1.

Other Markets/Funds

Calibration of other markets (funds) is being left to the judgment of the actuary, but the scenarios so generated must be consistent with the calibration points in Table 1. 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.

[14] In particular, parameters are needed to model time-varying volatility.

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

[16] For example, the stochastic log volatility ("SLV") model described later in this appendix requires the starting volatility. Also, the regime-switching lognormal model requires an assumption about the starting regime.

[17] 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".

The actuary should document the actual 1, 5, 10 and 20-year wealth factors of the scenarios at the frequencies given in Table 1. 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 should 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[18].

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[19], with the co-efficients 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[20] 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 capital requirements. 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.

Discount Rates

For discounting future capital strain, the Federal Income Tax adjusted swap curve rates may be used. Alternatively, an economic model built into the scenario generator may be used to simulate 1-year Treasury rates. In the latter case, the rates must start at current levels, approximately satisfy the 'no arbitrage' principle (on an expected basis) and exhibit deviations from expected values generally consistent with the Phase I interest model. In addition, if interest rates are not assumed to be independent of the equity scenarios, the basis for the assumed relationship needs to be well documented.

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

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

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

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 capital 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 capital.

Random Number Generator

A good pseudo-random number generator provides a set of values that are statistically indistinguishable from a truly random sequence from the given distribution for a given application. There are many algorithms for generating pseudo-random numbers, but the quality varies widely between them. The user should not indiscriminately deploy a generator without first confirming (through statistical testing) that it performs adequately under the conditions for which it will be used. In particular, the generator should have sufficiently high periodicity[21] and not exhibit material bias or serial correlation[22] unless such attributes are specifically desired for valid and appropriate reasons.[23]

Many stochastic simulations require the "mapping" of generated U(0,1) values to the real line $(-\infty , +\infty)$ in order to obtain random samples from the Normal or some other distribution. Such mapping can be accomplished by a variety of methods, but some routines are much more robust than others. In particular, the actuary should ensure that the mapping accomplishes the objective of representing the desired distribution within the context of the application (e.g., with a suitable degree of randomness). In the past, issues have arisen in connection with the mapping being "continuous" and 1-to-1 (within the precision of the computer).[24]

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 ensure that the number of scenarios used provides 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.

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[21] Periodicity is defined as the number of values that can be produced by the generator before the sequence repeats itself.

[22] Serial correlation of lag *k* occurs when values separated by *k* numbers exhibit significant correlation.

[23] Many variance reduction techniques deliberately introduce bias as a means to improve efficiency in estimation. See the next section for additional commentary.

[24] Small deviations in the U(0,1) sample should be associated with appropriately small deviations in the Normal values.

Suppose the number of scenarios used for simulation is N. Hence, the CTE estimator at the α-confidence level is the average of the $k = N \times (1 - \alpha)$ order statistics (i.e., sample results ordered from highest to lowest). The standard error of the estimator is a function of α, CTE(α) and the (k+1) order statistics divided by the square root of k. So, to increase the precision of the calculations, it may be necessary to increase significantly the number of scenarios.

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 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.[25]

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 TAR compared to using pseudo-random Monte Carlo numbers.

A practical 'brute force' approach to estimating the standard error of the CTE estimator would be to generate M independent sets of scenarios (using the same model parameters) where each set contains N scenario paths. Provided M is reasonably 'large' (say, $M \geq 10$), a sample variance may be calculated on the M different CTE(α) values. A rough ($100\times\beta$) percent confidence interval for CTE(α) may then be constructed using the normal approximation: $\text{CTE}(\alpha) \pm \sigma \cdot \Phi^{-1}[0.5 \times (1+\beta)]$ where σ is the sample standard deviation of the CTE(α) estimators and Φ^{-1} is the inverse cumulative density function for the standard normal distribution. If the interval appears 'too wide' (e.g., interval width > 10% of the CTE estimate), more scenarios may be required.

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 ensure that the use of a more frequent (i.e., shorter) time step does not materially increase capital requirements. 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 surplus costs (on a present value basis) from the scenarios.[26]

[25] However, with careful implementation, many variance reduction techniques can work well for CTE estimators. See Manistre, B.J. and Hancock, G. (2003), "Variance of the CTE Estimator", *2003 Stochastic Modeling Symposium*, Toronto, ON, September 2003.

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

Scenario Generator

The Enhanced C-3 Phase I Interest Rate Generator should be used in generating any interest rate scenarios or regenerating pre-packaged fund scenarios for funds that include the impact of bond yields. Details concerning the Enhanced C-3 Phase I Interest Rate Generator can be found on the American Academy of Actuaries webpage at the following address http://www.actuary.org/pdf/life/c3supp_jan06.pdf. The Enhanced C3 Phase 1 Interest Rate Generator with its ability to use the yield curve as of the run date and to regenerate pre-packaged fund returns using interest rates scenarios based on the current yield curve replaces the usage of the March 2005 pre-packaged scenarios.

The Enhanced C-3 Phase I Interest Rate Generator produces scenarios for the following asset classes:[27]

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
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 (or U.S. Treasury Yields) over a 30-year horizon in comma-separated value format (**.csv*). These scenarios have been appropriately correlated so that the K^{th} scenario for each asset class should be used together and considered one 'future investment return scenario'. Hence, the scenarios can be combined (by blending the accumulation factors[28]) 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.

[27] Because the reserves calculated using projections involve cash flow projections, the pre-packaged scenarios were developed under the "real world" probability measure (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.

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

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

Section 4. Specific Guidance and Requirements for Setting Prudent Best Estimate Mortality Assumptions

The guidance and requirements in this Methodology Note apply for setting Prudent Best Estimate mortality assumptions when determining the TAR (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.

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. The sections below address guidance and requirements for determining expected mortality curves and 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 shown below.

For purposes of setting Prudent Best Estimate mortality assumptions, the products falling under the scope of these requirements 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.

The expected mortality curves 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 Total Asset Requirement. 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 Methodology Note, 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.

Determination of Expected Mortality Curves

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 below for additional considerations. Finally, if there is no data, the company shall use the applicable table, as required below.

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. Margins shall be applied to the expected mortality curves to reflect any data uncertainty and/or differences between the business segments. 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.

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. If mortality experience on the business segment is expected to be a-typical (e.g., demographics of target markets are known to have higher (lower) mortality than typical), these "no data" mortality requirements may not be adequate.

The following considerations shall apply to mortality data specific to the business segment for which assumptions are being determined (i.e., direct data or other than direct data discussed above):

1) **Under-reporting of deaths.** Mortality data shall be examined for possible under-reporting of deaths. Adjustments shall be made to the data if there is any evidence of under-reporting. Alternatively, exposure by lives or amounts on contracts for which death benefits were in the money may be used to determine expected mortality curves. Under-reporting 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. 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 recent historic exposures (e.g. the prior 3 to 7 years), should not result in an estimate of aggregate deaths less (greater) than actual 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 curves that differ 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, considerations 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.

Adjustment for Credibility to Determine for Prudent Best Estimate Mortality

A. Adjustment for Credibility. Expected mortality curves determined according to Section II above 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[29].

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.

C. Credibility Procedure. The credibility procedure used shall:

a. produce results that are reasonable in the professional judgment of the actuary,
b. not tend to bias the results in any material way,
c. be practical to implement,
d. give consideration to the need to balance responsiveness and stability,
e. take into account not only the level of aggregate claims but the shape of the mortality curve, and
f. 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.

The items identified above were developed from material contained in Actuarial Standard of Practice No. 25, "Credibility Procedures Applicable to Accident and Health, Group Term Life and Property/Casualty Coverages".

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 industry wide 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 below.

Future Mortality Improvement

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

[29] 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.

margin for error (increasing assumed rates of improvement if that results in a higher TAR, reducing them otherwise).

Documentation Requirements

All Segments. The documentation should include any material considerations necessary to understand the development of mortality assumptions for the statutory RBC calculation 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:

(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 compares to recent historic experience and comment on any differences.

(h) Discuss how the mortality assumptions used are consistent with the goal of achieving CTE(90) over the joint distribution of all future outcomes, in keeping with Principle #3 and Section 3.

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 RBC calculation. Describe how these differences were reflected in the mortality used in modeling.

If mortality assumptions for the statutory RBC calculation 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).

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.

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.

Section 5. Reflecting Prudent Best Estimate Mortality Using the Alternative Method

The factors published for use in the Alternative Method are based on 100% of the MGDB 94 ALB mortality table. Companies using the Alternative Method may use these factors directly or may reflect the actuary's Prudent Best Estimate of mortality expectations in calculating TAR. When using the actuary's Prudent Best Estimate of mortality the steps to be used are as follows:

1. The company will need to develop a set of mortality assumptions for use in making the modifications. In setting the expectations for expected mortality, the company should be guided by the definition of Prudent Best Estimate and the principles discussed in Section 3 and Section 4.

2. The company then will calculate net single premia at each issue age to be valued using both 100% of the MGDB 94 ALB table (using a 5 year age setback for females) and the table based on the actuary's Prudent Best Estimate of mortality. In making these calculations the company should assume 3.75% interest and a flat lapse rate of 7% per year.

3. The cost factor ($f\left(\tilde{\theta}\right)$ in Appendix 8) is then multiplied by the ratio of the NSP calculated using the Prudent Best Estimate of mortality to the NSP calculated using the MGDB 94 ALB table (using a 5-year age setback for females) for the specific age being valued.

4. The TAR is then calculated using the modified cost factor. All other factors are calculated as they would have been without this adjustment.

Note that once a company had used the modified method, the option to use 100% of the table is no longer available.

Section 6. 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. In comparison to non-elective options, elective contractholder options may be more driven by economic conditions.
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 Section 3)
- 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 profile by collecting and maintaining the data required to conduct credible and meaningful studies of contractholder behavior.

Section 7. GMIB Purchase Rate Margins

The GMIB purchase rate margin is the difference 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. The modeling for this benefit can either use a point estimate for this margin or model the margin directly using a stochastic model of interest rates. If a point estimate is being used, following is guidance on how to apply this method to estimate this margin. If a stochastic model of interest rates is used instead of a point estimate then no such adjustment is needed.

If a point estimate is being used, it is important that the margin assumed reflects:

a) Current market expectations about future interest rates at the time of annuitization, as described more fully below.

b) A downward adjustment to the interest rate assumed in the purchase rate basis since a greater proportion of contract-holders 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, described below.

To calculate market expectations of future interest rates, the par or current coupon swap curve is used (documented daily in Federal Reserve H15 with some interpolation needed). Deriving the expected rate curve from this swap curve at a future date is a three step process.

Step 1: Calculate the implied zero coupon rates using a "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. However, each of these discount factors are based on the forward curve and therefore are based on different rates (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.

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

Step 3: This step 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. The source for these averages is a research report by Solomon Brothers.[30] From this table, we can see that to get the rate the market expects a 1 year swap to have five years from now; we have to subtract the risk premium associated with six year rates (.95%) and add back that associated with 1 year rates (.50%), a net reduction of .45%.

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.

[30] Solomon Brothers, United States Fixed Income Research Portfolio Strategies, "A Framework for Analyzing Yield Curve Trades – Understanding the Yield Curve: Part 6," November 1995. The bond risk premia were calculated over the period 1970-94, see figure 2.

Appendix 2
Approach to Determining C3 Requirements for Variable Annuities and Similar Products

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%		

Exhibit: Derivation of discount rates expected in the future

A	B	C	D	E	F	G	H
Projection Years	Swap Curve Rate	P.V. of Zero Coupon	Forward 1 year Rate	Risk Premium	Risk Premium 5 Years Out	Expected Forward Rate In Five Years	P.V. of Zero Coupon In 5 Years
1	2.57%	0.97494	2.5700%	0.50%			
2	3.07%	0.94118	3.5879%	0.75%			
3	3.44%	0.90307	4.2193%	0.75%			
4	3.74%	0.86231	4.7268%	0.85%			
5	3.97%	0.82124	5.0011%	0.90%			
6	4.17%	0.77972	5.3250%	0.95%	0.50%	4.8750%	0.95352
7	4.34%	0.73868	5.5557%	1.00%	0.75%	5.3057%	0.90547
8	4.48%	0.69894	5.6861%	1.10%	0.75%	5.3361%	0.85961
9	4.60%	0.66049	5.8209%	1.15%	0.85%	5.5209%	0.81463
10	4.71%	0.62303	6.0131%	1.15%	0.90%	5.7631%	0.77024
Cell formulas for Projection Year 10:		=(1-B13* SUM(C4:C12)) /(1+B13)	=C12/C13-1		=E8	=D13-E13+F13	=H12/(1+G13)

Section 9. Methods of Calculating Capital Requirements for Interest Rate Risk on the Guaranteed Fund of Variable Annuities

The objective is to assign a value for the risk of unexpected interest rate shocks comparable to that assigned to fixed dollar interest sensitive products. This risk may result from either a traditional duration mismatch or from optionality in either the product or the supporting assets.

Ideally, a fully integrated model of equity returns and interest rates, with rate volatility and expectations and frequency and duration of yield curve inversions consistent with the "Phase I" requirements, would be run to develop an estimate of the (combined) market risks. (Documentation of the Phase I model can be found on the AAA web site at www.actuary.org/pdf/life/lrbc_october.pdf.) The US Treasury Fund scenarios within the 10,000 prepackaged scenarios qualify as meeting this standard. Although an integrated modeling approach is desirable a number of simpler approaches are acceptable.

For companies that are modeling their equity risks (i.e., not using the Alternative Method), these methods include:

a) Use the Microsoft® Excel workbook from C3 Phase I to generate 200 interest scenarios and then assign them in rotation to the stochastic equity scenarios being tested.

b) Run the variable annuity model assuming a predetermined fixed crediting rate (not less than the contract guarantees). In the equity modeling, earned interest would equal that rate increased for fees. Then calculate the C3 Phase I values using the scenario testing method as though that (or a higher rate) is the rate to be credited.

c) Run the variable annuity model as though no assets were in the guaranteed fund. Then develop the C3 requirement as if all the assets were in the guaranteed fixed fund. The final requirements for both equity and fixed C3 components would be an appropriate weighted-average of these results. For these calculations, the actual assets and liabilities are increased in proportion to their actual distribution.

If the method used to reflect interest rate risk doesn't develop separate values for interest and equity risk, the factors used for interest rate risk for fixed contracts may be used as an approximate value for combining with other c3 interest rate risk, with the remainder of the RBC being considered equity risk.

Companies that use AM factors for GMDB risk can either use the model based approach or the C-3 interest rate risk factors as required or permitted by the RBC Instructions for Interest Rate Risk to determine the interest rate risk capital requirement. In either case, report the C-3 Phase 1 modeling result or the interest rate risk factor amount as the interest rate risk amount and the AM factor based C-3 Phase 2 amount as the market risk amount.

Companies not exempt from scenario testing for C3 interest rate risk for fixed products are not exempt for these products either. "Exempt companies" may choose to use scenario testing for these products, either on a free standing basis or consolidated with the interest sensitive fixed products or to use the current factor based process applicable to fixed annuities. If they choose to use scenario testing in one year, they are to continue using that method in the future unless regulatory approval is given to using factors (for example, if the volume of such business has declined significantly).

Section 8. Modeling of Hedges

Initial Considerations

The appropriate costs and benefits of hedging instruments that are currently held by the company in support of the contracts subject to these requirements shall be included in the projections. If the company is following a Clearly Defined Hedging Strategy ("hedging strategy") in accordance with an investment policy adopted by the Board of Directors, a committee of Board members, or an authorized committee, the company is eligible to reduce the amount of Total Asset Requirement ("TAR") otherwise calculated using the modeling methodology. 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 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 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 refers to the hedging assets 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 document. Nor is the distinction between investment strategy and hedging strategy formally made here. Where necessary to give effect to the intent of the document, 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 these Recommendations shall be included in the stochastic cash flow model (the "model") used to calculate the risk based capital amount. Provided 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 risk based capital 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.

Appendix 2
Approach to Determining C3 Requirements for Variable Annuities and Similar Products

Background

The analysis of the impact of the hedging strategy on cash flows is typically performed using either 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 TAR 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 greatest present value of the accumulated deficiencies 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 RBC cash flow model.

Regardless of the methodology used by the company, the ultimate effect of the current hedging strategy (currently held hedge positions) on the TAR 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 TAR 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 generally varies inversely 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, transform some risks into others, introduce new risks or have other imperfections. For example, a delta-only hedging strategy does not adequately hedge the risks measured by the "Greeks" other than delta. Another example is that financial indices underlying typical hedging instruments typically do not perform exactly like the separate account funds, and hence the use of hedging instruments has the potential for introducing basis risk.

Calculation of TAR (reported)

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

Because most models will include at least some approximations or idealistic assumptions, TAR (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 TAR 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 "TAR (adjusted)". In some situations the determination of TAR (adjusted) may include both direct and indirect techniques.

Finally, the reported value for the TAR is given by:

$$\text{TAR (reported)} = \text{TAR (best efforts)} + E \times \text{MAX}[0,\text{TAR(adjusted)} - \text{TAR(best efforts)}].$$

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 a minimum of 0.05 (i.e., the greater the ability of the TAR(best efforts) model to capture all risks and uncertainties, the lower the value of *E*). If the model used to determine the "TAR(best efforts)" is "state of art", the value "TAR(adjusted)–TAR(best efforts)" may be nominal. On the other hand, if the model used to determine the "TAR(best efforts)" is simplistic, the value "TAR(adjusted)-TAR(best efforts)" may be significant.

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 risk based capital, 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 policyholder 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:

(1) hedging strategies with no initial investment that never lose money in any scenario and in some scenarios make money; or

(2) 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 as to why the actuary believes the situations are not material for determining TAR. If the results do materially rely directly or indirectly on the use of such strategies, the strategies may not be used for the TAR 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 TAR. 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.

Certification and Documentation

The actuary must provide a certification that the values for "E", TAR(adjusted) and TAR (best efforts) were calculated using the process discussed above and the assumptions used in the calculations were reasonable for the purpose of determining RBC. The actuary must document the method(s) and assumptions (including data) used to determine TAR(adjusted) and TAR(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 TAR. 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 Clearly Defined Hedging Strategy is the hedging strategy being used by the company in its actual day to day risk mitigation efforts.

Section 9. Alternative Method for GMDB Risks

This section describes the Alternative Method for GMDB exposure in significant detail; how it is to be applied and how the factors were developed. Factor tables have been developed using the Conditional Tail Expectation ("CTE") risk measure at two confidence levels: 65% and 90%. The latter is determined on an "after tax" basis and is required for the RBC C3 Phase II standard for Total Asset Requirement ("TAR"). The former is a pre-tax calculation and should assist the Variable Annuity Reserve Working Group ("VARWG") in formulating a consistent "alternative method" for statutory reserves.

General

1. It is expected that the Alternative Method ("AltM") will be applied on a policy-by-policy basis (i.e., seriatim). If the company adopts a cell-based approach, only materially similar contracts should be grouped together. Specifically, all policies comprising a "cell" must display substantially similar characteristics for those attributes expected to affect risk-based capital (e.g., definition of guaranteed benefits, attained age, policy duration, years-to-maturity, market-to-guaranteed value, asset mix, etc.).

2. The Alternative Method determines the TAR as the sum of the Cash Surrender Value and the following three (3) provisions, collectively referred to as the *Additional Asset Requirement* ("AAR"):

   - Provision for amortization of the outstanding (unamortized) surrender charges;
   - Provision for fixed dollar expenses/costs net of fixed dollar revenue; and
   - Provision for claims (in excess of account value) under the guaranteed benefits net of available spread-based revenue ("margin offset").

   All of these components reflect the impact of income taxes and are explained in more detail later in this Appendix.

3. The total AAR (in excess of cash surrender value) is the sum of the AAR calculations for each policy or cell. The result for any given policy (cell) may be negative, zero or positive.

4. For variable annuities without guarantees, the Alternative Method for capital uses the methodology which applied previously to all variable annuities. The charge is 11 percent of the difference between fund balance and cash surrender value if the current surrender charge is based on fund balance. If the current surrender charge is based on fund contributions, the charge is 2.4 percent of the difference for those contracts for which the fund balance exceeds the sum of premiums less withdrawals and 11 percent for those for which that is not the case. In all cases, the result is to be multiplied by 0.65 to adjust for Federal Income Tax. For in-scope contracts, such as many payout annuities with no cash surrender value and no performance guarantees, there is no capital charge.

5. For variable annuities with death benefit guarantees, the AAR for a given policy is equal to: $R \times (CA + FE) + GC$ where:

CA (Charge Amortization)	=	Provision for amortization of the outstanding (unamortized) surrender charges
FE (Fixed Expense)	=	Provision for fixed dollar expenses/costs net of fixed dollar revenue
GC (Guaranteed Cost)	=	Provision for claims (in excess of account value) under the guaranteed benefits net of available spread-based revenue ("margin offset")

The components *CA*, *FE* and *GC* are calculated separately. *CA* and *FE* are defined by deterministic "single-scenario" calculations which account for asset growth, interest, inflation and tax at prescribed rates. Mortality is ignored. However, the actuary determines the appropriate "prudent best estimate" lapses/withdrawal rates for the calculations. The components *CA*, *FE* and *GC* may be positive, zero or negative. $R = h(\circ)$ is a "scaling factor" that depends on certain risk attributes $\tilde{\theta}$ for the policy and the product portfolio.

6. The "Alternative Method" factors and formulas for GMDB risks (component *GC*) have been developed from stochastic testing using the 10,000 "Pre-packaged" scenarios (March 2005). The pre-packaged scenarios have been fully documented under separate cover – see http://www.actuary.org/pdf/life/c3supp_march05.pdf at the American Academy of Actuaries' website.

7. The model assumptions for the AltM Factors (component GC) are documented in the section of this Appendix entitled *Component GC*.

8. The table of *GC* factors that has been developed assumes male mortality at 100% of the MGDB 94 ALB table. Companies using the Alternative Method may use these factors, or may use the procedure described in Methodology Note C3-04 to adjust for the actuary's Prudent Best Estimate of mortality. Once a company uses the modified method for a block of business, the option to use the unadjusted table 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.

9. There are five (5) major steps in using the *GC* factors to determine the "*GC*" component of the AAR for a given policy/cell:

    a) Classifying the asset exposure;
    b) Determining the risk attributes;
    c) Retrieving the appropriate nodes from the factor grid;
    d) Interpolating the nodal factors, where applicable (optional);
    e) Applying the factors to the policy values.

    Categorizing the asset value for the given policy or cell involves mapping the entire exposure to one of the eight (8) prescribed "fund classes". Alternative Method factors are provided for each asset class. The second step requires the company to determine (or derive) the appropriate attributes for the given policy or cell. These attributes are needed to calculate the required values and access the factor tables:

    - Product form ("Guarantee Definition"), *P*.
    - Adjustment to guaranteed value upon partial withdrawal ("GMDB Adjustment"), *A*.
    - Fund class, *F*.
    - Attained age of the annuitant, *X*.
    - Policy duration since issue, *D*.
    - Ratio of account value to guaranteed value, ϕ.
    - Total account charges, *MER*.

    Other required policy values include:

    - Account value, *AV*.
    - Current guaranteed minimum death benefit, *GMDB*.
    - Net deposit value (sum of deposits less sum of withdrawals), *NetDeposits*[31].

[31] Net deposits are required only for certain policy forms (e.g., when the guaranteed benefit is capped as a multiple of net policy contributions).

- Net spread available to fund guaranteed benefits ("margin offset"), α.

The next steps – retrieving the appropriate nodes from the factor grid and interpolation – are explained in the section entitled *Component GC* of this Appendix. Tools are provided to assist the company in these efforts (see Section 7), but their use is not mandatory. This documentation is sufficiently detailed to permit the company to write its own lookup and extraction routines. A calculation example to demonstrate the application of the various component factors to sample policy values is shown in the section *Component GC* of this Appendix.

Component *CA*

Component *CA* provides for the amortization of the unamortized surrender charges using the actual surrender charge schedule applicable to the policy. Over time, the surrender charge is reduced and a portion of the charges in the policy are needed to fund the resulting increase in surrender value. This component can be interpreted as the "amount needed to amortize the unamortized surrender charge allowance for the *persisting* policies plus an 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 company must project the unamortized balance to the end of the surrender charge period and discount the year-by-year amortization under the following assumptions. All calculations should reflect the impact of income taxes.

- Net asset return (i.e., after fees) as shown in Table 1 below. These rates roughly equate to an annualized 5th percentile return over a 10-year horizon[32]. The 10 year horizon was selected as a reasonable compromise between the length of a typical surrender charge period and the longer testing period usually needed to capture all the costs on "more expensive" portfolios (i.e., lower available spread, lower AV/GV ratio, older ages, etc.). Note, however, that it may not be necessary to use these returns if surrender charges are a function of deposits/premiums.
- Income tax and discount rates (after-tax) as defined in Table 9 of this Appendix.
- The "Dynamic Lapse Multiplier" calculated at the valuation date (a function of Account Value (AV) ÷ Guaranteed Value (GV) ratio) is assumed to apply in each future year. This factor adjusts the lapse rate to reflect the antiselection present when the guarantee is in-the-money. Lapse rates may be lower when the guarantees have more value.
- Surrender charges and free partial withdrawal provisions should be reflected as per the contract specifications.
- "Prudent best estimate" lapse and withdrawal rates. Rates may vary according to the attributes of the business being valued, including, but not limited to, attained age, policy duration, etc.
- For simplicity, mortality may be ignored in the calculations.

Unlike the GC component, which requires the actuary to map the entire contract exposure to a single "equivalent" asset class, the *CA* calculation separately projects each fund (as mapped to the 8 prescribed categories) using the net asset returns in Table 10-1.

[32] A 5th percentile return is consistent with the CTE90 risk measure adopted in the C3 Phase II RBC methodology.

Table 9-1: Net Asset Returns for "CA" Component

Asset Class/Fund	Net Annualized Return
Fixed Account	Guaranteed Rate
Money Market and Fixed Income	0%
Balanced	–1%
Diversified Equity	–2%
Diversified International Equity	–3%
Intermediate Risk Equity	–5%
Aggressive or Exotic Equity	–8%

Component *FE*

Component *FE* establishes a provision for fixed dollar costs (i.e., allocated costs, including overhead *and* those expenses defined on a "per policy" basis) less any fixed dollar revenue (e.g., annual administrative charges or policy fees). The company must project fixed expenses net of any "fixed revenue" to the earlier of contract maturity or 30 years, and discount the year-by-year amounts under the following assumptions. All calculations should reflect the impact of income taxes.

- Income tax and discount rates (after-tax) as defined in Table 9 of this Appendix.
- The "Dynamic Lapse Multiplier" calculated at the valuation date (a function of MV÷GV ratio) is assumed to apply in each future year. This factor adjusts the lapse rate to reflect the antiselection present when the guarantee is in-the-money. Lapse rates may be lower when the guarantees have more value.
- Per policy expenses are assumed to grow with inflation starting in the second projection year. The ultimate inflation rate of 3% per annum is reached in the 8th year after the valuation date. The company must grade linearly from the current inflation rate ("CIR") to the ultimate rate. The CIR is the higher of 3% and the inflation rate assumed for expenses in the company's most recent asset adequacy analysis for similar business.
- "Prudent best estimate" for policy termination (i.e., total surrender). Rates may vary according to the attributes of the business being valued, including, but not limited to, attained age, policy duration, etc. Partial withdrawals should be ignored as they do not affect survivorship.
- For simplicity, mortality may be ignored in the calculations.

Component *GC*

The general format for *GC* may be written as: $GC = GV \times f\left(\tilde{\theta}\right) - AV \times \hat{g}\left(\tilde{\theta}\right) \times h\left(\hat{\theta}\right)$ where *GV* = current guaranteed minimum death benefit, *AV* = current account value and $\hat{g}\left(\tilde{\theta}\right) = \frac{\alpha}{\hat{\alpha}} \times g\left(\tilde{\theta}\right)$.

The functions $f(\circ), g(\circ)$ and $h(\circ)$ depend on the risk attributes of the policy $\tilde{\theta}$ and product portfolio $\hat{\theta}$. $h(\circ) = R$ was introduced in the "General" section as a "scaling factor". α is the company-determined net spread ("margin offset") available to fund the guaranteed benefits and $\hat{\alpha} = 100$ basis points is the margin offset assumed in the development of the "Base" tabular factors. The functions $f(\circ), g(\circ)$ and $h(\circ)$ are more fully described later in this section.

Rearranging terms for *GC*, we have $GC = f\left(\tilde{\theta}\right) \times \left[GV - AV \times z\left(\tilde{\theta}\right)\right]$. Admittedly, $z\left(\tilde{\theta}\right)$ is a complicated function that depends on the risk attribute sets $\tilde{\theta}$ and $\hat{\theta}$, but conceptually we can view $AV \times z\left(\tilde{\theta}\right)$ as a shock to the current account value (in anticipation of the adverse investment return

scenarios that typically comprise the CTE(90) risk measure for the AAR) so that the term in the square brackets is a "modified net amount at risk". Accordingly, $f\left(\widetilde{\theta}\right)$ can be loosely interpreted as a factor that adjusts for interest (i.e., discounting) and mortality (i.e., the probability of the annuitant dying).

In practice, $f(\circ), g(\circ)$ and $h(\circ)$ are not functions in the typical sense, but values interpolated from the factor grid. The factor grid is a large pre-computed table developed from stochastic modeling for a wide array of combinations of the risk attribute set. The risk attribute set is defined by those policy and/or product portfolio characteristics that affect the risk profile (exposure) of the business: attained age, policy duration, AV/GV ratio, fund class, etc.

Fund Categorization

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. This calculation should be made over a reasonably long period, such as 25 to 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.

All exposures/funds must be categorized into one of the following eight (8) asset classes:

1. Fixed Account
2. Money Market
3. Fixed Income
4. Balanced
5. Diversified Equity
6. Diversified International Equity
7. Intermediate Risk Equity
8. Aggressive or Exotic Equity

Fixed Account. The fund is credited interest at guaranteed rates for a specified term or according to a 'portfolio rate' or 'benchmark' index. The funds offer a minimum positive guaranteed rate that is periodically adjusted according to company policy and market conditions.

Money Market/Short-Term. The fund is invested in money market instruments with an average remaining term-to-maturity of less than 365 days.

Fixed Income. The fund is invested primarily in investment grade fixed income securities. Up to 25% of the fund within this class may be invested in diversified equities or high-yield bonds. The expected volatility of the fund returns will be lower than the Balanced fund class.

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 and may include high yield bonds as long as the total long-term volatility of the fund does not exceed the limits noted below. 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. These funds usually have a long-term volatility in the range of 8% – 13%.

Diversified Equity. The fund 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 category 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%.

Diversified International Equity. The fund is similar to the Diversified Equity class, except that the majority of fund holdings are in foreign securities. These funds should usually have a long-term volatility in the range of 14% – 19%.

Intermediate Risk Equity. The fund has a mix of characteristics from both the Diversified and Aggressive Equity Classes. These funds have a long-term volatility in the range of 19% – 25%.

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. The fund (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%.

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 policy where the "grouped fund 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 volatilities for each fund and the correlations between the prescribed asset classes as given in Table 10-2.
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" (σ for the exposure being categorized) by the following formula using the volatilities and correlations in Table 2.

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

where $w_i = \dfrac{AV_i}{\sum_k AV_k}$ 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* (see Table 2). An example is provided at the end of this section.

Table 9-2: Volatilities and Correlations 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**

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 policy). The current fund holdings (in dollars) for five sample contracts are shown in Table 10-3.

Table 9-3: Fund Categorization Example

	1	2	3	4	5
MV Fund X (Fixed Income):	5,000	4,000	8,000	-	5,000
MV Fund Y (Diversified Equity):	9,000	7,000	2,000	5,000	-
MV Fund Z (Aggressive Equity):	1,000	4,000	-	5,000	5,000
Total Market Value:	15,000	15,000	10,000	10,000	10,000
Total Equity Market Value:	10,000	11,000	2,000	10,000	5,000
Fixed Income % (*A*):	33%	27%	80%	0%	50%
Fixed Income Test (*A*>75%):	No	No	Yes	No	No
Aggressive % of Equity (B):	10%	36%	n/a	50%	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***	**Fixed Income**	**Intermediate**	**Diversified**

* 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."

As an example, the "Volatility of Current Fund Holdings" for policy #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%.

Derivation of Total Equivalent Account Charges (MER) and Margin Offset (α)

The total equivalent account charge ("MER") is meant to capture *all* amounts that are deducted from policyholder funds, not only those that are commonly expressed as spread-based fees. The MER, expressed as an equivalent annual basis point charge against account value, should include (but not be limited to) the following: investment management fees, mortality & expense charges, administrative loads, policy fees and risk premiums. In light of the foregoing, it may be necessary to estimate the "equivalent MER" if there are fees withdrawn from policyholder accounts that are not expressed as basis point charges against account value.

The margin offset, α, represents the total amount available to fund the guaranteed benefit claims and amortization of the unamortized surrender charge allowance after considering most other policy expenses (including overhead). The margin offset, expressed as an equivalent annual basis point charge against account value, may include the effect of Revenue Sharing in the same manner as would be done for modeling as described in section 6 of the Modeling Methodology, except as may be thereby permitted, should be deemed "permanently available" in all future scenarios. However, the margin offset should not include per policy charges (e.g., annual policy fees) since these are included in *FE*. It is often helpful to interpret the margin offset as $\alpha = MER - X + RS$, where *X* is the sum of:

- Investment management expenses and advisory fees;
- Commissions, bonuses (dividends) and overrides;
- Maintenance expenses, other than those included in *FE*; and
- Unamortized acquisition costs not reflected in *CA*.

And *RS* is the Revenue Sharing to the extent permitted as described above.

Product Attributes and Factor Tables

The tabular approach for the *GC* component creates a multi-dimensional grid (array) by testing a very large number of combinations for the policy attributes. The results are expressed as factors. Given the seven (7) attributes for a policy (i.e., *P*, *A*, *F*, *X*, *D*, ϕ, *MER*), two factors are returned for $f(\circ)$ and $g(\circ)$. The factors are determined by looking up (based on a "key") into the large, pre-computed multi-dimensional tables and using multi-dimensional linear interpolation.

The policy attributes for constructing the test cases and the lookup keys are given in Table 10-4.

As can be seen, there are $6 \times 2 \times 8 \times 8 \times 5 \times 7 \times 3 = 80{,}640$ "nodes" in the factor grid. Interpolation is only permitted across the last four (4) dimensions: Attained Age (*X*), Policy Duration (*D*), AV÷GV Ratio (ϕ) and MER. The "MER Delta" is calculated based on the difference between the actual MER and that assumed in the factor testing (see Table 10), subject to a cap (floor) of 100 bps (–100 bps).

Functions are available to assist the company in applying the Alternative Method for GMDB risks. These functions perform the factor table lookups and associated multi-dimensional linear interpolations. Their use is not mandatory. Based on the information in this document, the company should be able to write its own lookup and retrieval routines. Interpolation in the factor tables is described further later in this section.

Table 9-4: Nodes of the Factor Grid

Policy 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 (excl. GMDB)
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 1 : 45 2 : 55 3 : 60 4 : 65 5 : 70 6 : 75 7 : 80
Policy 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 1 : 0.50 2 : 0.75 3 : 1.00 4 : 1.25 5 : 1.50 6 : 2.00
Annualized Account Charge Differential from Table 10-10 Assumptions ("MER Delta")	0 : −100 bps 1 : +0 2 : +100

A test case (i.e., a node on the multi-dimensional matrix of factors) can be uniquely identified by its key, which is the concatenation of the individual 'policy attribute' keys, prefixed by a leading '1'. For example, the key '12034121' indicates the factor for a 5% roll-up GMDB, where the GV is adjusted pro-rata upon partial withdrawal, balanced asset allocation, attained age 65, policy duration 3.5, 75% AV/GV ratio and "equivalent" annualized fund based charges equal to the 'base' assumption (i.e., 250 bps p.a.).

The factors are contained in the file "C3-II GMDB Factors 100%Mort CTE(90) (2005-03-29).csv", a comma-separated value text file. Each "row" represents the factors/parameters for a test policy as identified by the lookup keys shown in Table 10-4. Rows are terminated by new line and line feed characters.

Each row consists of 5 entries, described further below.

1	2	3	4	5
Test Case Identifier (Key)	Base GMDB Cost Factor	Base Margin Offset Factor	Scaling Adjustment (Intercept)	Scaling Adjustment (Slope)

GMDB Cost Factor. This is the term $f\left(\widetilde{\theta}\right)$ in the formula for *GC*. The parameter set $\widetilde{\theta}$ is defined by $\left(P, A, F, X, D, \phi, MER\right)$. Here, ϕ is the AV/GV ratio for the benefit exposure (e.g., policy) under consideration. The values in the factor grid represent CTE(90) of the sample distribution[33] for the present value of guaranteed benefit cash flows (in excess of account value) in all future years (i.e., to the earlier of contract maturity and 30 years), normalized by guaranteed value.

Base Margin Offset Factor. This is the term $g\left(\widetilde{\theta}\right)$ in the formula for *GC*. The parameter set $\widetilde{\theta}$ is defined by $\left(P, A, F, X, D, \phi, MER\right)$. Here, ϕ is the AV/GV ratio for the benefit exposure (e.g., policy) under consideration. The values in the factor grid represent CTE(90) of the sample distribution for the present value of margin offset cash flows in all future years (i.e., to the earlier of contract maturity and 30 years), normalized by account value. Note that the Base Margin Offset Factors assume $\hat{\alpha} = 100$ basis points of "margin offset" (net spread available to fund the guaranteed benefits).

[33] Technically, the sample distribution for "present value of net cost" = PV[GMDB claims] – PV[Margin Offset] was used to determine the scenario results that comprise the CTE90 risk measure. Hence, the "GMDB Cost Factors" and "Base Margin Offset Factors" are calculated from the same scenarios.

All else being equal, the margin offset α has a profound effect on the resulting AAR. In comparing the Alternative Method against models for a variety of GMDB portfolios, it became clear that some adjustment factor would be required to "scale" the results to account for the diversification effects[34] of attained age, policy duration and AV/GV ratio. The testing examined $W_1 = \frac{\alpha}{MER} = 0.20$ and $W_2 = \frac{\alpha}{MER} = 0.60$, where α = available margin offset and *MER* = total "equivalent" account based charges, in order to understand the interaction between the margin ratio ("*W*") and AAR.

Based on this analysis, the *Scaling Factor* is defined as:

$$h\left(\hat{\theta}\right) = R = \beta_0 + \beta_1 \times W$$

β_0 and β_1 are respectively the intercept and slope for the linear relationship, defined by the parameter set $\hat{\theta} = \left(P, F, \hat{\phi}\right)$. Here, $\hat{\phi}$ is 90% of the aggregate AV/GV for the *product form* (i.e., not for the individual policy or cell) under consideration. In calculating the *Scaling Factor* directly from this linear function, the margin ratio "*W*" must be constrained[35] to the range $\left[0.2, 0.6\right]$.

It is important to remember that $\hat{\phi} = 0.90 \times \frac{\sum AV}{\sum GV}$ for the product form being evaluated (e.g., all 5% Roll-up policies). The 90% factor is meant to reflect the fact that the cost (payoff structure) for a basket of otherwise identical put options (e.g., GMDB) with varying degrees of in-the-moneyness (i.e., AV/GV ratios) is more left-skewed than the cost for a single put option at the "weighted average" asset-to-strike ratio.

To appreciate the foregoing comment, consider a basket of two 10-year European put options as shown in Table 10-5. These options are otherwise identical except for their "market-to-strike price" ratios. The option values are calculated assuming a 5% continuous risk-free rate and 16% annualized volatility. The combined option value of the portfolio is \$9.00, equivalent to a single put option with *S* = \$180.92 and *X* = \$200. The market-to-strike (i.e., *AV*/*GV*) ratio is 0.905, which is less than the average *AV*/*GV* = 1 = $\frac{\$75+\$125}{\$100+\$100}$.

[34] By design, the Alternative Methodology does not directly capture the diversification benefits due to a varied asset profile and product mix. This is not a flaw of the methodology, but a consequence of the structure. Specific assumptions would be required to capture such diversification effects. Unfortunately, such assumptions might not be applicable to a given company and could grossly over-estimate the ensuing reduction in required capital.

[35] The scaling factors were developed by testing "margin ratios" $W_1 = 0.2$ and $W_2 = 0.6$. Using values outside this range could give anomalous results.

Table 9-5: Equivalent Single European Put Option

	Equivalent Single Put Option	Put Option A ("in-the-money")	Put Option B ("out-of-the-money")
Market value (*AV*)	$180.92	$75	$125
Strike price (*GV*)	$200.00	$100	$100
Option Value	$9.00	$7.52	$1.48

Scaling Adjustment (Intercept). The scaling factor $h\left(\hat{\theta}\right) = R$ is a linear function of *W*, the ratio of margin offset to MER. This is the intercept β_0 that defines the line.

Scaling Adjustment (Slope). The scaling factor $h\left(\hat{\theta}\right) = R$ is a linear function of *W*, the ratio of margin offset to MER. This is the slope β_1 that defines the line.

Table 10-6 shows the "Base Cost" and "Base Margin Offset" values from the factor grid for some sample policies. As mentioned earlier, the Base Margin Offset factors assume 100 basis points of "available spread". The "Margin Factors" are therefore scaled by the ratio $\frac{\alpha}{100}$, where α = the actual margin offset (in basis points per annum) for the policy being valued. Hence, the margin factor for the 7th sample policy is exactly half the factor for node 12044121 (the 4th sample policy in Table 6). That is, 0.02160 = 0.5 × 0.04319.

Table 9-6: Sample Nodes on the Factor Grid

KEY	GMDB TYPE	GV ADJUST	FUND CLASS	AGE	POLICY DUR	AV/GV	MER (bps)	OFFSET	COST FACTOR	MARGIN FACTOR
10132031	ROP	$-for-$	Balanced Allocation	55	0.5	1.00	250	100	0.01073	0.04172
10133031	ROP	$-for-$	Balanced Allocation	60	0.5	1.00	250	100	0.01619	0.03940
10134031	ROP	$-for-$	Balanced Allocation	65	0.5	1.00	250	100	0.02286	0.03634
12044121	5% Rollup	Pro-rata	Diverse Equity	65	3.5	0.75	250	100	0.18484	0.04319
12044131	5% Rollup	Pro-rata	Diverse Equity	65	3.5	1.00	250	100	0.12931	0.03944
12044141	5% Rollup	Pro-rata	Diverse Equity	65	3.5	1.25	250	100	0.08757	0.03707
12044121	5% Rollup	Pro-rata	Diverse Equity	65	3.5	0.75	250	50	0.18484	0.02160

Interpolation in the Factor Tables

Interpolation is only permitted across the last four (4) dimensions of the risk parameter set $\tilde{\theta}$: Attained Age (X), Policy Duration (D), AV÷GV Ratio (ϕ) and MER. The "MER Delta" is calculated based on the difference between the actual MER and that assumed in the factor testing (see Table 10-10), subject to a cap (floor) of 100 bps (–100 bps). In general, the calculation for a single policy will require *three* applications of multi-dimensional linear interpolation between the $16 = 2^4$ factors/values in the grid:

(1) To obtain the *Base Factors* $f\left(\tilde{\theta}\right)$ and $g\left(\tilde{\theta}\right)$.

(2) To obtain the *Scaling Factor* $h\left(\hat{\theta}\right) = R.$.

Based on the input parameters, the supplied functions (see Section 7) will automatically perform the required lookups, interpolations and calculations for $h\left(\hat{\theta}\right) = R$, including the constraints imposed on the margin ratio W. Use of the tools noted in Section 7 is not mandatory.

Multi-dimensional interpolation is an iterative extension of the familiar two-dimensional linear interpolation for a discrete function $V\left(x\right)$:

$$\tilde{V}\left(x_k + \delta\right) = \left(1 - \xi\right) \times V\left(x_k\right) + \xi \times V\left(x_{k+1}\right)$$

and

$$\xi = \frac{\delta}{x_{k+1} - x_x}$$

In the above formulation, $\widetilde{V}(x)$ is assumed continuous and x_k and x_{k+1} are defined values ("nodes") for $V(x)$. By definition, $x_k \le (x_k + \delta) \le x_{k+1}$ so that $0 \le \xi \le 1$. In effect, multi-dimensional interpolation repeatedly applies simple linear interpolation one dimension at a time until a single value is obtained.

Multi-dimensional interpolation across all four dimensions is not required. However, simple linear interpolation for *AV*÷*GV* Ratio (ϕ) is mandatory. In this case, the company must choose nodes for the other three (3) dimensions according to the following rules:

Risk Attribute (Dimension)	**Node Determination**
Attained Age	Use next higher attained age.
Policy Duration	Use nearest.
MER Delta	Use nearest (capped at +100 & floored at –100 bps.

For example, if the actual policy/cell is attained age 62, policy duration 4.25 and MER Delta = +55 bps, the company should use the nodes defined by attained age 65, policy duration 3.5 and MER Delta = +100.

Table 10-7 provides an example of the fully interpolated results for a 5% Roll-up "Pro Rata" policy mapped to the Diversified Equity class (first row). While Table 10-7 does not demonstrate how to perform the multi-dimensional interpolation, it does show the required 16 nodes from the *Base Factors*. The margin offset is assumed to be 100 basis points.

Table 9-7: Base Factors for a 5% Rollup GMDB Policy, Diversified Equity

Key	Age	Policy Dur	Policy Av/Gv	Mer (Bps)	Base Cost Factor	Base Margin Factor
INTERPOLATED	62	4.25	0.80	265	0.15010	0.04491
12043121	60	3.5	0.75	250	0.14634	0.04815
12043122	60	3.5	0.75	350	0.15914	0.04511
12043131	60	3.5	1.00	250	0.10263	0.04365
12043132	60	3.5	1.00	350	0.11859	0.04139
12043221	60	6.5	0.75	250	0.12946	0.04807
12043222	60	6.5	0.75	350	0.14206	0.04511
12043231	60	6.5	1.00	250	0.08825	0.04349
12043232	60	6.5	1.00	350	0.10331	0.04129
12044121	65	3.5	0.75	250	0.18484	0.04319
12044122	65	3.5	0.75	350	0.19940	0.04074
12044131	65	3.5	1.00	250	0.12931	0.03944
12044132	65	3.5	1.00	350	0.14747	0.03757
12044221	65	6.5	0.75	250	0.16829	0.04313
12044222	65	6.5	0.75	350	0.18263	0.04072
12044231	65	6.5	1.00	250	0.11509	0.03934
12044232	65	6.5	1.00	350	0.13245	0.03751

The interpolations required to compute the *Scaling Factor* are slightly different from those needed for the *Base Factors*. Specifically, the user should *not* interpolate the intercept and slope terms for each surrounding node, but rather interpolate the *Scaling Factors* applicable to each of the nodes.

Table 10-8 provides an example of the *Scaling Factor* for the sample policy given earlier in Table 10-7 (i.e., a 5% Roll-up "Pro Rata" policy mapped to the Diversified Equity class) as well as the nodes used in the interpolation. The aggregate AV/GV for the product portfolio (i.e., all 5% Roll-up policies combined) is 0.75; hence, 90% of this value is 0.675 as shown under "Adjusted Product AV/GV". As before, the margin offset is 100 basis points per annum.

Table 9-8: Interpolated Scaling Factors for a 5% Rollup GMDB Policy, Diversified Equity

Key	Age	Policy Dur	Adjusted Product Av/Gv	Mer (Bps)	Intercept	Slope	Scaling Factor
INTERPOLATED	62	4.25	0.675	265	n/a	n/a	0.871996
12043111	60	3.5	0.50	250	0.855724	0.092887	0.892879
12043112	60	3.5	0.50	350	0.855724	0.092887	0.882263
12043121	60	3.5	0.75	250	0.834207	0.078812	0.865732
12043122	60	3.5	0.75	350	0.834207	0.078812	0.856725
12043211	60	6.5	0.50	250	0.855724	0.092887	0.892879
12043212	60	6.5	0.50	350	0.855724	0.092887	0.882263
12043221	60	6.5	0.75	250	0.834207	0.078812	0.865732
12043222	60	6.5	0.75	350	0.834207	0.078812	0.856725
12044111	65	3.5	0.50	250	0.855724	0.092887	0.892879
12044112	65	3.5	0.50	350	0.855724	0.092887	0.882263
12044121	65	3.5	0.75	250	0.834207	0.078812	0.865732
12044122	65	3.5	0.75	350	0.834207	0.078812	0.856725
12044211	65	6.5	0.50	250	0.855724	0.092887	0.892879
12044212	65	6.5	0.50	350	0.855724	0.092887	0.882263
12044221	65	6.5	0.75	250	0.834207	0.078812	0.865732
12044222	65	6.5	0.75	350	0.834207	0.078812	0.856725

Adjustments to GC for Product Variations & Risk Mitigation/Transfer

In some cases, it may be necessary for the company 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 Table 10-9); and/or
2. A risk mitigation / management strategy that cannot be accommodated through a straight-forward and direct adjustment to the published values.

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. In the absence of material changes to the product design, risk management program and Alternative Method (including the published factors), the company would not be expected to redo this analysis each year.

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 policy near or beyond the maximum reset age or amount, the company should use the "return-of-premium" GMDB factors/formulas, possibly adjusting the guaranteed value to reflect further resets, if any). In other cases, the company might determine the RBC based on two different guarantee definitions and interpolate the results to obtain an appropriate value for the given policy/cell. Likewise, it may be possible to adjust the Alternative Method 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 policy design is sufficiently different from those provided and/or the risk mitigation strategy is non-linear in its impact on the AAR, and there is no practical or obvious way to obtain a good result from the prescribed factors/formulas, the company must justify any adjustments or approximations by stochastic modeling. Notably this modeling need not be performed on the whole portfolio, but can be undertaken on an appropriate set of representative policies.

The remainder of this section suggests a process for adjusting the published "Cost" and "Margin Offset" factors due to a variation in product design (e.g., a "step-up" option at every 7th anniversary whereby the guaranteed value is reset to the account value, if higher). Note that the "Scaling Factors" (as determined by the slope and intercept terms in the factor table) would not be adjusted.

The steps for adjusting the published *Cost* and *Margin Offset* factors for product design variations are:

1. Select a policy design in the published tables that is similar to the product being valued. Execute cashflow projections using the documented assumptions (see Tables 10-9 and 10-10) and the pre-packaged scenarios for a set of representative cells (combinations of attained age, policy duration, asset class, AV/GV ratio and MER). These cells should correspond to nodes in the factor grid. Rank (order) the sample distribution of results for the present value of net cost[36]. Determine those scenarios which comprise CTE(90).

2. Using the results from step 1., average the present value of cost for the CTE(90) scenarios and divide by the current guaranteed value. For a 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.

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

3. Extract the corresponding factors from the published grid. For each cell, calibrate to the published tables by defining a "model adjustment factor" (denoted by asterisk) separately for the "cost" and "margin offset" components:

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

4. Execute "product specific" cashflow 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 which comprise CTE(90).

5. Using the results from step 4., average the present value of cost for the CTE(90) scenarios and divide by the current guaranteed value. For a 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 a the J^{th} cell, denote this value by $\overline{G}_J$.

6. To calculate the AAR for the specific product in question, the company should implement the Alternative Method as documented, but use $\overline{F}_J \times F_J^*$ in place of $f\left(\tilde{\theta}\right)$ and $\overline{G}_J \times G_J^*$ instead of $\hat{g}\left(\tilde{\theta}\right)$. The company must use the "Scaling Factors" for the product evaluated in step 1. (i.e., the product used to calibrate the company's cashflow model).

Assumptions for the Alternative Method Published GMDB Factors

This subsection reviews the model assumptions used to develop the Alternative Method factors. Each node in the factor grid is effectively the modeled result for a given "cell".

Table 9-9: Model Assumptions & Product Characteristics

Account Charges (MER)	Vary by fund class. See Table 10-10 later in this section.
Base Margin Offset	100 basis points per annum
GMDB Description	1. ROP = return of premium ROP. 2. ROLL = 5% roll-up, capped at 2.5 × premium, frozen at age 80. 3. MAV = annual ratchet (maximum anniversary value), frozen at age 80. 4. HIGH = Higher of 5% roll-up and annual ratchet frozen at age 80. 5. EDB = ROP + 40% Enhanced Death Benefit (capped at 40% of deposit).
Adjustment to GMDB Upon Partial Withdrawal	"Pro-Rata by Market Value" and "Dollar-for-Dollar" are tested separately.
Surrender Charges	Ignored (i.e., zero). Reflected in the "CA" component of the AAR.
Single Premium / Deposit	$100,000. No future deposits; no intra-policy fund rebalancing.
Base Policy Lapse Rate	• Pro-rata by MV: 10% p.a. at all policy durations (before dynamics) • Dollar-for-dollar: 2% p.a. at all policy durations (no dynamics)
Partial Withdrawals	• Pro-rata by MV: None (i.e., zero) • Dollar-for-dollar: Flat 8% p.a. at all policy durations (as a % of AV). No dynamics or anti-selective behavior.
Mortality	100% of MGDB 94 ALB.
Gender /Age Distribution	100% male. Methodology accommodates different attained ages and policy durations. A 5-year age setback will be used for female annuitants.
Max. Annuitization Age	All policies terminate at age 95.
Fixed Expenses, Annual Fees	Ignored (i.e., zero). Reflected in the "FE" component of the AAR.
Income Tax Rate	35%
Discount Rate	3.74% (after-tax) effective = 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 Policy Lapse Rate' (not withdrawals).

Notes on GMDB Factor Development

- The roll-up is continuous (not simple interest, not stepped at each anniversary) and is applied to the previous roll-up guaranteed value (i.e., not the contract guaranteed value under HIGH).
- The Enhanced Death Benefit ("EDB") is floored at zero. It pays out 40% of the gain in the policy upon death at time *t*:

  $B_t = MIN\left[0.40 \times Deposit, 0.40 \times MAX\left(0, AV_t - Deposit\right)\right]$. The test policy also has a 100% return-of-premium GMDB, but the EDB Alternative Factors will be net of the GMDB component. That is, the EDB factors are 'stand-alone' and applied *in addition to* the GMDB factors.
- The "Base Policy Lapse Rate" is the rate of policy termination (total surrenders). Policy terminations (surrenders) are assumed to occur throughout the policy year (not only on anniversaries).
- Partial withdrawals (if applicable) are assumed to occur at the end of each time period (quarterly).
- Account charges ("MER") represent the total amount (annualized, in basis points) assessed against policyholder funds (e.g., sum of investment management fees, mortality and expense charges, risk premiums, policy/administrative fees, etc.). They are assumed to occur throughout the policy year (not only on anniversaries).

Table 9-10: Account-Based Fund Charges (bps per annum)

Asset Class / Fund	**Account Value Charges (MER)**
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

Calculation Example

Continuing the previous example (see Tables 10-7 and 10-8) for a 5% Roll-up GMDB policy mapped to Diversified Equity, suppose we have the policy/product parameters as specified in Table 10-11.

Table 9-11: Sample Policy Results for 5% Roll-up GMDB, Diversified Equity

Parameter	Value	Description
Deposit Value	$100.00	Total deposits adjusted for partial withdrawals.
Account Value	$98.43	Total account value at valuation date, in dollars.
GMDB	$123.04	Current guaranteed minimum death benefit, in dollars.
Attained Age	62	Attained age at the valuation date (in years).
Policy Duration	4.25	Policy duration at the valuation date (in years).
GV Adjustment	Pro-Rata	GMDB adjusted pro-rata by MV upon partial withdrawal.
Fund Class	Diversified Equity	Contract exposure mapped to Diversified Equity as per the Fund Categorization instructions in the section of this Appendix on Component GC.
MER	265	Total charge against policyholder funds (bps).
ProductCode	2	Product Definition code as per lookup key in Table 4.
GVAdjust	0	GV Adjustment Upon Partial Withdrawal as per key in Table 10-4.
FundCode	4	Fund Class code as per lookup key in Table 10-4.
PolicyMVGV	0.800	Contract account value divided by GMDB.
AdjProductMVGV	0.675	90% of the aggregate AV/GV for the Product portfolio.
RC	150	Margin offset (basis points per annum).

Using the usual notation, $GC = GV \times f\left(\tilde{\theta}\right) - AV \times \hat{g}\left(\tilde{\theta}\right) \times h\left(\hat{\theta}\right)$.

$f\left(\tilde{\theta}\right)$ = 0.150099 = GetCostFactor(2, 0, 4, 62, 4.25, 0.8, 265)

$\hat{g}\left(\tilde{\theta}\right)$ = 0.067361 = GetMarginFactor(2, 0, 4, 62, 4.25, 0.8, 265, 150)

$h\left(\hat{\theta}\right)$ = 0.887663 = GetScalingFactor(2, 0, 4, 62, 4.25, 0.675, 265, 150)

Hence, *GC* = $12.58 = (123.04 × 0.150099) – (98.43 × 0.067361 × 0.887663). As a normalized value, this quantity is 12.78% of account value, 10.23% of guaranteed value and 51.1% of the current net amount at risk (Net amount at risk = GV – AV).

Note that $\hat{g}\left(\tilde{\theta}\right) = \frac{\alpha}{\hat{\alpha}} \times g\left(\tilde{\theta}\right) = \frac{150}{100} \times 0.044907$ where $g\left(\tilde{\theta}\right)$ is "per 100 basis points" of available margin offset.

$g\left(\tilde{\theta}\right)$ = 0.044907 = GetMarginFactor(2, 0, 4, 62, 4.25, 0.8, 265, 100)

Section 10. Supplied Functions for the Alternative Method

Special functions have been supplied in the file GMDBFactorCalc.dll (C++ dynamic linked library) to retrieve the "cost", "margin offset" and "scaling" factors from the factor file *and* perform the multi-dimensional linear interpolation based on the input parameters. Cover functions in the Microsoft® Visual Basic "Add-In" are provided in the file GMDBFactorCalc(2004-05-19).xla so that the C++ routines are callable from Microsoft Excel. The VBA[37] and C++ functions are identically named and are described in Table 11-1. Installation instructions are given later in this section. A call to an Excel function (built-in or VBA) must be preceded by a "+" or "=" character (e.g., =GetCostFactor(...)).

Using the notation given earlier, $GC = GV \times f\left(\tilde{\theta}\right) - AV \times \hat{g}\left(\tilde{\theta}\right) \times h\left(\hat{\theta}\right)$.

GetCostFactor(ProductCode, GVAdjust, FundCode, AttAge, PolicyDur, PolicyMVGV, MER)

- Returns the "*Cost Factor*" $f\left(\tilde{\theta}\right)$, interpolating between nodes where necessary.

GetMarginFactor(ProductCode, GVAdjust, FundCode, AttAge, PolicyDur, PolicyMVGV, MER, RC)

- Returns the "*Margin Offset Factor*" $\hat{g}\left(\tilde{\theta}\right)$, interpolating between nodes where necessary and scaling for the actual margin offset ("RC").

GetScalingFactor(ProductCode, GVAdjust, FundCode, AttAge, PolicyDur, AdjProductMVGV, MER, RC)

- Returns the "*Scaling Factor*" $h\left(\hat{\theta}\right) = R$, interpolating between nodes where necessary.

[37] Visual Basic for Applications.

Table 10-1: Input Parameters (Arguments) to Supplied Lookup Functions

Input Parameter	Variable Type	Description
ProductCode	Long Integer	Product Definition code as per lookup key in Table 8-4 of Appendix 8.
GVAdjust	Long Integer	GV Adjustment Upon Partial Withdrawal as per key in Table 8-4 of Appendix 8.
FundCode	Long Integer	Fund Class code as per lookup key in Table 8-4 of Appendix 8.
AttAge	Floating Point Double	Attained Age of annuitant (in years).
PolicyDur	Floating Point Double	Policy Duration (in years).
PolicyMVGV	Floating Point Double	Account Value to GMDB ratio (AV/GV) for the policy.
MER	Floating Point Double	Total Equivalent Account Charges (annualized, in bps).
RC	Floating Point Double	Margin Offset (annualized, in basis points).
AdjProductMVGV	Floating Point Double	90% of the aggregate AV/GV for the Product portfolio.

Note that the calling syntax for the function **GetScalingFactor** requires input parameters for ***GVAdjust***, ***AttAge***, ***PolicyDur*** and ***MER*** even though the result does not vary by these attributes. However, this structure maintains consistency with the other functions and permits future refinements to the factor tables.

Installing and Using the GMDB Factor Calculation Routines

The Alternative Methodology makes use of a "Factor File". The AAA supplies the necessary factor files and a Factor Lookup Tool ("FLT"). The FLT is an Excel Add-In, which provides the user with Excel functions that retrieve the appropriate factors from the factor file for a given set of policy features.

The FLT has been updated on a number of occasions, and may be updated again in the future. Please ensure you are using the most up-to-date version. When upgrading to a new version of the Add-In, any old version should be deleted prior to installation:

1. Delete all existing files in the FLT installation folder (the default folder is 'C:\Program Files\C3Phase2').
2. Using the Tools…Add-Ins menu item in Excel, remove any references to the FLT Add-In (e.g. 'GMDBFactorCalc(2004-05-19)').
3. Download the latest set of GMDG factors and FLT from http://www.actuary.org/life/phase2.htm
4. Run the SETUP.EXE for the upgraded version of the FLT.
5. Next, the Microsoft Add-In must be loaded (into Excel) before the VBA functions can be called. Simply open "GMDBFactorCalc(2004-05-19).xla" from Microsoft Excel.

When the add-in is opened a pop-up will appear instructing you to browse directly to the GMDB factor file. To load another factor file choose the 'GMDB Factors' drop-down menu and select 'load another factor file.'

Section 11. Standard Scenario for C-3 Phase II Risk Based Capital (RBC) Determination

Calculation of the Standard Scenario Amount for Variable Annuities and Similar Products

I) Overview

A) Application to Determine RBC. A Standard Scenario Amount shall be determined for all of the contracts under the scope described in the June 2005 report, "Recommended Approach for Setting Risk-Based Capital Requirements for Variable Annuities and Similar products." If the Standard Scenario Amount is greater than the Total Asset Requirement less any amount included in the TAR but attributable to and allocated to C-3 (Interest Rate Risk) otherwise determined based on the Report, then the Total Asset Requirement before tax adjustment used to determine C-3 Phase 2 (Market Risk) RBC shall be the Standard Scenario Amount.

The Standard Scenario Amount shall be the sum of the following:

1. For contracts for which RBC is based on the Alternative Methodology applied without a model office using 100 percent of the MGDB mortality table, the Standard Scenario Amount shall be the sum of the total asset requirement before tax adjustment from the Alternative Methodology applied to such contracts.

2. For contracts without guaranteed death benefits for which RBC is based on the Alternative Methodology applied without a model office, the Standard Scenario Amount shall be the sum of the total asset requirements before tax adjustment from the Alternative Methodology applied to such contracts.

3. For contracts under the scope of the Report other than contracts for which paragraphs 1 and 2 apply, the Standard Scenario Amount is determined by use of The Standard Scenario Method described in Section III. The Standard Scenario Method requires a single projection of account values based on specified returns on the assets supporting the account values. On the valuation date an initial drop is applied to the account values based on the supporting assets. Subsequently, account values are projected at the rate earned on supporting assets less a margin. Additionally, the projection includes the cash flows for certain contract provisions, including any guaranteed living and death benefits using the assumptions in Section III. Thus the calculation of the Standard Scenario Amount will reflect the greatest present value of the accumulated projected cost of guaranteed benefits less the accumulated projected revenue produced by the margins in accordance with Subsection III (D).

B) The Standard Scenario Amount under the Standard Scenario Method.

The Standard Scenario Amount for all contracts subject to the Standard Scenario Method is determined as of the valuation date under the Standard Scenario Method described in Section III based on a rate, DR. 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 3 percent or more than 9 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. The accumulation rate, AR, is the product of DR and one minus the tax rate defined in paragraph III(D)(10).

No modification is allowed from the requirements in Section III unless the Domiciliary Commissioner approves such modification as necessary to produce a reasonable result.

C) Illustrative Application of the Standard Scenario Method to a Projection, Model Office and Contract by Contract. To provide information on the significance of aggregation, a determination of the Standard Scenario Amount based on paragraphs III(B)(1) and III(B)(2) is required for each contract subject to paragraph I(A)(3). The sum of all such Standard Scenario Amounts is described as row B in Table A. In addition, if the Conditional Tail Expectation Amount in the Report 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 the Standard Scenario Amount 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 and to determine the significance of aggregation.

Table A identifies the Standard Scenario Amounts required by this section. The Standard Scenario Amounts required are based on how the Conditional Tail Expectation projection or Alternative Methodology is applied. For completeness, the table also includes the Standard Scenario Amount required by paragraph I(A)(3). The amounts in Table A should be included as part of the certifying actuary's annual supporting memorandum specified in paragraph (H) of the "Calculation of the Total Asset Requirement" section of the RBC instructions.

- Standard Scenario Amounts in rows A and B in Table A are required of all companies subject to paragraph I(A)(3). No additional Standard Scenario Amounts are required if a company's stochastic or alternative methodology result is calculated on the statement date using individual contracts (i.e., without a model office).
- A company that uses a model office as of the statement date to determine its stochastic or alternative methodology result must provide the Standard Scenario Amount for the model office. This is row C.
- A company that uses an aggregation by duration of contract by contract projection 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 the Standard Scenario Amount for the prior inforce, row D.
- 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 the Standard Scenario Amount for the model office on the prior inforce date, row E.

Table A

Standard Scenario Amounts	Guideline Variations	Validation Measures	
		Model Office Projection	Projection of Prior Inforce
A. Aggregate valuation on the statement date on inforce contracts required in I(A)(3)	None	None	None
B. Seriatim valuation on the statement date on inforce contracts	None: Compare to A	None	None
C. Aggregate valuation on the statement date on the model office	If not material to model office validation	A/C compare to 1.00	None
D. Aggregate valuation on a prior inforce date on prior inforce contracts	If not material to projection validation	None	A/D - S/PS Compare to 0
E. Aggregate valuation on a prior inforce date of a model office	If not material to model office or projection validation	(A/E – S/PM) compare to 0	

Modification of the requirements in Section III 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. No modification is allowed for row B as of the statement date unless the Domiciliary Commissioner approved such modification as necessary to produce a reasonable result under the corresponding amount in row A.

II) Basic Adjusted Reserve

For purposes of determining the Standard Scenario Amount for Risk-Based Capital, the Basic Adjusted Reserve for a contract shall be the Working Reserve, as described in the Report, as of the valuation date.

III) Standard Scenario Amount - Application of the Standard Scenario Method

A) General

Where not inconsistent with the guidance given here, the process and methods used to determine results under the Standard Scenario Method shall be the same as required in the calculation under the modeling methodology required by the Report. Any additional assumptions needed to apply the Standard Scenario Method to the inforce shall be explicitly documented.

B) Results for the Standard Scenario Method.

The Standard Scenario Amount is equal to (1) + (2) – (3) where:

(1) is the sum of the Basic Adjusted Reserve as described in Section II for all contracts for which the Standard Scenario Amount is being determined,

(2) is zero or if greater the aggregate greatest present value for all contracts measured as of the end of each projection year of the negative of the Accumulated Net Revenue described below using the assumptions described in Subsection III(D) and a discount rate equal to the Accumulation Rate, AR. The Accumulated Net Revenue at the end of a projection year equals (i) + (ii) - (iii) where:

(i) is the Accumulated Net Revenue at the end of the prior projection year accumulated at the rate AR 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 as defined in paragraph III(D)(1) multiplied by one minus the tax rate and accumulated at rate AR to the end of current projection year, and

(iii) are the contract benefits paid in excess of account value applied plus the Individual reinsurance premiums (ceded less assumed) less the Individual reinsurance benefits (ceded less assumed) payable or receivable during the projection year multiplied by one minus the tax rate and accumulated at rate AR to the end of current projection year. Individual reinsurance is defined in paragraph III(D)(2).

(3) is the value of approved hedges and Aggregate reinsurance as described in paragraph III(E)(2). Aggregate reinsurance is defined in paragraph III(D)(2).

C) 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).

D) Assumptions for Paragraph III (B) (2) Margins and Account Values.

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

The Fixed Fund rate is the greater of the minimum rate guaranteed in the contract or 3.5 percent but not greater than the current rates being credited to Fixed Funds on the valuation date.

Account Values shall be accumulated after the initial drop using the rates from Table I with appropriate reductions applied to the supporting assets. The appropriate reductions for account values supported by assets in the Equity, Bond or Balance Classes are all fund and contract charges according to the provisions of the funds and contracts. The appropriate reduction for Account Values supported by Fixed Funds is zero.

The margins on Account Values 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 Values; and
   - 50% of the excess, if any, of all contract charges over (a) above.

However, on fixed funds after the surrender charge period, a margin of up to the amount in (a) above plus 0.4%. may be used.

Table I

	Initial	Year 1	Year 2+
Equity Class	-20%	0%	3%
Bond Class	0%	0%	4.85%
Balanced Class	-12%	0%	3.74%
Fixed Separate Accounts and General Account		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 reinsurance is Aggregate reinsurance.

Individual reinsurance premiums projected to be payable on ceded risk and receivable on assumed risk shall be included in the subparagraph III(B)(2)(iii). Similarly, Individual reinsurance benefits projected to be receivable on ceded risk and payable on assumed risk shall be included in subparagraph III(B)(2)(iii). No Aggregate reinsurance shall be included in subparagraph III(B)(2)(iii).

3) Lapses, Partial Withdrawals, and Moneyness. Partial withdrawals elected as guaranteed living benefits or required contractually (e.g., a contract operating under an automatic withdrawal provision on the valuation date) are to be included in subparagraph III(B)(2)(iii). No other partial withdrawals, including free partial withdrawals, are to be included. All lapse rates shall 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 future 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 projected account value is 90 percent of the value of the guaranteed benefit at the time of exercise or payment, the contract is said to be 10 percent in the money. If the income from applying the projected account value to guaranteed purchase rates exceeds the income from applying the projected 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. 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%		
Account Value Benefits ITM		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) Transfers and Future Deposits. No transfers between funds shall be assumed to determine the greatest present value amount required under paragraph III(B)(2) 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 values are transferred to the Accumulation of Net Revenue at year end and are subsequently accumulated at the Accumulation 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 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 funds.

5) Mortality. Mortality at 80 percent of the 1994 MGDB tables through age 95 increasing by 1 percent each year to 100 percent of the 1994 MGDB table at age 115 shall be assumed in the projection used to the determine the greatest present value amount required under paragraph III(B)(2).

6) Projection Frequency. The projection used to determine the greatest present value amount required under paragraph III(B)(2) 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 each projection year may be retained in such funds until year-end (i.e., pre-tax 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. Subsequent to each projection year end, Accumulated Net Revenues for the year shall earn the Accumulation Rate. Similarly, projected benefits, lapses, elections and other contract 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) Surrender Charge Period. If the surrender charge for the contract is determined based on individual contributions or deposits to the contracts, the surrender charge amortization period may be estimated for projection purposes. Such estimated period shall not be less than the remaining duration based on the normal amortization pattern for the remaining total contract charge assuming it resulted from a single deposit, plus one year.

8) Contract Holder Election Rates. Contract holder election rates to determine amounts in subparagraph III(B)(2)(iii) shall be 15 percent 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. Guaranteed Minimum Death Benefits are not benefits subject to election. Exception: Contract holder election rates shall be 100 percent 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 paragraph III(D)(3).

   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 assumed in subparagraph III(B)(2)(iii). 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 assumed in subparagraph III(B)(2)(iii).

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%

9) GMIBs. For subparagraph III(B)(2)(iii), GMIB cost at the time of election shall be the excess, if positive, of the reserve required for the projected annuitization stream over the available account value. If the reserve required is less than the account value, the GMIB cost shall be zero. The reserve required shall be determined using the Annuity 2000 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.

10) 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 up to the time the index is used. The sources of information and how the information is used to determine indexes shall be documented and, to the extent possible, consistent from year to year.

11) Taxes. All taxes shall be based on a tax rate of 35 percent.

E) Assumptions for use in paragraph III (B) (3).

1) The Value of Aggregate Reinsurance. The value of Aggregate reinsurance is the discounted value, at rate AR of the excess of: a) the benefit payments from the reinsurance, over b) the reinsurance premiums, where (a) and (b) are determined under the assumptions described in Subsection III(D).

2) The Value of Approved Hedges. The value of approved hedges shall be calculated separately from the calculation in paragraph III(B)(2). The value of approved hedges is the difference between: a) the discounted value at rate AR of the after-tax cash flows from the approved hedges; less b) their statement values on the valuation date.

To be an approved hedge, a derivative or other investment has to be an actual asset held on the valuation date, be designated as a hedge for one or more contracts subject to the Standard Scenario, and be part of a clearly defined hedging strategy as described in the Report. If the approved 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 approved 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 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, and the approved hedges are assumed to be accounted for at the average present value of the tail scenarios. The value of approved hedges for the standard scenario is the difference between an estimate of this "tail value" and the "fair value" of approved hedges. For this valuation to be consistent with the statement value of approved hedges, the statement value of approved hedges will need to be held at fair value with the immediate recognition of gains and losses. Accordingly, it is assumed that approved hedges are not subject to the IMR or the equity component of the AVR. Approved hedges need not satisfy SSAP No. 86. In particular, as gains and loses of approved hedges are recognized immediately, approved hedges need not satisfy the requirements for hedge accounting of fair value hedges.

It is the combination of hedges and liabilities that determine which scenarios are the tail scenarios. In particular, scenarios where the hedging is least effective are likely to be tail

scenarios and liabilities that are a left tail risk could in combination with hedges become a right tail risk.

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 one 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 Black-Scholes pricing, a risk free rate of DR, annual volatility implicit as of the valuation date in the statement value of the hedges under Black-Scholes pricing and a risk free rate of DR and the assumed returns in the Standard Scenario from the valuation date to the date of liquidation.

There is no credit in the Standard Scenario for dynamic hedging beyond the credit that results from hedges actually held on the valuation date. There is no credit for hedges actually held on the valuation date that are not approved hedges as the commitment to maintain the level of risk reduction derived from such hedges is not adequate.

3) Retention of Components. For the Standard Scenario Amounts on the statement date the company should have available to the Commissioner the following values:

   a) For runs A and B as defined in I(C) by contract and in aggregate the amounts determined in III(B)(1) and III(B)(2).

   b) For run A the aggregate amounts determined in III(E)(1) and III(E)(2).

Section 12. Certification and Documentation Requirements

1) Actuarial Memorandum

An actuarial memorandum should be constructed documenting the methodology and assumptions upon which the required capital is determined. The memorandum should also include sensitivity tests that the actuary feels appropriate, given the composition of their block of business (i.e., identifying the key assumptions that, if changed, produce the largest changes in the RBC amount.). This memorandum will be confidential and available to regulators upon request.

Companies using the Alternative Method do not have to opine on the underlying assumptions and model. Certification that expense, revenue, fund mapping, and product parameters have been properly reflected will be required.

The supporting memorandum shall include at least the following information:

a) *Alternative Methodology using Published Factors*.

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

ii) Disclosure of assumptions to include

(1) Component CA
  (a) Mapping to prescribed asset categories
  (b) Lapse and withdrawal rates

(2) Component FE
  (a) Determination of fixed dollar costs and revenues
  (b) Lapse and withdrawal rates
  (c) Inflation rates

(3) Component GC
  (a) Disclosure of contract features and how the company mapped the contract form to those forms covered by the Alternative Methodology factors
    (i) Product Definition
    If not conservatively assigned to a published factor, company-specific factors or stochastic modeling is required
    (ii) Partial Withdrawal Provision
    (iii) Fund Class
      1. Disclose the process used to determine the single asset class that best represents the exposure for a contract
      2. If individual funds are mapped into prescribed categories, the process used to map the individual funds should be disclosed.
    (iv) Attained Age
    (v) Contract Duration
    (vi) Ratio of Account Value to Guaranteed Value
    (vii) Annualized Account Charge Differential from Base Assumptions
  (b) Derivation of Equivalent Account Charges
  (c) Derivation of margin offset
  (d) Disclosure of interpolation procedures and confirmation of node determination

iii) 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.)

b) *Alternative Factors based on Company-Specific Factors*.

i) Disclosure of requirements consistent with Published Factors (as noted in section 3.b.)

ii) Additional Requirements

(1) Documentation of the basis of the actuary's Prudent Best Estimate of mortality if the GC factors are modified for mortality.

(2) Stochastic analysis supporting adjustments to Published Factors should be fully documented. This requirement does not apply to adjustments to Published Factors resulting from adjustments to the mortality assumption underlying the factors.
   (a) This analysis needs to be submitted when initially used and be available upon request in subsequent years.
   (b) Adjustments may include:
      (i) Policy design
      (ii) Risk mitigation strategy (excluding hedging); and
      (iii) Reinsurance

c) *Stochastic Modeling.*

i) Assets
   (1) Description including type and quality
   (2) Investment & disinvestment assumptions
   (3) Assets used at the start of the projection
   (4) Source of asset data
   (5) Asset valuation basis
   (6) Documentation of assumptions
      (a) Default costs
      (b) Prepayment functions
      (c) Market value determination
      (d) Yield on assets acquired
      (e) Mapping and grouping of funds to modeled asset classes
   (7) Hedging Strategy
      (a) Documentation of strategy
      (b) Identification of current positions
      (c) Description on how strategy was incorporated into modeling
         (i) basis risk
         (ii) gap risk
         (iii) price risk
         (iv) assumption risk
      (d) Document the methods and criterion used to estimate the apriori effectiveness of the hedging strategy

ii) Liabilities
   (1) Product Descriptions
   (2) Source of Liabilities
   (3) Grouping of Contracts
   (4) Reserve method and modeling (e.g. were reserves set to CSV)
   (5) Investment Reserves
   (6) Reinsurance
   (7) Documentation of assumptions to include:
      (a) Premiums and subsequent deposits
      (b) Withdrawal, Lapse and Termination Rates
         (i) Partial Withdrawal (including treatment of dollar-for-dollar offsets and required minimum distributions)
         (ii) Lapse / Surrenders
      (c) Crediting Strategy
      (d) Mortality
      (e) Annuitization Rates
      (f) Income Purchase Rates
      (g) GMIB and GMWB Utilization Rates
      (h) Commissions
      (i) Expenses
      (j) Persistency Bonuses

(k) Investment / Fund Choice
(l) Revenue Sharing
(m) Asset Allocation, Rebalancing and Transfer Assumptions
(i) Dollar Cost Averaging
(n) Federal Income Tax

iii) Scenarios
(1) Description of scenario generation for interest rates and equity returns
(a) Disclose the number "n" of scenarios used and the methods used to determine the sampling error of the CTE(90) statistic when using "n" scenarios.
(b) Time Step of Model (e.g. Monthly, Quarterly, Annual)
(c) Correlation of fund returns
(2) Calibration
(a) Gross Wealth Ratio for equity funds
(i) Disclosure of adjustments to model parameters, if any.
(ii) Disclosure of 1-year, 5-year and 10-year wealth factors, as well as mean and standard deviation.
(b) Consistency of other funds to equity funds
(c) Correlation between all funds
(3) Extent of use of pre-packaged scenarios and support for mapping variable accounts to proxy funds

iv) Description and results of sensitivity tests performed

2) Certification

The certification shall be provided by a qualified actuary and consist of at least the following:

i) A paragraph identifying the actuary and his or her qualifications;
ii) A scope paragraph identifying the statement values of Variable Annuities and Similar Products included in the certification and the methodology used for those statement values (e.g. Alternative Methodology, Cash Flow Testing);
iii) A reliance paragraph describing those areas, if any, where the certifying actuary has relied on other experts;
A reliance statement from each of those relied upon should accompany the certification. The reliance statements should note the information being provided and a statement as to the accuracy, completeness or reasonableness, as applicable, of the information.
iv) A paragraph certifying that required capital was determined in accordance with the principles and requirements of the NAIC RBC Instructions;
v) A paragraph certifying that the assumptions used for these calculations are Prudent Best Estimate assumptions for the products, scenarios, and purpose being tested.
vi) A paragraph disclosing all material changes in the model or assumptions from that used previously and the estimated impact of such changes; and
vii) A paragraph stating that the qualified actuary is not opining on the adequacy of the company's surplus or its future financial condition.

3) Regulatory Communication

If there is a material change in assumptions from the previous year, an executive summary should be sent to the state of domicile communicating such change and quantifying the impact it has on the results. Such communication shall remain confidential.

Section 13. Transition Rules

Smoothing and Transition Rules for Variable Annuities and Similar Products

If a company is following a Clearly Defined Hedging Strategy (See "Recommended Approach for Setting Risk-Based Capital Requirements for Variable Annuities and Similar Products Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee to the National Association of Insurance Commissioner's Capital Adequacy Task Force (June 2005)" for the definition of this phrase) on some or all of its business, a decision should be made whether or not to smooth the TAR. In all cases where "cash value" is to be used, the values used must be computed on a consistent basis for each block of business at successive year-ends. For deferred annuities with a cash value option, direct writers will use the cash value. For deferred annuities with no cash value option, or for reinsurance assumed through a treaty other than coinsurance, use the policyholder account value of the underlying contract. For payout annuities, or other annuities with no account value or cash value, use the amount as defined for variable payout annuities in the definition of Working Reserve. For any business reinsured under a coinsurance agreement that complies with all applicable reinsurance reserve credit "transfer of risk" requirements, the ceding company shall reduce the value in proportion to the business ceded while the assuming company shall use an amount consistent with the business assumed.

A company who reported an amount in Line (37) last year may choose to smooth the Total Asset Requirement. A company is required to get approval from its domestic regulator prior to changing its decision about smoothing from the prior year. To implement smoothing, use the following steps. If a company does not qualify to smooth or a decision has been made not to smooth, go to the step "Reduction for reported Statutory Reserves."

Instructions

1. Determine the Total Asset Requirement as the greater of that produced by the "Recommended Approach for Setting Risk-Based Capital Requirements for Variable Annuities and Similar Products Presented by the American Academy of Actuaries' Life Capital Adequacy Subcommittee to the National Association of Insurance Commissioner's Capital Adequacy Task Force (June 2005)" or the value produced by the "Standard Scenario" as outlined above.
2. Determine the aggregate cash value for the contracts covered by the Stochastic modeling requirements.
3. Determine the ratio of TAR / CV for current year.
4. Determine the Total Asset Requirement as actually reported for the prior year Line (37).
5. Determine the aggregate cash value for the same contracts for the prior year-end.
6. Determine the ratio of TAR / CV for prior year.
7. Determine a ratio as 0.4*(6) plus 0.6*(3) {40% prior year ratio and 60% current year ratio}.
8. Determine TAR for current year as the product of (7) and (2) {adjust (2) to be actual 12/31 cash value}.

Section 14. Reduction for Statutory Reserves

The amount of the TAR (post-Federal Income Tax) determined using the instructions for the applicable year is reduced by the reserve, net of reinsurance, for the business subject to this instruction reported in the current statutory annual statement.

Section 15. Allocation of Results

See step (9) located at the beginning of Section 12 relating to Variable Annuities and Similar Products for the allocation of results to Line (35) and Line (37).

Appendix 3
Approach to Determining C3 Requirements for Life Insurance Products

Introduction

This Appendix details a principle-based approach (PBA) to the determination of the C3 component of Risk-Based Capital for all life insurance products.

A principle-based approach is one that:

1. Captures the benefits and guarantees associated with the contracts and their identifiable, quantifiable and material risks, including the risks represented in the tails of the distribution and the funding of the risks.
2. Utilizes risk analysis and risk management techniques to quantify the risks and is guided by the evolving practice and expanding knowledge in the measurement and management of risk. This may include, to the extent required by an appropriate assessment of the underlying risks, stochastic models or other means of analysis that properly reflect the risks of the underlying contracts.
3. Incorporates assumptions, risk analysis methods, and models and management techniques that are consistent with those utilized within the company's overall risk assessment process. Risk and risk factors explicitly or implicitly included in the company's risk assessment and evaluation processes will be included in the risk analysis and cash flow models used in the PBA. Examples of company risk assessment processes include economic valuations, internal capital allocation models, experience analysis, asset adequacy testing, GAAP valuation and pricing.
4. Should use company experience, based on the availability of relevant company experience and its degree of credibility, to establish assumptions for risks over which the company has some degree of control or influence.
5. Incorporates assumptions that reflect an appropriate level of conservatism when viewed in the aggregate and that, together with the methods utilized, recognizes the solvency objective of statutory reporting.
6. Reflects risks and risk factors in the calculation of the PBA minimum statutory reserves and statutory Risk-Based Capital that may be different from one another and may change over time as products and risk measurement techniques evolve, both in a general sense and within the company's risk management processes.

These statements should be applied in a manner consistent with statutory requirements and company risk measurement practices then in effect.

The method defined in this Appendix applies to all life insurance policies including supplemental benefits, and riders on those policies, whether directly written or assumed through reinsurance.

The C3 RBC amount to be calculated is based on a prospective valuation method that appropriately captures all material C3 risks underlying the product being valued, the revenue to fund those risks, and the effect of any risk mitigation techniques.

While the method contemplates a stochastic approach to the determination of appropriate values, a deterministic approach may be sufficient for certain products, depending on the nature of the risks. A stochastic approach may be necessary for other products.

The only assumptions for which stochastic processes were considered are those for interest rates and equity returns. All other assumptions which are neither stochastically determined nor prescribed should incorporate appropriate margins for uncertainty. These margins should be consistent with those that would be appropriate for reserves.

Assumptions should be updated as experience data emerges and expectations of future experience and economic conditions change. In other words, assumptions are not locked in at issue.

Finally, it is recognized that 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. 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 amount being valued. As such:

1. The actuary must take the model's limitations into consideration when setting assumptions, applying the methodology and determining the appropriateness of the resulting amounts.
2. 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. Therefore, the use of assumptions, methods, models, risk management strategies (e.g., hedging), other Derivative Programs, structured investments or any other risk transfer arrangements (such as reinsurance) that serve to materially reduce the calculated amounts without also reducing risk on scenarios similar to those used in the actual cash flow modeling are inconsistent with these principles.

The stochastic modeling approach to calculating the RBC requirements for interest rate risk and market risk for all life insurance policies is summarized by the following steps. Terms which are capitalized are as they are defined in Section 1.

(1). Project asset and liability cash flows using Prudent Estimate Assumptions over a series of stochastically generated interest rate and/or equity return scenarios calculating the net accumulated asset amount (projected statement value of invested assets).

(2). Calculate the accumulated deficiency at the end of each projection year. The accumulated deficiency is the excess of the cash surrender value (zero is used for products that do not have a cash surrender value) over the net accumulated asset amount.

(3). For each scenario, calculate the present value of each accumulated deficiency and determine the greatest present value.

(4). The Scenario Amount is the sum of the statement value of starting assets and the greatest present value for that scenario.

(5). Determine the Stochastic Amount by calculating the CTE 90 value of the Scenario Amounts by taking the average of the highest 10% of the Scenario Amounts.

Recognizing the desire, in certain situations, to utilize approaches that are simpler than the process used to quantify the Stochastic Amount, simplified methods are included subject to a minimum based on the current C3 factors for life insurance products. Additionally, recognizing that there may be some liabilities not included in a company's models, an amount for non-modeled liabilities is included as an alternative. In determining the total C3 requirement, the Total Asset Requirement is the sum of the Stochastic Amount, Alternative Amount, Factor-based amount and an amount for non-modeled liabilities. The C3 component for Risk-Based Capital is the Total Asset Requirement less the statutory value on the valuation date of the liabilities included in the determination of the Total Asset Requirement.

This C3 RBC amount relates to interest rate risk and market risk. That portion which is attributable to interest rate risk is to be combined with the current C3a component of the formula. That portion which is attributable to market risk is to be allocated and combined with the current C3c component of the formula.

Appendix 3
Approach to Determining C3 Requirements for Life Insurance Products

Section 1. Definitions

The following terms shall have the indicated meanings for purposes of this Appendix:

A. Accumulated Deficiency. The projected working reserve, if any, less the annual statement value of projected assets and measured as of the projection start date and as of the end of each projection year.

B. Actuarial Report. A document prepared by the company that summarizes all of the material decisions supporting the calculation of the Reported Amount, including assumptions, margins and methodologies used to calculate the Reported Amount

C. Alternative Amount. Provides for all material C3 risks of a group of policies, including Material Tail Risk arising from sensitivities to changing economic conditions. It equals the amount determined by the actuary, using methods and assumptions deemed appropriate by the actuary, subject to the amount meeting the minimum requirements specified in this report.

D. Anticipated Experience Assumption. The actuary's expectation of future experience for a Risk Factor given available, relevant information pertaining to the assumption being estimated.

E. Asset-associated Derivative. A derivative program whose derivative instrument cash flows are combined with asset cash flows within the Cash Flow Model.

F. Business Segment. A group of assets associated with a group of policies that are modeled together to project future Accumulated Deficiencies.

G. Cash Flow Model. A model designed to simulate asset and liability cash flows.

H. Cash Surrender Value. The amount available to the contract/policyholder, if any, due to surrender of the contract/policy, prior to any outstanding contract/policy indebtedness and net of any applicable surrender charges. The cash surrender value shall reflect any applicable 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 not reported at market value. (Note: where there is a group certificate and it has a cash value, this applies to the certificate within the group contract/policy).

I. Clearly Defined Hedging Strategy. A type of prospective Derivative Program of the company established to hedge risks through the future purchase or sale or the opening and closing of hedging positions. Such Derivative Program may be dynamic, static or a combination thereof and must meet the requirements of a Clearly Defined Hedging Strategy as described in Subsection E (9) of Section 6.

J. Conditional Tail Expectation (CTE). A risk measure that is calculated as the average of all modeled outcomes (ranked from lowest to highest) above a prescribed percentile.

K. Derivative Instrument. An agreement, option, instrument or a series or combination thereof:.

a. To make or take delivery of, or assume or relinquish, a specified amount of one or more underlying interests, or to make a cash settlement in lieu thereof; or

b. That has a price, performance, value or cash flow based primarily upon the actual or expected price, level, performance, value or cash flow of one or more underlying interests.

This includes, but is not limited to, an option, warrant, cap, floor, collar, swap, forward or future, or any other agreement or instrument substantially similar thereto or any series or combination thereof. Each Derivative Instrument shall be viewed as part of a specific Derivative Program.

L. Derivative Program. A program to buy or sell one or more Derivative Instruments or open or close hedging positions to achieve a specific objective. Both hedging and non-hedging programs (e.g., for replication or income generation objectives) are included in this definition.

M. Discount Rates. The path of rates used to derive the present value.

N. Duration. The period of time elapsed from the Projection Start Date to a future date within the Projection Period.

O. Factor-based Amount. The portion of the Total Asset Requirement relating to liabilities which have been optionally subjected to and pass the Stochastic Exclusion Test.

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

Q. Liability-associated Derivative. A Derivative Program for which the Derivative Instrument cash flows are combined with liability cash flows within the Cash Flow Model.

R. Margin. The term "margin" means an amount included in the assumptions used to determine the Reported Amount that incorporates conservatism in the calculated value consistent with the requirements of the various sections of this Appendix. It is intended to provide for estimation error and adverse deviation.

S. Material Tail Risk. Material Tail Risk arises when the Scenario Amount for one or more Scenarios is materially higher when compared to the Scenario Amount for the rest of the Scenarios.

T. Net Asset Earned Rates. The path of earned rates reflecting the net general account portfolio rate in each projection interval (net of appropriate default costs and investment expenses).

U. Net Revenue Sharing Income. The amount of Revenue Sharing to be included in cashflow projections as defined in Subsection B of Section 3.

V. Non-Guaranteed Elements (NGE). Either: (a) dividends under participating policies or contracts; or (b) other elements affecting life insurance or annuity policyholder/contract holder costs or values that are both established and subject to change at the discretion of the insurer.

W. Non-modeled Amount. The portion of the Total Asset Requirement relating to liabilities for which neither the Stochastic Amount, Alternative Amount, nor Factor-based Amount has been quantified.

X. Policy. A life insurance policy included in the scope of this Report.

Y. Policyholder Behavior. Any action a policyholder, contract holder or any other person with the right to elect options, such as a certificate holder, may take under a policy or contract subject to this Act including, but not limited to, lapse, withdrawal, transfer, deposit, premium payment, loan, annuitization, or benefit elections prescribed by the policy or contract but excluding events of mortality or morbidity that result in benefits prescribed in their essential aspects by the terms of the policy or contract.

Z. Projection Start Date. The date on which the Projection Period begins.

AA. Projection Year. A 12-month period starting on the Projection Start Date or an anniversary of the Projection Start Date.

BB. Projection Interval. The time interval used in the Cash Flow Model to project the cash flow amounts (e.g. monthly, quarterly, annually).

CC. Projection Period. The period over which the Cash Flow Model is run.

DD. Prudent Estimate Assumption. A deterministic assumption, used to represent a Risk Factor, developed by applying a Margin to the Anticipated Experience Assumption for that Risk Factor.

EE. Qualified Actuary. An actuary who meets the qualifications as defined in Section 7 (Certification and Documentation Requirements) to certify that the amounts for the policies subject to this report have been calculated following all applicable laws, regulations, actuarial guidelines (AGs) and Actuarial Standards of Practice. The Qualified Actuary shall be referred to throughout this report as "the actuary".

FF. Risk Factor. An aspect of future experience that is not fully predictable on the Valuation Date.

GG. Reported Amount. The minimum amount as of the Valuation Date for the policies falling within the scope of this report using a principle-based approach. The Reported Amount equals the Total Asset Requirement less the statutory value on the valuation date of the liabilities included in the determination of the Total Asset Requirement.

HH. Revenue Sharing. 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 record-keeping. Only payments that are attributable to charges or fees taken from the underlying variable funds or mutual funds supporting the policies that fall under the scope of this report shall be included in the definition of Revenue Sharing.

II. Scenario. A sequence of outcomes used in the cash flow model, such as a path of future interest rates, equity performance, or separate account fund performance

JJ. Scenario Amount. Equals the amount determined in Section 2(I)(6) for a given set of policies for a given Scenario that is used as a step in the calculation of the Stochastic Amount.

KK. Starting Assets. The assets assigned to a Business Segment prior to the calculation of the Reported Amount, and valued as of the Projection Start Date.

LL. Stochastic Amount. The amount determined by applying a prescribed CTE level to the distribution of Scenario Amounts over a broad range of stochastically generated Scenarios calculated using Prudent Estimate Assumptions for all assumptions not stochastically modeled.

MM. Stochastic Exclusion Test. A test to determine whether the block of policies being tested is considered to have material tail risk arising from interest rate movements or equity performance. Passing the test allows the company to exclude the block of policies from the stochastic modeling calculation, and instead, use the current C3 RBC factors in determining the C3 amount on that block.

NN. Total Asset Requirement. The minimum amount as of the Valuation Date for the policies falling within the scope of this report using a principle-based approach and equals the sum over all Business Segments of the Stochastic Amount, Alternative Amount or Factor-based Amount for each Business Segment or combination of Business Segments, plus any Non-modeled Amount related to each segment or combination of segments.

OO. Valuation Date. The date for which the Reported Amount is to be valued as required by the NAIC Life Risk Based Capital Instructions.

PP. Working Reserve. The assumed reserve used in the projections of Accumulated Deficiencies supporting the calculation of the Scenario Amount.

Section 2. Definition of General Methodology

A. Summary

1. This Appendix applies the principles of risk management and asset adequacy analysis, using the tool of stochastic modeling to establish the C3 RBC risk component for the products within its scope. In general, a stochastic approach to interest rates and equity performance is preferred. However, an exception to the stochastic modeling requirement can be made if certain conditions are met, as described in Sections 2(I)(2) and 2(I)(3) below.
2. The Reported Amount for policies falling within its scope is to be based on an amount calculated using a stochastic method when appropriate (Stochastic Amount). The Stochastic Amount shall be determined based on projections of net cash flows using the methods described below.
3. The actuary may elect to perform the calculations required by this report on a date other than the Valuation Date, but in no event earlier than six months before the Valuation Date, as long as an appropriate method is used to adjust the amounts so determined to the Valuation Date. Disclosure of the results of such adjustment and the methodology used to determine the adjustment is required.
4. The Stochastic Amount is calculated in the aggregate using a projection of net cash flows over a broad range of stochastically generated Scenarios, using Prudent Estimate Assumptions for all assumptions not stochastically modeled, and then applying a prescribed Conditional Tail Expectation level.
5. It will not be necessary to determine the Stochastic Amount for groups of policies where such policies are deemed not have material tail risk by means of passing the Stochastic Exclusion Test detailed in Section 2(I)(2). For groups of policies passing the Stochastic Exclusion Test, the C3 amount may be determined as the Factor-based Amount as described in section 2K.
6. A company may elect to exclude certain policies from the stochastic modeling requirement if certain conditions are met (as described in Section 2(I)(3) below.) The Alternative Amount is otherwise determined for those policies not covered by the Factor-based Amount and otherwise excluded from the stochastic modeling requirement.
7. Recognizing that there may be some liabilities not included in a company's models, an amount for non-modeled liabilities should be included in the Total Asset Requirement determined.
8. The Total Asset Requirement is the sum over all Business Segments of the Stochastic Amount, the Alternative Amount or the Factor-based Amount for each Business Segment or combination of Business Segments plus any Non-modeled Amount related to each segment or combination of segments.
9. The Reported Amount is the Total Asset Requirement less the statutory value on the valuation date of the liabilities included in the determination of the Total Asset Requirement.

B. Prudent Estimate Assumptions

1. The actuary shall determine Prudent Estimate Assumptions used in the calculation for each Risk Factor that is not prescribed or is not stochastically modeled. The Prudent Estimate Assumptions shall vary from Scenario to Scenario as appropriate. A Prudent

Estimate Assumption is developed by applying a Margin to the Anticipated Experience Assumption for the Risk Factor. The Prudent Estimate Assumption for each Risk Factor shall be:

a. Consistent with those that would be appropriate for reserves;
b. Based on any relevant and credible experience that is available, including, but not limited to, the company's own experience studies and industry experience studies; and
c. Supported by a documented process to reassess the appropriateness of the assumptions in future valuations.

2. Anticipated Experience Assumption. The actuary shall use company experience, if relevant and credible, to establish the Anticipated Experience Assumption for any Risk Factor. To the extent that company experience is not available or credible, the actuary may use industry experience or other data to establish the Anticipated Experience Assumption, making modifications as needed to reflect the actuary's expectation of the risk.

3. In setting the Margin for a Risk Factor, the actuary must assure that:

   a. The Margin is directly related to uncertainty in the Risk Factor, whereby the greater the uncertainty, the larger the required Margin, with the Margin added or subtracted as needed to produce a larger Reported Amount than would otherwise result without it;

   b. Larger Margins are used if experience data are lacking or limited than would be the case if abundant and relevant experience data are available;

   c. The Margin satisfies any further conditions set forth by this report and applicable Actuarial Standards of Practice with respect to Margins or Prudent Estimate Assumptions for the Risk Factor.

4. In addition, in setting the Margin for a Risk Factor, the actuary must consider:

   a. That larger Margins may be required to reflect contingencies related to policyholder behavior in situations where a given policyholder action results in the surrender or exercise of a valuable option; and

   b. The margin should also reflect the extent to which the experience assumption is dynamically tied to the stochastically modeled elements, and therefore has variation already built into the base assumption; and

   c. The magnitude of fluctuation in the historical experience of the company for the Risk Factor, as measured by the standard deviation around the mean or other standard statistical measure (if meaningful historical experience data are available for the Risk Factor).

C. Cash Flow Models

1. Purpose. The Stochastic Amount calculations require the use of Cash Flow Models for each Business Segment. The Cash Flow Models shall:

   a. Project the premiums, benefits, expenses, and other applicable revenue items to be used in the calculations; and
   b. Project the total asset and liability cash flows, Net Investment Earnings, and invested asset balances for the purpose of determining the path of Accumulated Deficiencies.

2. General description of cash flow projections. For each Scenario for the Scenario Amount, a cash flow projection shall be made reflecting Federal Income Tax and shall reflect the dynamics of the expected cash flows for the entire Business Segment. The projection shall include the effect of all material product features, both guaranteed and non-guaranteed.

    a. Actual gross premiums received from the policyholder shall be included as revenue in the cash flow projection. Amounts charged to account values on General Account business (such as cost of insurance and expense charges) shall not be included in the cash flow projection as revenue, but shall be projected since they will affect the level of cash surrender benefits.

    b. All material benefits paid to policyholders, including but not limited to, death claims, surrender benefits, and withdrawal benefits, reflecting the impact of all material guarantees will be included in the cash flow projection.

    c. Net cash flows between the General Account and Separate Account for variable products will be included in the cash flow projection. Examples include allocation of net premiums to the Separate Account, policyholder-initiated transfers between fixed and variable investment options, transfers of Separate Account values to pay death or withdrawal benefits, and amounts charged to Separate Account values for cost of insurance, expenses, etc.

    d. Insurance company expenses and taxes (including overhead expenses), commissions, fund expenses, contractual fees and charges are to be reflected on a basis consistent with the requirements herein.

    e. Asset cash flows shall include cash receipts or disbursements associated with investment income, realized capital gains and losses, principal repayments, appropriate asset default costs, investment expenses, asset prepayments, and asset sales.

    f. Revenue sharing income received by the company (net of applicable expenses) and other applicable revenue and fees associated with the policies are to be reflected as described in Section 4.

    g. Cash flows from derivative liability and derivative asset programs are to be reflected as described in Section 3.

    h. Net cash flows associated with any reinsurance are to be reflected as described in Section 5.

    i. Throughout the projection, where estimates of asset or liability items are made that are neither stochastically generated nor prescribed, such estimates shall be on a Prudent Estimate basis.

3. Cash flows from starting assets. Assets at the beginning of the projection shall be selected from the company's actual assets backing the policies associated with each Business Segment. The amount of starting assets shall be determined as described in Section 2.E.1. Cash flows on General Account starting assets for each Projection Interval shall be determined as follows:

    a. Fixed income investments. (e.g., public bonds, convertible bonds, preferred stocks, private placements, ABS, commercial mortgage loans, residential mortgage loans, MBSs, and CMOs) including Derivative Instruments associated with these assets.

1. Gross investment income and principal repayments shall be modeled in accordance with the contractual provisions of each asset and in a manner consistent with each Scenario. Grouping of assets is allowed if the actuary can demonstrate that grouping does not result in a materially lower Scenario Amount than would have been obtained using a seriatim approach.
2. Appropriate asset default costs and investment expenses shall be reflected through a deduction to the gross investment income using Prudent Estimate Assumptions.
3. Realized capital gains and losses on asset sales shall be modeled in a manner that is consistent with the company's documented investment and disinvestment policy.
4. Any uncertainty in the timing and amounts of asset cash flows related to the paths of interest rates, equity returns, or other economic values contained in the various Scenarios shall be reflected directly in the projection of asset cash flows under the various Scenarios within the model as defined in Section 2.D.

b. Equity investments. (i.e., non-fixed income investments having substantial volatility of returns such as common stocks and real estate investments) including Derivative Instruments associated with these assets.

1. The number of equity investment categories, and the allocation of specific assets to each category (e.g. large cap stocks, international stocks, owned real estate, etc.) shall be determined by the actuary as described in Section 2.G.6.
2. The gross investment return (including realized and unrealized capital gains) for each investment category shall be projected in a manner that is consistent with the projected total return on the S&P 500 for the Scenario, reflecting any differences in the total return and risk between the S&P 500 and each equity investment category. This does not imply a strict functional relationship between the returns on the various investment categories and the return on the S&P 500, but it would generally be inappropriate to assume that an investment category consistently 'outperforms' (i.e. has lower risk, but achieves a higher expected return relative to the efficient frontier) the S&P 500.
3. The projected S&P 500 return for each Scenario shall be modeled stochastically as described in Section 2.D.
4. The time of sale of the asset shall be modeled in a manner that is consistent with the investment policy of the company for the respective equity investment categories. Investment expenses shall be reflected through a deduction to the gross investment return using Prudent Estimate Assumptions.

c. All other assets. Asset cash flows on other assets that are not described in item a) and b) above shall be modeled using methods consistent with the methods described in items a) and b) above. This includes assets that are a hybrid of fixed income and equity investments.

4. Cash flows from reinvestment assets. Net cash flows in each Projection Interval shall be reinvested in a manner consistent with the company's investment policy for each Business Segment. Handling of disinvestment shall be consistent with the company's investment policy and reflect economic reality such as the reasonable short-term

borrowing capacity of the company. Cash flows from reinvestment assets shall be determined as described in Section 2.C.3., but with the additional requirement that net spreads (net of default costs and investment expenses) over U.S. Treasuries reflect what a company expects to receive on the purchase and/or sale of securities and the strategies the company expects to utilize in managing its assets.

5. Frequency of Projection. 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 ensure that the use of a more frequent (i.e., shorter) timestep does not materially increase capital requirements. A more frequent time increment should always be used when the product features are sensitive to projection period frequency.
6. Length of Projection Period. The Projection Period shall be sufficiently long that no materially greater Stochastic Amount would result from a longer Projection Period.
7. Simplified approaches. Simplified approaches may be acceptable if they can be shown to produce amounts that are not materially less than those produced by a more robust Cash Flow Model.
8. Asset adequacy analysis principles and techniques as defined by applicable regulations, actuarial guidelines and Actuarial Standards of Practices shall be relied on for many of the detailed aspects encountered in projecting cash flows.

D. Description of Scenarios

1. The cash flow projections shall be made in a manner that reflect stochastically generated paths of U.S. Treasury yield curves, S&P 500 returns for General Account equity assets, and future fund performance for Separate Account assets. These stochastically generated paths shall be determined by:
    a. Stochastic generators and model parameters prescribed by the NAIC; or
    b. Pre-packaged scenarios generated from the stochastic generators and model parameters prescribed by the NAIC; or
    c. Stochastic models developed by the company, if mandated calibration criteria are met.
        1. Returns for equity performance and 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 in section E.
        2. Interest rate returns shall be determined on a stochastic basis such that the scenarios used must meet the scenario calibration criteria in section F.
        3. If the company chooses to use a fully integrated interest rate/equity return model, the equity return scenarios must satisfy the equity return calibration criteria adopted by the NAIC and the interest rate scenarios must satisfy the interest rate calibration criteria adopted by the NAIC.
2. For purposes of stochastically generating paths of S&P 500 returns for General Account equity assets, and future fund performance for Separate Account assets, pre-packaged scenarios may be downloaded from the American Academy of Actuaries webpage at the following address: http://www.actuary.org/life/phase2_2.asp.
3. For purposes of stochastically generating paths of paths of U.S. Treasury yield curves, the C3 Phase III generator model for interest rate scenarios, scenario picking tool, and pre-

packaged scenarios may be downloaded from the American Academy of Actuaries webpage at the following address: http://www.actuary.org/life/phase3.asp.

4. The number of scenarios for which Scenario Amounts are computed shall be considered to be sufficient if any resulting understatement in Reported Amount, as compared with that resulting from running a broader/more robust range of additional scenarios, is not material.

The actuary should document and justify the choice of scenarios used in the determination of C3 capital.

E. Calibration Criteria for Interest Rate Returns

1. Standard for the calibration of interest rate return models. In order to meet calibration requirements, the scenarios used must meet the requirements below. All tests must be considered (four time horizons point-in-time statistics for long and short rates, 30-year cumulative for spread). The Academy percentiles referred to below reflect the 10,000 scenarios created by the interest rate generator provided by the American Academy of Actuaries using the appropriate starting curve.

   a. For the short rate and long rate, point in time statistics at 1-, 5-, 10-, and 30-year horizons:
      1. Left Tail (low interest rates): 5^{th} percentile rate ≤ Academy 5^{th} percentile rate + max(a, b * Academy 5^{th} percentile rate)
      2. Right Tail (high interest rates): 95^{th} percentile rate ≥ Academy 95^{th} percentile rate - max(a, b * Academy 95^{th} percentile rate)
      3. For the 1-year horizon, a = 1.00% and b = 20%
      4. For the 5-, 10-, and 30-year horizons, a = 0.50% and b = 10%
   b. For the spread, cumulative statistics for the 30-year horizon:
      1. Left Tail (low spread): 5^{th} percentile spread ≤ Academy 5^{th} percentile spread + 0.50%
      2. Right Tail (high interest rates): 95^{th} percentile spread ≥ Academy 95^{th} percentile spread – 0.50%

F. Calibration Criteria for Equity Returns

1. Standard for the calibration of equity return models. Table 1 below provides the standard for the calibration of S&P500 equity return models.

Table 1: Calibration Standard for Total Return Wealth Ratios

Percentile	1 Year	5 Years	10 Years	20 Years
2.5%	0.78	0.72	0.79	n/a
5.0%	0.84	0.81	0.94	1.51
10.0%	0.9	0.94	1.16	2.1
90.0%	1.28	2.17	3.63	9.02
95.0%	1.35	2.45	4.36	11.7
97.5%	1.42	2.72	5.12	n/a

The "wealth factors" in Table 1 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.

To interpret the above values, consider the 5-year point of 0.72 at the $\alpha = 2.5^{th}$ percentile. This value implies that there is a 2.5 percent probability of the accumulated value of a unit investment being less than 0.72 in 5-years time, ignoring fees and expenses and without knowing the initial state of the process (i.e., this is an unconditional[1] probability). For left-tail calibration points (i.e., those quantiles less than 50%), lower factors after model calibration are required. For right-tail calibration points (quantiles above 50%), the model must produce higher factors.

The historic data do not permit credible inferences about long-term equity returns in the tails of the distribution. As such, factors for the 20-year horizon at the 2.5% and 97.5% points are deliberately excluded from the calibration.

2. Using the Calibration Points. The actuary may need to adjust the model parameters in order to satisfy the calibration criteria in Table 1. This can be accomplished in a variety of ways, but a straightforward approach would modify the parameters controlling "drift" (expected continuous return) and "volatility" (standard deviation of returns). This might be accomplished analytically, but in most practical applications would require simulation.

   As a first step, the actuary should determine which tail (left, right or both) is most relevant for the business being valued and then identify those calibration points not satisfied by the current scenario set.

   All else being equal, lowering drift will decrease the resulting wealth factors, while raising volatility will decrease the left-tail factors (i.e., those quantiles < 50%) and increase the right. Changes to both drift[2] and volatility parameters can obviously affect the entire shape of the curve, but as a general rule the "drift" terms have less impact over the shorter holding periods (i.e., the 1-year "tail factors" are more affected by volatility).

   As an example, suppose the company is using the independent lognormal ("ILN") model for equity returns. This is a two-parameter model whereby the log (i.e., continuous) returns are normally distributed with constant mean μ and variance $\sigma 2$. From the historic monthly S&P500TR data (December 1955 to December 2003, inclusive) we obtain the monthly maximum likelihood estimators of $\mu = 0.008356$ (10.03% annualized) and $\sigma = 0.042558$ (14.74 % annualized)[3].

   Without adjustment, ILN scenarios generated from these parameters would not satisfy the calibration requirements. Nevertheless, lowering the drift to $\mu = 0.006667$ (8% annualized) and increasing the standard deviation to $\sigma = 0.050518$ (17.5% annualized)

[1] In this context, the term "unconditional" should be interpreted to mean that the resulting values would be obtained "on average over the long term". This can be determined by using long-run or neutral values (e.g., median) for the initial state variables or by running the model with "current" state parameters over a longer period and ignoring the returns for the first 10 years.

[2] The term "drift" generically refers to those parameters which control the trend in the return process. The term volatility is reserved for the model components which affect the standard deviation of returns. For some models, such a fine distinction is not possible.

[3] Here, the parameters μ and σ are respectively the annualized mean and standard deviation of the associated normal distribution for the log (i.e., continuous) returns. μ is sometimes called the "drift" or "trend" parameter and is the expected log return over a 1 year horizon. The volatility parameter σ is the annualized standard deviation of the log returns.

would satisfy Table 1. This ILN model has an expected total return of 10% per annum. However, the resulting wealth factors would be too fat-tailed over the longer holding periods (relative to the criteria imposed by Table 1), indicating more conservatism than would strictly be necessary. As such, it should be clear that a two-parameter model (such as the ILN) does not offer much flexibility – to obtain a "better fit," it would be necessary to introduce more parameters. [4]

3. Satisfying the Calibration points. The scenarios need not strictly satisfy all calibration points, but the actuary should be satisfied that any differences do not materially reduce the resulting capital requirements. In particular, the actuary should be mindful of which tail most affects the business being valued. If capital is 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 benefit equal to a percentage of the gain would be most sensitive to the right tail, etc.), it is not absolutely necessary to meet the right (left) calibration points.

   If the scenarios are "close" to the calibration points, an acceptable method to true up the scenarios is to start with the lowest bucket not meeting the calibration criteria (e.g., one year factor at $\alpha = 2.5\%$) and randomly duplicate (or re-generate) a scenario meeting this criteria until the set of scenarios meets this calibration point. If a fixed number of scenarios is required, a scenario can be eliminated at random in the first higher bucket that satisfies the calibration criteria. The process would continue until all one-year calibration points are achieved and then be repeated for the 5, 10 and 20-year criteria. However, on completing the "bucket" for a given holding period, it may be necessary to redo the tests for the other horizons to ensure they still meet the calibration points. It is acknowledged that this method is not statistically correct, but it is not anticipated that the process would introduce any material bias in the calculated capital requirements.

   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.[5]

4. Other Markets/Funds. Modeling 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 Table 1. 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 should document the actual 1, 5, 10 and 20-year wealth factors of the scenarios at the frequencies given in Table 1. 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 should explain the reasonableness of any significant differences from the S&P500 calibration points.

[4] In particular, parameters are needed to model time-varying volatility.

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

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[6]. 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[7], with the co-efficients 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 establish consistency between the scenarios. While appealing, the above approaches do have drawbacks[8] and the actuary should not be overly optimistic in constructing the model parameters or the scenarios.

G. Starting and Projected Assets

1. Starting Asset Amount. The value of assets at the Projection Start Date shall be set equal to an amount no less than 98% of the statutory value of the reserve and other liabilities on the policies being valued at the Projection Start Date. All starting assets must be in the company's asset portfolios at the projection start date and be normally associated with supporting the Business Segment being modeled. Assets shall be valued consistently with their annual statement values. Starting assets shall include:
   a. Where assets supporting policies are held in Separate Accounts, the entire value of the assets in the Separate Accounts.
   b. The balance of any policy loans outstanding.
   c. An amount of assets in the General Account such that the sum of the assets in the Separate Account in G.1.a. and Policy Loans in G.1.b. and those selected from the

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

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

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

General Account are at least equal to 98% of the reserve and other liabilities on the policies being valued. If specific "hedge assets," such as equity put options, are being held for the benefit of these products, these are to be reflected in the model in full.

General Account assets chosen for use shall be selected on a consistent basis from one valuation hereunder to the next. For products in which a substantial portion of policyholder funds are allocated to Separate Accounts, in many instances the initial General Account assets may be negative, resulting in a projected interest expense.

2. Due and Accrued Investment Income. Starting Assets shall include the balance of any due and accrued investment income on the invested assets included in the starting asset amount.

3. Treatment of Derivative Instruments. Derivative Instruments currently held at the start of the projection that are part of a Derivative Program allocable to the business being valued and meeting the requirements described in Section 2.G.9 below shall be reflected in the projections and included with other General Account assets under Section 2.G.1.c above. To the extent that the sum of the value of such Derivative Instruments and the value of assets in Section 2.G.1.a. and b. above is greater than the estimated value of the Reported Amount as of the start of the projection, then the amount in Section 2.G.1.c. above may include enough negative General Account assets such that the sum of items 2.G.1.a and 2.G.1.b and 2.G.1.c above equals the estimated value of the Stochastic Amount as of the start of the projection.

4. Treatment of IMR. Any positive IMR balance allocable to the business being valued may be included. Any negative IMR balance allocable to the business being valued, to the extent it offsets positive IMR balances elsewhere in the entity, may also be included.

5. Valuation of Projected Assets. The values of projected Starting Assets shall be determined in a manner consistent with their values at the start of the projection. For reinvestment assets, 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.

6. Grouping of equity investments in the General Account. The portion of the Starting Asset Amount held in the General Account represented by equity investments (e.g. common stocks, real estate investments) may be grouped for modeling using an approach that establishes various equity investment categories, as determined by the actuary, with each investment category defined to reflect the different types of equity investments in the portfolio. In assigning each equity investment to an investment category, the fundamental characteristics of the asset shall have an appropriate relationship to the other assets assigned to the investment category.

   An appropriate proxy for each equity investment category shall be designed in order to develop the investment return paths. The development of the returns for the proxy equity investment categories is a fundamental step in the modeling and can have a significant effect on results. As such, the actuary must map each investment category to an appropriately crafted proxy investment category normally expressed as a linear combination of recognized market indices (or sub-indices). The proxy construction process should include an analysis that establishes a firm relationship between the investment return on the proxy and the specific equity investment category.

7. Grouping of Variable Funds and Sub-accounts. 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 sub-accounts 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 sub-account shall be designed in order to develop the investment return paths. The development of the returns for the proxy funds is a fundamental step in the modeling and can have a significant effect 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). The proxy construction process should include an analysis that establishes a firm relationship between the investment return proxy and the specific variable funds.

Funds can be grouped and projected as a single fund if such grouping is not anticipated to materially reduce capital requirements. 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.

8. Modeling of Derivative Programs. The appropriate costs and benefits of Derivative Instruments that are currently held by the company in support of the policies falling under the scope of this Appendix shall be included in the projections when determining the Stochastic Amount. The appropriate costs and benefits of anticipated future Derivative Instrument transactions associated with the execution of a Clearly Defined Hedging Strategy shall also be included in the projections when determining the Stochastic Amount. The appropriate costs and benefits of anticipated future Derivative Instrument transactions associated with non-hedging Derivative Programs (e.g., replication, income generation) undertaken as part of the investment strategy supporting the policies shall also be included in the projections when determining the Stochastic Amount provided they are normally modeled as part of the company's risk assessment and evaluation processes. Non-hedging programs included in the model should be appropriate to the business and not merely constructed to exploit foreknowledge of the components of the required methodology, and the actuary shall take due care in maintaining conditions in the model consistent with the requirements for permissibility of such programs.

   Specifics as to the modeling of Derivative Instruments are given in Section 3.

9. Requirements of a Clearly Defined Hedging Strategy. In order to qualify as a Clearly Defined Hedging Strategy, the strategy shall, at a minimum, identify:

   a. The specific risks being hedged (e.g., delta, rho, vega, etc.);
   b. The hedge objectives;
   c. The financial instruments that will be used to hedge the risks;
   d. The hedge trading rules including the permitted tolerances from hedging objectives; and
   e. The criteria, metrics and frequency for measuring hedging effectiveness.

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

   Strategies involving the offsetting of the risks associated with other products outside of the scope of this Appendix do not currently qualify as a Clearly Defined Hedging Strategy.

10. Modeling Federal Income Tax. The projections in support of the stochastic amount should be made on an after-tax basis. Reasonable approximations may be made by the Actuary for the projection of tax reserves and other items impacting the calculation of taxable income for a Business Segment. However, the actuary is required to consider

adjusting Scenario Amounts under circumstances described in Section I.6.a.5. where approximations for tax reserves are made.

H. Discount Rates

1. For the Scenario Amount calculations, the path of Discount Rates for each Business Segment shall be calculated as follows:

   a. Companies that model scenarios of interest rates either alone or integrated with scenarios of fund returns are to use the one-year treasury rates from that model multiplied by a factor of 105% and reduced for purposes of federal income tax.

   b. Companies that model only fund returns or do not model interest rates stochastically are to use the 90 CTE of the scenario discount factors. These factors are described below using an example.

   Assume the use of 200 scenarios. For year 1, 200 discount factors are determined, i.e. $1/(1+i_{1,s})$, where the discount rates are the one-year treasury yields from the pre-packaged scenarios referenced in section F.3, multiplied by 105%. These are ordered from lowest to highest, and the average of the highest 20 is taken. For year 2, 200 discount factors are determined, i.e. $1/(1+i_{1,s})(1+i_{2,s})$. These are ordered from lowest to highest, and the average of the highest 20 is taken. This process is continued for year 3 and so on. The interest rates are also tax adjusted above to a post-tax basis

   Over a 30 year horizon period the approach outlined above will give rise to 30 different discount rates. The company may simplify the discounting process by using fewer discount rates or even a single discount rate over the entire period. If the company follows this practice it must demonstrate or justify that the risk-based calculation is not materially lower as a result of this simplification.

   A numerical example of this process using 10 scenarios over a 10 year projection is given on the following page.

One Year Treasury Rates

Scenario / Year	1	2	3	4	5	6	7	8	9	10
1	1.99%	2.71%	2.71%	2.77%	2.93%	3.25%	2.87%	2.64%	2.40%	2.48%
2	1.38%	1.50%	1.86%	1.50%	1.67%	1.77%	1.56%	1.38%	1.32%	1.61%
3	1.71%	1.87%	1.81%	1.98%	1.65%	1.59%	1.37%	1.35%	1.33%	1.30%
4	1.93%	1.55%	1.69%	1.93%	1.83%	1.85%	1.80%	2.10%	2.27%	2.48%
5	1.96%	2.29%	2.41%	2.26%	2.01%	2.03%	2.27%	2.67%	2.70%	2.73%
6	1.87%	1.92%	1.72%	1.40%	1.68%	1.59%	1.49%	1.57%	1.42%	1.26%
7	1.91%	1.88%	2.16%	1.83%	1.91%	2.22%	2.24%	2.53%	2.74%	2.80%
8	1.67%	1.42%	1.51%	1.90%	1.80%	2.17%	2.10%	2.42%	2.55%	2.70%
9	2.00%	1.70%	2.03%	2.08%	2.02%	2.03%	2.06%	2.30%	1.93%	1.57%
10	1.94%	1.30%	1.52%	1.23%	1.44%	1.20%	1.23%	1.26%	1.48%	1.46%

105% of After-tax Discount Factors (taxes at 35%)

Scenario / Year	1	2	3	4	5	6	7	8	9	10
1	0.98658	0.96868	0.95106	0.93339	0.91508	0.89520	0.87801	0.86249	0.84860	0.83450
2	0.99065	0.98062	0.96834	0.95855	0.94777	0.93647	0.92663	0.91797	0.90975	0.89988
3	0.98850	0.97606	0.96413	0.95128	0.94066	0.93059	0.92196	0.91358	0.90536	0.89743
4	0.98703	0.97671	0.96555	0.95299	0.94123	0.92947	0.91817	0.90518	0.89136	0.87654
5	0.98677	0.97159	0.95587	0.94137	0.92865	0.91595	0.90196	0.88584	0.86982	0.85390
6	0.98742	0.97463	0.96331	0.95419	0.94336	0.93324	0.92387	0.91408	0.90529	0.89755
7	0.98711	0.97463	0.96051	0.94869	0.93650	0.92253	0.90864	0.89325	0.87683	0.86042
8	0.98873	0.97923	0.96925	0.95686	0.94526	0.93144	0.91830	0.90340	0.88793	0.87186
9	0.98652	0.97521	0.96187	0.94841	0.93549	0.92269	0.90990	0.89585	0.88419	0.87482
10	0.98694	0.97826	0.96819	0.96014	0.95078	0.94304	0.93517	0.92722	0.91793	0.90888

Re-ordered Highest to lowest within year

Scenario / Year	1	2	3	4	5	6	7	8	9	10
1	0.99065	0.98062	0.96925	0.96014	0.95078	0.94304	0.93517	0.92722	0.91793	0.90888
2	0.98873	0.97923	0.96834	0.95855	0.94777	0.93647	0.92663	0.91797	0.90975	0.89988
3	0.98850	0.97826	0.96819	0.95686	0.94526	0.93324	0.92387	0.91408	0.90536	0.89755
4	0.98742	0.97671	0.96555	0.95419	0.94336	0.93144	0.92196	0.91358	0.90529	0.89743
5	0.98711	0.97606	0.96413	0.95299	0.94123	0.93059	0.91830	0.90518	0.89136	0.87654
6	0.98703	0.97521	0.96331	0.95128	0.94066	0.92947	0.91817	0.90340	0.88793	0.87482
7	0.98694	0.97463	0.96187	0.94869	0.93650	0.92269	0.90990	0.89585	0.88419	0.87186
8	0.98677	0.97463	0.96051	0.94841	0.93549	0.92253	0.90864	0.89325	0.87683	0.86042
9	0.98658	0.97159	0.95587	0.94137	0.92865	0.91595	0.90196	0.88584	0.86982	0.85390
10	0.98652	0.96868	0.95106	0.93339	0.91508	0.89520	0.87801	0.86249	0.84860	0.83450

Discount rate = average of highest 10% within year

0.99065	**0.98062**	**0.96925**	**0.96014**	**0.95078**	**0.94304**	**0.93517**	**0.92722**	**0.91793**	**0.90888**

Appendix 3
Approach to Determining C3 Requirements for Life Insurance Products

I. The Stochastic Amount

1. Purpose. The purpose of the Stochastic Amount is to produce an amount that is adequate to cover the product benefits, revenue and expenses over a broad range of stochastically generated Scenarios for all policies falling under the scope of this Appendix. It is meant to capture all material C3 risks. The Stochastic Amount may be determined assuming that all, or only some, of the risks underlying the policies are modeled stochastically, but at a minimum, it must assume that interest rate movements, equity movements, and separate account fund performance be modeled stochastically.

2. Stochastic Exclusion Test

   It will not be necessary to perform stochastic modeling for groups of policies where such policies are deemed not have material tail risk by means of passing the Stochastic Exclusion Test detailed in Section 6. For groups of policies passing the Stochastic Exclusion Test the C3 amount may continue to be determined as the Factor-based Amount as described in Section 2K below.

3. Stochastic Modeling Exclusion: The actuary may elect to exclude certain groups of policies from the stochastic modeling requirement upon demonstration that the Alternative Amount for those policies will adequately provide for all material C3 risks underlying such policies. Policies that do not pass the Stochastic Exclusion Test are still eligible to use this stochastic modeling exclusion.

4. Stochastic Amount Calculation Description: The Stochastic Amount is determined using the following steps:
   a. Determine policy grouping as defined in Section 2.I.5;
   b. Determine Prudent Estimate Assumptions as defined in Section 2.B above;
   c. Project cash flows for each Business Segment for each Scenario as described in Section 2 C, D, and E;
   d. Calculate the path of Discount Rates for each Business Segment for each Scenario as described in Section 2H ;
   e. Calculate the Scenario Amount for each Scenario using the methodology described in Section 2.I.6; and;
   f. Calculate the Stochastic Amount as described in Section 2.I.7, below.

5. Grouping of Policies for Modeling: Projections may be performed for each policy in force on the date of valuation or by grouping policies into representative cells of model plans using all characteristics and criteria having a material impact on the size of the Reported Amount. Grouping shall not be done in a manner that intentionally understates the resulting Reported Amount.

6. Calculation of the Scenario Amount

   a. For each Scenario, the Scenario Amount for one or more Business Segments is determined by following steps (1) through (5) below:
      1. Calculate the net accumulated asset amount for each Business Segment at the end of each Projection Year and at the Projection Start Date, as described in 2.I.6.c below. Note that the net accumulated asset amount can be either positive or negative;
      2. Calculate the Accumulated Deficiency for each Business Segment at the end of each Projection Year and at the Projection Start Date for each Business Segment as the excess of the Working Reserve over the

net accumulated asset amount at that duration. Note that the Accumulated Deficiency can be either positive or negative. The Working Reserve is equal to the cash surrender value for purposes of this calculation. For policies having no cash surrender value the Working Reserve is equal to zero;

3. At the end of each Projection Year and at the Projection Start Date, calculate the discounted value of the Accumulated Deficiency for each Business Segment that was calculated in step 2.a.(2) above. The discounted value shall be calculated using the path of Discount Rates for the Business Segment from the Projection Start Date to the end of the Projection Year;
4. Determine the aggregate discounted value of the Accumulated Deficiency at the end of each Projection Year and at the Projection Start Date as the sum of the discounted value of Accumulated Deficiency at that Duration across Business Segments; and
5. Determine the Scenario Amount as the sum of (a) the statement value of the starting assets across Business Segments and (b) the maximum of the values calculated in step (4) above. Note that the amount in (b) herein can be either positive or negative.

The Actuary shall consider making an adjustment to the Scenario Amount for the difference between the modeled and actual tax reserves at the beginning of the projection, if necessary.

In the case where actual tax reserves are higher (lower) than the modeled tax reserve at the beginning of the projection period, the modeled tax expense may be understated (overstated) over the projection period. If a tax adjustment is required the Total Asset Requirement must be increased (decreased) on an approximate basis to correct for the understatement (overstatement) of modeled tax expense. A tax adjustment is more likely to be required where tax reserves are not projected directly; for example, where projected tax reserves are approximately modeled as cash values or other approximations.

An acceptable adjustment to the Scenario Amount may be calculated as the corporate tax rate (i.e. 35%) times "f" times the difference between modeled tax reserves and actual tax reserves at the start of the projections. For this calculation, f is calculated as follows. For the scenarios reflected in calculating CTE (90), the lowest of these present values of Accumulated Deficiency is determined for each calendar year-end and its associated projection duration is tabulated. At each such duration, the ratio of the number of contracts in force (or covered lives for group contracts) to the number of contracts in force (or covered lives) at the start of the modeling projection is calculated. The average ratio is then calculated, over all CTE (90) scenarios, and f is one minus this average ratio.

b. The aggregation of one or more Business Segments for purposes of determining the Scenario Amount is up to actuarial judgment.

It is not required that each Business Segment use the same set of stochastic Scenarios. However, any set of Scenarios would be subject to the scenario requirements specified in Section 2.D above. The use of a different set of

stochastic Scenarios would generally result in the inability to aggregate results across the two or more Scenario sets.

c. For each Scenario the net accumulated asset amount for a Business Segment at the end of each Projection Year is equal to the projected statement value of invested assets for that Business Segment. For all Scenarios, the net accumulated asset amount for a Business Segment at the Projection Start Date is the statement value of starting assets for that Business Segment. The projected statement value of invested assets at any future duration must reflect the accumulation of cash flows into and out of the portfolio for the items listed in (1) through (8) below as described in Sections 2.C.2. and 2.C.3. The net accumulated asset amount can be either positive or negative, according to:

1. Benefits, including but not limited to death and cash surrender benefits;
2. Expenses, including but not limited to, commissions, general expenses, and premium taxes;
3. Gross premium payments;
4. Other applicable revenue such as fees and revenue on assets invested in sub-accounts, and any Revenue Sharing income;
5. Net payments to/from the General Account from/to the Separate Account;
6. Net Investment Earnings (including realized gains);
7. Net cash flows from Liability-associated Derivatives, and
8. Federal income taxes.

7. <u>The Stochastic Amount</u>

The Stochastic Amount is determined as the sum of applying steps a. and b. below to each segment or set of segments for which a Scenario Amount has been calculated.

a. Rank the Scenario Amounts from lowest to highest; and
b. Take the average of the highest 10% of the Scenario Amounts.

If necessary, add an amount to item (b) above to capture any material risk included in the scope of these requirements but not already reflected in item (b) above.

The actuary may elect to base the projections on asset and policy inforce data that have an "as of" date prior to the valuation date, but in no event earlier than six months before the Valuation Date, provided that such data can be adjusted so that the calculated amount that is based on such data is, in the actuary's judgment, appropriate. The actuary should disclose and discuss in the supporting memorandum any use of prior period data and the reasoning leading to the conclusion that the calculated amount based on such data is appropriate. Disclosure of the results of such adjustment and the methodology used to determine the adjustment is required. Any such adjustment would generally consider:

1. Changes in economic conditions between the prior period date and the valuation date;
2. The recognition of estimated cash flows from new business during that period;
3. Material transactions such as reinsurance (either ceded or assumed) of a block of business;
4. Material changes in asset profile;
5. Material changes in liability profile;
6. Material change in matching position of assets and liabilities;

7. Change in the effectiveness of Derivative Programs; changes to existing or addition of new Derivative Programs; and
8. Changes to existing or addition of new reinsurance arrangements.

The Stochastic Amount may be reduced, but not to less than zero, by the factor-based RBC covering market volatility risk of equity assets used in the determination of the Stochastic Amount. The amount of such adjustment and its derivation is to be documented in the Actuarial Report. The adjustment reverses the factor-based C1cs relating to existing equity assets that are included in the determination of the market risk component for Life Insurance Products. The adjustment is determined by applying the applicable risk factors to the applicable amount of assets included in the models in determining the market risk component for Life Insurance Products. The source of the risk factor to be applied and line items that include the asset amounts are given in the table below.

	Asset Class	Amount	Factor
1	Admitted Unaffiliated Public Common Stock	LR005 line (23) column (1) [in part]	LR005 line (24) column (4)
2	Admitted Unaffiliated Public Common Stock	LR008 line (42) column (1) [in part]	LR008 line (42) column (4)

The actuary who certifies the RBC amount must be reasonably certain that the risks that the factor-based RBC are attempting to measure are captured in the Stochastic Amount and that the amount of assets included in determination of the adjustment is not greater than the statutory value of such assets included in the models underlying the Stochastic Amount.

The Stochastic Amount may be reduced, but not to less than zero, by the factor-based RBC covering recoverability of expense allowances at the valuation date relating to liabilities being modeled. The amount of such adjustment and its derivation is to be documented in the Actuarial Report. The adjustment reverses the factor-based C1cs relating to existing equity assets that are included in the determination of the market risk component for Life Insurance Products. The adjustment is determined by applying the applicable risk factors to the applicable amount of assets included in the models in determining the market risk component for Life Insurance Products. The source of the risk factor to be applied and line items that include the asset amounts are given in the table below.

	Asset Class	Amount	Factor
1	Expense Allowance Transfers - All Other	LR006 line (11) column (1) [in part]	LR006 line (11) column (2) x 0.65
2	Expense Allowance Transfers - Surrender Charge Based on Fund Contribution and the Fund Balance Exceeds the Sum of the Premiums Less Withdrawals	LR006 line (12) column (1) [in part]	LR006 line (12) column (2) x 0.65

The actuary who certifies the RBC amount must be reasonably certain that the risks that the factor-based RBC are attempting to measure are captured in the Stochastic Amount

and that the amount of expense allowances included in determination of the adjustment is not greater than the statutory value of such allowances relating to the liabilities included in the models underlying the Stochastic Amount.

To the extent the Stochastic Amount is based on data prior to the valuation date and the Total Adjusted Capital is less than 110 percent of the Company Action Level amount, it will be necessary to re-determine the Stochastic Amount subsequent to filing, using actual year-end data. If the re-determined RBC value exceeds that estimated earlier in the blanks filing by more than 5 percent, or if the actual value triggers regulatory action, a revised filing with the NAIC and the state of domicile is required by June 15; otherwise re-filing is permitted but not required.

J. The Alternative Amount

1. Purpose. The purpose of the Alternative Amount is to produce a C3 amount that is adequate to cover the C3 risks related to the product benefits and expenses, reflecting future revenue, for those policies for which the stochastic modeling exclusion has been made.

2. Alternative Amount Description. The Alternative Amount for a given set of policies within a Business Segment is to be determined by the actuary, subject to the minimum floor described in J.5. below. The actuary must be able to demonstrate how he/she came to the conclusion that the Alternative Amount covers adverse experience at a comparable CTE level to the Stochastic Amount which would have been calculated for such policies had the stochastic modeling exclusion not been made. The actuary must be able to demonstrate how he/she came to the conclusion that the Alternative Amount considers the dynamics of the liability and supporting asset cash flows in response to changes in interest rates and market movements.

3. The appropriate costs and benefits of Derivative Instruments that are currently held by the company in support of the policies falling under the scope of this Appendix shall be included in the projections when determining the Alternative Amount. The Alternative Amount shall take into account the appropriate costs and benefits of Derivative Instruments expected to be held in the future through the execution of that strategy only if the company is following a Clearly Defined Hedging Strategy and the hedging strategy meets the requirements as defined in Section 2.G.9 above.

4. As a minimum requirement, the Alternative Amount may be determined for a set of policies if and only if such policies have been subjected to asset adequacy testing at the valuation date. Asset adequacy testing analysis methods need not be limited to cash flow testing. The actuary should use professional judgment in choosing an appropriate testing method among those currently in use in generally accepted actuarial standards of practice.

5. The Alternative Amount may not be less than the sum of the following amounts:

    a. The statutory reserve at the Valuation Date relating to such policies; and
    b. 0.5% of the net balance of item (a) above less associated policy loans in the case of the company submitting an unqualified actuarial opinion based on asset adequacy testing; otherwise 0.75% of the net balance of item (a) above less associated policy loans.

[Note: the intent of the minimum amount is to provide assurance that the C3 requirements for blocks of business for which the Alternative Amount has been determined and not subjected to

stochastic scenario analysis are not less than the current factor-based rules. The minimum requirement is viewed as a temporary measure until regulators and industry are comfortable with the process, as a minimum requirement would not generally be included in a principle-based approach. It is recommended that the minimum requirement be removed after a period of 3 years following the date that the recommendations within this Appendix first become effective.]

If the Alternative Amount is determined on a date that precedes the Valuation Date, then the Alternative Amount shall be adjusted to the Valuation Date.

The actuary shall annually re-evaluate the adequacy of the Alternative Amount. If, as of the end of any calendar year, the actuary determines the Stochastic Amount will materially exceed the Alternative Amount for the group of policies:

i. The Alternative Amount shall be increased so the Stochastic Amount does not materially exceed the Alternative Amount, or
ii. The exclusion shall be discontinued and the Stochastic Amount shall be held.

6. Alternative Amount Demonstration and Analysis. A demonstration supporting the exclusion from stochastic modeling must be provided in the initial exclusion year and at least once every three calendar years subsequent to the initial exclusion. Such demonstration may use a series of deterministic scenarios with varying levels of imputed adverse deviations, or other techniques, to impute what confidence level and CTE level is covered, and that the resulting Alternative Amount is consistent with the intended conservatism implicit in the determination of the Stochastic Amount, had the Stochastic Amount been determined. The level of thoroughness required in the demonstration would be greater the more material the C3 risks related to the block, and the higher the level of volatility and unpredictability of the underlying variables (e.g., products with guarantees but investing in stocks would need more testing than a participating whole life product with a 3% guarantee.) Such demonstration must be accompanied by a high level analysis of the products, the associated C3 risks and the potential C3 capital needs of the products under adversity.

K. Factor-based Amount

1. The actuary may choose, for a given group of policies, to apply the Stochastic Exclusion Test as detailed in Section 6. It will not be necessary to perform stochastic modeling for groups of policies passing the Stochastic Exclusion Test. Such groups of policies are deemed not to have material tail risk and the C3 amount will be defined as the Factor-based Amount.

2. The Factor-based Amount will be determined as the sum of the following amounts:

   a. The statutory reserve at the Valuation Date relating to such policies; and
   b. 0.5% of the net balance of item (a) above less associated policy loans in the case of the company submitting an unqualified actuarial opinion based on asset adequacy testing.

L. Non-modeled Amount

1. There may be some immaterial amounts of liabilities covered by this recommendation that are not modeled. For these products, the Non-modeled Amount is equal to the statutory value on the valuation date of the non-modeled liabilities, plus the greater of

0.5% (the current C3 after-tax factor for life insurance products) or the ratio of the sum of the modeled Stochastic Amount and Alternative Amount to the modeled liabilities, times the statutory value on the valuation date of the non-modeled liabilities.

M. Total Asset Requirement

1. The Total Asset Requirement equals the sum over all Business Segments of the Stochastic Amount, the Alternative Amount or the Factor-based Amount for each Business Segment or combination of Business Segments, plus any Non-modeled Amount related to each segment or combination of segments.

N. The Reported Amount

1. The Reported Amount is the minimum amount as of the Valuation Date for the policies falling within the scope of this Appendix. The Reported Amount equals the Total Asset Requirement less the statutory value on the valuation date of the liabilities included in the determination of the Total Asset Requirement.

2. The Reported Amount relates to interest rate risk and market risk. The portion which is attributable to interest rate risk is to be combined with the current C3a component of the formula. The portion which is attributable to market risk is to be allocated and combined with the current C3c component of the formula.

   In allocating the Reported Amount between the interest and market risk components the actuary is guided by the following:

   a. In certain situations or for certain products the Reported Amount relates in its entirety to either interest rate risk or market risk. In such cases no allocation is necessary.

   b. In certain situations or for certain products the interest rate risk or market risk may not be a material portion of the Reported Amount. In such situations the actuary may consider allocating the entire amount to the more material portion of the two risk types comprising the Reported Amount. In doing so the actuary should consider the covariance effect of making such an allocation. The allocation of the non-material portion, through the allocation of the entire Reported Amount to one risk component, is conservative if the allocated to risk component has the lower covariance impact. The allocation of the non-material portion, through the allocation of the entire Reported Amount to one risk component, is not conservative if the allocated to risk component has the higher covariance impact. In such case the actuary will be required to document his/her assessment of the materiality of the risk and rationale for such allocation.

   c. In other situations or for other products both the interest rate risk and market risk may form a material portion of the Reported Amount. In this case allocating the Reported Amount to the component with the least covariance effect would be conservative and acceptable. Otherwise, the actuary must develop and document an appropriate basis for allocating the Reported Amount.

O. Treatment of Non-Guaranteed Elements

1. Non-Guaranteed Elements (NGE) are to be included in the models used to project future cash flows for the Stochastic Amount. Where NGEs are based on some aspect of experience, future changes in the level of NGEs can be reflected in the Cash Flow Model based on the experience assumed in each Scenario.
2. As would be the case in actual practice, the projected NGE should not be assumed to change simultaneously with the change in projected experience, but only at the date following the recognition of a change in experience on which the company would normally implement a change.
3. When determining the projected NGE for each Scenario, the actuary must take into consideration those factors that affect how the company will modify its current NGE scale, such as existence of contract guarantees, the company's past NGE practices and current NGE policies.
4. Due to the uncertainty in the future level of NGEs arising from factors such as those listed below, a Margin should be established for the projected NGE that would result in an increase in the Scenario Amount compared to the Scenario Amount that would result without a Margin.
5. The liability for dividends declared but not yet paid that has been established according to statutory accounting procedures as of the Valuation Date is reported separately from the statutory reserve. This liability may be included or not included in the Cash Flow Model at the company's option. If the dividends that give rise to the dividend liability are included in the Cash Flow Model, then the dividend liability may be included in the liabilities that are deducted from the Total Asset Requirement in calculating the RBC requirement.
6. Non-guaranteed elements that represent the payments of retained surplus, other than divisible surplus under participating contracts, may be excluded from these calculations.

Section 3. Modeling of Derivative Instruments

A. General Considerations

The appropriate costs and benefits of Derivative Instruments that are currently held by a company in support of the policies falling under the scope of this Appendix shall be included in the projections when determining the Stochastic Amount.

The appropriate costs and benefits of anticipated future Derivative Instrument transactions associated with the execution of a Clearly Defined Hedging Strategy shall also be included in the projections if a company is following a Clearly Defined Hedging Strategy and the hedging strategy meets the requirements as defined in Section 2.G.

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. To the extent these requirements conflict with any applicable law, the applicable law supersedes.

The analysis of the impact of the Derivative Program on cash flows is typically performed using either one of two methods as described below. Although a Derivative Program would normally be expected to reduce risk provisions, the nature of the Derivative Program and the costs to implement the strategy may result in an increase in the amount of the Reported 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 cash flow model used to determine the Reported Amount.

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

Regardless of the methodology used by the company, the ultimate effect of the current Derivative Program (including currently held Derivative Instruments), on the Reported Amount needs to recognize all risks, associated costs, imperfections in the hedges and hedging mismatch tolerances associated with the Derivative Program. 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 Reported Amount attributable to the Derivative Program may need to be limited due to the uncertainty associated with the company's ability to implement the Derivative Program 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, transform some risks into others, introduce new risks or may have other imperfections. For example, a delta-only hedging strategy does not adequately hedge the risks measured by the relationships between the sensitivities to equity markets and interest rates (commonly referred to as 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.

B. Specific Conditions and Requirements

As part of the process of choosing a methodology and assumptions for estimating the future effectiveness of the current Derivative Program (including currently held Derivative Instruments) for purposes of reducing the Reported 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 Derivative Program, 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 (Greeks) associated with some guaranteed policyholder options embedded in some products and these same sensitivities associated with the hedging assets are subject to material discontinuities. 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 policyholder 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 Reported 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.

The implementation of a strategy strongly dependent on the acquisition of hedging assets at specific times, which also depends on specific values of an index or other market indicators, may not happen precisely as planned.

The combination of elements of the 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 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:

1) Hedging strategies with no initial investment that never lose money in any scenario and in some scenarios make money; or
2) 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 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 as to why the actuary believes the situations are not material for determining the Reported 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 Reported 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 Reported 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.

C. Derivative Program Certification and Documentation

The actuary must provide a certification that the assumptions used in determining the impact of Derivative Programs on the calculations were reasonable for the purpose of determining the Reported Amount.

The actuary must provide a certification as to whether the Clearly Defined Hedging Strategy is fully incorporated into the cash flow model and any supplementary analysis of the impact of the Derivative Program on the Reported Amount. The actuary must document the extent to which elements of the Derivative Program (e.g., time between portfolio rebalancing) are not fully incorporated into the 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 Derivative Program designated as the Clearly Defined Hedging Strategy meets the requirements of a Clearly Defined Hedging Strategy. This includes certification that the implementation of the Derivative Program 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 Derivative Program modeled is the Derivative Program being used by the company in its actual day-to-day risk mitigation efforts.

Section 4. Revenue Sharing Assumptions

A. Requirements

1. Projections may include income from projected future Revenue Sharing (as defined in this Report**)** net of applicable projected expenses ("Net Revenue Sharing Income") if the following requirements are met**:**

   a. The Net Revenue Sharing Income is received by the company;[9]

   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.

B. Revenue Sharing Amounts

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;

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; or

g. 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 (e) above) shall be included in the projections as a company expense. 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 that reduce the Net Revenue Sharing Income.

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

C. Margins

1. The amount of projected Net Revenue Sharing Income shall also reflect a Margin (which decreases the assumed Net Revenue Sharing Income) directly related to the uncertainty of the revenue, including uncertainty regarding the creditworthiness of the provider of the Net Revenue Sharing Income. The greater the uncertainty, the larger the Margin. [10]

2. To the extent the agreements(s) guarantees[11] 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.[12]

D. Additional Requirements

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.

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[10] 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.

[11] 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.

[12] 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.

Section 5. Reinsurance

A. General Considerations

1. In this section, "reinsurance" includes retrocession and "assuming company" includes a retrocessionaire.
2. The company shall use assumptions and margins in developing the Reported Amount that are appropriate for each company pursuant to a reinsurance agreement. The ceding and assuming companies are not required to use the same assumptions and margins for the reinsured policies.
3. In determining the Reported Amount, one party to a reinsurance transaction may make use of calculations of the other party. If the company chooses assumptions that differ from those used by the other party, the company must either rerun the calculation or be prepared to demonstrate that appropriate adjustments to the other party calculation have been made.
4. A reinsurance agreement or amendment shall be considered in force and included in calculating the Reported Amount if:
   a. The agreement or amendment has been duly executed by both parties no later than the "as of date" of the financial statement; or
   b. A binding letter of intent has been duly executed by both parties no later than the "as of date" of the financial statement unless no final agreement or amendment has been executed more than 90 days after the execution date of the letter of intent; or
   c. If neither (a) nor (b), but the company has determined after review of the relevant facts and circumstances that it is likely to have legal obligations under the agreement or amendment and including the agreement or amendment would result in a higher Reported Amount.
5. To the extent that a single deterministic valuation assumption for risk factors associated with certain provisions of reinsurance agreements will not adequately capture the risk, the company shall:
   a. Stochastically model the risk factors directly in the cash flow model when calculating the Stochastic Amount, or
   b. Perform a separate stochastic analysis outside the cash flow model to quantify the impact on reinsurance cash flows to and from the company. The results of this analysis shall be used to adjust prudent estimate assumptions or to determine an amount to adjust the Stochastic Amount to adequately make provision for the risks of the reinsurance features.

B. Reinsurance Ceded

The company shall determine cash flows for reinsurance ceded subject to the following:

1. The company shall include the effect of projected cash flows received from or paid to assuming companies under the terms of ceded reinsurance agreements in the cash flows used in calculating the Stochastic Amount.
2. If cash flows received from or paid to assuming companies under the terms of any reinsurance agreement are dependent upon cash flows received from or paid to assuming companies under other reinsurance agreements, the company shall first determine reinsurance cash flows for reinsurance agreements with no such dependency and then use the reinsurance cash flows from these independent agreements to determine reinsurance cash flows for the remaining dependent agreements.

3. The company shall use assumptions to project cash flows to and from assuming companies that are consistent with other assumptions used by the company in calculating the Reported Amount for the reinsured policies, and that reflect the terms of the reinsurance agreements.

C. Reinsurance Assumed

1. The company shall determine cash flows for reinsurance assumed subject to the following:

   a. The company shall include the effect of cash flows projected to be received from and paid to ceding companies under the terms of assumed reinsurance agreements in the cash flows used in calculating the Stochastic Amount.

   b. If cash flows received from or paid to ceding companies under the terms of any reinsurance agreement are dependent upon cash flows received from or paid to ceding companies under other reinsurance agreements, the company shall first determine reinsurance cash flows for reinsurance agreements with no such dependency and then use the reinsurance cash flows from these independent agreements to determine reinsurance cash flows for the remaining dependent agreements.

2. The company shall use assumptions to project cash flows to and from ceding companies that reflect the assuming company's experience for the business segment to which the reinsured policies belong, and reflect the terms of the reinsurance agreement.

D. Reinsurance Assumptions

1. The company shall assume that the counterparties to a reinsurance agreement are knowledgeable about the contingencies involved in the agreement and likely to exercise the terms of the agreement to their respective advantage, taking into account the context of the agreement in the entire economic relationship between the parties. In setting assumptions for the non-guaranteed elements in reinsurance cash flows the company shall include, but not be limited to the following:

   a. The usual and customary practices associated with such agreements.

   b. Past practices by the parties concerning the changing of terms, in an economic environment similar to that projected.

   c. Any limits placed upon either party's ability to exercise contractual options in the reinsurance agreement.

   d. The ability of the direct-writing company to modify the terms of its policies in response to changes in reinsurance terms.

   e. Actions that might be taken by a party if the counterparty is in financial difficulty.

2. The company shall account for any actions that the ceding company and, if different, the direct-writing company have taken or are likely to take that could affect the expected cash flows of the reinsured business in determining assumptions for the Reported Amount.

   Examples of actions the direct-writing company could take include 1) instituting internal replacement programs or special underwriting programs, both of which could change expected mortality rates, or 2) changing non-guaranteed elements in the reinsured policies, which could affect mortality, policyholder behavior, and possibly expense and investment assumptions. Examples of actions the ceding company could take include: 1) the exercise of contractual options in a reinsurance agreement to influence the setting of

non-guaranteed elements in the reinsured policies, or 2) the ability to participate in claim decisions.

3. For actions taken by the ceding company, and, if different, the direct-writing company, the company shall set assumptions in a manner consistent with Section 2B. Note that these assumptions are in addition to, rather than in lieu of, assumptions as to the behavior of the underlying policyholders.

4. The company shall use assumptions in determining the Reported Amount that account for any actions that the assuming company has taken or is likely to take that could affect the expected cash flows of the reinsured business.

   Examples of such actions include, but are not limited to, changes to the current scale of reinsurance premiums and changes to expense allowances.

5. The company shall consider all elements of a reinsurance agreement that the assuming company can change and assumptions for those elements are subject to the requirements in Section 2O. Appropriate assumptions for these elements may depend on the scenario being tested. The company shall take into account all likely consequences of the assuming company changing an element of the reinsurance agreement, including any potential impact on the probability of recapture by the ceding company.

   The ability of an assuming company to change elements of a reinsurance agreement, such as reinsurance premiums or expense allowances, may be thought of as comparable to the ability of a direct-writing company to change non-guaranteed elements on policies.

6. The company shall set assumptions in a manner consistent with Paragraph 2 above taking into account any ceding company option to recapture reinsured business. Appropriate assumptions may depend on the scenario being tested (analogous to interest-sensitive lapses).

   The right of a ceding company to recapture is comparable to policyholder surrender options for a direct-writing company. Cash flows associated with recapture include recapture fees or other termination settlements.

7. The company shall set assumptions in a manner consistent with Paragraph 4 above taking into account an assuming company's right to terminate in-force reinsurance business. In the case in which the assuming company's right to terminate is limited to cases of non-payment of amounts due by the ceding company or other specific, limited circumstances, the company may assume that the termination option would be expected to have insignificant value to either party and therefore may exclude recognition of this right to terminate in the cash flow projections. However, if a reinsurance agreement contains other termination provisions with material impact, the company shall set appropriate assumptions for these provisions consistent with the particular scenario being tested.

8. If under the terms of the reinsurance agreement, some of the assets supporting the Stochastic Amount are held by the counterparty or by another party, the company shall

   a. Consider the following in order to determine whether to model such assets for purposes of projecting cash flows:

      (i). The degree of linkage between the portfolio performance, and the calculation of the reinsurance cash flows.

      (ii). The sensitivity of the valuation result to the asset portfolio performance.

   b. If the company concludes that modeling is unnecessary, document the testing and logic leading to that conclusion.

c. If the company determines that modeling is necessary, comply with the requirements in Section 2C and 3 and take into account:

(i). The investment strategy of the company holding the assets, as codified in the reinsurance agreement or otherwise based on current documentation provided by that company; and

(ii). Actions that may be taken by either party that would affect the net reinsurance cash flows (e.g., a conscious decision to alter the investment strategy within the guidelines).

In some situations, it may not be necessary to model the assets held by the other party. An example is modeling by an assuming company of a reinsurance agreement containing provisions, such as experience refund provisions, under which the cash flows and effective investment return to the assuming company are the same under all Scenarios.

Note: Special considerations for modified coinsurance. Although the modified coinsurance (ModCo) reserve is called a reserve, it is substantively different from other reserves. It is a fixed liability from the ceding company to the assuming company in an exact amount, rather than an estimate of a future obligation. The ModCo reserve is analogous to a deposit. This concept is clearer in the economically identical situation of funds withheld. Therefore, the value of the modified coinsurance reserve will generally not have to be determined by modeling. However, the projected modified coinsurance interest may have to be modeled. In many cases, the modified coinsurance interest is determined by the investment earnings of an underlying asset portfolio, which in some cases will be a segregated asset portfolio or in others the ceding company's general account. Some agreements may use a rate not tied to a specific portfolio.

9. If a ceding company has knowledge that an assuming company is financially impaired, the ceding company shall establish a margin for default by the assuming company. In the absence of knowledge that the assuming company is financially impaired, the ceding company is not required to establish a margin for default by the assuming company.

10. If an assuming company has knowledge that a ceding company is financially impaired, the assuming company shall establish a margin for default by the ceding company. Such margin may be reduced or eliminated if the assuming company has a right to terminate the reinsurance upon non-payment by the ceding company. In the absence of knowledge that a ceding company is financially impaired, the assuming company is not required to establish a margin for default by the ceding company.

11. In setting margins to reflect potential uncertainty regarding the receipt of cash flows from a counterparty, the company shall take into account the ratings, risk-based capital ratio or other available information related to the probability of default by the counterparty, as well as any security or other factor limiting the impact on cash flows.

E. Treatment of Certain Reinsurance Provisions

Certain reinsurance provisions are difficult to appropriately reflect in the cash flow model with an appropriate level of conservatism. Therefore, specified treatment of these reinsurance provisions in the cash flow model is prescribed.

1. Reinsurance agreements where the ceding company is required to make representations or warranties in a reinsurance agreement not reasonably related to the business reinsured or about the future performance of the business reinsured.

The assumptions used to determine the Reported Amount shall include the effect on cash flows resulting from such representations or warranties when possible. For example, if the

ceding company warrants that the ceded reinsurance will be profitable to the assuming company, cash flows under scenarios that would otherwise result in a loss to the assuming company must be adjusted to reflect the warranty.

If the impact of such a representation or warranty is not possible to include in projected cash flows, the company should determine the legal consequence of breaching the representation or warranty under the agreement. The Reported Amount is the greater of the calculation assuming the breach of the representation or warranty has occurred, or the calculation assuming the breach has not occurred. For example, if the ceding company warrants that it will remain solvent during the term of the agreement, and the consequence of a breach will be immediate termination of the reinsurance, such immediate termination shall be assumed in the model if doing so will decrease the company's surplus.

2. A reinsurance agreement that does not contain provisions:

   a. Acknowledging the entire agreement between the parties with respect to the business being reinsured, or

   b. That any changes to the agreement shall be null and void unless made by amendment to the agreement signed by both parties.

In this case, each company shall use assumptions for such agreements that reflect the company's obligations under the agreement but do not reflect the obligations of the other party. For example, the ceding company will assume that it has outgoing cash flows for reinsurance premiums and other amounts due to the assuming company, but no incoming cash flows for benefit reimbursements or other amounts due from the assuming company.

3. A reinsurance agreement contains automatic or optional triggers relating to financial deterioration of one of the parties, such as a ratings downgrade or a declaration of conservatorship or insolvency.

In this case the assumptions used to determine the Reported Amount shall reflect a conservative valuation for the trigger. If the trigger results in the automatic occurrence of an event or the occurrence of the event at the option of the other party, the Reported Amount is the greatest of the calculation assuming the event caused by the trigger has occurred, or the calculation assuming the event has not occurred but will occur at some future date, or the calculation assuming the event has not occurred and will never occur. Examples of critical trigger events include termination, recapture, an increase in amounts due under the reinsurance agreement, and immediate payment of funds withheld.

Section 6. Stochastic Exclusion Test

A. Purpose of the Test

1. The Stochastic Exclusion Test identifies those blocks of policies not having material tail risk arising from interest rate movements or equity performance, i.e., not having significant variation in financial results depending upon future economic conditions.
2. The Stochastic Exclusion Test constitutes a series of deterministic scenarios which establish a range of results. If the range of results is beyond the specified tolerance for variability then the block of policies are considered to have material tail risk and do not pass the test.
3. The Stochastic Exclusion Test is passed if the Stochastic Exclusion Test Ratio relating to the block of policies tested, determined in accordance section 6B, is less than 4%. Those blocks of policies that pass the test are not considered to have material tail risk for the risks of interest rate movements or equity performance.
4. For blocks of policies which both pass the exclusion test and which meet the reserve adequacy certification requirements of section 6C, the C3 requirement may be determined as the Factor-based Amount as defined in section 6D.
5. Passing the Stochastic Exclusion Test does not preclude the actuary from determining the C3 requirements on a given block of policies in accordance with the Stochastic Amount should the Stochastic Amount relating to such block of policies result in a lower C3 requirement.

B. Stochastic Exclusion Test Ratio

1. For each test scenario described in Section 6F, determine the Test Scenario Amount. The Test Scenario Amount is the amount required to fund the future benefits and expenses.
2. The Test Scenario Amount for any test scenario is determined using a Gross Premium Valuation methodology (present value of net cash flows) with the following assumptions:
    a. Anticipated Experience Assumptions within each scenario that are dynamically adjusted as appropriate for consistency with each tested scenario;
    b. Starting Assets are no less than 98% of the statutory reserve relating to the policies modeled;
    c. No recognition of federal income taxes in the cashflows or discount rates;
    d. Discount rates are the net asset earned rates each period where net asset earned rates are equal to gross asset earned rates less defaults and investment expenses.
3. As a practical measure, the actuary may alternatively use cash flow testing assumptions rather than Anticipated Experience Assumptions in the determination of the Test Scenario Amount for those blocks of policies whose reserves are not determined under a principle-based approach.
4. The Stochastic Exclusion Test ratio is determined as the ratio of:
    a. The excess of the highest Test Scenario Amount in each of the test scenarios, over the Test Scenario Amount in the Base Scenario; to
    b. An amount calculated from the Base Scenario that represents the present value of benefits and expenses for the policies, adjusted for reinsurance as appropriate to achieve consistency between the numerator and denominator.

C. Reserve Adequacy Certification Requirement

1. For those blocks of policies which pass the exclusion test and which the Qualified Actuary is able to certify that the statutory value on the valuation date of the policies included in the exclusion test are adequate, the C3 requirement may be determined as the Factor-based Amount as defined in section 6D.
2. The adequacy of a given block of policies is to be determined using the same methods and assumptions as applied to the block of policies in performing the annual Asset Adequacy Analysis.
3. The adequacy of a given block of policies is to be determined on a stand-alone basis for that block.
4. Certification and documentation are to be completed in accordance with Section 7.

D. Factor –based Amount

1. The Factor-based Amount is determined as the sum of the following amounts:
   a. The statutory reserve at the Valuation Date relating to policies which have been tested for exclusion by the Stochastic Exclusion Test ; and
   b. 0.5% of the net balance of item (a) above less associated policy loans in the case of the company submitting an unqualified actuarial opinion based on asset adequacy testing; otherwise 0.75% of the net balance of item (a) above less associated policy loans.

E. Stochastic Exclusion Test Timing

1. The exclusion test shall be carried out annually for a given block of policies to continue to qualify for the stochastic testing exclusion, and shall be done within the 12 month period prior to the valuation date. It would be expected that the timing of the test would be consistent from year to year and that the actuary would document both the current and prior year timing of the exclusion testing as well as rationale for any change in timing.
2. The actuary will certify that no material subsequent event has occurred after the date of the current year testing.

   To the extent a material subsequent event has occurred between the date of current year testing and the actual year-end, it will be necessary to re-perform the testing subsequent to filing, using actual year-end data. If the actual RBC value (Company Action Level RBC) exceeds that estimated earlier in the blanks filing by more than 5 percent, or if the actual value triggers regulatory action, a revised filing with the NAIC and the state of domicile is required by June 15; otherwise re-filing is permitted but not required.

3. For purposes of the above, a material subsequent event is one or more circumstances which, if reflected in the exclusion testing would be anticipated to result in a failure of the exclusion test.

F. Stochastic Exclusion Test Scenarios

The Stochastic Exclusion Test is based on the sixteen test scenarios described in this subsection. The specific interest rate and equity return rate paths representing each test scenario may be downloaded from the American Academy of Actuaries webpage at the following address: http://www.actuary.org/life/phase3.asp.

Appendix 3
Approach to Determining C3 Requirements for Life Insurance Products

The test scenarios are defined in terms of 90 percentile random shocks in various directions over various periods of time. The sum of the random shocks over n periods has a distribution, and the 90 percent level of that distribution is 1.28 times the square root of n. As an example, to get a 90 percent level shock over 5 years assuming monthly shocks, the sum of the 60 shocks must be 1.28 times the square root of 60. The test scenarios are as follows:

1. Test Scenario 1 – Pop up, high equity

   Interest rate shocks that maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 90% level.

   For illustration, the pop-up scenario has shocks of
   1.28 times (sqrt(1) - sqrt(0)) in period 1;
   1.28 times (sqrt(2) - sqrt(1)) in period 2;
   1.28 times (sqrt(3) - sqrt(2)) in period 3; and so on.
   By the end of period n, the cumulative shock is -1.28 times sqrt(n).

2. Test Scenario 2 – Pop up, low equity

   Interest rate shocks that maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 10% level.

3. Test Scenario 3 – Pop down, high equity

   Interest rate shocks that maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 90% level.

4. Test Scenario 4 – Pop down, low equity

   Interest rate shocks that maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 10% level.

5. Test Scenario 5 – Up/down, high equity

   Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during "up" periods and at the 10% level during "down" periods. Equity returns that maintain the cumulative equity return at the 90% level.

6. Test Scenario 6 – Up/down, low equity

   Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during "up" periods and at the 10% level during "down" periods. Equity returns that maintain the cumulative equity return at the 10% level.

7. Test Scenario 7 – Down/up, high equity

   Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during "up" periods and at the 10% level during "down" periods. Equity returns that maintain the cumulative equity return at the 90% level.

8. Test Scenario 8 – Down/up, low equity

Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during "up" periods and at the 10% level during "down" periods. Equity returns that maintain the cumulative equity return at the 10% level.

9. Test Scenario 9 – Base scenario

All shocks are zero.

10. Test Scenario 10 – Inverted yield curves

Zero shocks to long term rates and equities. Shocks to the spread between short and long rates that are consistently in the same direction for each three-year period. The shocks for the first three-year period are in the direction of reducing the spread (usually causing an inverted yield curve). Shocks for each subsequent three year period alternate in direction.

11. Test Scenario 11 – Volatile equity returns

Zero shocks to interest rates. Shocks to equity returns that are consistently in the same direction for each two-year period, and then switch directions.

12. Test Scenario 12 – Deterministic scenario for valuation

Uniform downward shocks each month for 20 years, sufficient to get down to the 80% point on the distribution of 20 year shocks. After 20 years, shocks are at a level that keeps the cumulative shock at the 80% level (or the 20% level, depending on how you look at it).

13. Test Scenario 13 – Delayed pop up, high equity

Interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks each 1.414 (square root of 2) times those in the first 10 years of Scenario 1. This gives the same 20-year cumulative shock as scenario 1 but all the shock is concentrated in the second 10 years. After 20 years, the same as scenario 1. Equity returns that maintain the cumulative equity return at the 90% level.

14. Test Scenario 14 – Delayed pop up, low equity

Interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks each 1.414 (square root of 2) times those in the first 10 years of Scenario 2. This gives the same 20-year cumulative shock as scenario 2 but all the shock is concentrated in the second 10 years. After 20 years, the same as scenario 1. Equity returns that maintain the cumulative equity return at the 10% level.

15. Test Scenario 15 – Delayed pop down, high equity

Interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks each 1.414 (square root of 2) times those in the first 10 years of Scenario 3. This gives the same 20-year cumulative shock as scenario 3 but all the shock is concentrated in the second 10 years. After 20 years, the same as scenario 3. Equity returns that maintain the cumulative equity return at the 90% level.

16. Test Scenario 16 – Delayed pop down, low equity

Interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks each 1.414 (square root of 2) times those in the first 10 years of Scenario 4. This gives the same 20-year cumulative shock as scenario 4 but all the shock is concentrated in the second 10

years. After 20 years, the same as scenario 4. Equity returns that maintain the cumulative equity return at the 10% level.

Section 7. Certification and Documentation Requirements

A. Certification

1. A Qualified Actuary shall provide a certification that the Reported Amount was calculated in a manner that meets the requirements of this Appendix and complies with all applicable Actuarial Standards of Practice. The certification shall consist of at least the following:

   a. A paragraph identifying the Qualified Actuary and his or her qualifications as described under the U.S. Qualification Standards;

   b. A scope paragraph identifying the statement values of the products included in the certification and the methodology used for those statement values (e.g. Stochastic Amount, Alternative Amount, Factor-based Amount, and Non-modeled Amount);

   c. A paragraph identifying whether a material subsequent event as defined in Section 6E.3 had occurred in the context of the performing the Stochastic Exclusion Test, if applicable;

   d. A reliance paragraph describing those areas, if any, where the certifying actuary has relied on other experts. A reliance statement from each of those relied upon should accompany the certification. The reliance statements should note the information being provided and a statement as to the accuracy, completeness or reasonableness, as applicable, of the information;

   e. A paragraph certifying that required capital was determined in accordance with the principles and requirements of the NAIC RBC Instructions;

   f. A paragraph certifying that where the assumptions are not prescribed, and the requirements do not permit or require otherwise, the assumptions used for these calculations are Prudent Estimate Assumptions for the products, scenarios, and purpose being tested;

   g. A paragraph, if applicable, providing an unqualified opinion based on actuarial analysis of reserves and assets supporting reserves for a given block of policies utilizing the stochastic exclusion test, using the same methods and assumptions applied to the block of policies in performing the annual Asset Adequacy Analysis;

   h. A paragraph disclosing all material changes in the model or assumptions from that used previously and the estimated impact of such changes; and

   i. A paragraph stating that the Qualified Actuary is not opining on the adequacy of the company's surplus or its future financial condition.

2. A financial duly authorized officer of the company (e.g., Chief Financial Officer, Treasurer, or Chief Investment Officer) or an authorized person designated by them who has direct or indirect supervisory authority over the actual trading of assets and derivatives must certify that the Clearly Defined Hedging Strategy modeled is the Derivative Program being used by the company in its actual day-to-day risk mitigation efforts**.**

3. All certifications shall be filed with the annual Risk-Based Capital return filing.

B. Actuarial Report

1. A Qualified Actuary shall prepare an Actuarial Report each year that documents all material decisions made, and information used, to support the certification, including assumptions, margins and methodologies used to calculate the Reported Amount. The Actuarial Report will be confidential, to the extent permitted by law, and available to regulators upon request, as authorized by the company or as required by law**.** The Actuarial Report may, at the option of the Qualified Actuary be a separate report or an addendum to or otherwise incorporated in the Actuarial Opinion Memorandum.

2. The Actuarial Report shall include:

   a. The Stochastic Amount, including the distribution of the Scenario Amounts and the result of applying the CTE risk level.

   b. The Alternative Amount, if any, and any necessary demonstration regarding the determination of the Alternative Amount.

   c. The Factor-based Amount, if any, including the Stochastic Exclusion Test Scenario Amount and the test ratio.

   d. The Non-modeled amount, if any.

   e. Documentation of the key modeling decisions made by the Qualified Actuary, including but not limited to:

      i. Assets:
         (1.) Description including type and quality
         (2.) Investment & disinvestment assumptions
         (3.) Assets used at the start of the projection
         (4.) Source of asset data
         (5.) Asset valuation basis
         (6.) Documentation of assumptions:
            (a) Default costs
            (b) Prepayment functions
            (c) Market value determination
            (d) Yield on assets acquired
            (e) Mapping and grouping of funds to modeled asset classes

      ii. Liabilities
         (1.) Product Descriptions
         (2.) Source of Liabilities
         (3.) Grouping of Contracts
         (4.) Investment Reserves
         (5.) Reinsurance
         (6.) Tax Adjustment
         (7.) Documentation of assumptions to include:
            (a) Premium Pattern, Persistency and Allocation
            (b) Withdrawal, Lapse and Termination Rates
            (c) Non-guaranteed Elements
            (d) Expenses
            (e) Investment / Fund Choice
            (f) Asset Allocation, Rebalancing and Transfer Assumptions
            (g) Revenue Sharing
            (h) Federal Income Tax

iii. Derivative Program
(1.) Documentation of strategy
(2.) Identification of current positions
(3.) Description on how strategy was incorporated into modeling:
(a) basis risk
(b) gap risk
(c) price risk
(d) assumption risk
(4.) Document the methods and criterion used to estimate the *a priori* effectiveness of the Derivative Program

iv. Scenarios
(1.) Description of scenario generation for interest rates and equity returns
(2.) Disclose the number "n" of scenarios used and the rationale for using "n" scenarios.
(3.) Time Step of Model (e.g. Monthly, Quarterly, Annual)
(4.) Correlation of equity and / or fund returns
(5.) Processes to ensure scenarios meet calibration requirements
(6.) Support for mapping variable accounts to proxy funds

v. Other
(1.) Description of and support for any simplified approaches in the Cash Flow Models.
(2.) Basis for decision to aggregate Business Segments if aggregation is done.
(3.) Description of the use of data prior to the valuation date.

f. Description and results of material sensitivity tests performed.

3. If there is a material change in assumptions from the previous year, an executive summary shall be sent to the state of domicile communicating such change and quantifying the impact it has on the results. Such communication shall remain confidential, subject to applicable law.

C. This Appendix requires that a Qualified Actuary make various determinations, verifications and certifications. The company shall provide the Qualified Actuary with the necessary information sufficient to permit the actuary to fulfill the responsibilities set forth in this report and responsibilities arising from applicable Actuarial Standards of Practice.

D. Except in cases of fraud or willful misconduct, the Qualified Actuary shall not be liable for damages to any person (other than the insurance company and the commissioner) for any act, error, omission, decision or conduct with respect to the actuary's opinion, to the extent permitted by law.

E. The qualifications to be considered a "Qualified Actuary" under this Appendix are**:**

1. Be a member of the American Academy of Actuaries qualified under the U.S. Qualification Standards;

2. Be familiar with all appropriate standards of practice that apply to principle-based approaches;
3. Not have been found by the commissioner, following appropriate notice and hearing to have:
   a. Violated any provision of, or any obligation imposed by, the insurance law or other law in the course of his or her dealings as a Qualified Actuary or an Appointed Actuary;
   b. Been found guilty of fraudulent or dishonest practices;
   c. Demonstrated his or her incompetence, lack of cooperation, or untrustworthiness to act as a Qualified Actuary; or
   d. Resigned or been removed as a Qualified Actuary within the past five (5) years as a result of acts or omissions indicated in any adverse report on examination or as a result of a failure to adhere to generally acceptable actuarial standards;
4. Not failed to notify the commissioner of any action taken by a commissioner of another state similar to that under Paragraph (3) above.