

A PUBLIC POLICY PRACTICE NOTE

The Application of C3 Phase II and Actuarial Guideline XLIII

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PRACTICE NOTE FOR THE APPLICATION OF C-3 PHASE II AND ACTUARIAL GUIDELINE XLIII

July 2009

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This practice note was prepared by a work group set up by the Life Practice Note Steering Committee of the American Academy of Actuaries (“VA Practice Note Work Group”). It is an update of the September 2006 C-3 Phase II Practice Note and represents a description of practices believed by the VA Practice Note Work Group to be commonly employed by actuaries in the United States in 2009. This practice note is not a promulgation of the Actuarial Standards Board, is not an actuarial standard of practice, is not binding upon any actuary and is not a definitive statement as to what constitutes generally accepted practice in the area under discussion. Events occurring subsequent to this publication of the practice note may make the practices described in this practice note irrelevant or obsolete.

Members of the working group developing this practice note include:

Tim Gaule (Co-Chair)	Marc Slutzky (Co-Chair)
Rich Ash	Ted Chang
Tom Campbell	Todd Erkis
Mark Evans	Peter Gourley
Craig Morrow	Zohair Motiwalla
Craig Ryan	Patty Schwartz
Larry Seller	Lyle Semchyshyn
Van Villaruz	

Additional input was received from Mike Dubois, Allen Elstein, Jim Reiskytl, Bill Wilton and others.

This practice note follows a structure similar to the September 2006 C-3 Phase II Practice Note and utilized many of the questions and answers from that Note. Members of the current work group acknowledge the contributions of the following individuals who developed the earlier note:

Hubert Mueller (Chair), Larry Bruning (Vice Chair), Kory Olsen (Vice Chair), Fred Anderson, Rich Ash, Bob Brown, Tom Campbell, Richard Combs, Mike Dubois, Mark Evans, Tim Gaule, Larry Gorski, Kerry Krantz, Jim Lamson, Dennis Lauzon, Jeffrey Leitz, Bob Meilander, John O’Sullivan, Tony Phipps, Scott Schneider, Don Skokan, Sheldon Summers, Mark Tenney, and Bill Wilton

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This practice note has been organized into a “Question & Answer” format, providing answers to a variety of issues companies are expected to deal with when implementing C-3 Phase II and Actuarial Guideline XLIII (referred to as “AG 43” throughout this practice note). The primary changes from the September 2006 C-3 Phase II practice note are updates of the answers to many questions to reflect the guidance in AG 43. In addition, several new questions, as well as

a comparison of C-3 Phase II to AG 43 have been incorporated into this Practice Note.

The NAIC website contains a list of questions that were received by the NAIC relative to implementing C-3 Phase II. The questions and suggested answers were posted on the NAIC website in January 2006 and can be found at

http://www.naic.org/documents/committees_e_capad_lrbc_C3_phasel2_questions.doc.

Due to changes in the RBC calculation, some line numbers and other references in this list of questions are outdated, but the information is still valid. Additional information can be found on the NAIC website at http://www.naic.org/committees_e_capad_lrbc_c3_market.htm.

It is anticipated that this practice note will be posted to the Academy website in July 2009.

Please provide any comments to the Academy's Life Policy Analyst, Dianna Pell, at

Pell@actuary.org.

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1) DETAILS ON PRODUCTS COVERED

Q1.1 What are some examples of products that are covered by the AG 43 and C-3 Phase II requirements?

A: The scope sections of both AG 43 and C-3 Phase II requirements indicate they apply to the following examples of benefit features:

- (a) AG 43 applies to variable deferred annuity products subject to the Commissioner's Annuity Reserve Valuation Method (CARVM) whether or not they include Guaranteed Living Benefits (GLBs) or Guaranteed Minimum Death Benefits (GMDBs), as defined in the guideline. C-3 Phase II applies to individual VA products whether or not they include GLBs or GMDBs. Examples of GMDBs include return of premium, rollup of premiums less withdrawals at stated rates of interest, ratchets such as maximum anniversary values, resets, and enhanced death benefits (e.g., additional death benefit equal to 40% of the gain in the contract). Examples of GLBs include guaranteed minimum accumulation benefits (GMABs), guaranteed minimum income benefits (GMIBs) (e.g., annuitization at stated income rates of the larger of the account value and a rollup of premiums less withdrawals at stated rates of interest) and guaranteed minimum withdrawal benefits (GMWBs). GLBs may also include a minimum waiting period following issue or minimum attained age before benefit options may be elected.
- (b) Group life coverages that provide GMDB or GLB amounts for mutual funds, even if the company does not provide the funds to which these guarantees relate.
- (c) Variable universal life (VUL) products, to the extent they include GLBs not having a separate reserve standard, and then only to the extent of establishing a reserve or capital requirement for those benefits. Once a Principle Based Approach has been implemented for VUL products, VUL products may be expected to be included under that approach for new issues after the effective date of that approach, and removed from AG 43 and C-3 Phase II. More details about the extent to which AG 43 would apply and how it would apply are discussed in AG 43.
- (d) Group annuities (e.g., those covering participants of 401(k) plans), but only if they also contain guaranteed living or death benefits.
- (e) Any variable immediate annuity product, including those containing Guaranteed Payout Annuity Floor (GPAF) benefits.
- (f) Group life contracts that wrap a GMDB around a mutual fund.

Q1.2 Are there examples of individual or group, life or annuity contracts that have a GMDB or other equity investment guarantees and are excluded from the AG 43 and C3 Phase II requirements?

A: VUL products often contain minimum guaranteed death benefits, regardless of fund performance, as long as stated minimum premium payment rules have been satisfied by the policyholder. To the extent that reserve requirements covering these minimum guaranteed benefits are prescribed elsewhere, such as in Actuarial Guideline 37, AG 43 and C-3 Phase II would not apply.

Fixed Indexed Annuities (FIAs) can theoretically provide more extensive equity investment guarantees, including return of premium GMDBs or roll-up guarantees depending on whether the annuitant lives or dies. To the extent that reserve requirements explicitly covering these minimum guaranteed benefits are prescribed elsewhere, such as in Actuarial Guideline 35, AG 43 and C-3 Phase II would not apply. However, even if there is not an explicit reserve requirement, C-3 Phase II and AG 43 may not apply if the guarantees are not similar in nature to GMDBs or VAGLBs (variable annuity guaranteed living benefits).

Q1.3 Modified Guaranteed Annuities are also excluded from covered products. What constitutes a Modified Guaranteed Annuity?

A: As is defined in the NAIC Modified Guaranteed Annuity Model Regulation a “Modified guaranteed annuity” means a deferred annuity contract, the underlying assets of which are held in a separate account, and the values of which are guaranteed if held for specified periods. The contract contains nonforfeiture values that are based upon a market-value adjustment formula if held for shorter periods.

Q1.4 How would the AG 43 and C-3 Phase II requirements be applied to a variable annuity product with a GMDB or GLB that has both variable and Modified Guaranteed subaccounts, given that the requirements do not apply to Modified Guaranteed Annuities?

A: The C-3 Phase II documentation states in its Scope section, “all variable annuities except for Modified Guaranteed Annuities” are included. AG 43 also excludes Modified Guaranteed Annuities, but does state that it applies to contracts that include one or more subaccounts containing features similar in nature to those contained in Modified Guaranteed Annuities.

One approach under C-3 Phase II could be to view a variable annuity with one or more MGA subaccounts as being covered under the first category of the C-3 Phase II scope. An alternative approach could be to view the product as belonging to the third category which includes “all other products that contain guarantees similar in nature to GMDBs or VAGLBs where there is no explicit reserve requirement (other than AG 43) for such guarantees.” In this case, the Scope paragraph of C-3 Phase II states: “If such a benefit is offered as a part of a contract that has an explicit reserve requirement other than AG VACARVM, the methods of this capital requirement shall be applied to the benefit on a standalone basis.”

Under the alternative approach, some actuaries may bifurcate the product into three pieces:

- (a) The non-MGA subaccounts with any associated GMDBs and VAGLBs;
- (b) The MGA subaccounts; and
- (c) Any GMDB and VAGLB associated with the MGA subaccounts.

The C-3 Phase II requirements would apply to the first and third components.

Q1.5 Are group annuity products such as those funding 401(k), 457, 403(b), etc. plans that do not have guaranteed living or death benefits covered by the AG 43 and C-3 Phase II requirements?

A: No. Group annuities without death benefit or living benefit guarantees are outside the scope specified in AG 43 and C-3 Phase II.

Q1.6 Are group life contracts that wrap guaranteed death benefits or living benefits around mutual funds that are offered by another company covered under the AG 43 and the C-3 Phase II requirements?

A: Some actuaries believe this is what is anticipated by the phrase “products that contain guarantees similar in nature to GMDBs or VAGLBs, even if the insurer does not offer the mutual funds or variable funds to which these guarantees relate” in AG 43, and by the nearly identical wording in the C-3 Phase II requirements.

Footnote 2 to the C-3 Phase II Scope and Footnote 5 to the AG 43 Scope both state: “For example, a group life contract that wraps a GMDB around a mutual fund would generally fall under the scope of this requirement since there is not an explicit reserve requirement for this type of group life contract.”

Q1.7 Are risk-based capital (RBC) and statutory reserves for variable life products containing either guaranteed death benefits or guaranteed living benefits determined under the AG 43 and C-3 Phase II requirements?

A: RBC and statutory reserves for variable life products containing only guaranteed death benefits for which existing reserve requirements exist are determined following those existing requirements. If guaranteed living benefits are included in a variable life product or there are no requirements for RBC or statutory reserve determination that are otherwise prescribed, the AG 43 and C-3 Phase II requirements are applied on a “standalone basis,” as described therein and in the answer to question Q1.9.

Q1.8 Covered products are defined to include "all other products that contain guarantees similar in nature to GMDBs or VAGLBs." How would that phrase be interpreted?

A: Some actuaries believe the quoted phrase means that such a guarantee provides a minimum death or living benefit to a contractholder that relates to benefits derived from funds for which investment risk is ordinarily borne by the contractholder. Such funds could be held in a life insurer’s separate account or in mutual funds, whether or not they are owned or managed by the party making the guarantees.

Footnote 1 to the C-3 Phase II Scope and footnote 4 to the AG 43 Scope give guidance on this point: “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).”

Q1.9 It is stated in the requirements that if a guaranteed benefit “similar in nature to GMDBs or VAGLBs” is offered as part of a contract that has an explicit reserve requirement other than AG 43, the GMDB or VAGLB feature for which there is no explicit reserve requirement shall have RBC and reserves determined under C-3 Phase II and AG 43 on a standalone basis. How are the AG 43 and C-3 Phase II requirements determined on a standalone basis for such a guaranteed benefit?

A: Some actuaries believe that to be “similar in nature to GMDBs or VAGLBs” means that the guaranteed benefit should be in lieu of, or supplemental to, a benefit that is dependent upon the growth of contractholder premiums that have been invested in separate accounts, mutual funds similar to the benefit provided by variable annuity products, or other market value funds or market indexed funds. Thus, these actuaries believe that applying the requirements on a “standalone basis” means that the projections required to calculate the Conditional Tail Expectation (CTE) Amount for AG 43 and the Total Asset Requirement (TAR) for C-3 Phase II should only reflect the revenues, benefit costs and expenses directly related to these benefits. Of course, the funds in which the premiums have been invested would usually also be projected, but only for purposes of determining the guaranteed benefits and to determine the excess, if any, of the guaranteed benefit over what would have been provided in the absence of the guarantee for purposes of calculating benefit costs

The scope section of AG 43 states “If such a benefit is offered as part of a contract that has an explicit reserve requirement other than AG 43 and that benefit does not currently have an explicit reserve requirement:

- (a) The Guideline shall be applied to the benefit on a standalone basis (i.e., for purposes of the reserve calculation, the benefit shall be treated as a separate contract);
- (b) The reserve for the underlying contract is determined according to the explicit reserve requirement; and
- (c) The reserve held for the contract shall be the sum of a) and b).”

The C-3 Phase II Scope states that “If such a benefit is offered as part of a contract that has an explicit reserve requirement other than AG VACARVM, the methods of this capital requirement shall be applied to the benefit on a standalone basis.”

Q1.10 Does a General Account annuity product incorporating minimum death or living benefits and having a cash value minimum floor established by compliance with the Standard Nonforfeiture Law, but having amounts credited to it based on the investment performance of a segregated portfolio of assets, such as certain types of bonds, fall under the AG 43 and C-3 Phase II requirements?

A: In evaluating whether the minimum death or living benefits associated with this type of product fall under the AG 43 and C-3 Phase II requirements the actuary should consider evaluating if the guarantees are similar in nature to GMDBs or VAGLBs and whether there is another explicit reserve requirement.

As was stated in the response to Q1.9, above, some actuaries believe that to be “similar in nature to GMDBs or VAGLBs” means that the guaranteed benefit should be in lieu of, or supplemental to, a benefit that is dependent upon the growth of contractholder premiums that have been invested in separate accounts, mutual funds similar to the benefit provided by variable annuity products, or other market value funds or market indexed funds. Assuming that there is not an explicit reserve

requirement, those actuaries would believe that this type of product does fall under the scope of the AG 43 and C-3 Phase II requirements. The “similar in nature” requirement could be supported in this case by the fact that the guarantees are based on a segregated portfolio of assets.

2) GUIDANCE ON COMMON PRACTICE

Q2.1 Which Actuarial Standards of Practice (ASOPs) apply to the actuary when performing the tasks in conjunction with determining reserves and capital according to the requirements in C-3 Phase II and AG 43?

A: While the actuary is ultimately responsible for determining which ASOPs are applicable to any specific task, the following list of ASOPs may be among those that apply:

No. 7. Analysis of Life, Health, or Property/Casualty Insurer Cash Flows
(Doc. No. 089; June 2002)

Scope—This standard applies to actuaries when performing the analysis of part or all of an insurer's asset, policy, or other liability cash flows for life or health insurers (including health benefit plans). The standard also applies to actuaries when performing the analysis of cash flows involving both invested assets and liabilities for property/casualty insurers. Cash flow analysis subject to this standard should be considered in connection with professional services such as the following:

- (a) Determination of reserve adequacy;
- (b) Determination of capital adequacy;
- (c) Product development or ratemaking studies;
- (d) Evaluations of investment strategy;
- (e) Financial projections or forecasts;
- (f) Actuarial appraisals; and
- (g) Testing of future charges or benefits that may vary at the discretion of the insurer (for example, policyholder dividend scales and other non-guaranteed elements of the insurer's liabilities).

No. 11. Financial Statement Treatment of Reinsurance Transactions Involving Life or Health Insurance (Doc. No. 098; June 2005)

Scope— This standard applies to actuaries when performing professional services in connection with preparing, reviewing, or analyzing financial statement items that reflect reinsurance ceded or reinsurance assumed on life insurance (including annuities) or health insurance.

To the extent that life/health insurance is reinsured by property/casualty companies, this standard will apply. If a reinsurance transaction involves both life/health and property/casualty insurance, the actuary should use professional judgment to determine whether this standard, ASOP No. 36, Statements of Actuarial Opinion Regarding Property/Casualty Loss and Loss Adjustment Expense Reserves, or aspects of both are most appropriate to determine the proper treatment of the reinsurance transaction.

No. 21. Responding to or Assisting Auditors or Examiners in Connection with Financial Statements for All Practice Areas (Doc. No. 095; September 2004).

Scope— This standard applies to actuaries when providing professional services as a Responding Actuary or as a Reviewing Actuary in connection with an audit or examination of a financial statement, where:

- (a) “Financial statement” means a report prepared for the purpose of presenting the financial position and the change in the financial position for the reporting period of an entity, prepared in accordance with accounting requirements prescribed or permitted by state regulators, governmental accounting standards, or applicable generally accepted accounting principles.
- (b) “Responding Actuary” means an actuary expressly designated by an entity to respond to the auditor or examiner with respect to specified elements of the entity’s financial statement that are based on actuarial considerations. An entity may expressly designate one or more actuaries as responding actuaries for a particular audit or examination.
- (c) “Reviewing Actuary” means an actuary expressly designated by the auditor or examiner to assist with the audit or examination of a financial statement with respect to specified elements of the financial statement that are based on actuarial considerations.

No. 23. Data Quality (Doc. No. 097; December 2004). This applies to actuarial work products begun on or after July 1, 2006; in addition, it applies to actuarial work products for which data is provided to, or developed by, an actuary on or after May 1, 2005. (See section 1.4 for details.)

Scope – This standard applies to all areas of practice. Other actuarial standards may contain additional data quality requirements that are applicable to particular areas of practice, or types of actuarial assignment.

Other References

The actuary may also wish to review the following ASOPs to determine whether they provide relevant guidance (please note that some of these ASOPs are in the process of revision at the time of publication and may change):

- (a) If products under scope have non-guaranteed elements: ASOP No. 1
- (b) If products under scope have dividends: ASOP No. 15
- (c) Measuring pension obligations: ASOP No. 4
- (d) Statement of opinion based on asset adequacy analysis: ASOP No. 22
- (e) Credibility procedures for A&H, Group Life and P&C: ASOP No. 25
- (f) Selection of economic assumptions for measuring pension obligations: ASOP No. 27
- (g) Using models outside the actuary’s area of expertise: ASOP 38
- (h) Actuarial Communications ASOP: No. 41

3) SIMILARITIES AND DIFFERENCES BETWEEN C-3 Phase II AND AG 43 REQUIREMENTS

Q3.1 What are the steps required for reporting C-3 Phase II amounts?

A: C-3 Phase II amounts are included in Market Risk of the NAIC Life RBC forms. The instructions are given with the RBC instructions.

Because there are smoothing and transition rules specified, the actual steps and process are slightly different for each of the years 2005, 2006, and 2007 and beyond. These smoothing and transition rules apply to all companies. However, as noted in the instructions, a company can opt to not smooth the TAR.

Q3.2a What differences are there between the calculation of C-3 Phase II TAR and the AG 43 CTE amount under the stochastic process?

A: The more significant differences under the stochastic process are as follows:

Scope: As far as scope is concerned, AG 43 applies to Issues 1981 and later, whereas C-3 Phase II covers all issue years. Additional information is provided in section 1 of this practice note.

Tax basis on Accumulation and Discounting: The key difference is that the calculation required by AG 43 is performed on a pre-tax basis (i.e., federal income tax is ignored in the projections and the discount rates are pre-tax). The calculation required by C-3 Phase II is performed on an after-tax basis (i.e., federal income tax is included in the projections and the discount rates are after-tax).

Starting Assets: The starting assets may also be different to the extent C-3 Phase II is calculated using actual AG 43 reserves (some actuaries believe this is allowed or required). See Q5.3 for more discussion on this issue.

Treatment of AVR and IMR: The Asset Valuation Reserve (AVR) and Interest Maintenance Reserve (IMR) may be treated differently between C-3 Phase II and AG 43. Section A1.1 (G) of AG 43 states that "the AVR and the IMR shall be handled consistently with the treatment in the company's cash flow testing", while the C-3 Phase II instructions do not explicitly address AVR and IMR. The RBC C-3 Phase I instructions state that 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). The same C-3 Phase I instructions also state that IMR assets should also be used for C-3 modeling.

Some actuaries consider the guidance given in the C-3 Phase I instructions regarding the treatment of AVR and IMR both in situations where the interest rate risk is calculated separately within C-3 Phase II and where interest rate risk is integrated with equity risk.

Net Revenue Sharing Income: Both C-3 Phase II and AG 43 describe what the actuary would consider in setting the Net Revenue Sharing Income assumption. It basically requires the actuary to consider the likelihood that the Net Revenue Sharing Income continues on to the future. A difference between C-3 Phase II and AG 43 exists in that AG 43 defines a cap for the Net Revenue Sharing Income (as outlined in A1.1E)

The amount of Net Revenue Sharing shall not exceed (a) + (b)

(a) contractually guaranteed Net Revenue Sharing Income

(b) estimated non-contractually guaranteed Net Revenue Sharing Income before any margins of uncertainty multiplied by the following factors:

- i. 1.0 in the first projection year
- ii. 0.9 in the second projection year
- iii. 0.8 in the third projection year
- iv. 0.7 in the fourth projection year
- v. 0.6 in the fifth projection year
- vi. 0.5 in the sixth and all subsequent projection years

Note that the contractually non guaranteed Net Revenue Sharing Income outlined in part b) above is not allowed to exceed 0.25% on separate account assets in the 6th and subsequent projection years.

CTE: C-3 Phase II requires a CTE 90 metric whereas AG 43 requires CTE 70.

Hedging: There are explicit limits on hedge efficiency included in AG 43. See Q11.7 for more detail.

Standard Scenario: The C-3 Phase II standard scenario is compared to the market risk portion of TAR, while in AG 43 the standard scenario result is compared to the entire reserve. In addition, the AG 43 standard scenario is calculated seriatim while the C-3 Phase II standard scenario is calculated in aggregate. Additional detail is provided in section 9 of this practice note.

Q3.2b What differences are there between the calculation of C-3 Phase II TAR and the AG 43 CTE amount under the standard scenario process?

A: The following table highlights some of the differences between the RBC C-3 Phase II and AG 43 Standard Scenarios. Details on the standard scenario can be found in section 9 of this practice note.

	AG 43	C-3 Phase II
Discount Rate	SVL interest rate for annuities	10 year CMT rate, plus 50 bps, with a floor of 3% and a cap of 9%
Drop and Recovery Assumptions		C-3 Phase II assumptions are more conservative
Aggregation	Not permitted	Allowed
Revenue Margins used to calculate Net Revenues	Likely to be higher under AG 43 because: <ul style="list-style-type: none"> 1) Guaranteed revenue sharing can be included 2) Larger of 0.20% of AV and Explicit Contract charges in AG 43 vs. just Explicit Contract charges for C-3 Phase II 	
Mortality		Higher mortality under C-3 Phase II
Lapses/In-the-moneyness (ITM)	More developed under AG 43 and more consistent with emerging recommendations	
GMIB Election Rates	Tiered by ITM	15%

Q3.3 Would the actuary use the same assumptions for both stochastic models (C-3 Phase II and AG 43)?

A: The assumption setting process is similar for both C-3 Phase II and AG 43. However, it is possible that some assumptions, especially contractholder behavior assumptions, can be different. Contractholder behavior assumptions should be consistent with the behavior that would be anticipated in the scenarios that are employed in the CTE calculation. Since C-3 Phase II uses a CTE 90 metric versus CTE 70 for AG 43, the contractholder behavior assumptions may be more conservative for C-3 Phase II. Another assumption that would be different would be the discount rate, which is an after tax rate for C-3 Phase II and a before tax rate for AG 43.

Q3.4 Could one use the same stochastic scenario set for both models?

A: Since the calibration criteria in C-3 Phase II and AG 43 are similar, the same set of scenarios could be used for both models provided the criteria are met. However, if the actuary is using an integrated model of equity returns and interest rates for C-3 Phase II that is designed to be consistent with the C-3 Phase I requirements described in Appendix 6 of C-3 Phase II, or if the other optional methods of incorporating the interest rate risk scenarios into the C-3 Phase II model are used, then the actuary might be able to meet the interest rate scenario requirements by using a different scenario set for AG 43 (provided that set meets the calibration criteria).

Q3.5 What are the differences in treatment of federal income taxes between C-3 Phase II and AG 43?

A: All calculations used in AG 43 are pre-tax: accumulations, earnings, costs, and discount rates. All calculations used in the TAR calculation under C-3 Phase II are post-tax. In situations where the tax reserve as at the valuation date exceeds the starting "working reserve" used in developing the TAR, a tax adjustment (increase) to RBC may be necessary to account for future taxable income not captured in the TAR calculation.

Q3.6 How would the actuary integrate the work to calculate AG 43 reserves and C-3 Phase II TAR with the requirements for the Actuarial Opinion and Memorandum?

A: To the extent a company is using projections to calculate AG 43 reserves and C-3 Phase II, the actuary may wish to consider whether the projections can be a substitute for the work otherwise required to support the Actuarial Opinion under the NAIC Model Actuarial Opinion and Memorandum Regulation (AOMR).

The actuary may also wish to consult section 3.3.2 of Actuarial Standard of Practice No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers* to determine whether the projections required for AG 43 and/or C-3 Phase II would be an acceptable asset adequacy analysis method.

Some actuaries believe the projections run to calculate AG 43 reserves and C-3 Phase II may be appropriate for the company-wide asset adequacy analysis in support of the Actuarial Opinion.

Other actuaries believe that it may be appropriate to rely on parts of the modeling work used to calculate AG 43 reserves or C-3 Phase II in support of the Actuarial Opinion (e.g., model cells, product characteristics).

In addition, some actuaries believe the modeling requirements in C-3 Phase II and AG 43 will provide emerging practice on modeling variable annuity risk and that the sensitivity tests and actuarial memorandums supporting the AG 43 reserve and C-3 Phase II calculations may have many similarities with the actuarial memorandum supporting the asset adequacy analysis of the relevant products.

In addressing these issues, the actuary may also wish to consider the differences between the model-based calculations required under this approach and asset adequacy analysis required in support of the Actuarial Opinion. Some of the differences include the following:

- The asset adequacy analysis applies to the entire company, while the scope of AG 43 and C-3 Phase II is limited to the types of products described in Section 1.
- The calculations for AG 43 and C-3 Phase II include the change in Working Reserves as an expense item, while the asset adequacy analysis may not.
- The calculations for AG 43 and C-3 Phase II employ results using the greatest present value of accumulated deficiencies (as defined in AG 43) and CTE measures. While these are not a required standard for asset adequacy analysis, some actuaries do consider interim shortfalls in accumulated surplus in analyzing results for asset adequacy analysis.

Where the Alternative Methodology (AM) is used, the appointed actuary may wish to consider additional analysis where asset adequacy analysis is required for the Actuarial Opinion. For instance, some companies may use deterministic assumed equity returns or a single representative index for equity funds.

However, if the actuary is using the AM, the actuary may find it preferable to perform asset adequacy analysis for the Actuarial Opinion. If the actuary adjusts the factors, the actuary may wish to consider using the analysis supporting the adjustments.

In addition, there appears to be consistency between the sensitivity tests and the documentation required by these requirements and those required by the AOMR. Since AG 43 and C-3 Phase II provide more detail on this, including a section covering documentation, this detail may serve as additional guidance for the actuarial memorandum.

Q3.7 How would the actuary combine the results of the AG 43 projections with cash flow testing projections to satisfy the requirements for asset adequacy analysis?

A: The calculation of reserves under AG 43 is separate and distinct from asset adequacy requirements. Although many companies may use similar models, reserves are established to meet the requirements of AG 43. For asset adequacy analysis, combined projections of business may be utilized to determine adequacy or adequacy can be determined for individual segments of the business.

For companies that use an integrated model for cash flow testing supporting the Actuarial Opinion, the integrated model may be designed to be sufficient for products subject to AG 43 as well as other business. For these companies, products may be combined and projected in aggregate to determine asset adequacy when cash flow testing is used. Alternatively, companies may perform the projection separately for various blocks of business and combine results of the individual models.

Companies that do not use an integrated model and separate the projection of separate account funds versus general account funds may wish to consider whether the model

used for general account funds could also be used for the fixed portion of products subject to AG 43.

Q3.8 Suppose the actuary applies the same scenarios used to calculate AG 43 reserves and C-3 Phase II TAR for the company-wide asset adequacy analysis and the appointed actuary determines that the reserves for the company, in aggregate, are inadequate. Would the actuary increase the reserves calculated under AG 43?

A: In the situation where the appointed actuary determines that reserves in aggregate for a company are inadequate, the AOMR requires (in AOMR Section 5E(2)) that the actuary set up additional reserves. Typically, the additional reserve is held on a separate line of the Annual Statement. There does not appear to be any requirement in either the AOMR or the SVL to allocate the additional reserve to any line of business. If the actuary is satisfied that the reserves calculated for the business falling under the scope of AG 43 meet the requirements of AG 43, then there does not appear to be a requirement to increase the reserves calculated under AG 43.

Q3.9 Suppose the Standard Scenario reserve on a company's variable annuity business is larger than the reserve calculated from model projections and application of the CTE measure required by AG 43. Is it appropriate to use the excess to offset reserve shortfalls on other blocks of business that are outside the scope of AG 43?

A: There is nothing in AG 43 or the Standard Valuation Law that expressly permits the Standard Scenario reserve, the reserve calculated using modeling, or the AM reserve to meet formulaic minimums on other blocks of business. Like other formulaic reserves, the amount of reserves held based on the Standard Scenario provide starting asset levels for asset adequacy analysis and not target liability requirements.

It is not required to aggregate asset adequacy analysis results, however, reserve redundancies under asset adequacy analysis for a given product may be used to offset reserve redundancies under asset adequacy analysis in another product.

4) TYPES OF MODELS / GRANULARITY

Q4.1 Does the modeling approach call for one model to be created that covers all products within the Scope?

A: Since the actuary may choose to use the Alternative Methodology (AM) for some contracts and the modeling method for others, a company does not need to use one model. For those contracts that are modeled, either one model or a multitude of models may be used, as deemed appropriate by the actuary. See Q4.2 for more detail.

Q4.2 What granularity of models is usually appropriate?

A: For large blocks of business, the actuary may choose to employ grouping methods to in-force seriatim data in order to improve model run times. The actuary should normally use enough model points such that results would not materially change with additional model points (model cells). Grouping methods usually retain the characteristics required to model all material risks and options embedded in the liabilities. AG 43 Section IV) D states that the Conditional Tail Expectation Amount at the option of the company may be determined by applying the methodology to sub-groupings of contracts,

Appendix 8 of AG 43 and Appendix 11 of C-3 Phase II both specify that the supporting memorandum should specify the grouping of contracts. The actuary may wish to consider describing in the supporting memorandum any testing performed to support the degree of granularity that has been used in the modeling of results.

Q4.3 What time step should be used for projections?

A: Appendix 2 of C-3 Phase II states that use of an annual cashflow frequency (“timestep”) is generally acceptable for benefit features that are not sensitive to projection frequency. Appendix 2 of C-3 Phase II and Subsection A5.7 of AG 43 state that the actuary should validate by testing that the use of a more frequent time step does not materially increase capital requirements. As most cash flows on insurance products occur no more frequently than monthly, some actuaries believe that a monthly model should suffice in most circumstances. Some products have step up features where the guarantee may be set equal to the account value when the account value exceeds the guarantee. Often this comparison is done annually, or perhaps monthly, but sometimes it is daily. In this case the actuary should assess the impact of modeling daily step ups with a monthly model.

The actuary may wish to consider providing support for the choice of time step in the supporting memorandum. Appendix 11 of C-3 Phase II and AG 43 Subsection A8.3 state that the actuary should identify the time step used in the Supporting Memorandum.

Q4.4 Is there specific software that the actuary normally would use to perform the analysis?

A: Any software, whether purchased commercially or developed in-house, may be used. However, the actuary normally would use software that is capable of performing the sophisticated calculations required, incorporating stochastic modeling techniques and contractholder behavior dynamics critical for this analysis, as well as having auditable calculation processes.

Q4.5 To what extent is the decision of using projections versus using the Alternative Methodology for one of the requirements (either C-3 Phase II or AG 43) binding on the other?

A: Since either method (modeling and the AM) may be appropriate, the only condition imposed by the requirements is that once a company chooses the modeling method for a block of business within a given requirement (e.g., AG 43), the company must continue using the modeling approach for that same block of business unless it obtains regulatory approval for switching.

Q4.6 Is it appropriate for models developed for C-3 Phase II and AG 43 purposes to be used for cash flow testing purposes as well?

A: The same model may be appropriate for cash flow testing purposes. Regardless of the model structure used, the actuary typically considers whether the model structure and the underlying assumptions appropriately reflect all material risks, and all options embedded in the liabilities and the underlying assets, and are appropriate for the purpose for which they were created.

While it may be appropriate to use the same basic model structure, the actuary may wish to consider taking into account the calculation differences and difference in purpose of C-3 Phase II, AG 43 models, and cash flow testing. For example, C-3 Phase II and AG 43 are focused on tail risk, whereas the focus of cash flow testing is usually the adequacy of reserves over a range of scenarios. See Q 3.8 for more discussion and examples of the differences.

Q4.7 Principle 2 in Section I of AG 43 and Appendix 7 of C-3 Phase II recognizes the fact that the modeling-based approach of both C-3 Phase II and AG 43 permits the aggregation of results over all products subject to the recommendation. The guidance in Principle 2 contains the statement “performed in aggregate (subject to limitations related to contractual provisions) to allow the natural offset of risks within a given scenario”. What contractual provisions could limit aggregation?

A: Two examples of such contractual provisions are: (1) group annuities with GMDBs and/or VAGLBs that are experience rated or pooled with a limited number of other similar contracts; (2) contracts within the scope of the requirements that are reinsured under a reinsurance treaty containing an experience refund feature.

Q4.8 When using the model for performing sensitivity testing of key assumptions is it necessary to perform the sensitivity testing for the entire set of scenarios?

A: As is also discussed in Q 7.4 and 7.5, the actuary would ordinarily consider performing sensitivity tests to identify those assumptions that materially impact results. Sensitivity testing is especially important in creating assumption margins, if little or no company or industry experience data is available. Sensitivity testing can range from re-running the model using the full set of stochastic scenarios to testing on a subset of scenarios to testing a single deterministic scenario. Based on the June 2006 summary of the results of the Life Capital Adequacy Subcommittee’s C-3 Phase II survey (survey results summary), which can be located at http://www.actuary.org/pdf/life/survey_june06.pdf, companies most frequently based sensitivity testing on the full set of scenarios or a subset of the scenarios. Sensitivity testing was also performed using the scenario that replicated the CTE 90 value, the

scenarios that produced the worst X% of results, or a specified number of scenarios. Methodology Note C3-03 of C-3 Phase II and Appendix 9 of AG 43 provide further guidance.

Q4.9 In the creation of the C-3 Phase II and AG 43 models, what are the considerations for determining an appropriate proxy for each variable fund in order to develop the investment return path? As a default, is it appropriate for the actuary to simply map the various variable accounts into the AG 34 classifications?

A: Methodology Note C3-01 (Note) of the Life Capital Adequacy Subcommittee's June 2005 C-3 Phase II report incorporated into the NAIC's RBC Instructions (C-3 Phase II Report) provides some suggestions to assist actuaries in the determination of an appropriate crafted proxy fund for each variable account. The Note states that "the proxy would normally be expressed as a linear combination of recognized market indices (or sub-indices)". For example a Mid-Cap stock fund might use a proxy that was a linear combination of the S&P 500 index and the Russell 2000 index. The Note goes on to state that "[i]t would rarely be appropriate to estimate the stochastic model parameters (for the proxy funds) directly from actual company data.

As a default, it is would not appear appropriate to simply map the variable accounts into the AG 34 classifications. The proxy construction process would ordinarily 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

If sufficient recent historical performance data is available, the analysis would ordinarily examine the relationship of these data to market/sector indices. If credible historical data is not available, the proxy may 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. It may 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. Higher expected returns can only be attained by assuming greater risk.

The actuary may consider verifying that the fund mapping and grouping methods used in creating the C-3 Phase II and AG 43 models are comparable to the fund methodology and assumptions used by the company for other purposes, such as internal capital models, pricing analysis and the company's actual hedging program. Some actuaries would also consult with the individuals at their companies who are familiar with the investment objectives and performance data of each fund. The actuary should verify that the fund mapping and grouping methods used in creating the C-3 Phase II and AG 43 models meet the guidance provided in the AG 43 and C-3 Phase II requirements

5) DETAILS ON STARTING ASSETS

Q5.1 How are starting assets determined?

A: C-3 Phase II (“Modeling Methodology,” section 3) and AG 43 (Appendix 1, section A1.4) require “the value of assets at the start of the projection be equal to the approximate value of statutory reserves at the start of the projection” (estimated reserves). This includes general and separate account reserves for products and product features in the scope of C-3 Phase II. Some actuaries believe the AVR and/or IMR may also be included in the estimated reserves as well, depending on the calculation (see Section 3 for a discussion on the treatment of the AVR and IMR).

Both C-3 Phase II (“Modeling Methodology,” section 3) and AG 43 (Appendix 1, section A1.4) require all separate account assets and hedge assets associated with products in-scope be included. All or a portion of the general account assets associated with products in scope (which may be negative in amount if representing a borrowed position) are then added such that the starting assets equal the statutory reserves in the model as of the start of the model projection. Note that the borrowed position may be significant enough such that the general account assets (exclusive of the hedge assets held in the general account) are negative. Assets should be valued consistently with their annual statement values.

Some companies use reserves as of the last reported date as an estimate. Other companies use a ratio of reserve to account value where the ratio is estimated based on analysis of historical data. Other reasonable approximation methods may also be used. See also Q5.2.

In determining which assets to include and how to project those assets, the actuary may wish to consider Actuarial Standards of Practice, such as Sections 3.3 and 3.4 in Actuarial Standard of Practice No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*.

Q5.2 How close are starting assets expected to be to the actual reserves ultimately held for in-scope products?

A: There are no specific criteria for C-3 Phase II or AG 43. Some believe that the actuary should be reasonably certain that the level of starting assets has not resulted in a material understatement/overstatement of the actual reserve.

Q5.3 Could the same level of starting assets be used for the C-3 Phase II and AG 43 reserves?

A: To the extent the treatment of AVR and/or IMR differs, the starting asset amounts could be different. Some actuaries believe a way to avoid differing starting assets is to adjust the resulting reserve after the reserve calculation to account for the AVR. This is described in the 1995 Practice Note - *Use of the AVR/IMR in Cash Flow Testing* and the December 2004 Practice Note - *Asset Adequacy Analysis Practice Note*, published by the Academy’s Life Practice Council.

Also, to the extent the actuary decides to set the starting assets for the C-3 Phase II calculation equal to the approximate or actual value of the reserve on the valuation date, it may be possible that the reserve as of the valuation date could be available by the time the calculation for C-3 Phase II is performed, depending upon the timing of calculating reserves.

For some companies, differences in starting assets may occur due to in-scope issue year considerations; for instance, AG 43 applies to contracts issued in and after 1981, whereas C-3 Phase II applies to all issue years for in-scope products

6) DETAILS ON SCENARIOS / SCENARIO GENERATORS / ECONOMIC ASSUMPTIONS

Q.6.1 Could the same scenarios be used in AG 43 and C-3 Phase II calculations?

A. Yes, as long as the scenarios chosen conform to the Scenario requirements of AG 43 and C-3 Phase II.

Q6.2 With respect to the calibration of scenarios, both Appendix 2 of the C-3 Phase II Report and Subsection A5.2) of AG 43 provide calibration points for the S&P 500 index. How would one go about calibrating other fund types?

A: This question essentially relates to determining how to generate returns for the funds underlying the VA product and to ensure that those returns are consistent with the S&P 500 calibration points.

Fund returns can be generated in many different ways. In a one-factor approach, returns are generated for a reference index (in this case, the S&P 500), and returns for various funds are specified by a linear relationship to this index. For example, in a Capital Asset Pricing Model (CAPM) approach we find slope (beta) and intercept (alpha) terms which can then be applied to modeled S&P 500 returns to give the desired fund returns for different paths and steps. In this setting, systematically riskier funds have a greater slope term (beta), and less risky funds have a lower beta.

The references in both the C-3 Phase II Report and AG 43 suggest that if the fund being simulated is riskier than the S&P 500, then the calibration points would usually be more “fat tailed” than those of the S&P 500. Under a CAPM approach, this would typically be the case, unless a high intercept term (alpha) was used. Therefore, the actuary would not usually assume an alpha term that results in a thinner left tail for a more risky fund, unless there is persistent evidence to the contrary. As stated in A5.4) AG 43 “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.”

Another related one-dimensional approach to determining fund returns is to assume a constant or rational market price of risk across different funds. This may be expressed through a Sharpe ratio. For example, one may compare the historical Sharpe ratio of the S&P 500 to the Sharpe ratio implied by the distribution of returns created to meet the calibration points, and use this relationship as a guide in modeling returns of other funds. This method would normally require a reasonably stable relationship between the historical Sharpe ratios for the fund and the S&P 500.

While the one-dimensional nature of a CAPM or market-price-of-risk approach can simplify fund modeling, it can also oversimplify it, by failing to appropriately represent cross-correlations among funds or fund types. Therefore, another common fund modeling approach is to generate correlated returns simultaneously for all funds. The required parameter estimation and computational intensity can be prohibitive as the number of funds increases, so under this method, the actuary may map funds to a limited number of proxy indices (e.g., S&P 500, Lehman Aggregate Bond, Russell 2000, etc.). Returns are then modeled for the proxy indices rather than for the underlying funds.

The mapping from funds to indices often takes the form of a constrained linear regression as first outlined by Sharpe and the actuary would usually consider appropriate constraints. For example, the actuary may force the regression coefficients

to be nonnegative, or to add to 100%, or both. The actuary typically tests any mapping to ensure that the returns of proxy mappings are consistent with the returns of underlying funds. In particular, the actuary is usually prudent to take care that the proxy mapping does not systematically overstate mean returns or understate volatility.

As with other fund modeling approaches, when using a multiple-mapping approach, distribution parameters are developed for each of the proxy indices. When doing so, the actuary is usually prudent to maintain a constant or rational market price of risk across different asset classes. As noted above with regard to the Sharpe ratio, adjustment may be made to reflect the market price of risk inherent in the S&P 500 calibration points.

If sufficient historical data is not available to draw robust conclusions the actuary usually relies on the stated investment objectives, policies and strategies of the fund and less direct information (e.g., similar funds run by the same managers).

The actuary shall document the actual 1-, 5-, 10- and 20-year wealth factors of the scenarios at the same frequencies as in the "S&P 500 Total Return Gross Wealth Ratios at the Calibration Points" table in Subsection A5.2) of AG 43.

Note: Subsection A5.4) of AG 43 is dedicated to the calibration of "Other Funds" and lists the full requirements therein.

Q6.3 Is it appropriate to select a subset of scenarios from the C-3 Phase II pre-packaged scenarios available on the Academy website at <http://www.actuary.org/life/phase2.asp>? If so, what does the actuary do if the subset of the scenarios fails to meet the calibration criteria?

A: Both AG 43 Subsection A5.8) and C-3 Phase II, Appendix 2 appear to imply that a subset of the prepackaged scenarios may be used but the "the actuary shall verify that the scenario calibration criteria are met". In fact, the Academy website at <http://www.actuary.org/life/phase3.asp> includes a "picking tool" that allows the actuary to choose a subset of the 10,000 scenarios.

If the chosen set of scenarios does not meet the calibration criteria, the actuary may wish to increase the number of scenarios or choose another subset. It is usually inappropriate to shop for scenarios or introduce selection bias. Additionally the actuary ordinarily considers the loss of information and the increase in uncertainty when seeking to meet the criteria with as few scenarios as possible. The minimum number of scenarios will depend on the specifics of what the actuary is modeling and typically equal or exceed 1000 as per Subsection A5.6) of AG 43.

Q6.4 How may the actuary determine if an appropriate number of scenarios has been used?

A: Subsection A1.3)A) of AG 43 states: "The number of scenarios for which projected greatest present values of Accumulated Deficiencies shall be computed shall be the responsibility of the actuary and shall be considered to be sufficient if any resulting understatement in total reserves, as compared with that resulting from running additional scenarios, is not material."

One method to determine this would be to perform a statistical analysis. For example, the variance of the CTE measure is approximated by this formula:

$$(\text{VAR}(x_1, \dots, x_k) + a (\text{CTE} - x_k)^2) / k,$$

where the x values are the results of the items being included in the CTE calculation (sorted in order with x_1 being the worst present value of surplus and x_k being the best and $x_{k+1} \dots x_n$ are excluded), a is the level of the CTE measure (such as 70% for reserves or 90% for Phase II), and n is the total number of scenarios, and k is the k^{th} sample order statistic x_k and equal to $(1-a) n$. (Source: Manistre and Hancock, Variance of the CTE Estimator, North American Actuarial Journal, volume 9, number 2 (April 2005), pages 129-156.)

Another method would be to compare the size of the standard deviation (SD) of the CTE measure to the CTE itself. If the ratio is relatively small one may accept the CTE measure as calculated. Otherwise, one could create and use additional stochastic scenarios. Doubling the number of scenarios may have a small impact on the CTE measure and reduce the standard deviation by about 30% (1 minus the inverse of the square root of 2).

Another method involves a form of stratified sampling to potentially reduce sampling error as described by Hancock in Record Volume 29, #3 available from the Societies of Actuaries (SOA). Determine a significant measure, S , for every scenario (10,000 if using the Academy scenario file) and note that S is a function of the scenario (inputs to the model), not the resulting cashflows from that scenario (outputs from the model). In words, S is the square root of the sum of squared discounting values over some time horizon. The discounted values are a function of the accumulation factors in the scenarios and the time horizon should be long enough to account for the majority of cash flows. To arrive at a representative scenario (to help determine if you have an appropriate number of scenarios) you sort the values of S and stratify into a desired number of samples followed by picking the midpoint of each stratum. This approach coupled with a 'reference portfolio' can help improve the quality of the CTE measure without the potential need for running more scenarios.

Other methods include various variance reduction techniques, such as those described in the Manistre and Hancock paper referenced above.

Bootstrap techniques could also be used to estimate the standard error in the CTE estimate. If the estimated standard error is too large, it may be possible to add runs to the initial runs and re-estimate the standard error using the same bootstrap techniques. This can be continued until the standard error is deemed low enough. At the Society of Actuaries 2004 annual meeting in New York, Mary Hardy ran a teaching session, Session 72, showing how to apply bootstrap techniques to estimate the standard error of a CTE measure (http://www.soa.org/files/pdf/072_hardy-ny04.pdf). Another way of accessing the material is to go to <http://www.soa.org/meetings-and-events/handouts/detail.aspx>, click on 2004 Handouts, then look for "Session #72 TS - Bootstrap Methods" in the handouts under "Annual Meeting (New York, NY)."

Other statistical procedures may be used to demonstrate appropriateness of the number of scenarios.

Disclosure requirements of the number of scenarios chosen and methods used to determine sampling errors are in Appendix 11 and Appendix 8 of the C-3 Phase II and AG43 reports.

Q6.5 Are the Short-Term, Medium-Term, and Long-Term US Treasury prepackaged fund yields appropriate for calculating the interest rate component of C-3 Phase II?

A: Appendix 6 of C-3 Phase II states that “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”. It goes on to say “The US Treasury Fund scenarios within the 10,000 prepackaged scenarios qualify as meeting this standard”. If using a subset of the pre-packaged scenario, the actuary may wish to verify that the subset meets these characteristics. The scenarios for the different maturities are correlated and are used as a set.

Note that Appendix 6 of C-3 Phase II Report contains other simplified approaches for calculating the interest rate risk component of C-3 Phase II.

Q6.6 What are the considerations for meeting the calibration points in the first 20 years? What calibration requirements apply to projected fund returns for time periods in excess of 20 years?

A: S&P 500 calibration points are provided for a 20-year time horizon. An insurer using the modeling approach to calculate the TAR may use the pre-packaged scenarios or the fund scenarios meeting the calibration criteria produced by an internal company model that satisfy the calibration criteria as per Subsection A5.2) of AG 43. Strict compliance with all calibration points is not required for S&P 500 funds, but the actuary should be satisfied that any differences do not materially reduce the TAR.

Subsection A5.3) of AG 43 states that while “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.” These adjustments should be clearly documented and justified by historical data.

For many investment funds the actuary may not have more than 10 years of historical data. As industry experience increases with these issues, the actuary’s practice in dealing with such cases would normally reflect the sophistication or rigor consistent with a range of industry practice. This does not mean, however, that the actuary would always use the most complicated or newest method. The dollar value of non-S&P 500 funds would usually be a consideration, as well as whether these funds are balanced funds or bond funds which have lower risk.

Calibration of other markets (funds) is left to the judgment of the actuary, but the scenarios so generated must be consistent with the calibration criteria in subsection A5.2). This does not imply a strict functional relationship between the model parameters for various markets/funds, but it may 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.

Appendix 2 and Section A5.4) of the C-3 Phase II and AG43 reports cover requirements for the other market funds.

Q6.7 What are the considerations in modeling fund returns?

A: The type of fund is a primary consideration. Another consideration is the amount of historical data available for a fund. A variety of models can be used. If the actuary has two closely related funds, similar models would normally be used for each. A larger fund would usually receive more attention. For example a lognormal model could be used for a small fund and a regime switching model could be used for a larger fund. Calibration criteria would usually have a reasonable relationship among the different funds modeled. This can result from a combination of theory and empirical analysis. See Appendix 2 of C-3 Phase II report.

Appendix 2 and Section A5.4) of the C-3 Phase II and AG43 reports cover requirements for the other market funds.

Q6.8 What characteristics would integrated equity/interest rate scenarios typically have?

A: It may be appropriate for the integrated equity/interest rate scenarios and modeled trading strategies not to produce profits without risk (i.e., no free lunch). If a company is hedging, it may be appropriate for the models to determine the prices of hedge instruments using an appropriate set of risk-neutral scenarios which do not underestimate the cost of hedging.

According to Appendix 6 of the C-3 Phase II report, 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 need to be run to develop an estimate of the (combined) market risks. The US Treasury Fund scenarios within the 10,000 prepackaged scenarios available on the Academy website qualify as meeting this standard. [However, it should be noted that the prepackaged equity and interest rate scenarios provided by the Academy are not correlated. Hence, they may not be appropriate when incorporating hedging analysis.]

Q6.9 Are the pre-packaged scenarios appropriate for the purposes of projecting the market value of future hedge instruments within a projection?

A: Because AG 43 and C-3 Phase II involve cash flow projections, the pre-packaged scenarios were developed on a “real-world” basis (as opposed to a “risk-neutral” basis). Therefore, the pre-packaged scenarios are not appropriate for purposes of valuing hedge instruments within a projection. For this purpose, it is usually 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.

Q6.10 How can correlations between funds and market indices be incorporated into scenarios produced by an internal model?

A: This can be difficult as many funds lack adequate data. There can also be changes in fund management that make the correlation relationship to market indices unstable. When developing fund correlation assumptions, the actuary may consider the standard error associated with pair wise correlation estimates and may consider the overall portfolio variance and return characteristics for consistency. Alternatively, one may estimate the correlation structure of individual fund returns using single index (CAPM) models, multi-index models (Chen/Roll/Ross, Fama/French, Rosenberg), or factor/principal component analysis.

Q6.11 What other reference materials are available to assist an actuary in determining how to generate integrated scenarios from an internal model?

A: The actuary should consider the FAQ on scenario generators currently under development by the Academy Economic Scenario Implementation Working Group (ESIWG). In addition, here is a select list of titles that may be of help to the interested reader:

Title	Author	Publisher
Active Portfolio Management	Richard C. Grinold; Ronald N. Kahn	McGraw Hill
Applied Multivariate Statistical Analysis	Richard Johnson; Dean Wichern	Prentice-Hall
Bootstrap Methods and their Application	A.C. Davison; D.W. Hinkley	Cambridge University Press
Derivatives	Paul Wilmott	John Wiley & Sons
Derivative Securities	Robert Jarrow; Stuart Turnbull	South-Western College Publishing
Futures & Options: Theory and Applications	Hans R. Stoll; Robert E. Whaley	South-Western Publishing Company
A Guide to Simulation	Paul Bratley; Bennett L. Fox; Linus E. Schrage	Springer-Verlag
Interest Rate Modeling	Jessica James; Nick Webber	John Wiley & Sons
Interest-rate Option Models	Riccardo Rebonato	John Wiley & Sons
Modeling of Economic Series Coordinated with Interest Rate Scenarios	Keven C. Ahlgrim; Stephen P. D'Arcy; Richard W. Gorvett	SOA/CAS Research Project; downloadable from the SOA webpage
Modern Portfolio Theory & Investment Applications	Edwin J. Elton; Martin J. Gruber	John Wiley & Sons
Monte Carlo: Concepts, Algorithms, & Applications	George S. Fishman	Springer-Verlag

Title	Author	Publisher
Monte Carlo Methodologies and Applications for Pricing and Risk Management	Bruno Dupire (Editor)	Risk Books, a specialist division of Risk Publications
Monte Carlo Methods in Finance	Peter Jackel	John Wiley & Sons
Monte Carlo Methods in Financial Engineering	Paul Glasserman	Springer-Verlag
Nonparametric Regression and Generalized Linear Models	P.J. Green; B.W. Silverman	Chapman & Hall/CRC
A Non-Random Walk Down Wall Street	Andrew W. Lo; Craig A. MacKinlay	Princeton University Press
Numerical Analysis	Richard L. Burden; J. Douglas Faires	PWS Publishing Company
Options Markets	John C. Cox; Mark Rubenstein	Prentice-Hall
Options: Theory, Strategy and Applications	Peter Ritchken	HaperCollins Publishers
Pricing Financial Instruments, The Finite Difference Model	Domingo Tavella; Curt Randall	John Wiley & Sons
Quantitative Modeling of Derivative Securities	Marco Avellaneda in collaboration with Peter Laurence	Chapman & Hall/CRC
Quantitative Risk Analysis: A Guide to Monte Carlo Simulation Modeling	David Vose	John Wiley & Sons
Quasi-Likelihood and Its Application	Christopher C. Heyde	Springer-Verlag
Simulation	Sheldon M. Ross	Academic Press
Statistical Inference	George Casella; Roger L. Berger	Duxbury Press
A Stochastic Asset Model & Calibration for Long Term Planning Purposes	John Hibbert; Philip Mowbray; Craig Turnbull	Downloadable at www.barrhibb.com

Title	Author	Publisher
The Treasury Bond Basis	Galen D. Burghardt; Terrence M. Belton	Probus Publishing Company
Value at Risk	Philippe Jorion	McGraw Hill

Q6.12 For companies developing internal equity return models, must a specific model be used?

A: No. While the stochastic log volatility model was the basis for the S&P 500 Total Return Diversified Equity Calibration Points, any model with suitable parameterization that meets the Calibration Criteria can be used. For examples of models and parameterizations that have been evaluated, see the Life Capital Adequacy Subcommittee's June 2005 Report – Appendix 2 - page 32 (http://www.actuary.org/pdf/life/c3_june05.pdf).

Q6.13 Could the actuary use a state or path dependent equity return model?

A: Yes, as long as the actual scenarios produced by the model and used in the calculation required by C-3 Phase II meet the Calibration Criteria. The calibration requirements that the actual scenarios produced by the state or path dependent model must fulfill can be found in the NAIC RBC Instruction (currently LR025 Line 37 Step (1) for 2008).

7) DETAILS ON ACTUARIAL/MODELING ASSUMPTIONS

Q7.1 What do "best estimate" and "anticipated experience" mean?

A: The terms "best estimates" and "anticipated experience" are used in describing the setting of deterministic assumptions to be used for modeling. The C-3 Phase II Report uses the term "best estimate" whereas AG 43 uses the term "anticipated experience". Both are defined to be an actuary's reasonable estimate of future experience, given the available, relevant information. Best estimate is defined in the Glossary of the C-3 Phase II report and anticipated experience is defined in Section III B) 8) of the AG 43 report.

The reason for the difference in nomenclature is that concerns were raised about the term "best estimate" after C-3 Phase II had been completed, and was subsequently replaced by the term "anticipated experience".

Q7.2 What do "prudent best estimate" and "prudent estimate" mean?

A: The terms "prudent best estimate" and "prudent estimate" are used in describing the setting of deterministic assumptions to be used for modeling. The C-3 Phase II Report uses the term "prudent best estimate" whereas AG 43 uses the term "prudent estimate". A prudent best estimate (under C-3 Phase II) or prudent estimate (under AG 43) assumption would normally be defined by applying a margin to the actuary's best estimate or anticipated experience for the given assumption. The amount of margin applied to the best estimate or anticipated experience, typically may reflect some or all of the following:

- Potential estimate error;
- Potential random fluctuation from best estimates or anticipated experience;
- Potential for adverse trends in experience; and
- Potential anti-selection (e.g., possible correlation of lapses and mortality).

In general, the greater the uncertainty in any one of these factors the larger the margin, with each margin being set such that it increases the liability or provision over that which would be held in absence of the margin. For example, assumptions for circumstances that have never been observed would typically require more margin for estimation error than those for which abundant and relevant experience data are available. In addition, more margin might also be applied to risks that will occur farther into the future.

For further guidance, refer to Section III.B.(8), Appendix 9, and Appendix 10 of AG 43, and the Glossary (page 7), Methodology Note C3-03, and Methodology Note C3-04 of C-3 Phase II.

Q7.3 Are the margins included in "prudent best estimate" or "prudent estimate" assumptions developed assumption by assumption or in the aggregate?

A: Principle 3 in the Appendix 7 of the C-3 Phase II Report and Section I) of the AG 43 Report states, "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."

As is further stated in Methodology Note C3-03 of the C-3 Phase II Report:

"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 logical and internally consistent across the scenarios tested;
- Represent plausible outcomes; and
- Lead to appropriate, but not excessive, asset requirements."

AG 43 includes similar language in Principle 3, but specifies that the intent of the Principle is to "describe the conceptual framework for setting assumptions" and that Appendix 9 provides "the requirements and guidance for setting contractholder behavior and includes alternatives to this framework if the actuary is unable to fully apply this principle". In Appendix 9 section A9.2) of the AG 43 report, it is recognized from a practical stand point, that it may not always be possible to determine the level of margin in aggregate for all behavior assumptions. Therefore it requires that "the actuary shall determine Prudent Estimate assumptions independently for each behavior (e.g., mortality lapses, and benefit utilization), using the requirements and guidance in this Appendix and throughout the guideline, unless the actuary can demonstrate that an appropriate method was used to determine the level of margin in aggregate for two or more behaviors."

Q7.4 What is an appropriate discount rate?

A: C-3 Phase II addresses this in three areas. First, in the body of the C-3 Phase II Report, Modeling Methodology, section 7. Expected Interest Rates, it states that "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."

Second, in Appendix 1- General Methodology, it states, "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)."

Finally, in Appendix 2-Scenario Requirements it states, under the "Discount Rates" heading, "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 one-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 the survey results summary, which covered the first year of practice, the predominant approach (36%) was the use of the after-tax one-year treasury rate. Another group of companies (12%) used the after-tax swap curve. Some companies appeared to use methodologies that do not directly appear to reflect the reduction for Federal Income Taxes. These included the use of the swap curve itself (14%), the portfolio yield (12%), a modified swap curve 10%) and LIBOR (4%) (see the last paragraph.)

AG 43 addresses discount rates in Appendix 1, section A1.2)B),

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

Section A1.4)D) gives the actuary the choice among the following:

- (a) The forward rates implied by the swap curve in effect as of the valuation date,
- (b) The 200 interest rate scenarios available as prescribed for Phase I, C-3 Risk Based Capital calculation, couple with the Separate Account return scenarios by mating them up with the first 200 such scenarios and repeating this process until all Separate Account return scenarios have been mated with a Phase I scenario, or
- (c) Interest rates developed for this purpose from a stochastic model that integrates the development for interest rates and the Separate Account returns.

AG 43 goes on to say, "When the option described in 1) above (the forward interest rates implied by the swap curve) is used, an amount shall be subtracted from the interest rates to reflect the current market expectations about future interest rates using the process described in section A1.5)A).

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

Whichever approach a company is using, the actuary should consider documenting the methodology and discuss how the approach meets the requirements.

Q7.5 What assumptions might be used in the calculations required by C-3 Phase II and AG 43 and how would they be established?

A: There are many assumptions that underlie these calculations. The complete list will be a function of the company doing the modeling and the type of product being modeled. The actuary may wish to consider the potential impact of any variable that is expected to have a material effect on the outcome.

Values for each assumption are typically based on credible experience of the company doing the testing, company experience on similar products, or industry experience, in that order of preference. Margins are added, as discussed in Q7.3.

Sensitivity testing is a useful tool in creating assumptions for which no experience or industry data is available. The survey results summary indicated that in this situation, most companies developed their base and dynamic assumptions by creating a baseline assumption and using sensitivity testing. Possible sources of an appropriate baseline assumption might be the company's Cash Flow Testing or pricing assumptions.

Several required assumptions are provided below:

- Mortality
- General account crediting rate strategy
- Lapse rates (including full and partial withdrawals)
- Expenses (including overhead and investment expenses)
- Living benefit utilization rates
- Expected credit losses
- Expected revenue sharing income
- Future premium flows
- Renewal and trail commissions
- Inforce grouping

Refer to Appendix 9 of AG 43 for more guidance and requirements.

Q7.6 What process would the actuary follow in establishing the assumptions?

A: Appendix 9 of AG 43 states that the company shall use actual experience data directly applicable to the business segment (i.e., direct data) if it is available. Appendix 9 goes on to say "In the absence of direct data, the company should then look to use data from a segment that are similar to the business segment (i.e., other than direct experience), whether or not the segment is directly written by the company. If data from a similar business segment are used, the assumption shall be adjusted to reflect differences between the two segments. Margins shall reflect the data uncertainty associated with using data from a similar but not identical business segment. The actuary shall document any significant similarities or differences between the two business segments, the data quality of the similar business segment and the adjustments and the margins applied".

If company experience data is unavailable, then some actuaries may consider other sources of data such as industry studies from blocks of similar products. Pricing assumptions may also be a source; for dynamic assumptions it was a primary source for a majority of companies in the survey results summary.

Whatever the source of the data, the actuary may wish to consider the credibility of this data in creating assumptions and the appropriateness of those sources to the business being modeled. If the actuary used a feedback loop or some other method to evaluate actual versus expected results, the actuary may wish to consider discussing how this review was used in setting the assumptions.

Guidance for establishing these assumptions is provided in the prudent best estimate or prudent estimate definition in C-3 Phase II and AG 43 (e.g., the margin for error in assumptions should be directly related to uncertainty in the underlying risk factor).

In calculating results under C-3 Phase II the actuary may wish to consider adjusting assumptions based on historical experience to consider those guarantees that are available in the contracts that were not materially prevalent in the experience base. Appendix 9 of AG 43 states that the actuary should do this.

The actuary may also wish to consider the possibility of anti-selection impacting assumptions. For example, anti-selection may involve a combination of lapses, persistency, mortality, and in-the-moneyness of guarantees.

In calculating results under C-3 Phase II the actuary should consider performing sensitivity tests of assumptions to identify those that materially impact results and how various assumptions impact results (Appendix 9 of AG 43 states that sensitivity testing is required.). Sensitivity testing can range from full stochastic testing to testing on a subset of scenarios to testing a single deterministic scenario. Some actuaries will use asset adequacy sensitivity testing as a tool. These tests may be used as guidance regarding areas in which additional study may be warranted to increase the accuracy of the key assumptions. From the survey results summary, mortality and lapse assumptions were by far the most frequently sensitivity tested; however, assumptions such as expenses, revenue sharing and expected future premium also received significant attention.

The actuary may also wish to consider reviewing guarantees related to cash inflows and outflows to determine to what degree these future cash flows may be incorporated in the model.

The actuary may wish to consider the probability of events occurring that may materially impact future assumptions. Examples of these events include increased expected volatility of markets affecting the distribution of future returns or changes in inflation expectations affecting future expenses.

Q7.7 What assumptions would the actuary consider making dynamic and would the addition of a dynamic element to a given assumption normally be expected to impact the actuary's determination of the prudent best estimate or prudent estimate for the underlying base assumption?

A: According to the survey results summary, dynamic assumptions were amongst the most difficult to determine.

Dynamic assumptions are most commonly used to model contractholder behavior. The survey results summary indicated that lapses and (re)election of benefits were by far the most common use of dynamic assumptions. As practice grows, it might be expected to also include activities such as partial withdrawals, transfers between investment options, inflation assumptions and recurring deposits. In establishing behavior-related assumptions, actuaries may wish to consider the following:

- (a) Contractholder behavior can vary by product, market,

distribution channel, fund performance, time/product duration, etc.

- (b) Options embedded in the product may impact behavior.
- (c) Options may be elective or non-elective in nature. Living benefits are often elective, while death benefit options are often non-elective.
- (d) Elective contractholder options may be driven more by economic conditions than non-elective options.
- (e) As the “value” of a product option increases, the likelihood of contractholder behavior anti-selecting against the insurer increases.
- (f) Behavior formulas may have both a rational and irrational component. The rational component normally would be dynamic.

Contractholder behavior can be difficult to predict accurately, and the related assumptions can have a significant impact on the results. In determining these assumptions, some actuaries apply the following considerations:

- (a) Some actuaries believe that in the absence of empirical data, it is preferable to set behavior assumptions on the conservative side for purposes of determining C-3 Phase II requirements. This is required by AG 43.
- (b) As stated in Methodology Note C3-03 of the C-3 Phase II Report and Appendix 9 Section A9.6) of the AG 43 report, policyholder behavior assumptions should be consistent with the behavior that would be anticipated in the scenarios that are employed in the CTE calculation (generally, the top 1/3, or less, of the loss distribution).
- (c) Methodology Note C3-03-Contractholder Behavior and Appendix 9 Section A9.4) of the AG 43 report also states that it is reasonable to assume a certain level of non-financially motivated contractholder behavior. It states “The actuary need not assume that all contractholders act with 100% efficiency in a financially rational manner.”

Some actuaries believe the addition of a dynamic element to a given assumption does not impact the actuary’s determination of the prudent best estimate or prudent estimate for the underlying base assumption. Each dynamic contractholder behavior assumption reflects the actuary’s prudent best estimate or prudent estimate for how the given assumption will vary by economic scenario. This issue and more guidance on the setting of contractholder behavior assumptions is also further described in Methodology Note C3-03 in the C-3 Phase II and Appendix 9 of the AG 43 report. Section A9.5 of AG 43 specifically addresses dynamic assumptions.

Q7.8 What factors might the actuary choose to consider in estimating how contractholder behavior is likely to impact assumptions that vary based on the underlying equity/interest rate scenario?

A: Some actuaries consider the following items (among others) when estimating how contractholder behavior might impact assumptions:

- Results of company and industry experience studies;
- Product design;
- Distribution channel;
- In-the-moneyness;
- Combination of guaranteed benefits;
- Attained age (especially as retirement nears); and
- Contractholder/Agent sophistication.

Q7.9 What factors might the actuary choose to consider in determining the earned rate for the general account assets?

A: The C-3 Phase II Report is not specific regarding assets held as of the valuation date, but some actuaries believe that it is appropriate for the earned rates to be determined consistent with the book value of those assets and to be those rates expected to be realized in future periods. AG 43 is more specific, stating in Appendix 1, section A1.4)D), “General Account assets shall be projected, net of projected defaults, using assumed investment returns consistent with their book value and expected to be realized in future periods as of the date of valuation.” In certain instances, it may be possible for the value of the assets at the start of the projection attributable to the general account to be negative (e.g., if the value of separate account assets and hedges exceeds the estimated reserve as of the start of the projection). In this case, some actuaries believe it is preferable for the earned rates used to reflect the cost of borrowing money to support such negative assets. Other actuaries believe an asset portfolio could be constructed in the amount of the negative assets with a return equal to the negative of the return such assets would produce if actually owned. This portfolio could be constructed consistent with the investment strategy used in the modeling exercise.

The C-3 Phase II Report discusses earnings on future asset purchases in Section 7 Expected Interest Rates. The report allows for the use of earned rates from an integrated model, or alternatively allows the use of implied forward rates from the swap curve. Some actuaries believe that to the extent these calculations already include a spread above the Treasury yields, no additional spread should be added to the earned rates derived in this manner, but that provision should be made for projected asset defaults.

Aside from these two choices, AG 43 in Section A1.4) D) General Account Assets mentions the possible use of the 200 C3 Phase I Scenarios in projecting General Account Cash flows.

Conceptually, the same earned rates may be used for both C-3 Phase II and AG 43 calculations.

While the commentary above discusses rates that potentially may be used for earnings on general account assets, see the previous question 7.3 for rates to be used for discounting.

Q7.10 Could the actuary assume that cash flows generated from variable annuity contracts are reinvested into assets as part of the general account investment strategy for their models?

A: Some actuaries believe that a true integrated model that reflects the price that assets can be purchased at is the desired approach, however this approach is not required. Other actuaries believe that it may not be practical or desirable to follow an integrated model approach. Item 1 of Section A1.4)D) of AG 43 provides an alternatives to an integrated model and permits the use of forward interest rates implied by the swap curve (subject to the requirements in the guideline).

Q7.11 What are special factors related to variable annuity guarantees that the actuary might choose to consider when establishing lapse assumptions?

A: Variable annuities with guarantees may experience different lapse behavior than similar annuities without guarantees or with different guarantees.

In analyzing the lapse behavior of variable annuity policyholders, the actuary may wish to consider several factors, including, but not limited to: the current and potential value of policy guarantees, the nature of the guarantees (elective vs. non-elective), possible anti-selection on the part of contractholders, and increasing sophistication of policyholders and advisors.

The actuary may also wish to consider the credibility of applicable past experience and whether there are any factors that would indicate that past observed experience will differ from future experience. Possible factors may include replacement activity that may have resulted in artificially high lapse experience that may not be sustained and lapse experience trends for business in which projected results are sensitive to lapse experience.

Q7.12 As mentioned in the Modeling Methodology section, item 3 Assets of the C-3 Phase II Report and Appendix 1 Section A1.4A) Starting Asset Amount of the AG 43 report, assets at the start of the projection may include negative general account assets. At what rate would negative general account assets normally be financed?

A: As mentioned in Q7.9, some actuaries believe it is preferable for the earned rates used to reflect the cost of borrowing money to support such negative assets. Other actuaries believe an asset portfolio could be constructed in the amount of the negative assets with a return equal to the negative of the return such assets would produce if actually owned. This portfolio could be constructed consistent with the investment strategy used in the modeling exercise.

Q7.13 The C-3 Phase II Report provides (Section 10, paragraph 2) that "The Risk-Based Capital requirement is the Total Asset Requirement adjusted for taxes, minus the statutory reserve actually held."

(a) What is the reason for the tax adjustment?

A: The working reserve included in the projections is typically the cash surrender value. To the extent that actual tax reserves as of the valuation date exceed the working reserve, there is an element of future expense that is not considered in the projection (i.e., the tax associated with the release of the portion of the tax reserve in excess of the working reserve). This adjustment is made to reflect this item.

(b) What is included in the "statutory reserve actually held"?

A: The actual reserve would include the actual statutory reserve held by the company on the valuation date for contracts within the scope of C-3 Phase II. For the treatment of AVR and IMR, please see Appendix 1(a), items 3 & 4 under Single Scenario C-3 Measurement Considerations of the RBC Instructions or its equivalent on the most recent RBC instruction. For further guidance on AVR/IMR please see Questions 3.2.

Q7.14 The sixth paragraph of section 10 of the C-3 Phase II Report describes a method for approximating the Tax Adjustment.

(a) What is the Tax Adjustment?

A: The C-3 Phase II Instructions state: "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 the tax reserves assumed in the model are set equal to the working reserves and if the tax reserves actually exceed the working reserves at the beginning of the projection, a tax adjustment is required.

The Tax Adjustment is not required in the following situations:

1. 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.
2. Tax reserves at the beginning of the projection period are equal to Working Reserves.
3. 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."

(b) Are other approximation methods appropriate?

A: The illustrated methodology adds the tax adjustment recognizing the understatement of tax reserves at the start of the projection to the duration producing the lowest present value for each scenario. Some actuaries believe that other reasonable approximations may be made as long as the adjustment is consistent with the principles for C-3 Phase II.

A large majority of the C3 Phase II survey respondents did use the tax adjustment to TAR defined in the report. Less than half that number actually modeled tax reserves.

Some actuaries believe it is permissible to calculate tax reserves, as well as any other tax items that may be applicable, within both the stochastic and the standard scenario models in order to compute taxable income. Whenever an explicit assessment of taxable income has already been included in the models, no additional tax adjustment would be needed.

Section 1)A) in the section of LR025 that details the calculation of the Standard Scenario Amount states "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 II (Market Risk) RBC shall be the Standard Scenario Amount." As a result of this statement, some actuaries believe that it is appropriate to include a tax adjustment in calculating the Standard Scenario result.

(c) The approximation specified is based on numbers of contracts or lives. Would it be appropriate to use an approximation based on account values?

A: Some actuaries believe that other reasonable approximations may be used provided the results of the approximation are consistent with the principles for C-3 Phase II.

Q7.15 When including Net Revenue Sharing Income into either C-3 Phase II or AG 43 projections, how is the definition of "controlled" interpreted in the context of a parent and subsidiary company situation when no guarantee language exists (or when no formal contract exists)? The specific situation is that the parent company is the fund manager, but the subsidiary has written the contracts.

A: A necessary condition for the Net Revenue Sharing Income to be included in the determination of the TAR in C-3 Phase II is that such revenue be received and controlled by the company. Another necessary condition is that there be a signed agreement in place on the valuation date, which supports the current payment of the Net Revenue Sharing Income. These necessary conditions make no distinction as to whether the entity providing the payment is an affiliate or whether the amount is guaranteed for a specific period of time.

Some actuaries would additionally consider the contractual commitments to the customer, representations and other statements in filings with security regulators, the contractual arrangement with entities providing investment

or other services, and the degree to which the insurer was an active participant to the contractual arrangement, either directly or indirectly.

The requirement that the revenue be controlled was removed from AG 43 but is specified in the C-3 Phase II Section on Modeling Methodology 6) Revenue Sharing. In setting the Net Revenue Sharing Income assumption and considering whether a company has control on the Net Revenue Sharing Income, the concept of setting Prudent Best Estimate and Prudent Estimate assumptions should be considered. Some actuaries view control over the Net Revenue Sharing Income as having contracts showing the company as the owner and/or receiver of the income.

Q7.16 Would there usually be any connection between the assumptions for Net Revenue Sharing Income and the deduction for fund expenses when reaching a net return on the funds?

A: In modeling future separate account fund performance, gross returns are developed typically through some type of stochastic process. Where these returns are on a gross basis, investment expenses (along with other appropriate charges) must be deducted from these gross returns.

The definition of Net Revenue Sharing Income could include an arrangement under which the entity providing investment services makes payments to the insurance company (or an affiliate) in exchange for administrative services provided by the insurance company (or an affiliate). It should be noted that only those payments that are attributable to charges or fees taken from the underlying funds supporting the contracts are included in the definition of revenue sharing.

In interpreting the requirement that only those payments attributable to the charges or fees taken from the underlying funds, some actuaries would interpret the requirement in the context of the arrangement and prevalent business practices within the insurance and mutual fund industries. For example, some fund managers may structure the revenue sharing arrangement using a common numerical value across all funds, even though the typical expense ratios vary by type of mutual fund (money market, bond, domestic equity, etc.). As another example, a payment to the insurance company may be structured in terms other than as a percent of assets even though the mutual fund charges are made as a percent of assets. This situation is similar to the structure prevalent in the mutual fund industry under which maintenance charges are covered by asset-based charges.

Other business practices used within the mutual fund industry could include the use of expense caps on smaller mutual funds and the banding of investment advisory fees by asset size.

Q7.17 What might the actuary consider when projecting applicable expenses in the context of Net Revenue Sharing Income?

A: The actuary may wish to consider examining the nature of the expenses incurred as part of a revenue sharing agreement. Expenses that bear no relationship to the funds invested (e.g., accounting expenses) may be tracked as part of the company's maintenance expenses and projected with them. It may be preferable for expenses that are related to the funds under management (e.g., sub-advisor fees) to be tracked and projected separately.

Q7.18 In order to include Net Revenue Sharing Income in projections, three requirements must be met. The third of these is that “the Net Revenue Sharing Income is not already accounted for directly or indirectly as a company asset.” What does this mean?

A: One example may be that Net Revenue Sharing Income may not be included in the projections if the entity providing it is a subsidiary of the company and the stock of the subsidiary is carried on the books of the company at an estimation of market value equal to present value of future profits.

Q7.19 The rules providing for the amount of Net Revenue Sharing Income that may be included in projections include the two provisions below. What is the purpose of these provisions?

“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):

(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.”

A: Revenue Sharing arises as the result of two entities being involved in the sale or servicing of variable annuities. Two common types of revenue sharing are:

1. Payment of 12b-1 fees from the asset manager or the investment fund to the insurance company, as a method of recompensing the insurance company for marketing expenses. 12b-1 fees are typically paid on new sales, the inclusion of these fees in either the C-3 Phase II or AG 43 calculations should only be related to projected future premiums paid into the contracts.
2. Payment of administrative expenses from the investment fund to the insurance company. Typically the insurance company maintains all of the individual participant records. The investment fund receives only bulk purchase and sale information and not detailed participant data. However, the expense charges of the investment fund are determined assuming that the fund must maintain detailed participant records. The payment of administrative expenses is intended as a way to compensate the party actually doing the work (the insurance company) by the person who charges for the work to be done (the investment fund).

The two provisions cited apparently require the actuary to consider the likelihood of continuation of the Revenue Sharing agreements and what would be the financial effect of their termination.

In the second type of Revenue Sharing above, the investment fund cannot do the work itself. If it were to unilaterally terminate the agreement with the insurance company, the latter would likely move the funds to some other investment fund. Thus the relevant consideration isn't whether the insurance company will lose all of the revenue sharing, but rather whether it will obtain as good an arrangement with the hypothetical replacement investment fund.

The Net Revenue Sharing Income assumption needs to include a margin (reducing the projected net revenue sharing income) to reflect uncertainty of the revenue. This margin is consistent with the setting of Prudent Best Estimate assumptions for C-3 Phase II and Prudent Estimate assumptions for AG 43.

Q7.20 What is the meaning of “... 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.”

A: The expenses to be considered are those associated with the fees charged to the variable annuities contract owners and the revenue sharing arising from those fees. The point of this requirement appears to be to consider the likelihood that the revenue sharing agreement will be continued and the likely economic ramifications if it is not. If the actuary is including revenue sharing, all expenses which the company incurs in providing the services for which it is getting the revenue sharing would be included.

This assumption needs to include a margin (reducing the projected net revenue sharing income) to reflect uncertainty of the revenue. This margin is consistent with the setting of Prudent Best Estimate assumptions for C-3 Phase II and Prudent Estimate assumptions for AG 43.

Q7.21 What can be done to shift some of the work for C-3 Phase II compliance into periods other than the busy year-end period?

A. Two methods that some actuaries have identified as a basis for meeting the criteria were described in the March 2004 report of the Variable Annuity Reserve Work Group to the Life and Health Actuarial Task Force. They are called the Interpolation Method and the Informed Projection Method. These methods may be appropriate for estimating TAR. Other methods will likely emerge as practice develops.

The survey results summary indicated that the overwhelming majority of companies used the year-end inforce for the actual determination of TAR in 2005. Of those companies which choose a date other than year-end, there was a relatively equal split between September 30 and November 30. A variant of the “Informed Projection” Method appeared to be the most popular.

Actuaries using these approaches are usually prudent to determine whether they are appropriate for the business to which they are being applied.

Q7.22 Do companies base the projections needed for C-3 Phase II on business in force prior to the valuation date?

A: Section I of the *General Instruction LR025 Interest Rate Risk and Market Risk* for C-3 Phase II titled “Calculation of the Standard Scenario Amount” appears

to anticipate that companies might base their models on business in force prior to the valuation date. Specifically, subsection (C) of this section, titled "Illustrative Application of the Standard Scenario Method to a Projection, Model Office and Contract-by-Contract" references "a projection of an inforce prior to the statement date."

Both the Interpolation Method and the Informed Projection Method referenced above use business in force prior to the valuation date for purposes of running the stochastic projections. Each method also incorporates an adjustment to reflect the actual business in force on the valuation date. For the electronic filing of risk-based capital the reported Authorized Control Level Risk-Based Capital would be no less than the amount required using year-end data.

(a) What is the Interpolation Method?

This method attempts to relate projected fund performance to resulting changes in TAR by measuring the present values of "Risk Elements" in three categories: death benefits, living benefits, and surrender charge amortization. An estimate of the TAR on the valuation date can be obtained by interpolating between the CTE results, expressed as an amount per dollar of net amount at risk, which are obtained from running multiple calculations (perhaps as many as five) on the business in force on a previous valuation date. An estimate for TAR at a later valuation date can then be obtained by applying the interpolated result to the actual Risk Elements. The steps in the process are as follows:

- 1) The account values as of the previous valuation date are "shocked" up and down by various percentages to simulate market movements that could occur before the end of the financial reporting period (this is referred to below as the "shocked account values").

For example, an actuary might assume that market values would go up or down by no more than 15% over this period (if markets change by more than this, the actuary then runs an additional valuation since "extrapolation" would not be permitted – only interpolation). To improve the accuracy of the interpolation, the actuary might also choose to run projections at +/- 10%, as well. The starting account values and asset values would then be increased by +/- 10% and +/- 15%, resulting in calculation of CTE results on five different starting values (including the original values).

- 2) A CTE result is calculated for each of these shocked account values.
- 3) For each of these CTE results, the present value of the Risk Elements is determined by measuring the net amounts at risk for each of the Risk Elements on a seriatim basis, assuming a single scenario occurs following the initial shock and using statutory valuation mortality and interest rates. A separate present value of Risk Elements is established for CTE (90).

The single scenario is determined by selecting, from the scenarios run to determine the CTE (90) TAR on the previous valuation date, the scenario producing the greatest present value

of accumulated deficiencies numerically closest to the reserve held on the previous valuation date. The present value of the Risk Elements is measured over the period at which the greatest present value of Accumulated Deficiency for reserves, or lowest present value of accumulated statutory surplus for TAR, occurs within the single scenario (e.g., if the greatest present value of Accumulated Deficiency occurs at year 5, the present value is based on the Risk Elements over five years).

Note that the determination of the present value of Risk Elements is similar to that of Actuarial Guideline 34 (i.e., an immediate drop or growth at the shock percentage, followed by assumed returns associated with the single scenario described above).

- 4) For each of the shock scenarios, the CTE value from the projection in step #2 is set equal to the corresponding present value of Risk Elements (from step #3) multiplied by a factor that is a function of the shock percentage associated with the projection. In formulas for CTE (90), this can be expressed as a series of equations for each shock percentage “P” as shown below. Formulas for TAR determination at CTE (90) are similar.

$${}_p CTE(90) = PV(RiskElements_p) \times f(P)$$

And in our example from above, we would have five equations as follows:

$${}_0 CTE(90) = PV(RiskElements_0) \times f(0)$$

$${}_{10} CTE(90) = PV(RiskElements_{10}) \times f(10)$$

$${}_{-10} CTE(90) = PV(RiskElements_{-10}) \times f(-10)$$

$${}_{15} CTE(90) = PV(RiskElements_{15}) \times f(15)$$

$${}_{-15} CTE(90) = PV(RiskElements_{-15}) \times f(-15)$$

In each of these equations, the function value $f(P)$ can be solved for by setting it equal to the CTE value divided by the present value of the Risk Elements corresponding to that CTE. This may be thought of as the CTE value per dollar of present value of Risk Elements.

- 5) Mathematical interpolation can then be used to calculate this ratio for intermediate shock values and the interpolated value can be applied to the present value of Risk Elements to obtain an estimate of the corresponding TAR.

For example, in order to illustrate a TAR estimate, the VARWG used the LaGrange interpolation method with five valuations to construct a

fourth degree polynomial that relates the CTE (90) values per dollar of present value of Risk Elements to changes in the market values underlying the account values. That is, the CTE (90) per dollar of present value of Risk Elements is the dependent variable, $f(P)$, with the independent variable, "P" representing the percentage change in the market values underlying the account values. The coefficients of the interpolation formula are derived from the five CTE (90) values per dollar of present value of Risk Elements.

- 6) Once the actual account values at the end of the financial reporting period are known, the present values of Risk Elements corresponding to each CTE value can be calculated on a seriatim basis using the corresponding single scenario used to develop the CTE value per dollar of Present Value of Risk Element calculated in step #4. The interpolated result is then applied to these values to obtain the estimated reserve or TAR at the end of the financial reporting period.

Some actuaries believe this could result in fairly accurate reserve and TAR estimates. The primary advantages to this approach are that the seriatim Risk Element calculation reflects the actual characteristics of the business in force and "in-the-moneyness" on the valuation date and that it could be performed at year-ends and quarter-ends on a routine basis. A potential concern is the amount of work needed to perform the additional projections.

(b) What is the Informed Projection Method?

Under this approach, reserves and TAR are estimated on the "current date" and prior to the valuation date using the actual in-force file from a prior period (the "prior period start date"), updated for actual experience through the "current date". An example would be to estimate the December 31 reserves on December 15 (the "current date") using the in-force file from a "prior period start date" of September 30, updated for actual fund performance and new sales through December 15. Such an estimate would allow the company additional time to meet its reporting deadlines.

The description below assumes that TAR are being estimated for year end. This method could also be used for estimates at other time periods.

Some actuaries believe estimated results would be more accurate for shorter observation periods (e.g., starting with the November 30 in-force file instead of September 30) and where the current date is closer to the end of the year (e.g., December 22 vs. December 15). The method may also need to take into consideration the time step of the underlying model (e.g., if the model is a quarterly time step model, it may be difficult to use November 30 as the "prior period start date"). The usual steps in the process are as described below:

- 1) Start with the actual in-force file as of the "prior period start date" (e.g., September 30, October 31 or November 30).
- 2) Determine the increase or decrease in the S&P 500 and other representative indices during the "observation period" (i.e., the period starting with the "prior period start date" through the

- "current date").
- 3) Estimate performance of the S&P 500 and the other representative indices for the remainder of the calendar year (or use 0%).
 - 4) Determine the actual sales during the "observation period", along with its actual or estimated age/gender/fund mix, etc.
 - 5) Estimate the expected sales for the remainder of the calendar year along with its estimated age/gender/fund mix, etc. This can be done based on the actual sales during the observation period adjusted for cyclical trends (i.e. sales activity at end of quarter or end-of-year) or assuming no sales for the remainder of the calendar year.
 - 6) Model the business starting with the "prior period start date" using the in-force file as of that date. Use fund performance during the "observation period" based on the information in 2) and fund performance based on 3) for the remainder of the calendar year. Incorporate actual and new sales, similarly using the information from 4) and 5).
 - 7) Beginning January 1 within the projection, use stochastically generated returns and no new sales in the model.
 - 8) Calculate the CTE assuming the model start date is December 31 (i.e., using gains and losses beginning on January 1 and discounting to December 31).
 - 9) Subtract the result in 8) from the projected account value as of December 31. It is possible (especially for TAR) that this will result in a negative amount, but the ultimate result in step 10 is still correct.
 - 10) Subtract the amount in 9) from the actual December 31 account value to determine the estimated reserve or TAR as of December 31.

The steps in 9) and 10) are intended to adjust for differences between modeled and actual December 31 account value. A good test of the modeling is to see how close these two account values are.

Possible refinements include: determine actual surrenders, deaths, fund transfers, subsequent premium, etc. for the "observation period", rather than using model assumptions.

8) DETAILS ON ALTERNATIVE METHODOLOGY

Q8.1 What is the Alternative Method (C-3 Phase II)/Alternative Methodology (AM)?

A: C-3 Phase II (“Alternative Method”) and AG 43 (Appendix 4 – Alternative Methodology) allow a factor based approach (as opposed to scenario testing) for variable annuity contracts that either contain no guaranteed benefits or only GMDBs (i.e. no VAGLBs). The AM approach is available if the company has not used scenario based testing on this business in prior years. AG 43 allows an exception to this constraint if approval is obtained from the Domiciliary Commissioner (C-3 Phase II is silent here).

Q8.2 How is non-proportional reinsurance incorporated into the Alternative Methodology (AM)?

A: Some actuaries believe that the only way non-proportional reinsurance can be incorporated into the Alternative Methodology is by use of stochastic modeling to support any adjustment or approximation. Other actuaries believe non-stochastic approaches may be appropriate as well.

Q8.3 Would credit be taken for hedging when using the AM?

A: No credit is allowed for hedging when using the AM.

Q8.4 What happens when the margin offset is either less than 20% of the management expense ratio (MER) or greater than 60% of the MER?

A: C-3 Phase II (Appendix 8, “Base Margin Offset Factor”) and AG 43 (Appendix 4, Section A4.1, subsection E) requirements state that, when looking up the appropriate factors for GC, the margin offset, expressed as a percentage of MER, should never be less than 20%, nor more than 60%. Thus, if the actual margin offset is less than 20%, one should use the factor value for 20% and if greater than 60%, one should use the factor value for 60%.

Q8.5 How is ϕ calculated for purposes of determining the scaling factor, R?

A: ϕ reflects the overall in-the-moneyness for an entire type of guarantee (e.g., return of premium GMDB, maximum anniversary value GMDB, etc.) in the aggregate, not for an individual contract. It equals the aggregate account value for all contracts of that product type, divided by the aggregate guaranteed value for the product type, multiplied by 90%.

Q8.6 At what level of aggregation would the margin offset, alpha, be calculated? For example, would it usually be expressed as an aggregate percentage of the MER for the block as a whole?

A: The margin offset is intended to represent the portion of the MER that is available to fund the cost of the guaranteed benefits exceeding the account value. The highest level of aggregation for this determination would normally be the product level. As a result, unless the structures of several or all of the products in a portfolio were substantially the same, one would not usually expect alpha to be determined in the aggregate. Hence, alpha would normally not be a constant percentage of MER across products.

Q8.7 Is a Standard Scenario calculation appropriate when using the Alternative Methodology?

A: Yes, the Standard Scenario calculation is still required even for companies using the AM. However, under C-3 Phase II the Standard Scenario Amount equals the Total Asset Requirement when the AM is applied on a seriatim basis with mortality assumed at 100% of the 1994 Variable Annuity MGDB Mortality Table. See Section 9 for further details.

Q8.8 The assets backing each contract are assigned to predefined asset classes for three different purposes: calculating the GC component of the Alternative Methodology, calculating the CA component of the Alternative Methodology, and calculating the Standard Scenario Amount. How does each of these three assignments differ?

A: For the GC component, each contract's entire asset exposure is assigned to one of the eight asset classes that are prescribed under the Alternative Methodology. Each separate account and general account investment option is first mapped to one of the eight prescribed asset classes. Then, the overall expected long-term volatility for the contract's combined asset holdings is determined, based on the volatilities for each fund and the correlations between the prescribed asset classes. Finally, the asset composition and expected volatility for the contract is evaluated to determine which prescribed asset class best represents the overall asset exposure for the contract.

For the CA component, such a mapping usually is only done if the surrender charges are a function of the projected account value. In such cases, the mapping process for the CA is similar to that for the GC, except that each contract's entire asset exposure is not mapped to a single "equivalent" prescribed asset class. Each separate account and general account investment option is still assigned to one of the eight prescribed asset classes, but then each of those prescribed asset classes is projected under the CA calculation. This means that up to eight asset classes will be modeled when projecting account values for the CA calculation.

The asset mapping for the Standard Scenario differs from that for the Alternative Methodology. The Standard Scenario defines four different prescribed asset classes. The underlying separate and general account assets for each contract are assigned to these prescribed classes based on the characteristics of the contract holdings. The assignment to these prescribed asset classes impacts the projection rate used in the Standard Scenario calculation.

Q8.9 Is it possible for the GC component to be negative for a given contract?

A: Yes, it is possible for the GC component to be negative for a contract. In fact, it is even possible for the Additional Asset Requirement (AAR) to be negative. This will generally not be the case for newer issues, but it would be more likely to occur in contracts that have more conservative guarantees (such as return of premium), that are relatively far out of the money, that have their assets invested in less volatile funds, and/or that have a relatively large margin offset factor.

Q8.10 In the description of the CA component, what is meant by “amount needed to amortize the unamortized surrender charge allowance for persisting policies plus an implied borrowing cost?”

A: The CA component is intended to reflect the future financial impact of the runoff of surrender charges. For companies that hold the cash surrender value as the basic reserve, the runoff of the surrender charge for persisting contracts reduces the net gain by contributing to the increase in reserves. The CA component is intended to capture that future hit to gain. Presumably, that cost will be at least partially offset by charges that are assessed against the contract to recoup acquisition costs. These charges will generally be reflected in the MER and margin offset in the GC calculation, leaving the related costs to be reflected in the CA component. The CA component requires companies to project the year-by-year runoff of the surrender charge and then discount back to the valuation date reflecting both interest and survival.

Q8.11 For a small closed block, must all modeling outlined in the report be done or is there a safe harbor provision?

A: There are no safe harbor provisions. For GMDBs, the actuary has the option of using the Alternative Method. If the actuary chooses not to use the Alternative Method or is not allowed to because of the existence of VAGLBs, the actuary may simplify the modeling by choosing methods and assumptions that are demonstrably conservative.

9) DETAILS ON STANDARD SCENARIO

Q9.1 Where is the Standard Scenario for C-3 Phase II/AG 43 described?

A: The C-3 Phase II Standard Scenario is described in the NAIC Risk Based Capital Instructions for Line (37) of LR025, Interest Rate Risk and Market Risk. The Standard Scenario for Reserves is defined in AG 43, Appendix 3.

Q9.1a What differences are there between the Standard Scenario calculation of RBC C-3 Phase II and AG 43?

The more significant differences between the RBC C-3 Phase II and AG 43 Standard Scenarios are as follows:

Discount Rate (DR): C-3 Phase II defines this to be annual effective rate of the 10 year CMT plus 50 bps. AG 43 defines this to be the Valuation rate under the Standard Valuation Law issue year basis plan A with Guarantee duration greater than 10 but less than 20 years.

Basic Adjusted Reserve: For C-3 Phase II this is the working reserve which is generally the Cash Surrender Value. For AG 43, this is similar to an AG33 reserve calculation, and it requires that the Asset Charges, GMDB and GLB charges are deducted from the accumulation rate, and that partial withdrawal provisions are disregarded when determining surrender charges. See Appendix 3 of AG 43 for more detail.

Tax basis on Accumulation and Discounting: The key difference is that the calculation required by AG 43 is performed on a pre-tax basis (i.e., federal income tax is ignored in the projections and the discount rates are pre-tax). The calculation required by C-3 Phase II is performed on an after-tax basis (i.e., federal income tax is included in the projections and the discount rates are after-tax). C-3 Phase II standard scenario is accumulated and discounted at $AR = DR \cdot (1 - FIT \text{ rate})$, in which AR is defined as the accumulation rate, whereas AG 43 standard scenario is done at the DR.

Account Value Return – Gross Annual Rate: Drop and recovery scenarios for RBC C-3 Phase II are more conservative than for AG 43. The RBC C-3 Phase II account value gross annual effective rates of return can be found in Table I of the NAIC RBC Instructions for Line 37 of LR025. The AG 43 account value returns are defined in Table I of A3.3(C)1).

RBC C-3 Phase II Prescribed (Gross) Returns

	Initial	Yr 1	Yr 2+
Equity	-20%	0%	3.00%
Bond	0%	0%	4.85%
Balanced	-12%	0%	3.74%
Fixed/Gen	Fixed Fund Rate		

Fixed Fund Rate = $\text{Min}\{\text{Max}(\text{Min guar rate}, 3.5\%), \text{Curr credit rate}\}$

AG 43 Prescribed (Gross) Returns

	Initial	Yr 1	Yr 2-5	Yr 6+
Equity	-13.5%	0%	4%	5.5%
Bond	0%	0%	4.85%	4.85%
Balanced	- 8.1%	0%	4.34%	5.24%
Fixed/Gen	Fixed Fund Rate			

Fixed Fund Rate= Min{ Max (Min guar rate, 4.0%), Curr credit rate}

Account Value Return – Revenue Margins: Margins used to calculate net revenues are different. The RBC C-3 Phase II margins on account value can be found in section III)D)1) of the RBC Instructions for Line 37 of LR025. The AG 43 margins are defined in section A3.3)C)1).

Hedging: AG 43 has prescribed limits on hedge efficiency.

Dynamic lapse withdrawal and (ITM): Both RBC C-3 Phase II and AG 43 have lapse rates that vary by different levels of ITM. The primary difference is that AG 43 allows a 2% lapse rate on Guaranteed Account Balance Benefits when they are ITM during the surrender charge period or only slightly ITM after the surrender charge period. ITM is also defined differently for RBC C-3 Phase II and AG 43. ITM definitions as well as Table II, which defines the lapse assumptions, can be referenced in section III)D)2) of the RBC Instructions for Line 37 of LR025 and AG 43 section A3.3)C)3).

C-3 Phase II definition of ITM:

ITM = Max {1 – (Account Value/ Value of Guarantee Benefit at time of Exercise of benefit), 0}, where maximum is over the future possible benefit payout start

AG 43 definition of ITM:

ITM = 100% * ((Current Value of the guaranteed living benefit /Account Value) - 1)

C-3 Phase II Lapse Assumptions

Table II - Lapse Assumptions

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

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AG 43 Lapse Assumptions

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 Minimum Accumulation Benefit ITM	2%	2%	0%	0%
Any Other Guaranteed Living Benefits ITM	3%	7%	5%	2%

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Mortality Assumption:

C-3 Phase II uses 80% of 1994 MGDB table then grades to 100% from attained age 95 to 115

AG 43 uses 70% of 1994 MGDB table then grades to 100% from attained age 85 to 115

Contractholder Election Rates for Living Benefits: There are no differences between the RBC C-3 Phase 2 and AG 43 guaranteed withdrawal assumptions for GMWBs. Election rates for exercisable ITM guaranteed living benefits other than GMWBs are a constant 15% per year for RBC C-3 Phase II. AG 43 varies the election rate by ITM levels as follows:

	ITM < 10%	10% <=ITM < 20%	20% <=ITM
Guaranteed Living Benefits other than GMWB	5%	15%	25%

Margins

C3 Phase II

(a) During the Surrender Charge Period

- i. 0.10% of Account Value, plus
- ii. Maximum (0.20% of Account Value, Explicit Charges for Guaranteed Living and Death benefits)

(b) After the Surrender Charge Period

- i. the amount determined in (a) plus
- ii. Minimum {0.65% of Account Value , 50% * [Maximum (0, All Contract charges less (a) above)] }
- iii. But for fixed funds use (a) + 0.4%

AG43

(a) During the Surrender Charge Amortization Period

- i. 0.20% of Account Value plus
- ii. Maximum (0.20% of Account Value, Explicit Charges for Guaranteed Living benefits) plus
- iii. Maximum (0.20% of Account Value, Explicit Charges for Guaranteed Death benefits) plus
- iv. Guaranteed New revenue sharing income

(b) After Surrender Charge Amortization Period

For Non Fixed Funds

- i. The amount in (a) plus
- ii. 50% (Maximum (0, all contract charges less(ai + aii +aiii above)

For Fixed Funds

- i. The amount in (a) plus
- ii. .0.4% of Account Value

To determine the Surrender Charge Amortization period

1. Determine the Basic Adjusted Reserve (BAR) duration which is equal to the duration of the greatest present value of projected benefits.
2. Determine the Unamortized Surrender Charge in BAR:
3. Maximum (0, Account Value at BAR duration less Cash Surrender Value at BAR duration) Determine Surrender Charge Amortization Period before rounding:
$$\text{BAR duration} + (\text{Unamortized Surrender Charge in BAR}/\text{Account Value})$$
4. Determine the Surrender charge amortization period for the contract, which equals the result from Step 3 rounded to the nearest projection duration.

Comparison to TAR: The C-3 Phase II standard scenario is compared to the market risk portion of TAR, while in AG 43 the standard scenario result is compared to the entire reserve.

Seriatim: The AG 43 standard scenario is calculated seriatim while the C-3 Phase II standard scenario is calculated in aggregate. Additional detail is provided in Q9.2, below.

Q9.2 Does the Standard Scenario for C-3 Phase II and AG 43 have to be applied to each contract? Is the Standard Scenario Amount determined in the aggregate or by summing the results for each contract?

A: The Standard Scenario for C-3 Phase II is applied on a contract-by-contract basis as described in subsection (B) of section (I) of Line (37) of LR025 in the NAIC RBC Instructions. However, there are two results obtained from this application. The Standard Scenario Amount used for the comparison anticipated in subsection (A) of section (I) is determined “in the aggregate,” meaning that the Accumulated Net Revenue is summed across all contracts before determining the greatest present value in subsection (B)(2) of section III. This is result “A” in Table A contained within subsection (C) of section I. The second result is when the greatest present value is determined for each contract by itself, and the resulting Standard Scenario Amount for each contract is summed to provide result “B” in Table A. As indicated in subsection (C), this is “To provide information on the significance of aggregation ...” In addition to these calculations performed on a contract-by-contract basis, subsection (C) of section (I) may also require the application of the Standard Scenario Method to a model office, see C and E of Table A, or a prior inforce, see D and E of Table A.

Similarly, the Standard Scenario is defined in Section IV(C) of AG 43 with additional detail found in Appendix 3 and it must be applied on a contract-by-contract basis.

Q9.3 Is the discount rate used for the AG 43 standard Scenario the same for all contracts for a given valuation date (i.e., on 12/31/2009 you use the valuation rate on an issue year basis, Plan Type A, and Guarantee Duration greater than 10 years but not more than 20 years for 2009 issues and use it for all contracts); or do you use the valuation rate applicable to each contract's issue year?

A; Subsection A.3.1)B)2)AG 43 defines the Discount Rate (DR) to be “the valuation interest rate specified by the Standard Valuation Law for annuities valued on an issue year basis, using Plan Type A and a Guarantee Duration greater than 10 years but not more than 20 years. The presence of guarantees of interest on future premiums and/or cash settlement options is to be determined using the terms of the contracts”.

Some actuaries believe that the intent of this definition is to use the valuation rate applicable to each contract's issue year and those actuaries point to the language in subsection 3.3)D)1) of AG 43 as support.

Q9.4 Subsection (C) of section I of the *General Instruction LR025 Interest Rate Risk and Market Risk* document and Subsection A.3.1)C) of AG 43 describe situations where the Standard Scenario Amount is determined on a contract-by-contract basis and others where it is determined using a model office. Since the calculation depends on deriving death and living benefits within the projection of Accumulated Net Revenue, how would those benefits be derived?

A: For the contract-by-contract calculation, some actuaries believe it is preferable to reflect the terms of each individual contract in the determination

of these benefits. If any modifications or additional assumptions are made, section III(A) of the RBC instructions and section A3.1)C) of AG 43 require explicit documentation of the new information. For calculations based on a model office, some actuaries believe for the purposes of validation given in Table A it is preferable to derive the benefits using the characteristics of the model plans making up the model office.

Q9.5 Would the actuary normally do anything in the Standard Scenario for death benefits based on a dollar-for-dollar reduction for partial withdrawals when the RBC/Reserves Standard Scenario Amount is not based on the Alternative Methodology?

A: Partial withdrawals are included in the Standard Scenario calculation only if the withdrawals are elected as a guaranteed benefit or required contractually. When projecting withdrawal benefits, the death benefit exposure would reflect the reduction that would occur based on the terms of the contract, dollar for dollar or pro-rata. No other distinction is made between dollar for dollar and pro-rata death benefits in the Standard Scenario.

Q9.6 Section A3.3)C)4) of AG 43 states: “No future deposits to Account Value shall be assumed unless required by the terms of the contract to prevent contract or guaranteed benefit lapse, in which case they must be modeled.” Would the actuary usually include future deposits needed to prevent the lapse of a benefit but not include future deposits necessary to prevent lapse of the whole contract?

A: As stated in that section of AG 43, future deposits must be modeled if required to prevent either a guaranteed benefit in the contract or the entire contract from lapsing.

Q9.7 Regarding the requirement to use a contractholder election rate is 15% for any elective ITM benefit, but only to the extent such election does not terminate a more valuable benefit subject to election, assume that a contract has two guaranteed living benefits that are both ITM. Benefit A is first available at age 60 and Benefit B is first available at age 70. The contractholder is 65. Benefit B is more ITM than Benefit A. Would the election rate at age 65 for Benefit A be zero since it would terminate the more valuable Benefit B even though B is not yet available to be exercised?

A: Please refer to the examples of ITM provided in Question 9.8.

Q9.8 What are some examples of ITM?

A: Typically, the actuary would not calculate ITM under the Standard Scenario for a guaranteed death benefit for the purpose of determining a lapse rate but would calculate ITM for living benefit guarantees for determining lapse rates or the election rates for guaranteed living benefits. The following situations provide possible methods of how to calculate ITM for guaranteed living benefits that are in the money. Other methods may be used as well (note – these examples use the RBC ITM formula, the AG 43 ITM formula is different).

The projected GMIB benefit base under the terms of the contract to the year-end subsequent to the first date on which the benefit base is available to purchase an annuity is \$110,000. The GMIB purchase rate on that year end

given the contractholder's age and sex is \$8.00 per \$1,000 of benefit base. Further, the projected account value under the Standard Scenario assumptions on that year-end is \$100,000 and the guaranteed purchase rate is \$7.80. The GMIB is currently in the money by 11.4% based on that year-end: $1 - (7.80 \times 100) / (8 \times 110) = 0.114$. The ITM percent would also be calculated for subsequent year-ends with the largest in the money percentage determining the actual lapse rate to be employed for each year.

After reflecting historical partial withdrawals, a contract at the end of the 7th contract year has a remaining GMWB amount of \$150,000 and an Account Value of \$125,000. The GMWB provisions allow that amount to be withdrawn in equal amounts at the end of the next three years regardless of the contract's account value. Assume that the projected net rate for the Account Value under the Standard Scenario is 4%. The table below shows the guaranteed withdrawals and projected Account Values. Some actuaries would determine the ITM percentage at the end of year 7 for purposes of the Standard Scenario to be 10.3%: $1 - (50,000 + 50,000 + 34,528) / (150,000)$.

EOY	AV before w/d	GMWB	AV after w/d
7	N/A	N/A	125,000
8	130,000	50,000	80,000
9	83,200	50,000	33,200
10	34,528	50,000	0

Q9.9 What investment returns would the actuary normally use in order to project the account value to a future date for the purpose of the in-the-moneyness calculation?

A: The Standard Scenario requires the use of the Standard Scenario return assumptions.

Returns are stated for four asset classes: equity, bond, balanced, and fixed accounts. The Standard Scenario states that Money Market funds shall be considered as part of the Bond class.

The specified returns for the initial drop are net rates whereas the rates specified for the first and subsequent projection years are gross rates. These gross rates would be reduced for fund and contract charges according to the provisions of the funds and contracts.

Note that different drop and recovery return assumptions exist for the Standard Scenario calculation under C-3 Phase II and AG 43.

Q9.10 What is the meaning of the statement in section A3.3)C)3) of AG 43 that "all lapse rates should be applied as full contract surrenders"?

A: As is also stated in that section of AG 43, no partial withdrawals, including free partial withdrawals, other than those withdrawals that are required under the Standard Scenario are to be deducted from the Account Value. Some actuaries believe that, because of the probability of prior deaths and lapses, future years in the projection will reflect less than a full unit of the contract. Some actuaries believe that the statement does not mean that a "coin should be flipped" to decide if the entire contract terminates or persists but, rather, that lapses would be reflected in the probability of a

contract remaining in force.

Q9.11 What guaranteed investment rate would usually be assumed on fixed funds when the current guarantee rate expires? Would it be a bond rate or minimum contract level guarantee?

A: The fixed fund rate for the RBC Standard Scenario calculation would be the greater of 3.5% and the minimum contract level guaranteed investment rate, but not more than the current credited rate. A similar provision exists for AG 43, except that a floor of 4% rather than 3.5% is assumed.

Q9.12 Would the Standard Scenario on assumed business usually be performed on data for an earlier time period aged forward?

A: The Standard Scenario is to be applied to the contracts in force on the valuation date. However, in practice, actuaries may need to incorporate approximation techniques such as the aging of business in force at an earlier date when faced with practical problems such as the one alluded to in this question. If any modifications or additional assumptions are made, section III(A) of the NAIC RBC Instructions and section A3.1)C) of AG 43 require explicit documentation of the new information.

Q9.13 What is the Basic Adjusted Reserve for an assuming company that only reinsures the guaranteed death or guaranteed living benefit?

A: The C-3 Phase II Basic Adjusted Reserve, defined as the Working Reserve in the instructions for the RBC Standard Scenario, may or may not be zero for the assuming company depending on the type of reinsurance and the provisions of the reinsurance agreement. The AG 43 Basic Adjusted Reserve, which is defined in section A3.2), also may or may not be zero depending on the type of reinsurance and the provisions of the reinsurance agreement.

Q9.14 Could an assuming company use Standard Scenario reinsurance cash flows and amounts provided by the ceding company?

A: Yes, but the assuming company is ultimately responsible for the calculations. The assuming company actuary may find it prudent to review the ceding company's calculation in order to provide the necessary certification for the assuming company.

Q9.15 Would an assuming company usually treat fixed accounts as bond funds?

A: No. There are different returns specified in the Standard Scenario for projecting assets associated with the Bond Class and the Fixed Separate Account / General Account.

Q9.16 For an assuming company, are both premiums receivable and benefits payable included in Accumulated Net Revenue? Would net revenue be negative if claims exceeded premiums?

A: Both premiums and benefits are included in net revenue. If claims with interest exceeded premiums with interest and the return on accumulated net revenue at the start of the year, net revenue for the year would be negative. However, since section A3.3)2)B) sets a floor for the Accumulated Net Revenue at zero, the standard scenario amount would not be negative

Q9.17 The C-3 Phase II Standard Scenario defines a contract as ITM if it includes a guaranteed living benefit and at any time (including future years) the portion of the projected account value required to obtain the benefit would be less than the value of the guaranteed benefit at the time of exercise or payment. Does this mean that in a period when a contract is ITM the relevant ITM lapse assumptions are used? If a contract subsequently goes out of the money (OTM), would the OTM lapse factors be used?

A: Some actuaries believe the OTM lapse rates would be used when the event causing the contract to be ITM has passed and the contract will no longer be ITM at any projected duration. In other words, since ITM for living benefits is determined by “looking ahead,” a contract only becomes OTM once there are no living benefits that will be ITM at any time in the future

This is in contrast to the definition specified in A3.3)C)3) of AG 43 which states that “the contract shall be considered “out of the money” for a projection interval if the Current Value of the guaranteed living benefit at the beginning of the projection interval is less than or equal to the Account Value at the beginning of the same projection interval”.

Q9.18 In the NAIC RBC Instructions Section III(D)(1) and AG 43 A.3.3)C) of the Standard Scenario, the surrender charge period is used as a point of reference. For a contract which has a surrender charge schedule that runs independently from the date of each gross consideration, what is an appropriate surrender charge period?

A: Extensive guidance is given in section A.3.3)E) of AG 43 and Section III(D)(7) of the NAIC RBC Instructions.

Q9.19 Is the hedge value determined under the Standard Scenario return assumptions?

A: Other than when the RBC Standard Scenario amount is based on the Alternative Methodology, there is recognition for the value of approved hedges. The value of approved hedges is the difference between the discounted cash flows from the approved hedges and their statement value on the valuation date. The RBC/Reserve Standard Scenario requirements describes the conditions that must be satisfied to be an approved hedge. In certain circumstances, the commissioner may exclude any portion of the value of approved hedges.

For hedges that expire in less than one year, the cash flow projection is based on holding the hedges to their expiration. In other cases, the value is based on liquidation one year from the valuation date. The Standard Scenario describes the method for determining the liquidation method: consistent with Black-Scholes, a risk-free rate equal to the 10Yr CMT + 50 bp in RBC or 5-Year CMT in AG 43, annual volatility implicit on the valuation date, and the assumed returns in the Standard Scenario from the valuation date to the date of liquidation.

Q9.20 What is an example of the application of contract charges?

A: A contract has a \$1,000 account value, a \$10 policy fee at the beginning of the year, a weighted average net return on funds (after deducting

fund charges) of 5% and a contract M&E charge of 1%. Under this example, reasonable contract charges would be \$10 at the start of the year and the difference between \$990 dollars accumulated at 5% and 4% at the end of the year (i.e., \$9.90 cents at the end of the year). A reasonable accumulated account value at the end of the year would be $\$1029.60 = (\$1,000 - \$10) \times 1.05 - \9.90 . The net revenue could vary depending upon the time step and whether charges were removed from the funds and accumulated at the discount rate or left in the funds to earn 5%.

Q9.21 Is a GMIB ITM based on the projected account value under the terms of the contract?

A: The methodology varies for C-3 Phase II and AG 43. Section III(D)(7) of the NAIC RBC Instructions states: “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.” The actuary would apply the terms of the contract given the returns and assumptions required by the Standard Scenario.

This is in contrast to the definition specified in A3.3)C)3) of AG 43 which states that “For purposes of determining the dynamic lapse assumptions shown in Table II below, a guaranteed living benefit is in the money (ITM) for any projection interval if the Account Value at the beginning of the projection interval is less than the Current Value of the guaranteed living benefit (as defined below) also at the beginning of that projection interval.”

Q9.22 Is reinsurance eligible for credit on the valuation date under the Standard Scenario?

A: As is stated in A3.3)B) of AG 43: “No reinsurance shall be considered in the Standard Scenario Amount if such reinsurance does not meet the statutory requirements that would allow the treaty to be accounted for as reinsurance.” Section III(C) of the NAIC RBC Instructions states: “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.” If the Standard Scenario is based on the Alternative Methodology, then the adjustments to be considered are described in the Life Capital Adequacy Subcommittee’s June 2005 report on a Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products – Appendix 8 - page 59 (http://www.actuary.org/pdf/life/c3_june05.pdf). If the Standard Scenario is not based on the Alternative Methodology, then the reinsurance adjustment is either reflected in the calculation for Accumulated Net Revenue (in the case of individual reinsurance) or in the allocation of the value for aggregate reinsurance.

Section A3.3)B) of AG 43 requires that all treaty limitations to be reflected and any options in the treaty are assumed to be exercised so as to reduce the value of the reinsurance to the reporting company. Under certain circumstances, the Commissioner may require the exclusion of any portion of the value of the reinsurance.

Q9.23 Would a hedge usually satisfy Statement of Statutory Accounting Principles (SSAP) 86 before taking hedge credit?

A: Both C-3 Phase II and AG 43 require that the hedge must be part of a Clearly Defined Hedging Strategy and satisfy the requirements in the standard scenario for an approved hedge.

However both C-3 Phase II and AG 43 state that “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”. Section A3.3D)2) of AG 43 also states “To be an approved hedge for purposes of the Standard Scenario Reserve, a derivative or other investment has to be an actual asset held by the company on the valuation date, be used as a hedge supporting the contracts falling under the scope of the Guideline, and comply with any statutes, laws, or regulations (including applicable documentation requirements) of the domiciliary state or jurisdiction related to the use of derivative instruments.”

Q9.24 The value of Aggregate Reinsurance is based on the "... excess of a) the benefit payments from the reinsurance; over b) the reinsurance premiums...." Does this mean that the value of Aggregate Reinsurance can only be positive?

A: The value of Aggregate Reinsurance can be either positive or negative. This interpretation is consistent with the handling of Individual Reinsurance, as described.

Q9.25 Assume a reinsurance treaty would otherwise qualify as individual reinsurance, except that it includes one or more provisions that are applied in the aggregate (e.g., a cap so that reinsurance claims cannot exceed a percentage of the account value). If those aggregate provisions do not govern at any time during the Standard Scenario projection, can the reinsurance be categorized as Individual reinsurance in the RBC instructions section III(B)(2)(iii) and AG 43 section A.3.3.B)2)b)(iii)?

A: The Standard Scenario categorizes the reinsurance as Individual or Aggregate based on the treaty’s provisions. In the example of a treaty with an aggregate cap provision, the treaty would only be included if it meets the statutory requirements that would allow the treaty to be accounted for as reinsurance. If the treaty meets these requirements, it would be categorized as Aggregate reinsurance, regardless of the impact of aggregate provisions during the Standard Scenario projection, because in this case the total premiums for and benefits of the reinsurance can not 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. The Standard Scenario incorporates Individual reinsurance as a component in a greatest present value process while Aggregate reinsurance is handled separately based simply on the present value of its cash flows.

Some actuaries believe that because the aggregate provision does not affect the calculation in this example, it may be possible to model this treaty as an Individual reinsurance treaty for practical purposes if they can demonstrate that it does not result in a lower Standard Scenario Amount.

Q9.26 Does “in the money” in the RBC instructions sections III(D)(3) and III(D)(8) of the RBC instructions or A.3.3)C)3) and A.3.3)C)7) of AG 43 prescribe a point-in-time test or a forward-looking test and is the definition consistent in the lapse and election rate sections of the instructions?

A: Some actuaries believe the working definition of “in the money” in the RBC instructions section III(D)(3) is a forward-looking test based on the inclusion of the phrase “at any time”. The full definition states that “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”. This requires the actuary to determine the guaranteed living benefit at future projection intervals. The working definition of “is more valuable” in III(D)(8) is also a forward-looking determination based on the inclusion in III(D)(8) of the sentence “A benefit is more valuable if it is more ITM in absolute dollars using the definition of ITM in paragraph III(D)(3)”. Determining whether a contract is in ITM in III(D)(8) is a point in time calculation since it is dealing with the actual utilization of an elective benefit.

The working definition of ITM in AG 43 section A.3.3)C)3) is a point-in-time test based on the inclusion of the phrase “for any projection interval” in A.3.3)C)3). The full definition states that “For purposes of determining the dynamic lapse assumptions shown in Table II below, a guaranteed living benefit is ITM for any projection interval if the Account Value at the beginning of the projection interval is less than the Current Value of the guaranteed living benefit (as defined below) also at the beginning of that projection interval”. The working definition of “in every projection interval” in A.3.3)C)7) is also forward-looking and therefore they are consistent.

For both C-3 Phase II and AG 43 it is necessary to project guarantee benefits to future projection intervals and to compare the projected guarantee benefits to the projected account value to determine if the benefit is in the money. However, as discussed in Q9.21, a contract is ITM under C-3 Phase II 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. This is in contrast to AG 43 which states that a contract is in the money for any projection interval if the Account Value at the beginning of the projection interval is less than the Current Value of the guaranteed living benefit

Q9.27 How should margins in the RBC instructions section III(D)(1) or AG 43 section A.3.3)C)1)b) be calculated for fixed funds after the surrender charge?

A: Section III(D)(1)(b) of C-3 Phase II and Section A.3.3)C)1)b) of AG 43 state “On fixed funds after the surrender charge period, a margin of up to the amount in (a) above plus .4% may be used.”

10) TREATMENT OF REINSURANCE

Q10.1 Is the TAR calculated gross or net of reinsurance?

A: Subsection 2 of the Modeling Methodology section of the C-3 Phase II Report states, "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."

Appendix 1 of the same report states, "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."

Describing the Alternative Method (AM), Section 12 of Appendix 8 of the same report states, "The actuary must decide if existing reinsurance arrangements can be accommodated by a straightforward adjustment to the factors and formulas (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). For more complicated forms of reinsurance, the company will need to justify any adjustments or approximations by stochastic modeling."

In considering whether to take credit for reinsurance the actuary should also consider Principle 5 of the Life Capital Adequacy Subcommittee June 2005 Report which states "...the use of assumptions, methods, models, risk management strategies (e.g., hedging), derivative instruments, structured investments or any other risk transfer arrangements (such as reinsurance) that serve solely to reduce the calculated Conditional Tail Expectation Amount without also reducing risk on scenarios similar to those used in the actual cash flow modeling are inconsistent with these principles. The use of assumptions and risk management strategies should be appropriate to the business and not merely constructed to exploit 'foreknowledge' of the components of the required methodology."

There are other limitations on credit for reinsurance ceded discussed elsewhere in this section and in Section 9 of this practice note.

There is no requirement in the C-3 Phase II instructions to calculate the Total Asset Requirement gross of reinsurance.

Q10.2 Is the Aggregate Reserve calculated gross or net of reinsurance ceded?

A: Subsection IV)B) of AG 43 states, "Where reinsurance is ceded for all or a portion of the contracts, both components in the above general description (and thus the Aggregate Reserve) shall be determined net of any reinsurance treaties that meet the statutory requirements that would allow the treaty to be accounted for as reinsurance."

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

Therefore, the Aggregate Reserve shall be determined net of reinsurance, from treaties that meet the requirements to be accounted for as reinsurance, but an Aggregate Reserve gross of reinsurance may need to be calculated for regulatory reporting or other purposes.

In considering whether to take credit for reinsurance ceded the actuary should also consider Principle 5 of AG 43 which states “...the use of assumptions, methods, models, risk management strategies (e.g., hedging), derivative instruments, structured investments or any other risk transfer arrangements (such as reinsurance) that serve solely to reduce the calculated Conditional Tail Expectation Amount without also reducing risk on scenarios similar to those used in the actual cash flow modeling are inconsistent with these principles. The use of assumptions and risk management strategies should be appropriate to the business and not merely constructed to exploit ‘foreknowledge’ of the components of the required methodology.”

There are other limitations on credit for reinsurance ceded discussed elsewhere in this section and in Section 9 of this practice note.

Q10.3 How is the Aggregate Reserve net of reinsurance ceded determined using projections?

A: For the Conditional Tail Expectation Amount, Subsection A2.1)B) of Appendix 2 of AG 43 states, “Accumulated Deficiencies, Scenario Greatest Present Values, and the resulting Conditional Tail Expectation Amount shall be determined reflecting the effects of reinsurance treaties that meet the statutory requirements that would allow the treaty to be accounted for as reinsurance within the projections. This involves including, where appropriate, all anticipated reinsurance premiums or other costs and all reinsurance recoveries, where both premiums and recoveries are determined by recognizing any limitations in the reinsurance treaties, such as caps on recoveries or floors on premiums.”

For the Standard Scenario Amount, Subsection A2.1)D) of Appendix 2 of AG 43 states, “the Standard Scenario Amount shall be calculated as described in Appendix 3 to reflect the reinsurance costs and reinsurance recoveries under the reinsurance treaties.”

Q10.4 How is the Aggregate Reserve gross of reinsurance ceded determined using projections?

A: For the Conditional Tail Expectation Amount, Subsection A2.1)B) of Appendix 2 of AG 43 states, “Accumulated Deficiencies, Scenario Greatest Present Values, and the resulting Conditional Tail Expectation Amount shall be determined ignoring the effects of reinsurance within the projections. One acceptable approach involves a projection based on the same Starting Asset Amount as for the Aggregate Reserve net of reinsurance and by ignoring, where appropriate, all anticipated reinsurance premiums or other costs and all reinsurance recoveries in the projections.”

For the Standard Scenario Amount, Subsection A2.1)D) of Appendix 2 of AG 43 states, “the Standard Scenario Amount shall be calculated prior to reinsurance

ceded using the methods described in Appendix 3, but ignoring the effects of the reinsurance ceded.”

Q10.5 How does the actuary incorporate hedging credit into the model when reinsurance is present?

A: The Modeling of Hedges guidance in Appendix 10 of C-3 Phase II indicates that, provided the company is following a Clearly Defined Hedging Strategy, the model 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.”

The Modeling of Hedges guidance in Appendix 7 of AG 43 indicates that, provided the company is following a Clearly Defined Hedging Strategy, the model should “take into account the costs and benefits of hedge positions expected to be held by the company in the future based on the operation of the hedging strategy.”

Some actuaries treat reinsurance consistently between the hedge targets used in the model to determine hedge positions expected to be held and the hedge targets actually used in support of the Clearly Defined Hedging Strategy.

For example, if a proportional reinsurance agreement exists and actual hedge positions are calculated based on the Greeks associated with the net retained liability, then the hedge positions expected to be held for the purposes of modeling would normally be based on the estimated net retained liability.

Incorporating hedging credit in the model gross of reinsurance is consistent with the practices described in Section 11 of this practice note. Some actuaries would eliminate the impact of both reinsurance premiums and reinsurance benefits from their projections, however, they would model the impact of the hedge positions expected to be held based on the estimated net retained liability.

Q10.6 Could either the Total Asset Requirement or the reserves under AG 43 for the reinsurer be different than the reduction in TAR or reserve credit taken by the direct writing company?

A: It is possible that the Total Asset Requirement and the AG 43 reserve held by the assuming company for reinsurance coverage of a particular block of business will be different than the reduction in TAR or the reserve credit obtained by the ceding company for several reasons:

- The risk to the reinsurer may be different than the risk to the ceding company. For example, reinsurance premiums may not be equal to the direct fees charged for the guarantee, or the reinsurer’s expenses will be different from the direct company’s expenses. In addition, to the extent the “base contract” is not ceded (e.g., only the living benefit rider is ceded), the ceding company receives revenue from the underlying contract that the reinsurer does not receive.
- Reinsurance may involve a subset of the direct company’s block of business such that the experience of the reinsured portion is different from

that of the block as a whole. Even if the experience is the same, the model may use the same assumption for a group of contracts involving different blocks of business.

- Typically, the reserve involves an aggregate calculation of which the reinsured business is only a part. Since the reinsurer and the ceding company are valuing different total liability portfolios, the impact of the reinsured block of business will be different for each company.

11) TREATMENT OF HEDGING

Q11.1 To the degree the hedge position introduces basis, gap, price, or assumption risk, a suitable reduction for effectiveness of hedges shall be made. How is this accomplished?

A: Contractholder behavior assumptions such as mortality, persistency, withdrawal, annuitization, and sub-account transfer can be analyzed by sensitivity testing in hedging simulation or liability valuation work. Each assumption can be increased and decreased by reasonable variations from what is expected to determine the impact on the hedge costs. Basis risk can be analyzed historically and then projected accordingly in asset returns and option payoffs. Gap risk can be analyzed by comparing option costs before and after a large drop in the equity market, and assuming hedge underperformance will be approximately equal to the change in modeled option costs.

Q11.2 If an insurer intended to reflect the effect of a hedging program in the calculations required by AG 43 and C-3 Phase II, would the insurer use a “stochastic within stochastic” model?

A: Not necessarily. While a “stochastic within stochastic” approach may be used, the following in the context of C-3 Phase II (an analogous approach may be done for AG 43 using a CTE 70 level instead) discusses an alternative approach which may work in certain situations. Other approaches may also be appropriate. As always, the actuary is encouraged to test the results for reasonableness.

Let PVP = the present value of hedged minimum guarantee related claims across all scenarios used in the calculations.

Let PVQ = the present value of hedged minimum guarantee related claims based on risk-neutral principles.

The minimum guarantee-related claims for a scenario are based on the present value of GMD-Account Value or appropriate proportion thereof if a partial hedging strategy is employed. Similarly, in the case of a hedged and non-hedged guaranteed minimum benefit in the same policy, the present value of hedged minimum guarantee-related claims would reflect only the hedged benefit. Both the hedged and unhedged benefit can be handled in the same projection.

E = hedge effectiveness/model sophistication error factor ($E \geq .05$).

Let $CTE(90)'$ be analogous to a $CTE(90)$ calculation except that all hedged minimum guarantee claim payments are multiplied by E during the projection process. $CTE(90)'$ is based on a greatest present value calculation just as $CTE(90)$ is. Profitable scenarios may be reflected in $CTE(90)'$ as long as each such profitable present value is capped at $\max(PVP, PVQ)$.

Then $TAR = CTE(90)' + \max(PVP, PVQ)$

An insurer may also choose to hedge the fees collected for the guaranteed minimum benefit. These would normally be treated in a manner consistent with the treatment of the benefit.

Comments:

This formula removes the hedged claims from the projections and replaces them via the addition of an option cost. This is what hedging is all about and, as such, is consistent with Black-Scholes theory, etc.

Stochastic within stochastic modeling is not necessary for this calculation, although the derivation of E may be based in part on stochastic-on-stochastic analysis. Even then, a large number of base paths may not be required since this will only be measuring hedge effectiveness, not trying to get a stochastic based price or CTE. Also E can be based on analysis done prior to the valuation date. This can have huge practical implications as far as reducing required computations and moving work outside the quarter/year end crunch time.

The max (PVP, PVQ) term means that a company cannot reduce the average claims in the model by switching from a p measure to a q measure.

Since PVP and PVQ are based on hedged minimum guarantee related claims rather than total minimum guarantee related claims, partial hedging strategies are accommodated.

PVP and PVQ are based only on the liability. They do not take into account any actual hedge positions, current or future as anticipated under an approved hedging program. However, under capital market assumptions, the cost of hedging theoretically corresponds to PVQ (with allowances for differences reflected in the E-Factor). The value of any hedges currently held will be reflected in the insurer's current balance sheet. This is consistent with how liabilities are hedged: 1) Evaluate the liability including risk-neutral present value, Greeks, and sensitivities to large moves. 2) Construct a hedge portfolio to match the Greeks and/or sensitivities to large moves. 3) Monitor 1) and 2) overtime and adjust 2) as needed. This approach also avoids issues of circularity.

For further details, the reader is encouraged to review Appendix 7 of AG 43 and Appendix 10 of the C-3 Phase II Report.

Q11.3 If an insurer uses the Alternative Methodology (AM) for determining the TAR and/or the Conditional Tail Expectation (CTE) Amount, is it appropriate for the insurer to reduce the otherwise calculated TAR and/or the CTE Amount for the effects of a hedging program?

A: A reduction for hedges is not allowed under the AM.

Q11.4 How are unhedged Greeks reflected in the calculation of credit for hedging?

A: Appendix 7 of AG 43 and Appendix 10 of the C-3 Phase II Report discusses two methods for analysis of the impact of hedging strategies on cash flows. The fundamental characteristic of the first method is that all hedging positions, both the currently held positions and those expected to be held in the future, are included in the stochastic cash flow model used to determine the Scenario Greatest Present Value for each scenario. With this approach, any unhedged risks would automatically be included in the model. For example, if a hedge program hedged delta, but not rho, then the scenarios used in the stochastic model would impact the claims and cause them to differ from the hedging cash flows due to unhedged interest rate changes.

In the second method, the hedge strategy effectiveness is modeled in part or in whole outside of the stochastic cash flow model. For example, if a hedge strategy did not hedge rho, this would be explicitly reflected by increasing E, increasing hedge costs assumed, or some other method. Unhedged first order Greeks (delta and rho) are logically addressed by increasing E. Second order unhedged Greeks (gamma, interest rate convexity, vega) tend to increase risk in proportion to option costs as opposed to in proportion to tail claims as appearing in CTE measures.

The following is an example of estimating the cost of not hedging convexity when using the second method. Calculate option costs at the valuation date based on A) the swap curve, and B) arbitrage-free stochastic risk-neutral scenarios based on the current swap curve.

Then the difference between B and A is usually a good estimate of the cost of not hedging convexity and would usually increase the CTE amount or TAR otherwise held.

Q11.5 How are risk-neutral scenarios developed for evaluating hedge competitiveness?

A: As described in Question 11.4, there are essentially two methods to develop risk-neutral scenarios. Analysis based on the first method involves the use of risk-neutral scenarios at future points in time that are consistent with the other assumptions for a given scenario. In particular, risk-neutral scenarios and real-world scenarios should be consistent. If the pre-generated real-world scenarios are used, one approach to generating risk-neutral rates is to use the Treasury rates plus a swap spread based on reasonable historical results. Interpolation and extrapolation may be appropriate for other points on the curve, but once again this can be based on historical relationships. If company-generated scenario sets are used, the scenario may explicitly include development of risk-neutral scenarios. Analysis based on the second method may be based only on knowledge of the swap curve at the valuation date.

Q11.5(a) Can you expand more on what you mean by consistency between risk-neutral scenarios and real-world scenarios?

A: The risk-neutral scenarios are often driven by three assumptions. (1) risk-free rates (or swap rates), (2) fund correlations, and (3) implied volatility.

The risk-free rates (for which swap rates may be considered a reasonable estimate) for a particular scenario at a particular point in time are based on the real-world yield curve at that point in time.

Fund correlations would normally be the same for the real-world and risk-neutral scenarios.

The implied volatility is arbitrage free at time zero and should evolve in arbitrage-free fashion. For example, at any time frame the implied volatility surface would not slope down too quickly in terms of maturity or in terms of strike to avoid arbitrage opportunities. If historical volatilities at each point in time are known for the real-world scenarios, these can be used to estimate the implied volatility surface at each point. An example here would be where a company uses real-world scenarios that are driven by a stochastic volatility process. If historical volatilities are not known they can be estimated.

One method of estimation would be to base historical volatilities on prior movements for the particular fund index.

One method of calculating implied volatilities would be to add a premium to historical volatilities. Another method would be to base implied volatilities on a regression of historical volatilities.

Q11.5(b) What about consistency in other assumptions when modeling hedging?

A: Hedging is an investment strategy. It's usually preferable to model the actual hedging strategy used in practice as closely as possible in the model, including the assumptions used therein to determine hedging targets.

This means that the assumptions used to determine those targets in the hedging portion of the model may differ from the prudent estimate assumptions assumed elsewhere in the model. For example, a company may have a hedging strategy which targets liability "greeks" based on expected mortality rates which may differ from the prudent estimate assumptions used in the model. When determining the hedging targets in the model, the mortality rates actually used to determine the "greeks" would be used (if they differ, one needs to reflect this disjoint in the "E" factor). However, the mortality rates used in other portions of the model, when determining projected claims in the accumulated surplus results for example, would be based on a prudent estimate basis, which may differ.

Q11.5(c) Does one always use risk-neutral valuation when incorporating the impact of hedging?

A: No. The risk-neutral scenarios are used to value derivative assets at future valuation points in time. They may also be used if the hedge strategy depends on a risk-neutral valuation (e.g. targeting "greeks").

Here's an example where risk-neutral valuations would not necessarily be used: A company has one-year put options on the balance sheet as of the valuation date and the investment strategy is to exercise these if the market drops x% or more. Since the options will expire at the next valuation date and the investment strategy does not depend on risk-neutral valuations, there is no reason to incorporate risk-neutral logic into the AG 43 reserve model or C3 Phase II model.

Q11.6 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 calculating C-3 Phase II RBC, the actuary should review actual historical hedging effectiveness. When reviewing the actual historical hedging effectiveness, what factors (including the frequency of measuring effectiveness) would the actuary consider for evaluating the effectiveness of the hedging program?

A: The factors the actuary may wish to consider include, but are not limited to: tracking error between fund values and mapped index exposures, basis risk between derivative contracts and underlying index exposures, market gap risk, price risk, parameter estimation risk expenses, and variation in assumptions (mortality, persistency, withdrawal, annuitization, etc.).

A key area to focus on is the difference between a) and b) where a) is the change in the value of the guaranteed contractholder options embedded in the variable annuities and other in-scope products and b) is the change in the value of the hedge assets. In calculating a), cash flows generated by the guarantees would normally be included. In calculating b), cash flows generated by the hedge assets would usually be included. If revenue is hedged as well, then that typically would be reflected in a). Tracking error and basis error is usually evaluated on a time series of differences between two sample returns on a monthly or more frequent basis and is typically quoted as an annualized sample standard deviation figure. Tracking error should be measured in both low and high volatility environments. Other assumptions, if material, are normally evaluated annually

Expenses encompass both explicit and implicit costs and include, but are not limited to: transaction, margin (opportunity costs associated with margin requirements), market impact (bid-ask spreads and the opportunity costs of working a trade order) and administration. These factors have an impact on hedge costs and will not always be as expected and will therefore impact the effectiveness of the hedge program. Further guidance is provided in Appendix 10 of C-3 Phase II.

In addition, the actuary may wish to consider whether to limit the reduction to the CTE amount attributable to the hedging strategy, based on the uncertainty associated with the company's ability to implement the hedging strategy in a timely and effective manner. The actuary may also wish to consider whether 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.

Q11.7 Are the E factors in AG 43 and C-3 Phase II different?

A: Yes, the E factor in Appendix 7 of AG 43 and Appendix 10 of the C-3 Phase

II Report are different. The E factor in AG 43 is an “effectiveness factor” while in C-3 Phase II it is an “error factor”. Conceptually one may be considered the complement of the other. As the sophistication of the Cash Flow Model (incorporating the hedge strategy) increases, the “effectiveness factor”, E, in AG 43 increases while the “error factor”, E, in C-3 Phase II decreases.

The value for E reflects the actuary’s view as to the level of sophistication of the stochastic cash flow model and its ability to properly reflect the parameters of the hedging strategy (i.e., the “Greeks” being covered by the strategy) as well as the associated costs, risks, and benefits. Appendix 7 of AG 43 specifies that the value of E will be no greater than 0.70. Some actuaries believe that the derivation of “E” may be based in part on stochastic-on-stochastic analysis and can be performed prior to the valuation date without including a large number of base paths since the calculation is not involving a stochastic-based price nor a CTE.

Example Adjustments to the ‘E’ Effectiveness factor:

Targeting liability “Greeks” using expected mortality while Prudent Estimate mortality is used elsewhere in the model. This difference in assumptions should be reflected in the “E” factor.

A hedging strategy that does not hedge rho can explicitly be reflected by decreasing E.

Appendix 7 of AG 43 specifies the following limits on “E”:

Model Type	Level of E
Hedge Cash Flows Not Directly or Simplistically Modeled (or for a company that does not have 12 months of experience to date)	Low (less than 0.30)
Hedge Cash Flows, ‘Greeks’ covered effectively	High (up to 0.70)
Hedge Cash Flows, ‘Greeks’ not covered Effectively	(between 0.30 and 0.70)

Q11.8 What is the difference between the TAR(adjusted) and CTE(adjusted) from a hedging point of view?

A: In concept, both TAR (adjusted) and CTE (adjusted) are computed to compensate for potential overstatement of the impact of the hedging strategy. In C-3 Phase II, the adjusted TAR reflects impacts of risk not reduced, eliminated, contemplated by the hedging strategy, imperfections and uncertainty of the effectiveness of the program. In AG 43, the adjusted CTE assumes the company has no dynamic hedging strategy. AG 43 further clarifies that this means that it only reflects the hedge positions held by the company at the Valuation Date. Some actuaries may, for practical purposes, model this as if the company has no hedging at all for both TAR (adjusted) and CTE (adjusted) if it can be demonstrated that this does not materially misstate the results. Some actuaries may compute TAR (adjusted) and CTE (adjusted), putting more refined considerations in the computation of the former as compared to the latter, if it can be demonstrated that this does not materially misstate the results.

Q11.9 Is there any restriction of having to use hedging in AG 43 if hedging is used in calculating C-3 Phase II?

A: A1.1)D) of AG 43 states the following and is irrespective of what was assumed in calculating the results under C-3 Phase II: “The appropriate costs and benefits of hedging instruments that are currently held by the company in support of the contracts falling under the scope of the Guideline shall be included in the projections. If the company is following a Clearly Defined Hedging Strategy and the hedging strategy meets the requirements of Appendix 7, the projections shall take into account the appropriate costs and benefits of hedge positions expected to be held in the future through the execution of that strategy”.

12) CONSISTENCY OF AG 43 AND C-3 Phase II TO C-3 Phase I MODELS

Q12.1 How would interest rate risk associated with the guaranteed fund option be treated under C-3 Phase II and AG 43?

A: In both cases interest rate risk associated with the guarantee fund option is to be recognized.

Principle 2 of the C-3 Phase II and AG 43 reports refers to "...asset and liability cash flows produced by the application of a stochastic cash flow model to equity return and interest rate scenarios". Section 1 of AG 43 explicitly mentions credit risk and disintermediation risk as risks that should be reflected in the reserve calculations. AG 43 Section A1.1)A) says that "cash flows from fixed account options should be included," and AG 43 Section A1.4)D) then provides options for determining the interest rate returns on general account assets. The C-3 Phase II report also presents such options, and Appendix 6 discusses Methods of Calculating Capital Requirements for Interest Rate Risk on the Guaranteed Fund of Variable Annuities.

Subsection 8 of the Modeling Methodology section in the C-3 Phase II report (http://www.actuary.org/pdf/life/c3_june05.pdf) gives some suggestions to the actuary as to how to incorporate the interest rate risk associated with the guaranteed fund option of VAs into the determination of TAR. This paragraph allows for this risk to be handled in either an "integrated model" or a "non-integrated model"

Integrated Model

Appendix 6 of the LCAS report suggests that an integrated model is preferred and gives more guidance to the actuary for situations where one is used. Specifically, guidance is given on the interest rate scenarios used in the integrated model (see Q12.2 for more details). It states:

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 Academy website 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.

Appendix 6 also suggests how to determine what portion of the RBC is calculated using an integrated model to report as interest rate risk under C-3 for VAs in the company's RBC report. It states: "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 C-3 interest rate risk, with the remainder of the RBC being considered equity risk."

Some actuaries believe this allows the company to use C-3 Phase I scenario testing as one of the ways to determine the portion of the RBC under C-3 Phase II that should be reported as interest rate risk. Some actuaries believe that other approaches may be appropriate as long as the approach effectively measures the interest rate risk within the integrated model and the approach is consistently

applied each year (but allowing for model improvements over time).

Non-integrated Model

Appendix 6 of the LCAS report also suggests using a non-integrated model. It suggests that “a number of simpler approaches are acceptable,” and that “these methods” include:

- a) Using the Microsoft® Excel workbook from C-3 Phase I to generate 200 interest scenarios and then assigning them in rotation to the stochastic equity scenarios being tested.
- b) Running 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 C-3 Phase I values using the scenario testing method as though that (or a higher rate) is the rate to be credited.
- c) Running the variable annuity model as though no assets were in the guaranteed fund. Then developing the C-3 requirement as if all the assets were in the guaranteed fixed fund. The final requirements for both equity and fixed C-3 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.

Some actuaries believe that there may be other approaches that may be used for non-integrated models. In using other approaches, these actuaries believe it is preferable for any such approach to appropriately reflect all of the interest rate risks captured by the C-3 Phase I scenario testing and at a level comparable to a CTE 90 level.

Some actuaries (pointing to the language in subsection 8) believe that a company that is exempt from using C-3 Phase I scenario testing may use the original C-3 interest rate factors in place of C-3 Phase I scenarios in the non-integrated model approaches.

While the AG 43 report does not provide explicit guidance in the manner of the C-3 Phase II note, some actuaries may view the general principles underlying the use of either an integrated or non-integrated model as applicable to an AG 43 calculation. In this case, C-3 Phase II-specific language such as C-3 and CTE 90 could effectively be replaced by AG 43-specific language such as reserves and CTE 70. It is acceptable for treatment to differ between the calculations, as long as the approach complies with the general principles.

Q12.2 How will C-3 Phase I (interest rate risk) be determined in conjunction with C-3 Phase II for the fixed option within VAs?

A: C-3 Phase II allows for two approaches to reflect interest rate risk within C-3 Phase II. In either case, the C-3 risk excluding the interest rate risk is combined with the C-1(cs) component for covariance purposes.

The first is via an integrated model of equity returns and interest rates where the total risk for the contracts is captured. Using a methodology to be determined by the actuary, the C-3 interest rate risk associated with these policies is calculated and then deducted from TAR calculated by the C-3 Phase II modeling to obtain the

TAR attributable to non-C-3 Interest Rate Risk. This might be interpreted as choosing scenario testing for these products and the standard factors might NOT be available to calculate the interest rate risk component. The actuary might instead use a modeling method conforming to the C-3 Phase I rules. Additional guidance can be found in the responses to questions 3.11, 6.4 and 6.7 of this practice note.

The second is if the C-3 Phase II model or methodology used does NOT capture the C-3 interest rate risk, in which case an independent calculation of any interest rate risk would be required within C-3 Phase II. Appendix 6 to the C-3 Phase II Report includes possible alternatives to incorporating interest rate risk into a “non-integrated” model for companies that are modeling equity risk (i.e., not using the Alternative Method).

Subsection 8 of the Modeling Methodology section of the C-3 Phase II Report states, “In addition to the equity risk of products subject to these requirements, there is a traditional credit risk and C-3 interest rate risk for funds supporting the guaranteed fund option”. The report then recommends “...that the C-3 interest rate risk 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 Appendix 6).” The report then goes on to state “(i) Companies may combine the guaranteed fund portions of variable annuities and similar contracts with the other interest sensitive products included in C-3 interest rate risk or may handle them separately and differently. (ii) If the company is exempt from regular C-3 Phase I scenario testing, it may elect to be nonexempt for the variable annuity portion or for all C-3 interest rate testing. However, a company that makes such a choice may not revert to the factor method without regulatory approval.”

Q12.3 How should reserves for the fixed funds of variable annuities be determined?

A. AG 43 requires explicit recognition of the contribution of fixed funds to the total reserve. Section A.2.2 states that the “The amount of the reserve held in the General Account shall not be less than the excess of the Aggregate Reserve over the sum of the Basic Reserve, as defined in section A.3.2), attributable to the variable portion of all such contracts”.

It is the responsibility of the actuary to determine the best method for calculating the Aggregate Reserve. As a practical starting point, some actuaries believe that the materiality of the fixed funds relative to the total fund values should be considered, with increasing materiality indicating the need for increased precision. Some actuaries believe both the amount and nature of the fixed funds needs to be considered – just because the amount of fixed fund dollars may be small, they may present a disproportionate amount of risk. That is, while fixed funds are not subject to the volatility that can impact separate account funds, their performance can still impact future exposures and reserves. For example, if a VAGLB is indexing at 5% (and is applied to funds in the fixed account), and the fixed fund credited rate has been 3%, then the fixed funds have not kept pace with the index and exposure has increased. Similarly, if credited rates were, say, 8% during a period of weak equity market performance, then the fixed funds will mitigate the increase in guaranteed benefit risk exposure.

An example of a high level of precision would be the use of an integrated model, as discussed above in question 12.2, utilizing distinct sets of stochastically generated interest rate and equity scenarios. An example of a lower level of

precision would be to aggregate the fixed funds into a variable fund.

Whatever approach is used, the actuary may wish to consider whether it is necessary to perform sensitivity testing to confirm that a more precise methodology will not produce a materially higher calculated amount, with both the method and the testing being documented in the certification report.

13) DETAILS ON CERTIFICATION & REQUIRED DOCUMENTATION

Q13.1 What are the qualification standards applicable to the certifying actuary?

A: The actuary may wish to consider whether the Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States promulgated by the Academy apply to providing the certification with respect to AG 43 and C-3 Phase II. This includes satisfying basic education, experience and continuing education requirements. It may also be helpful to review the Applicability Guidelines on the ASB website at <http://www.actuarialstandardsboard.org/appguide.asp> to determine which Actuarial Standards of Practice (ASOP) may apply to such certification.

Q13.2 Does the appointed actuary provide the certification for C-3 Phase II?

A: Appendix 11 of the instructions states only that “the certification shall be provided by a qualified actuary.” The qualified actuary doesn’t have to be the appointed actuary. The qualified actuary could be the appointed actuary, who would need to meet the U.S. qualification standards, or another actuary who also needs to meet the U.S. qualification standards. Some companies have considered having their Board of Directors formally appoint the qualified actuary for purposes of providing the required certification for C-3 Phase II.

Q13.3 Who provides the certification for AG 43?

A: Section A8.2)A) of AG 43 says that the AG 43 certification will be provided by a qualified actuary. The appointed actuary will provide the Actuarial Opinion on the adequacy for the reserves and may be the one who provides the certification. However, the appointed actuary does not need to be the qualified actuary providing the certification for AG 43. Any qualified actuary meeting the applicable qualification standards can provide the certification.

Q13.4 What is a suggested format of the required certification (i.e., sample wording)?

A: There is no suggested format. However, there are required components of the Certification, as outlined in Appendix 11 for C-3 Phase II Report and Appendix 8 for AG 43.

Q13.5 How does the certification of reserves under AG 43 differ from the Statement of Actuarial Opinion?

A: The Certification of reserves under AG 43 differs from the Statement of Actuarial Opinion in a few ways, which include:

- i. The appointed actuary would provide the Actuarial Opinion, but any qualified actuary may provide the Certification. In many cases this will be the same individual, but AG 43 allows a broader range of certifying actuaries.
- ii. The scope of AG 43 is different in that it only addresses specific products.

iii. The certifying statement for AG 43 is that the reserve was calculated in accordance with the principles and requirements of AG 43.

iv. If hedging was incorporated, additional disclosures are required under AG 43 as to the incorporation of a Clearly Defined Hedging Strategy and values for the CTE amount (adjusted) and the CTE amount (best efforts). Specific detail on the requirements is discussed in the answer to question 13.8.

Q13.6 What are the differences between the certification requirements for C-3 Phase II and AG 43?

A: AG 43 requires additional specific disclosure items for the standard scenario in Appendix 8; no such requirement exists for C-3 Phase II in either LR025 or C-3 Phase II RBC report. The actuary may wish to consider whether similar disclosure should be used for the memorandum supporting the C-3 Phase II certification.

AG 43 also requires management to provide signed and dated written representations as part of the valuation documentation that the valuation appropriately reflects management's intent and ability to carry out specific courses of actions on behalf of the entity where such is relevant to the valuation (Appendix 8 A8.1). C-3 Phase II does not have such a requirement.

The certification for C-3 Phase II is to include a disclosure of all material changes in the model or assumptions from that used previously and the estimated impact of such changes. For AG 43, such disclosure is included in the supporting memorandum.

Q13.7 Are there any distinctions in the certification required from a direct writer, vs. what would be required from a VA reinsurer (i.e., no actual VA assets)?

A: There are no required distinctions between the certifications required from a direct writer and a reinsurer. However, some actuaries believe additional clarification in the scope may be beneficial and there may be implicit differences in the reliance statements provided. Some sources for guidance on the contents of certifications can be found in ASOP's 7, 22, and 41.

Q13.8 What additional certification is required if hedging is reflected?

A: If hedging is reflected, the qualified actuary certifies under C-3 Phase II (AG 43) that the values for "E", TAR (CTE amount) (adjusted) and TAR (CTE amount) (best efforts) were calculated using the prescribed process and that the assumptions used in the calculations were reasonable for the purpose of determining RBC. The actuary must provide a certification as to whether the Clearly Defined Hedging Strategy is fully incorporated into the stochastic cash flow model and any supplementary analysis of the impact of the hedging strategy on the TAR (CTE amount). Both regulations also require that:

- i. 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.

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

Q13.9 What does the qualified actuary do at the time of filing to confirm that the company is actually implementing the hedging strategy modeled?

A: The qualified or appointed actuary is providing the certification and therefore it may be prudent to confirm that the Clearly Defined Hedging Strategy incorporated into the stochastic model is a reasonable representation of the actual hedging strategy being implemented based on the information available at the time of filing, and is consistent with the underlying principles of AG 43 and the NAIC RBC Instructions. Some actuaries performing these calculations review historical hedging results, operational documents and other hedging program documentation as part of their confirmation process. A certification that actual activities conform to the Clearly Defined Hedging Strategy is required from a financial officer of the company who has direct or indirect supervision of the actual trading of assets and derivatives.

Q13.10 What are the certification requirements if the hedging has actually been outsourced to a third party, or is conducted by another company within the reporting company's group?

A: The certification requirements do not change if hedging has been outsourced to a third party or is conducted by another company. The qualified actuary is still responsible for the certification.

To the extent the actuary relies on others, including those providing hedging calculations and processes for the company, the actuary may wish to consider reflecting such reliance in the reliance statements included in the certification and to make any appropriate further reliance disclosures in the supporting memorandum(a). The actuary may wish to consider whether it is necessary to perform his or her own analysis of the third party calculations in sufficient detail to be comfortable with the results. Guidance regarding statements of reliance can be found in paragraphs 4.1 of ASOP 7, 4.3 of ASOP 22, 3.3 and 3.4 of ASOP 23 and ASOP 41.

Q13.11 What additional documentation is required if hedging is incorporated?

A: 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 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).

AG 43, Section A7.4) states “Additionally, the company shall demonstrate that, based on an analysis of at least the most recent 12 months, the model is able to replicate the hedging strategy in a way that justifies the value used for E. A company that does not have 12 months of experience to date shall set E to a value no greater than 0.30.”

For AG 43 purposes, the actuary must also provide a certification that the values for CTE Amount(adjusted) and CTE Amount(best efforts) were calculated using the process described in Section A7.3), and that the assumptions used in the calculations were reasonable for the purpose of determining the Conditional Tail Expectation Amount. The actuary shall document the method(s) and assumptions (including data) used to determine CTE Amount(adjusted) and CTE Amount(best efforts) and maintain adequate documentation as to the methods, procedures and assumptions used to determine the value of E, the “Effectiveness Factor”.

Q13.12 What are the differences between the requirements for the supporting memorandum for C-3 Phase II and AG 43?

A: In general the requirements are the same. There are some specific items that need to be discussed regarding C-3 Phase II are not relevant to AG 43, such as taxes; and other specifications about the calculations, such as CTE level and assumptions related to it, will also differ.

14) ALLOCATION OF THE AGGREGATE RESERVES TO THE CONTRACT LEVEL

Q14.1 AG 43 states that the Aggregate Reserve shall be allocated to the contracts falling within the scope of the Guideline. What is included in the contract level reserves?

A: The contract reserve is the sum of two parts: the seriatim Standard Scenario Reserve (SSR) and the allocation of any excess of the Aggregate Reserve (AR) over the Standard Scenario Amount (SSA) to the contract.

When AR equals SSA, the reserve for a contract is simply the seriatim reserve calculated for the contract under the Standard Scenario method.

When AR is greater than SSA, AR is given by the Conditional Tail Expectation Amount (CTEA). The allocation of the excess of AR over SSA is illustrated in the next two questions.

Refer to Appendix 6 – Allocation of the Aggregate Reserves to the Contract Level, in AG 43 for additional guidance and examples.

Q14.2 How is the excess of Aggregate Reserve over the Standard Scenario Amount allocated to the contracts when the Conditional Tail Expectation Amount is determined using a single grouping?

A: According to Appendix 6 of AG 43, the excess of AR over SSA is allocated to each contract on the basis of the difference between the SSR and the Cash Surrender Value (CSV) on the valuation date for the contract. If CSV is not defined or not available, the SSR will be the basis of allocation.

For example, consider a block of two contracts A and B with the following data:

- SSR = \$100 for each contract and thus SSA = \$200 for the block,
- CTEA = \$240,
- CSV(A) = \$40, but CSV(B) is not defined/available.

The allocation basis for A is \$60 (=SSR – CSV) and for B is \$100 (=SSR).

Therefore, the excess of \$40 (= \$240 – \$200) is allocated \$15 (= $40 * 60 / (60 + 100)$) to A and \$25 (= $40 * 100 / (60 + 100)$) to B. The reserves for A and B are \$115 and \$125, respectively.

Since it is theoretically possible to have no contracts with an excess of SSR over CSV, some actuaries deal with that situation by allocating the excess of the AR over SSA using the SSR as a basis.

Q14.3 How is the excess of Aggregate Reserve over the Standard Scenario Amount allocated to the contracts when the Conditional Tail Expectation Amount is determined using sub-grouping?

A: According to Appendix 6 of AG 43, the allocation is done in two steps. The first step is to allocate the aggregate excess to the sub-grouping level. The excess of the aggregate CTEA over the SSA is allocated, in proportion to the difference

between CTEA and SSA, only to the sub-groupings whose CTEA is greater than SSA.

For example, for a company with three sub-groupings with the following results, the total excess of \$75 is allocated to sub-grouping A and C only:

<u>Sub-grouping</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Total</u>
Conditional Tail Expectation Amount	84	120	156	360
Standard Scenario Amount	60	135	90	285
Aggregate Reserve				360
(CTEA) – (SSA)	24	-15	66	75
Allocation of Excess*	20	0	55	75
Aggregate Reserve	80	135	145	360

* Allocation to A = $75 * 24 / (24 + 66)$ and allocation to B = $75 * 66 / (24 + 66)$.

The second step is to allocate the allocated amount of each sub-grouping to the contract level. This is done in the manner illustrated in Q 16.2.

15) PEER REVIEW & WORKING WITH A PEER REVIEWER

Q15.1 Is peer review required for actuarial procedures carried out in connection with the establishment of AG 43 or C-3 Phase II?

A: Peer review is not currently required by the NAIC model laws and regulations, nor by current actuarial guidelines that govern the establishment of reserves for variable annuities in the US, nor by the instructions that establish risk-based capital in the US. Moreover, it is not required under current US regulatory or professional guidance. However, state insurance departments have the authority to require an independent review of reserves and risk-based capital. In Canada, starting in 2003, independent reviews have been required in connection with all life and health insurance public actuarial opinions given by actuaries. Beginning in 2005, independent reviews have been required for annual statement certifications in Mexico.

The use of peer review is gaining wider usage in the US as a prudent or internally required practice for companies relying on stochastic modeling of risks for management and/or reporting purposes. The Academy's Committee on Professional Responsibility has updated its 1997 paper on peer review in 2005.

Q15.2 What are the advantages of a peer review?

A: A comprehensive peer review can provide greater confidence that the work performed meets professional standards and is consistent with the principles underlying the AG 43 and C-3 Phase II Instructions. When appropriate and practicable, an independent third party is usually preferable to fulfill the peer review role. The role of the peer reviewing actuary is to provide an independent opinion to the user of the peer review. This does not preclude the peer reviewer from discussing the acceptability of practices and procedures with the actuary whose work he or she is reviewing, as would be the case in a financial audit. However, in the end, the peer reviewing actuary may provide an independent opinion regarding the work, whether or not it confirms the work as originally done.

Peer review can be used to give an additional assurance and perspective to management. Both AG 43 and C-3 Phase II include complex new concepts and methods. Peer review may well be recommended and desired by company management or mandated by a company's ERM requirements in order to benefit from the additional insights and assurance offered from such a process.

Q15.3 In what situations could peer review of the actuarial work be requested in connection with AG 43 or C-3 Phase II occur?

A: Peer review of the actuarial work required in connection with AG 43 and C-3 Phase II could occur in several instances, including:

1. Engagement by the certifying actuary to provide a second look on his or her work.
2. Engagement by management, the audit committee or the board of an insurer writing variable annuities. While some organizations may have an independent corporate or ERM process to do this, the level of independence desired may require the use of a qualified third party

for the peer review role. The peer review is prudently performed in accordance with Actuarial Standards of Practice. Typically, the peer review engagement usually would have an agreed upon scope which may include a checklist provided prior to the work being performed. The scope typically would state the reviewer's responsibilities, which might include:

- i. Determining that the assumptions made are clearly documented, are appropriate for the purpose intended, and fall within reasonable ranges.
 - ii. Reviewing the processes which use the assumptions to develop the measurement or projected values at both a macro and micro level in order to determine that the output produced is reasonable.
 - iii. Determining if flow charts (or similar documentation), worksheets, system narratives, and data definitions are consistent with the processes.
 - iv. Testing whether or not the processes produce expected results through the use of simplified input or sample checks.
 - v. Commenting on whether the sensitivity testing results communicate an appropriate range of possible divergences from the final numbers.
3. Engagement by or on behalf of an insurance department or other regulatory authority.

It is assumed that the peer reviewing actuary will usually provide background on his or her qualifications for peer review to the engaging party.

Q15.4 What formats for a peer review have proven useful?

A: Several formats are in common use. One format that has proved useful is the input, process, output format. In using this format, the peer reviewer prepares a checklist which is then provided to the person whose work will be reviewed prior to the work itself being carried out. The checklist is generally in the form of statements with responses of "yes," "no" or "not applicable." The level of detail for documentation would normally be consistent with ASOP 21, *The Actuary's Responsibility to the Auditor* (Doc. No. 041; April 1993), ASOP 23, *Data Quality* (Doc. No. 044; July 1993), and ASOP 41, *Actuarial Communications* (Doc. No. 086; March 2002).

As an example of how such a checklist could be constructed, consider the following statement taken from Methodology Note C3- 02: (Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products):

"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".

In light of this statement, the checklist described above might include questions such as the following:

1. Does the documentation describe a static basis for validating the model? (Yes/No)
2. Does the documentation describe a dynamic basis for validating the model? (Yes/No)
3. Have any changes been made to the assumptions since the previous measurement or projection which may have a material impact on the results being discussed in the report? (Yes/No)

Q15.5 What tools are available to reviewing actuaries and regulators to get them comfortable with the model validation and process?

A: A reviewer might consider asking the responsible actuary to supply a detailed income statement and balance sheet from a single scenario model run. The reviewer could then perform a cross check of aggregate cash flows such as death benefits, withdrawal benefits etc. to the company's annual statement for the underlying product line. This would be a reasonableness test. The reviewer could also ask to see the most recent company studies of mortality, lapse, partial withdrawal, expenses, etc. These studies could be used to cross check the model assumptions.

If a company calibrated its own scenario set, a reviewer could ask the company to run a set of calibrated scenarios determined by the regulator using the Life Capital Adequacy Subcommittee's C-3 Phase II pre-packaged scenarios as a cross check of the calibration. In addition, the following checks could be performed:

- Review what management actions and reports are based on the modeled results.
- Review of the discussion and results of the AG 43 or C-3 Phase II required sensitivity disclosure to company management (or review of the internal sensitivity testing done in the model building process).

Q15.6 Which items could be included in a checklist to be used by reviewing actuaries and regulators during the review process?

A: A reviewer might include, among others, checklist items such as the following:

1. Review Product Types and Benefits Covered
 - (a) Variable Annuities
 - (b) VUL Contracts containing guaranteed living benefits
 - (c) Group Life Contracts containing guaranteed living or death benefits
 - (d) Group Annuities containing guaranteed living or death benefits
 - (e) Variable Immediate Annuities containing guaranteed payout annuity floor benefits.

2. Review Types of Models or Methodologies Used and Determine if

Appropriate for Product Type:

- (a) Alternative Factor Methodology
- (b) Calibrated Stochastic Model
- (c) Standard Scenario Model

3. Review and validation of the model assumptions, especially review of the documentation and reasons for the choice of the prudent estimate assumptions for AG 43 or the prudent best estimate assumptions for C-3 Phase 2:

- (a) Mortality Rates
- (b) Lapse Rates
- (c) Partial Withdrawal Rates
- (d) Annuitization Rates
- (e) Expenses (general and investment)
- (f) Tax Rate
- (g) Discount Rate(s)
- (h) Fund Return Rate(s)
- (i) Other Policyholder Utilization Rates
- (j) Fund Transfers
- (k) Starting Assets
- (l) Allocated Amounts of IMR and AVR
- (m) Appropriate Treatment of Reinsurance

4. Appropriate Review of any Hedging Program

5. Review of the discussion and results of the required sensitivity disclosure in AG 43 or C-3 Phase II to company management (or review of the internal sensitivity testing done in the model building process).

Q15.7 What other references concerning peer review and required regulatory reviews are available?

A: 1. In Canada, a formal peer review process became effective for 2003 public opinions, requiring an external, independent party to review all regulatory filings done by the Appointed Actuary on a triennial basis. References to the guidance provided by the Canadian Insurance Supervisory Authority (OSFI) can be obtained from the following websites:

http://www.osfi-bsif.gc.ca/app/DocRepository/1/eng/guidelines/sound/guidelines/e15_final_e.pdf

<http://www.actuaries.ca/members/publications/2003/203066e.pdf>

2. Peer review can assist an actuary in complying with applicable ASOPs and, thereby, producing a work product that meets the profession's standards. Some actuaries have established peer review programs within their organizations or have arranged for outside actuaries to peer review their work. For assistance in understanding the various types and levels of peer review and how to put a peer review program into place, actuaries may read the discussion papers on peer review published by the Committee on Professional Responsibility in 2005 and available on the Academy's website under:

<http://www.actuary.org/pdf/prof/peerrevi.pdf>

[Peer Review - Concepts on Improving Professionalism; Discussion Paper Prepared by Committee on Professional Responsibility; Professionalism Series; 1997 * No. 1; American Academy of Actuaries]

<http://www.actuary.org/pdf/prof/whitepaper.pdf>

[American Academy of Actuaries Council on Professionalism - The Actuary's Relationships with Users of a Work Product]