PRACTICE NOTE FOR THE APPLICATION OF C-3 PHASE II

September 2006

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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 intended to provide guidance to actuaries dealing with the implementation of the new C-3 Phase II (VA RBC) requirements for Variable Annuities (VAs).

Members of the working group developing this practice note include:

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This practice note attempts to describe practices believed by the work group to be commonly employed by actuaries in the United States at the time this document was drafted. However, no representation of completeness or acceptability is made, nor whether these constitute appropriate practice at the time they are read. Other approaches may also be in common use, and events may occur subsequent to publication of this Practice Note that may make the practices described herein irrelevant or inappropriate. The information contained in this practice note is not

binding on any actuary and is not a definitive statement as to what constitutes generally accepted actuarial practice in this area. This practice note has not been promulgated by the Actuarial Standards Board nor by any other authoritative body of the American Academy of Actuaries.

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 the new regulation. In some places, we also include references to the proposed VACARVM reserving guideline. While VA RBC has been approved for implementation effective year-end 2005, VACARVM is still under discussion at this time. All comments on VACARVM in this practice note relate to the version which was created in June 2006, and has been posted to the Academy website.

A glossary of key terms has been included. These have been underlined in the text. In addition, the Appendix contains a list of questions and answers related to the implementation of C-3 Phase II from the December 2005 NAIC meeting, which have been posted to the NAIC website. The document has been included in full, with approval from the NAIC.

It is anticipated that this practice note will be posted to the Academy website in September 2006. Please provide any comments to the Academy's Policy Analyst, Amanda Yanek at yanek@actuary.org.

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1) DETAILS ON PRODUCTS COVERED

Q1.1 What are some examples of products that are covered by VACARVM and the VA RBC requirements?

A: The VA RBC requirements indicate they apply to the following examples of benefit features:

(a) Individual VA products whether or not they include Guaranteed Living Benefits (GLBs) or Guaranteed Minimum Death Benefits (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 amounts for (unrelated) mutual funds.

(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 requirements for those benefits. Once C-3 Phase III has been implemented, VUL products would be expected to be included under that RBC regulation, and removed from C-3 Phase II.

(d) Group annuities covering participants of 401(k) plans, but only if they also contain guaranteed living or death benefits.

(e) Any variable immediate annuity, including those containing Guaranteed Payout Annuity Floor (GPAF) benefits.

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 VA RBC 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. Reserve

requirements covering these minimum guaranteed benefits are prescribed in Actuarial Guideline 37 and the capital requirement is defined in the traditional RBC formula.

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. EIAs are not covered by the VA RBC requirements, since they are general account products, not variable. The reserves for these products must satisfy specific requirements for FIAs as set forth in Actuarial Guideline 35.

Each of these guarantees has requirements for risk-based capital (RBC defined by the traditional RBC formula), based on the reserve requirements for these products. They are thus excluded from VA RBC.

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

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 VA RBC requirements be applied to a variable annuity product with a GMDB or GLB that has both variable and Modified Guaranteed subaccounts, given that they do not apply to Modified Guaranteed Annuities?

A: The VA RBC documentation states in its Scope section, "all variable annuities except for Modified Guaranteed Annuities" are included.

The American Academy of Actuaries groups that developed the VA RBC and VACARVM recommendations stated within their deliberations that the products covered in VA RBC and VACARVM are intended to be the same. (See Q1.10 below)

One approach is to view a variable annuity with MGA subaccounts as being a variable annuity (with additional fixed accounts). Under this approach, the product would be covered under the first category of the VA RBC scope. An alternative approach is 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 VACARVM) for such guarantees." In this case, VA RBC states: "If such a benefit is offered as a part of a contract that has an explicit reserve requirement other than VACARVM, the methods of this capital requirement shall be applied to the benefit on a standalone basis."

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

1. the non-MGA subaccounts with any associated GMDBs and VAGLBs;

2. the MGA subaccounts; and

3. any GMDB and VAGLB associated with the MGA subaccounts.

The VA RBC 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 VA RBC requirements?

A: No. Group annuities without death benefit or living benefit guarantees are outside the scope specified in VA RBC.

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 VA RBC requirements?

A: Many 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 VACARVM, and by the nearly identical wording in the VA RBC requirements.

Footnote 2 to the VA RBC Scope states: "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 Is risk-based capital (RBC) for variable life products containing either guaranteed death benefits or guaranteed living benefits determined under the VA RBC requirements?

A: RBC 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 determination that are otherwise prescribed, the VA RBC 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 contract holder that relates to benefits derived from funds for which investment risk is ordinarily borne by the contract holder. 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 VA RBC Scope gives 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 VACARVM, the GMDB or VAGLB feature for which there is no explicit reserve requirement shall have RBC and reserves determined under VA RBC and VACARVM on a standalone basis. How are VA RBC 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 contract holder 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 VACARVM and the

Total Asset Requirement (TAR) for VA RBC 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.

Q1.10 How are inconsistencies between the proposed requirements for applicability of VA RBC and the scope requirements contained in VACARVM reconciled? If there are differences, would they be applied differently to the same block of business?

A: The American Academy of Actuaries groups that developed the VA RBC and VACARVM recommendations stated within their deliberations that the products covered in VA RBC and VACARVM are intended to be the same. One exception to this, however, is that contracts issued prior to 1981 are not subject to VACARVM. (For further details, we refer the reader to Section 3 of this practice note, which discusses consistency and differences between VA RBC and VACARVM).

Q1.11 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 VA RBC requirements?

A: This type of product does not fall under the scope of the VA RBC requirement inasmuch as the product is not a variable annuity or one of the other similar products specified in the requirements as falling within scope. The death and living benefits under the product described above are not "similar in nature to GMDBs or VAGLBs" because the premiums have not been invested in separate accounts or mutual funds similar to the benefits provided by variable annuity products.

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 VA RBC and VACARVM?

A: While the actuary is ultimately responsible for determining which ASOPs are applicable to any specific task, the following list of ASOPs are likely to 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. The Treatment of Reinsurance Transactions in Life and Health Insurance Company Financial Statements (Doc. No. 013; July 1989) [Effective until January 1, 2006]

No. 11. Financial Statement Treatment of Reinsurance Transactions Involving Life or Health Insurance (Doc. No. 098: June 2005) [Effective as of January 1, 2006]

Scope—These standards apply to both ceding company and assuming company actuaries who are operating subject to these standards.

No. 21. Responding to or Assisting Auditors or Examiners in Connection with Financial Statements for All Practice Areas (Doc. No. 095; September 2004). Effective April 30, 2005

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. 044; July 1993) This document will be superseded by the December 2004 revision (Doc. No. 097), which applies to actuarial work products begun on or after July 1, 2006; in addition, the December 2004 revision 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 of the revision for details.)

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—These standards apply to all areas of practice. Other actuarial standards may contain additional data quality requirements that are applicable to particular areas of practice.

No. 41. Actuarial Communications (Doc. No. 086; March 2002)

Scope—This standard applies to actuaries issuing actuarial communications. However, when the actuary is providing testimony in a regulatory, judicial, or legislative environment, the actuary's ability to satisfy the requirements of this standard may be limited by the constraints of that forum. When providing testimony in such a forum, the guidance in this standard nevertheless applies to the actuary to the extent practicable in the particular circumstances.

The actuary is responsible for reviewing new ASOPs and revisions to existing ASOPs for their applicability to the tasks under discussion.

For example, a revision to ASOP No. 38, Using Models Outside the Actuary's Area of Expertise (All Practice Areas) is under consideration. The Scope of the current draft reads as follows:

Scope—This standard applies to actuaries who use models that incorporate specialized knowledge outside of the actuary's own area of expertise when performing actuarial services in any practice area. For the purpose of determining the applicability of this standard, specialized knowledge outside the actuary's own area of expertise shall be determined by the actuary based on his or her education, training, and experience.

This standard applies to the use of all models whether or not they are proprietary in nature.

This standard does not apply to computer programs where the mathematical equations, logic, and algorithms described in Section 2.2 fall within the actuary's expertise.

When applicable law, regulation, or other binding authority conflicts with this standard, compliance with such law, regulation, or other binding authority shall not be deemed a deviation from this standard, provided the actuary makes the disclosures specified in section 4.1 of this standard.

Other References

The actuary may also find that the following ASOPs provide relevant advice:

1) If products under scope have non-guaranteed elements: ASOP No 1.

2) If products under scope have dividends: ASOP No 15.

3) Measuring pension obligations: ASOP No 4.

4) Selection of economic assumptions for measuring pension obligations: ASOP No 27.

5) Credibility procedures for A&H, Group Life and P&C: ASOP No 25.

6) Statement of opinion based on asset adequacy analysis: ASOP No 22.

3) CONSISTENCY AND DIFFERENCES BETWEEN VA RBC AND VACARVM MODELS

NOTE: The comments below are based on the current version of VACARVM as of June 2006. Since VACARVM has not yet been finalized and LHATF is making significant changes to the original proposal, there may be other differences between VA RBC and VACARVM.

Q3.1 What are the steps required for reporting VA RBC amounts?

A: VA RBC amounts are included in page LR024 (Market Risk) of the NAIC Life RBC forms. A nine-step summary is included in the revised instructions adopted by the NAIC Capital Adequacy Task Force in June 2006, which is included in the July 2006 RBC Newsletter of the NAIC (http://www.naic.org/committees_e_capad_lrbc.htm).

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.

Q3.2 What differences are there between the calculation of TAR and the proposed VACARVM reserve?

A: The more significant differences are as follows:

The key difference is that the calculation required by VACARVM 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 VA RBC is performed on an after-tax basis (i.e., federal income tax is included in the projections and the discount rates are after-tax).

The starting assets may also be different to the extent VA RBC is calculated using actual VACARVM reserves (some actuaries believe this is allowed or required). See Q5.3 for more discussion on this issue.

The Asset Valuation Reserve (AVR) and Interest Maintenance Reserve (IMR) may be treated differently between VA RBC and VACARVM. Section A1.1)G) of VACARVM states that "the AVR and the IMR shall be handled consistently with the treatment in the company's cash flow testing". While the VA RBC instructions and the

Academy's Life Capital Adequacy Subcommittee June 2005 Report do not explicitly address AVR and IMR, Appendix 1a of the RBC C-3 Phase I instructions states 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), and 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.

Since VACARVM has not yet been finalized and LHATF is making significant changes to the original proposal, there may be other differences, which may include the way assumptions are developed, the treatment of revenue sharing, and the standard scenario.

Q3.3 Would the actuary use the same assumptions for both models (VA RBC and VACARVM)?

A: Since VACARVM has not yet been finalized and LHATF has made significant changes to the assumption setting process in VACARVM, this question cannot be answered until VACARVM is finalized.

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

A: Since the calibration criteria in VA RBC and VACARVM 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 VA RBC that is designed to satisfy the C-3 Phase I requirements described in Appendix 6 of VA RBC or if the other optional methods of incorporating the C-3 Phase I interest scenarios into the VA RBC model are used, then the actuary might consider using a different scenario set for VACARVM (provided that set meets the calibration criteria).

Q3.5 What are the differences in treatment of the fixed option between the two models?

A: Unless an integrated model, as described in Appendix 6 of the LCAS June 2005 report, is used, the actuary may pursue one of the options described in Appendix 6 of the June 2005 LCAS report for incorporating interest rate risk into the VA RBC requirements. Section A1.4)D) of VACARVM describes the approaches the actuary may choose to reflect scenario interest rates in the projections used for reserve calculation. There are some similarities in the approaches given in VACARVM, but it appears that the treatment of the portion of the account value held in the fixed accounts could be different between VACARVM and VA RBC.

Q3.6 What are the differences in treatment of federal income taxes between VA RBC and VACARVM?

A: All calculations used in VACARVM are pre-tax: accumulations, earnings, costs, and discount rates. All calculations used in the TAR calculation under VA RBC 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.

Q3.7 How would the actuary integrate the work to calculate VACARVM reserves and VA RBC under this approach with the requirements for the Actuarial Opinion and Memorandum?

A: To the extent a company is using projections to calculate VACARVM reserves and VA RBC, 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 VACARVM and/or VA RBC would be an acceptable asset adequacy analysis method.

Some actuaries believe the projections run to calculate VACARVM reserves and VA RBC 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 VACARVM reserves or VA RBC

in support of the Actuarial Opinion (e.g., model cells, product characteristics).

In addition, some actuaries believe the modeling requirements in VA RBC and VACARVM will provide emerging practice on modeling variable annuity risk and that the sensitivity tests and actuarial memorandums supporting the VACARVM reserve and VA RBC 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 VACARVM and VA RBC is limited to the types of products described in Section 1.

- The calculations for VACARVM and VA RBC include the change in Working Reserves as an expense item, while the asset adequacy analysis may not.

- The calculations for VACARVM and VA RBC employ results using the greatest present value of accumulated deficiencies (as defined in VACARVM) 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. Of course, if the actuary adjusts the factors, the actuary may use the analysis supporting the adjustments.

In addition, there is a lot of consistency between the sensitivity tests and the documentation required by these requirements and by the AOMR -- and this is by design. Since VACARVM and VA RBC give

more detail on this, including a section covering documentation, they may serve as additional guidance for the actuarial memorandum.

Q3.8 How would the actuary combine the results of the VACARVM projections with cash flow testing projections to satisfy the requirements for asset adequacy analysis?

A: The calculation of reserves under VACARVM is separate and distinct from asset adequacy requirements. Although many companies may use similar models, reserves are established to meet the requirements of VACARVM. 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.

Many companies may 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 VACARVM as well as other business. For these companies, products can 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.

Many companies do not use an integrated model and separate the projection of separate account funds versus general account funds. For these companies, the model used for general account funds may also be used for the fixed portion of products subject to VACARVM.

Q3.9 Suppose the actuary applies the same scenarios used to calculate reserves and RBC under these requirements for the company-wide asset adequacy analysis and the actuary determines that the reserves for the company, in aggregate, are inadequate. Would the actuary increase the reserves calculated under VACARVM?

A: In the situation where the 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 VACARVM meet the requirements of VACARVM, then there does not appear to be a reason to increase the reserves calculated under VACARVM.

Q3.10 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 VACARVM. Is it appropriate to use the excess to offset reserve shortfalls on other blocks of business that are outside the scope of VACARVM?

A: There is nothing in VACARVM 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 testing and not target liability requirements.

The redundancies are frequently used in asset adequacy testing, but normally are not used to meet aggregate minimum formulaic requirements.

Q3.11 If an insurer chooses to use the scenario testing approach for all of its fixed annuities, what method would be used to determine the RBC for the interest rate risk associated with the guaranteed (fixed) options of variable annuities?

A: VA RBC requires that interest rate risk be included in the determination of TAR. Appendix 6 to the June 2005 LCAS report 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". The Appendix 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).

Appendix 6 also states that companies "not exempt from scenario testing for C3 interest rate risk for fixed products are not exempt for these products either. "Exempt companies" may choose to use scenario testing for these products, either on a free standing basis or consolidated with the interest sensitive fixed products or to use the current factor based process applicable to fixed annuities."

Therefore, companies that are using scenario testing for fixed products under C-3 Phase I must use scenario testing to reflect interest rate risk

under variable annuities products in their C-3 Phase II calculation, using the guidance in Appendix 6.

Finally, Appendix 6 states that “Companies that use AM factors for GMDB risk can either use the model based approach or the C-3 interest rate risk factors as required or permitted by the RBC Instructions for Interest Rate Risk to determine the interest rate risk capital requirement”.

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: No. In fact, the actuary may choose to use the Alternative Methodology (AM) for some contracts and the modeling method for others. For those contracts that are modeled, either one model or a multitude of models may be used, as deemed appropriate by the actuary.

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 normally uses enough model points that the VA RBC result 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. The actuary may wish to consider describing the degree of granularity chosen in the supporting memorandum.

Q4.3 What is the usual timing for projections?

A: The actuary may wish to consider using a time step of the model such that using a more frequent time step does not make a material difference in the RBC result. One approach to determine the sensitivity of results would be to determine the RBC for a representative sample of contract but using all equity returns – interest rate scenarios used to determine the reported RBC. The actuary may wish to consider providing support for the choice of time step in the supporting memorandum.

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

A: No. 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 a decision of actual modeling vs. using the Alternative Methodology for VA RBC binding on the other model?

A: Since either method (modeling and the AM) is appropriate for calculation under VA RBC, the only condition imposed by the requirements is that once a company chooses the modeling method for RBC for a block of business, the company must continue using the modeling approach for RBC for that same block of business (unless they obtain regulatory approval for switching back).

Q4.6 Is it appropriate for a model developed for VA RBC 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, it is usually prudent for the actuary to take into account the calculation differences and difference in purpose of VA RBC and cash flow testing. For example, VA RBC is focused on the tail risk, whereas the focus of cash flow testing is usually the adequacy of reserves over a range of scenarios. See question 3.8 for more discussion and examples of the differences.

Q4.7 Principle 2 recognizes the fact that the modeling-based approach in VA RBC permits the aggregation of results over all products subject to the recommendation. The guidance in Principle 2 contains the statement "performed in the 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 such contractual provisions are: (1) group annuities with GMDBs and/or GLBs 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 an experience rated reinsurance treaty.

Q4.8 In 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 questions 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 Prudent Best Estimate assumptions, 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 AAA survey, 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 CTE90 value, the scenarios that produced the worst X% of results, or a specified number of scenarios.

Q4.9 In the creation of the VA RBC model, 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 AG34 classifications?

A Methodology Note C3-01 of the Academy's Life Capital Adequacy Subcommittee June 2005 Report provides guidance in the determination of an appropriate crafted proxy fund for each variable account. The proxy fund would normally be expressed as a linear combination of recognized market 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. It would rarely be appropriate to estimate the stochastic model parameters for the proxy funds from actual company data.

As a default, it is not appropriate to simply map the variable accounts into the AG34 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
  - AG34 classifications

- If sufficient 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 would be imprudent to ignore the concept of market efficiency in establishing the proxy funds and the associated model parameters used to generate the investment return scenarios. Higher expected returns can only be attained by assuming greater risk.

- The actuary would typically verify that the fund mapping and grouping methods used in creating the VA RBC Model are comparable to the fund methodology and assumptions used by the company for other purposes, such as internal capital models and the company's actual hedging program. Most actuaries would also consult with the individuals at their company who are familiar with the investment objectives and performance data of each fund and with those individuals responsible for maintaining the company's hedging program.

5) DETAILS ON STARTING ASSETS

Q5.1 How are starting assets determined for both the separate account and the general account?

A: VA RBC provides that "the value of assets at the start of the projection shall be set equal to the approximate value of statutory reserves at the start of the projection" (estimated reserves). Some actuaries believe this typically includes general and separate account reserves for products and product features in the scope of VA RBC. In addition, 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).

VA RBC requires that all separate account assets associated with products in-scope are to 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 also included. General account assets must include all relevant hedge assets owned by the company with regard to in-scope products as of the model start date.

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.

Assets used in the model, including starting assets, are typically valued according to normal statutory accounting methods (such as book value for most assets in the general account).

In determining which assets to include and how to project those assets, the actuary may wish to consider Actuarial Standards of Practice, such as Section 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: The required calculation within VA RBC allows for starting assets to be greater than Working Reserves as of the start of the projections.

Some actuaries believe that a good approximation to the ultimate reserve can be used in computing the amount of starting assets, especially if the actual assets to be allocated to the CTE 90 "add on"

have investment returns significantly different from the discount rates used to compute them.

Q5.3 Could the same level of starting assets be used for the VA RBC and proposed principles-based reserve calculations?

A: To the extent the treatment of AVR is different, the starting asset amounts could potentially 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*.

Also, to the extent the actuary decides to set the starting assets for the RBC 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 VA RBC 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, the application of CARVM. Actuarial Guidelines and principles-based proposals is normally limited to contracts issued in and after 1981, whereas all issue years for in-scope products are covered by VA RBC.

6) *DETAILS ON SCENARIOS / SCENARIO GENERATORS / ECONOMIC ASSUMPTIONS*

Q6.1 With respect to the calibration of scenarios, the VA RBC Report provides calibration points for the S&P 500 index. How would one go about calibrating other fund types?

A: The essence of this question 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 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 the VA RBC Report suggest that if the fund being simulated is riskier than the S&P 500, then the calibration points would usually be at least as "fat tailed" as those of the S&P500. 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.

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 other funds returns. 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).

Q6.2 Is it appropriate to select a subset of scenarios from the pre-packaged scenarios available on the Academy website? If so, what does the actuary do if the subset of the scenarios fails to meet the calibration criteria?

A: (1) Yes. Both VACARVM and VA RBC imply that a subset of the pre-packaged scenarios may be used. In fact, the Academy website includes a "picking tool" that allows the actuary to choose a subset of the 10,000 scenarios.

(2) 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 consider 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.

Q6.3 How may the actuary determine if an appropriate number of scenarios has been used?

A: The VA RBC Report states: "Minimum Required Scenarios. The number of scenarios for which projected greatest present values of

Accumulated Deficiencies shall be computed shall be the responsibility of the actuary and shall be considered to be sufficient if any resulting understatement in total reserves, as compared with that resulting from running additional scenarios, is not material."

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

$$(VAR(x_1,\ldots,x_k) + a\ (CTE - x_k)^2) / k,$$

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), a is the level of the CTE measure (such as 65% for reserves or 90% for Phase 2), and n is the total number of scenarios, and k is (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 of the CTE to the CTE itself. If the ratio is relatively small one would 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 would be to calculate the reserve based on the standard deviation. For example, use CTE 65 + SD /2, where SD is the standard deviation of the CTE measure. Assuming (because of the law of large numbers) that the distribution of the CTE is normal, this would imply that the value proposed would be at least 70% certain to be larger than the theoretical CTE from an infinite number of scenarios.

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

Bootstrap techniques can 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. The material can be found at the Society of Actuaries website:

http://handouts.soa.org/conted/cearchive/newyork04/072_hardy.pdf

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

Q6.4 Are the Short Term, Medium Term, and Long Term US Treasury pre-packaged fund yields appropriate for calculating the interest rate RBC C-3 Phase I requirements for the Guaranteed (fixed) Funds of Variable Annuities?

A: Yes. Appendix 6 of VA RBC states that the scenarios meet the rate volatility and expectations and frequency and duration of yield curve inversions characteristics of the C-3 Phase I scenarios. 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.

Q6.5 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&P500 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 produced by an internal company model. Strict compliance with all calibration points is required for S&P500 funds subject to the level of materiality acceptable for statutory reporting. Hence, the actuary would normally take reasonable steps to confirm that any known differences are not material.

The distribution beyond 20 years normally continues to widen. However, there is room for judgment on how this might be handled. It is normally preferable for the choice taken to have a basis in theory or empirical modeling or both.

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.

Q6.6 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.

Q6.7 What characteristics would integrated equity/interest rate scenarios typically have?

A: It is 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 is 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 VA RBC 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 qualify as meeting this standard. However, it should be noted that the pre-packaged equity and interest rate scenarios provided by the Academy are not correlated. Hence, they may not be appropriate when incorporating hedging analysis.

Q6.8 Are the pre-packaged scenarios appropriate for the purposes of projecting the market value of future hedge instruments within a projection?

A: Because VA RBC and VACARVM 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.

Q6.9 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.

Q6.10 What other reference materials are available to assist an actuary in determining how to generate integrated scenarios from an internal model?

A: 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

Title	Author	Publisher
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
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

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

Q6.11 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 LCAS June 2005 Report – Appendix 2 - page 32 (http://www.actuary.org/pdf/life/c3_june05.pdf).

Q6.12 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 VA RBC 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 General Instruction for LR024 (RBC).

7) DETAILS ON ACTUARIAL/MODELING ASSUMPTIONS

Q7.1 What does "prudent best estimate" mean?

A: “Prudent best estimates” are used in setting deterministic, as opposed to stochastic, assumptions. A prudent best estimate assumption would normally be defined by applying a margin to the actuary’s best estimate for the given assumption. The best estimate would typically be the actuary’s most reasonable estimate of future experience for a risk factor, given all available and relevant information pertaining to the risk being valued. The amount of margin applied to the best estimate typically would reflect some or all of the following:

- Potential estimate error;
- Potential random fluctuation from best estimates;
- Potential for adverse trends in experience;
- Potential catastrophe risk; 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.

Q7.2 Are the margins included in “prudent best estimate” assumptions developed assumption by assumption or in the aggregate?

A: Principle 3 in Appendix 7 of the Academy’s Life Capital Adequacy Subcommittee June 2005 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 Academy's June 2005 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.

Q7.3 What is an appropriate risk discount rate?

A: VA RBC 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."

In an AAA survey for the first year of practice, the predominant approach was the use of the after-tax one-year treasury rate. Another group of companies (about 1/3 as many) 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, the portfolio yield, a modified swap curve and LIBOR. If a company documents its methodology in this fashion, it should be able to demonstrate an appropriate reflection of Federal Income Taxes in its discounting approach.

Q7.4 What assumptions might be used in the calculations required by VA RBC 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 Q7.2.

Sensitivity testing is a useful tool in creating assumptions for which no experience or industry data is available. The results of the AAA survey indicated that in this situation, most companies developed their VA RBC 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 specific assumptions are provided below:

a. Mortality

b. General account crediting rate strategy

c. Lapse rates (including full and partial withdrawals)

d. Expenses (including overhead and investment expenses)

e. Living benefit utilization rates

f. Expected credit losses

g. Expected revenue sharing income

h. Future premium flows

i. Renewal and tail commissions

j. Inforce grouping

Q7.5 What process would the actuary follow in establishing the assumptions?

A: Some actuaries believe it is preferable for the primary source for the assumptions to be company experience data. If company experience data is unavailable, then those actuaries would 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 AAA survey.

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 definition in VA RBC (e.g., the margin for error in assumptions should be directly related to uncertainty in the underlying risk factor).

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.

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.

The actuary would be well advised to consider performing sensitivity tests of assumptions to identify those that materially impact results and how various assumptions impact results. 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 AAA survey, 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.

Q7.6 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 for the underlying base assumption?

A: According to a recent AAA survey, dynamic assumptions were amongst the most difficult to determine.

Dynamic assumptions are most commonly used to model policyholder behavior. The AAA survey 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:

1. Policyholder behavior can vary by product, market, distribution channel, fund performance, time/product duration, etc.

2. Options embedded in the product may impact behavior.

3. Options may be elective or non-elective in nature. Living benefits are often elective, while death benefit options are often non-elective.

4. Elective policyholder options may be driven more by economic conditions than non-elective options.

5. As the "value" of a product option increases, the likelihood of policyholder behavior anti-selecting against the insurer increases.

6. Behavior formulas may have both a rational and irrational component. The rational component normally would be dynamic.

Policyholder 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 VA RBC requirements.

b. As stated in Methodology Note C3-03 of the Academy's June 2005 Report, it is preferable that policyholder behavior assumptions be consistent with the behavior that would be anticipated in the scenarios

that get used in the CTE calculation (generally, the top 1/3, or less, of the loss distribution).

c. Methodology Note C3-03 also states that it is reasonable to assume a certain level of non-financially motivated policyholder 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 for the underlying base assumption. Each dynamic policyholder behavior assumption reflects the actuary's prudent best estimate for how the given assumption will vary by economic scenario. This issue is also further described in Methodology Note C3-03 in VA RBC.

Q7.7 What factors might the actuary choose to consider in estimating how policyholder 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 policyholder behavior might impact assumption:

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

Q7.8 What factors might the actuary choose to consider in determining the earned rate for the general account assets?

A: Some actuaries believe that for general account assets held as of the valuation date, 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.

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 VA RBC Report discusses earnings on future asset purchases in Section 7. The regulation 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.

Q7.9 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.

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 policyholders, 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.

Q7.10 As mentioned in the Modeling Methodology section, item 3, Assets, 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 Q7.8, 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.

Q7.11 The VA RBC document 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 for contracts within the scope of VA RBC. 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. For further guidance on AVR/IMR please see Questions 3.1 and 3.3.

Q7.12 The sixth paragraph of section 10 starts out "This increase to TAR may be approximated as the corporate tax . . . ."

(a) 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 VA RBC.

A large majority of the Academy 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.

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

A: Yes, provided the results of the approximation are consistent with the principles for VA RBC.

Q7.13 When including revenue sharing into the projection, 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 Income to be included in the determination of the Accumulated Deficiency (or TAR) 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.

Q7.14 Would there usually be any connection between the assumptions for 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 revenue sharing would 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.

Q7.15 What might the actuary consider when projecting applicable expenses in the context of revenue sharing?

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.

Q7.16 In order to include Net Revenue Sharing 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 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.

Q7.17 The rules providing for the amount of Net Revenue Sharing 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.

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.

Q7.18 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 is 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

Q7.19 What can be done to shift some of the work for VA RBC 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 AAA survey 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.

Q7.20 Do companies base the projections needed for VA RBC on business in force prior to the valuation date?

A: Section I of the *General Instruction LR024 Interest Rate Risk and Market Risk* for VA RBC 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 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 reserve or 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 reserves or 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.

$$_{P}CTE(90) = PV\left(RiskElements_{p}\right) \times f(P)$$

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

$$_{0}CTE(90) = PV\left(RiskElements_{0}\right) \times f(0)$$

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

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

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

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

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 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.

Q8.2 Would credit be taken for hedging when using the AM?

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

Q8.3 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: The VA RBC 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%.

Q8.4 How is $\hat{\phi}$ calculated for purposes of determining the scaling factor, R?

A: $\hat{\phi}$ 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%.

Q8.5 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 structure 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.

Q8.6 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, 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.

Q8.7 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.

Q8.8 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 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.

Q8.9 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.

Q8.10 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 GLBs, 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 RBC described?

A: The RBC Standard Scenario is described in the RBC Instructions for Line (35) of LR 024, Interest Rate Risk and Market Risk.

It should be noted that the instructions have changed for 2006. In particular, the asset return assumptions have been changed, and now reflect an initial drop of 20% for equities.

Q9.2 Does the Standard Scenario for VA RBC 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 is applied on a contract-by-contract basis as described in subsection (B) of section (I) of Line (35) of LR 024 in the 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.

Q9.3 Subsection (C) of section I of the *General Instruction LR024 Interest Rate Risk and Market Risk* document describes 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, it is preferable to reflect the terms of each individual contract in the determination of these benefits. If additional assumptions are made, section III(A) of the instructions require explicit documentation of the additional assumptions. 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.

Q9.4 Would the actuary normally do anything in the Standard Scenario for death benefits based on a $1 for $1 reduction for partial withdrawals when the RBC 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.

Q9.5 Since the Standard Scenario includes a premium assumption to prevent lapses, would the actuary usually include premiums needed to prevent the lapse of a benefit but not include premiums necessary to prevent lapse of the whole contract?

A: Premiums would normally be included at the time and to the extent they are needed to prevent a guaranteed benefit in the contract or the entire contract from lapsing.

Q9.6 Assume the contract holder election rate is 15% for any elective in-the-money (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 contract holder 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: Yes. Please refer to the examples of ITM provided in Question 9.7.

Q9.7 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.

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 contract holder'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 x 100) / (8 x 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

Q9.8 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. Although the Standard Scenario does not provide guidance as to the classification of funds to the different asset classes, one approach the actuary may

wish to consider would be to use the guidance offered by Actuarial Guideline 34.

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.

Q9.9 What is the meaning of the statement that "all lapse rates should be applied as full contract surrenders"?

A: It means the projection for a contract assumes no partial surrenders (that is, partial withdrawals) other than those withdrawals that are required under the Standard Scenario. Because of the probability of prior deaths and lapses, future years in the projection will reflect less than a full unit of the contract. 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.

Q9.10 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 higher of 3.5% and the minimum contract level guaranteed investment rate, but not more than the current credited rate.

Q9.11 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 additional assumptions are made, section III(A) of the instructions require explicit documentation of the additional assumptions.

Q9.12 What is the basic adjusted reserve for an assuming company that only reinsures the guaranteed death or guaranteed living benefit?

A: The instructions for the RBC Standard Scenario define the term "basic adjusted reserve" as the Working Reserve. The Working Reserve for

the assuming company may or may not be zero depending on the type of reinsurance and the provisions of the reinsurance agreement.

Q9.13 Could an assuming company use Standard Scenario reinsurance cash flows and amounts provided by the ceding company?

A: Yes, but the assuming company actuary may find it prudent to review the ceding company's calculation to provide the necessary certification for the assuming company and adjust them to reflect the reinsurer's margins.

Q9.14 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.

Q9.15 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.

Q9.16 A contract is 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: Yes. 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.

Q9.17 In Section III(D)(1) 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: Some actuaries would view the presence of any surrender charge as meaning that the contract was within the surrender charge period. Other actuaries may determine the margin and lapse rate for each premium and take a weighted average of the margin and lapse rates respectively based on the percentage of the account value resulting from each premium to the total account value resulting from all premiums.

Q9.18 What level of precision is appropriate in computing the Standard Scenario amount, given its dual purpose in serving as: a) a floor on the Total Asset Requirement; and b) a benchmark to validate the model office used in computing the Total Asset Requirement?

A: The Standard Scenario amount is required to accurately reflect the benefit provisions applicable to each contract and all transactions that affect those provisions (e.g., historical account values, gross considerations and partial withdrawals.) This may cause differences when comparing results with those produced by the model office. Some actuaries would view it as a requirement that, when differences arise, these differences be immaterial or explainable and not biased to understating RBC (e.g., due to different fund mappings). If these criteria are not met, the model office and the Total Asset Requirement computed from it may be deemed unreliable. The Preamble to the Accounting Practices and Procedures Manual provides guidance on materiality.

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

A: When the Standard Scenario amount is not 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 after-tax cash flows from the approved hedges and their statement value on the valuation date. The RBC Standard Scenario 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 DR, 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) x 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: Yes. The actuary would apply the terms of the contract given the returns and assumptions required by the Standard Scenario.

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

A: Yes. If the Standard Scenario is based on the Alternative Methodology, then the adjustments are described in the Academy's Report. 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.

All treaty limitations are 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 Accounting Principles (SAP) 86 before taking hedge credit?

A: A hedge does not need to satisfy SAP 86 to be included in the value of approved hedges. The hedge must be part of a Clearly Defined Hedging Strategy and satisfy the requirements in the standard scenario for an approved hedge.

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 become governing at any time during the Standard Scenario projection, can the reinsurance be categorized as Individual reinsurance in section III(B)(2)(iii)?

A: It is appropriate to categorize the reinsurance based on the treaty's provisions. In the example of a treaty with an aggregate cap provision, the treaty should be categorized as Aggregate reinsurance, regardless of the impact of aggregate provisions during the Standard Scenario projection. 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.

Q9.26 Does "in the money" in sections III(D)(3) and III(D)(7) of the instructions prescribe a point-in-time test or a forward-looking test and is the definition consistent in sections III(D)(3) and III(D)(7) of the instructions?

A: The working definition of "in the money" in III(D)(3) is a forward-looking test based on the inclusion of the phrase "at any time". The working definition of "is more valuable" in III(D)(7) is also a forward-looking determination based on the inclusion in III(D)(7) 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)(7) is a point in point time calculation since it is dealing with the actual utilization of an elective benefit. By the reference to III(D)(3) in III(D)(7), the definitions are consistent.

Q9.27 How should margins in section III(D)(1) be calculated for fixed funds after the surrender charge? It appears the result of b) would always be zero since the 2nd bullet will return a zero value for fixed funds, therefore the entire result would be the same as during the surrender charge period.

A: For 2006 it is expected that the standard scenario will be modified to include, "However, on fixed funds after the surrender charge period, a margin of up to the amount in (a) above plus .4% may be used." You should review any changes made to the 2006 instructions.

10) TREATMENT OF REINSURANCE

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

A: Subsection 2 of the Modeling Methodology section of VA RBC 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 straight-forward 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."

There is no requirement in the RBC instructions to calculate the Total Asset Requirement gross of reinsurance.

Q10.2 How does the actuary incorporate hedging credit into the model when reinsurance is present?

A: The Modeling of Hedges guidance in Appendix 10 of VA RBC 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."

It would usually be prudent on the part of the actuary to 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.

Q10.3 Could different results be obtained if both the direct writing company and the reinsurer calculate the **Total Asset Requirement?**

A: The Total Asset Requirement for reinsurance coverage of a particular block of business will usually be quite different from the TAR of the underlying block of business for several reasons:

1. The reinsurance may not be completely proportional. 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.

2. 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.

3. Typically, the TAR 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.

Q10.4 If business is covered by a reinsurance agreement, how are the values used in the smoothing formulae determined for:

a. The ceding company

b. The assuming company

c. Within a retrocession agreement?

A: For deferred annuities with no cash value option, or for reinsurance assumed through a treaty other than coinsurance, the actuary may

use the policyholder account value of the underlying contract. For any business reinsured under a coinsurance agreement that complies with all applicable reinsurance reserve credit "transfer of risk" requirements, the ceding company shall reduce the value in proportion to the business ceded while the assuming company shall use an amount consistent with the business assumed.

11) TREATMENT OF HEDGING

Q11.1 The VA RBC report states in Appendix 10 that "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: Policyholder 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 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 VA RBC, would the insurer use a "stochastic within stochastic" model?

A: Not necessarily. While a "stochastic within stochastic" approach may be used, the following 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 GMDB-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 >= .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 10 of the VA RBC Report.

Q11.3 If an insurer uses the Alternative Methodology (AM) for determining the TAR, is it appropriate for the insurer to reduce the otherwise calculated TAR 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 10 of the VA RBC 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 reserves 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 an 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 best 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 best 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 best 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 C-3 Phase 2 model.

Q11.6 Appendix 10 of the VA RBC Report contains the following paragraph "As part of the process of choosing a methodology and assumptions for estimating the future effectiveness of the current hedging strategy (including currently held hedge positions) for purposes of reducing risk based capital, the actuary should review actual historical hedging effectiveness." 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 would usually consider include, but are not limited to: tracking error between policyholder 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 policyholder 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. 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.

In addition, it may be preferable to limit the reduction to the CTE amount attributable to the hedging strategy, due to the uncertainty associated with the company's ability to implement the hedging strategy in a timely and effective manner. The level of operational uncertainty varies indirectly with the amount of time that the new or revised strategy has been in effect or mock tested.

12) CONSISTENCY BETWEEN VA RBC AND C-3 PHASE I MODELS

Q12.1 How would interest rate risk associated with the guaranteed fund option be treated under VA RBC?

A: Subsection 8 of the Modeling Methodology section in the VA RBC report states (http://www.actuary.org/pdf/life/c3_june05.pdf), "In addition to the equity risk of products subject to these requirements, there is traditional credit risk and C-3 interest rate risk for funds supporting the guaranteed fund option". In addition, it states "C-3 interest rate risk for the guaranteed options in these contracts is considered in the C-3 Phase I calculation but only for variable annuities sold as fixed. The current formula does not recognize this risk for other variable annuities with guaranteed fund options." 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."

Subsection 8 also gives some guidance 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 a combined ("integrated model") or separated manner. It also specifies that if handled in a separate manner, that different approaches may be used. It states that:

> There are a number of ways in which this may be accomplished (see Appendix 6). In reflecting this risk:
>
> (i) Companies may combine the guaranteed fund portions of variable annuities and similar contracts with the other interest sensitive products included in 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 non-exempt 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.

Based on this subsection, if using a separate model to incorporate interest risk, the actuary may use C-3 Phase I scenario testing to determine the provision for interest rate risk, or may elect to use the original C-3 interest rate factors if the company is exempt.

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 AAA web site at www.actuary.org/pdf/life/lrbc_october.pdf.) The US Treasury Fund scenarios within the 10,000 prepackaged scenarios qualify as meeting this standard.

Appendix 6 also gives guidance on how to determine what portion of the RBC 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 VA RBC 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 gives guidance to the actuary 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. Finally, 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. Next, develop 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 rates risks captured by the C-3 Phase I scenario testing and at a level comparable to a 90 CTE 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.

Q12.2 How will C-3 Phase I be applied in conjunction with VA RBC for the fixed option within VAs?

A: VA RBC allows for two main ways for C-3 Phase I (or interest rate risk) to be handled in conjunction with VA RBC. The actuary would normally determine which method to use and handle the C-3 Phase I RBC in a manner consistent with that method. In either case, the C-3 risk excluding the interest rate risk is combined with the $C1_{CS}$ 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 VA RBC 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 C-3 Phase I RBC. The actuary might instead use a modeling method conforming to the C-3 Phase I rules.

The second is if the model or methodology used does NOT capture the C-3 interest rate risk. In that case, we do not concern ourselves with the C-3 Phase I risk as part of this calculation. The standard Scenario is a special case of this situation. For exempt companies, the C-3 Phase I RBC could be calculated by either of the currently available methods – standard factors or the C-3 Phase I modeling

Subsection 8 of the Modeling Methodology section of the American Academy of Actuaries' report on the Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products 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. C-3 interest rate risk for the guaranteed options in these contracts is considered in the C-3 Phase I calculation but only for variable annuities sold as fixed. The current formula does not recognize this risk for other variable annuities with guaranteed fund options." 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). In reflecting this risk: (i) Companies may combine the guaranteed fund portions of variable annuities and similar contracts with the other interest sensitive products included in 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 non-exempt 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." Finally, Appendix 6 of the report identifies three methods that may be used for calculating capital requirements for interest rate risk on the guaranteed fund of variable annuities.

Q12.3 If an insurer chooses to use the scenario testing approach for all fixed annuities including guaranteed (fixed) options of variable annuities on a consolidated basis, would capital needs be determined using the CTE methodology or the methodology contained in the C-3 Phase I requirements?

A: The scenario-based approach cannot be used for fixed annuities (see also the answer to Question 12.2). Hence, RBC for fixed annuities will be determined using the C-3 Phase I requirements.

For the fixed option within variable annuities, the total risk would be captured with a CTE-based methodology, but the carve-out would be

either the standard factors or a methodology consistent with C-3 Phase I for the interest rate risk.

Q12.4 If an insurer chooses to use the scenario testing approach for all fixed annuities including guaranteed (fixed) funds of variable annuities on a consolidated basis, would the VA RBC certification and documentation requirements contained in Appendix 11 of the VA RBC Report (June 2005) apply?

A: Both the VA RBC and C-3 Phase I requirements would apply to the calculation of the total risk. See also the answer to Question 12.3.

Q12.5 If an insurer chooses to use the scenario testing approach for all fixed annuities including guaranteed (fixed) funds of variable annuities on a consolidated basis, would the Principles contained in Appendix 7 of the VA RBC Report (June 2005) apply?

A: Both the VA RBC and C-3 Phase I requirements would apply to the calculation of the total risk. See also the answer to Question 12.3.

13) DETAILS ON CERTIFICATION & REQUIRED DOCUMENTATION

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

A: The Qualification Standards for Prescribed Statements of Actuarial Opinion determine the standards required for providing the Certification with respect to VA RBC. This includes satisfying basic education, experience and continuing education requirements.

Q13.2 Does the appointed actuary provide the Certification?

A: The appointed actuary does not need to be the qualified actuary providing the certification. Any qualified actuary meeting the applicable qualification standards can provide the Certification. Some companies have considered having their Board of Directors formally appoint the qualified actuary for purposes of providing the required certification.

Q13.3 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 VA RBC.

Q13.4 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.

Q13.5 What additional certification is required if hedging is reflected?

A: If hedging is reflected, the qualified actuary certifies that the $TAR_{adjusted}$ and $TAR_{best\ efforts}$ were calculated consistent with requirements of the NAIC Instructions for LR024, and were reasonable for the stated purpose. In addition, the qualified actuary certifies that the hedging strategy meets the requirements of a Clearly Defined Hedging Strategy, whether the strategy is fully incorporated into the stochastic cash flow model and that any

supplementary analysis does not include knowledge of events that occur after any action dictated by the hedging strategy.

Q13.6 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 actuary is providing the certification and therefore is usually 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 the NAIC Instructions. 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.

Q13.7 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 of the qualified actuary 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 qualified actuary relies on others, including those providing hedging calculations and processes for the company, the actuary is usually well advised to reflect such reliance in the reliance statements included in the certification and to make any appropriate further reliance disclosures in the supporting memorandum(a).

14) PEER REVIEW & WORKING WITH A PEER REVIEWER

Q14.1 Is peer review required for actuarial procedures carried out in connection with the establishment of RBC for variable annuities?

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 annual statement 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 currently 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 will be required for annual statement certifications in Mexico.

1. 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. Moreover, the Academy's Committee on Professional Responsibility has updated its 1997 paper and the SVL II Committee is working with regulators to draft what a review required by a regulator might entail.

2. Peer review can be used to give an additional assurance and perspective to management. The new VA RBC regulation includes 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 take advantage of the additional insights and assurance offered from such a process.

3. A required, independent review began in 2003 for all public actuarial opinions performed by actuaries in Canada and has been required in Mexico since 2005 for annual statement certifications.

Q14.2 What are the advantages of a peer review?

A: A comprehensive peer review can provide confidence that the work performed meets professional standards and is consistent with the principles underlying the VA RBC 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 states an independent opinion regarding the work, whether or not it confirms the work as originally done.

Peer review can be used to provide additional assurance and perspective to management. The proposed new VA regulation includes 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 take advantage of the additional insights and assurance offered from such a process.

Q 14.3 In what situations could peer review of the actuarial work required in connection with VA RBC occur?

A: Peer review of the actuarial work required in connection with VA RBC could occur in several instances, including:

1. Engagement by the opining actuary to provide a second opinion 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.

Q14.4 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?

Q14.5 What tools are available to actuaries and regulators to get them comfortable with the model validation and process?

A: A reviewer might ask the certifying actuary to supply a detail 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 Academy software as a cross check of the calibration. In addition, the following checks could be performed:

1. Review what management actions and reports are based on the modeled results.

2. Review of the discussion and results of the VA RBC required sensitivity disclosure to company management (or review of the internal sensitivity testing done in the model building process).

Q14.6 Which items could be included in a checklist to be used by 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 prudent best estimate assumptions:

    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 VA RBC to company management (or review of the internal sensitivity testing done in the model building process).

Q14.7 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/eng/documents/guidance/docs/e15_final_e.pdf

http://www.actuaries.ca/publications/2001/20107e.pdf

2. The Standard Valuation Law (SVL) II Taskforce is currently in the process of drafting a conceptual framework for required regulatory reviews. This project is a major objective of the Taskforce for 2006.

A framework for peer review principles-based accounting (PBA) for risk-based capital and reserves has been published by the Regulatory Interface, Governance and Peer Review Work Group in May 2006.

We refer the reader to the current version of the Peer Review framework, which can be accessed on the Academy's website under www.actuary.org. Preliminary findings and recommendations of this group (the Regulatory Interface, Governance and Peer Review Work Group) have been discussed at the Academy's Spring Meeting in May 2006 and presented at the June and September 2006 NAIC meetings.

3. 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 in their offices 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 Web site 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/life/svl_june05.pdf

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

15) GLOSSARY OF ADDITIONAL TERMS

The following terms have been defined here, for easier use in reviewing this document. They can also be found in the June 2005 VA RBC regulations.

Accumulated Deficiencies – this term is defined in VACARVM – Section (III) Definitions, as being the Working Reserves less projected assets. An alternative view of this is the accumulation of cash flows and changes in the Working Reserve. In theory, the two will be equal. Some actuaries believe that it may make sense to look at both as a way to make sure the model is calculating correctly. One item that might put this out of balance is the way the model handles negative assets (i.e., there is a possibility that the actuary starts the model with negative general account assets in order to have separate account assets equal to the account value and the Working Reserve is the cash surrender value).

Clearly Defined Hedging Strategy – See Appendix 10 – "Modeling of Hedges" in the June 2005 release of the VA RBC Report.

GC – GC is referred to in the Alternative Methodology, providing for the cost of the excess of the Guaranteed Minimum Death Benefit (GMDB) over the account value, less available risk-based charges. [Reference: VA RBC Appendix 8 on page 56.]

Management Expense Ratio (MER) – The MER is defined as the average amount (in dollars) charged against policyholder funds in a given year divided by average account value. Normally, the MER would vary by fund class and be the sum of investment management fees, mortality and expense charges, guarantee fees/risk premium, etc. [Reference: Alternative Methodology – Appendix 8 of VA RBC, page 67.]

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

More guidance on "prudent best estimate" is provided in Principle 3 of the VA RBC documentation, and in Section 7 of this practice note.

Standard Scenario – Single scenario, consisting of specified assumptions for interest rates, economic assumptions, lapse rates, withdrawal rates and benefit election rates. The RBC requirements determined using this scenario are a minimum floor for the results determined using VA RBC. The standard scenario is a tool used to evaluate model cell calculations, compare results from year to year and for allocating aggregate results to individual contracts.

Total Asset Requirement (TAR) – is the sum of the Additional Asset Requirement (AAR) for a particular scenario plus the starting assets. The AAR is the negative of the lowest present value of the statutory surplus at any year-end. The AAR may be negative (sufficient) or positive (deficient).

APPENDIX – C-3 Phase II Implementation Questions and Answers (from NAIC Website)

Below is a list of questions that have been received by the NAIC relative to implementing C-3 Phase II. The questions and suggested answers have been summarized below; and were posted on the NAIC website in January 2006.

General and Reporting:

1. Does all of C-3 Phase II go into line 35 or does the C-3 Phase I component go into Line 34?

    A. One hundred per cent of the resulting RBC attributable to interest rate risk (Interest Rate Risk Component) should go into Line 34. A discussion of the need to calculate the interest rate risk RBC amount for fixed funds in variable annuities and potential methods to perform the calculation is contained in the Modeling Methodology Section on page 13 and in Appendix 6 of the LCAS Report (Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products - June 2005). It is also important to note that the Standard Scenario requires a separation of the total asset requirement (TAR) to determine the amount attributable to interest rate risk and therefore breaking the amounts out may be necessary for consistency.

2. For a company accounting for variable annuity fixed subaccounts within the general account, do the changes in C3 Phase II apply to the fixed subaccounts? If so, in what area of C-3 would an adjustment for the fixed subaccounts be made, since they are not included with the separate account amounts?

    A. Yes – The changes in C-3 Phase 2 do apply to fixed subaccounts of variable annuities accounted for within the general account. The adjustment for the fixed funds should be included with the other C-3 Phase 2 amounts and reported in Line 35.

3. On what line of what page does the smoothed RBC get reported and how does that integrate with any instructions for co-variance?

    A. The smoothed RBC gets reported on line 35 of LR024, it will then be combined with the C-1cs amount in the covariance calculation.

Stochastic Modeling:

4. Regarding the calculation of the CTE (90), the example in the second paragraph of page 16 of the AAA recommendation implies any positive amounts should be floored at $0. Yet the glossary defines CTE as “the average over all remaining values in the tail” and item 9 under the Modeling Methodology section (page 13) states the AAR “may be negative or positive”

and item 10 (page 14) states the TAR is the average of the highest 10%. Can the CTE calculation underlying the TAR can reflect both sufficiencies and deficiencies related to the scenarios comprising the 10% tail?

A. The example glosses over some of the details that underlie the necessary calculations.

There are a couple of concepts involved in the actual calculation. It is correct to say that scenario specific Additional Asset Requirements "AAR" may be positive (deficient) or negative (adequate).

As noted in item #9 of the Modeling Methodology in the LCAS Report: "The Additional Asset Requirement (AAR) for a particular scenario is the negative of the lowest present value of statutory surplus at any year-end, including the current one. This value may be negative (sufficient) or positive (deficient). The Scenario Specific Total Asset Requirement for that scenario is the sum of the AAR plus the starting assets."

5. Recently the American Academy of Actuaries Life Capital Adequacy Subcommittee released an enhancement to earlier versions of the pre-packaged scenarios in that this latter utility affords the company the flexibility to input the starting U.S. Treasury yield curve and re-generate scenarios (interest rates and bond index returns) consistent with that initial term structure. However, only the interest rate scenarios (and consequently, index returns for Fixed Income and Balanced funds) have changed to reflect a 10/31/2005 starting yield curve. All other scenario components (i.e., equity index returns, random samples, etc.) remain the same as for the March 2005 pre-packaged scenarios. Is the use of this enhancement consistent with the LCAS Report (Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products - June 2005)?

A. Yes. Before using the new pre-packaged scenarios with interest rates and bond yields calculated using the embedded C-3 Phase 1 Interest Rate Generator ("the enhanced pre-packaged scenarios"), make sure that the enhancement has been adopted by the American Academy of Actuaries Life Capital Adequacy Subcommittee. This can be verified by consulting the AAA webpage.

6. The LCAS Report (Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products - June 2005) says, "In addition to the equity risk of products subject to these requirements,…" The current formula also includes (in C1) a reflection of the risk of "CARVM allowance recovery". This separate calculation is no longer needed because it is considered in the calculations recommended by this report in other ways. How should this be done in the RBC calculation since the instruction for LR006 does not exclude the CARVM allowance charge for VA subject to C-3 Phase II?

A. Due to an oversight, the 2005 instructions did not provide for a reduction in the RBC requirement for the risk of not recovering the CARVM Allowance. Since the values based on the C-3 Phase II report are incorporated with a weighed average in 2005 (see Q 13) implicitly the risk of not recovering the CARVM Allowance is in line 35 of LR024.

   For year-end 2005 it should be acceptable for a company to exclude the expense allowance transfers for contracts subject to the C-3 Phase II requirements in rows 11 and 12 of LR006.

Alternative Methodology:

7. For a small closed block, must all the modeling outlined in the report be done? Is there a safe harbor provision?

   B. There are no safe harbors. For GMDBs, the actuary has the option of using the Alternative Methodology. If the actuary chooses not to use the Alternative Methodology or can't use it due to existence of GLBs, the actuary may simplify the modeling by choosing methods and assumptions that are demonstrably conservative.

Standard Scenario:

8. Does "in the money" in sections III) D) 3) and III) D) 7) of the instructions prescribe a point-in-time test or a forward-looking test and is the definition consistent in sections III)D)3) and III)D)7) of the instructions?

   A. The working definition of "in the money" in III) D) 3) is a forward-looking test based on the inclusion of the phrase "at any time". The working definition of "is more valuable" in III) D) 7) is also a forward-looking determination based on the inclusion in III) D) 7) 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) 7) is a point in point time calculation since it is dealing with the actual utilization of an elective benefit. By the reference to III) D) 3) in III) D) 7), the definitions are consistent. See Practice Note – Q9.21.

9. Should a company with surrender charges defined as a percentage of the premiums deposited calculate its Standard Scenario Amount using lapse and margin assumptions for the surrender charge period even if a renewal deposit is small relative to the total policy value?

   A. The preferred method is to determine the margin and lapse rate for each premium and take a weighted average of the margin and lapse rates respectively based on the percentage of the account value resulting from each premium to the total account value resulting from all premiums. However, a company may treat an entire policy as still in the surrender charge period as long as any surrender charge remains on any part of the policy. This question is addressed in the Practice Notes – Q9.17.

10. How should margins in section III)D)1) be calculated for fixed funds after the surrender charge? It appears the result of b) would always be zero since the 2nd bullet will return a zero value for fixed funds, therefore the entire result would be the same as during the surrender charge period.

    A. If in fact the 2nd bullet point always produces a value of zero, the margin for fixed funds during and after the surrender charge will always be the same. This will likely be re-examined in 2006.

Smoothing and Transition:

11. If business is covered by a reinsurance agreement, how are the values used in the smoothing formulae determined for
    a. The ceding company
    b. The assuming company
    c. Within a retrocession agreement.

    A. For deferred annuities with no cash value option, or for reinsurance assumed through a treaty other than coinsurance, the actuary would typically use the policyholder account value of the underlying contract. For any business reinsured under a coinsurance agreement that complies with all applicable reinsurance reserve credit "transfer of risk" requirements, the ceding company shall reduce the value in proportion to the business ceded while the assuming company shall use an amount consistent with the business assumed.

12. Must values be determined consistently at the beginning and end of year?

    A. In all cases where 'cash value' is to be used, the values used must be computed on a consistent basis for each block of business at successive year-ends. The smoothing process takes a weighted average of two ratios – if those ratios are not on a consistent basis, the averaging will produce a meaningless number.

13. What values of RBC are used from the prior year (2004)?

    2004 ratio:
    [Interest risk on CARVM allowance (parts of LR006 lines11 & 12 generated by the CARVM allowance) plus Equity risk associated with VA GLBs (LR023 lines 23 & 28 in part) plus total reserve for VA (general and separate accounts)]
    divided by [total reserve** for VA (general and separate accounts)]

    2005 ratio:
    [TAR less C3 interest risk relating to fixed subaccounts included in the model used to compute TAR *** (part reported on line 34 per Q.1.)
    divided by [total cash value for VA (fixed and equity components)]

* The risk of CARVM non-recovery is included in the risks tested by modeling, and included in TAR. Including that value in the opening ratio is appropriate in coordination with the answer to Q 6 above.
** See answer to Q 14 regarding the permitted use of the cash surrender value in the 2004 ratio. See also Q 11 for a discussion of denominators.
*** The adjustment for C-3 risk is not needed if TAR is based on the Standard Scenario or if TAR is based on the CTE(90) results and the model is not integrated, that is, does not calculate both $C\text{-}1_{CS}$ equity risk and C-3 interest rate risk.

14. The instructions call for the use of cash value as the denominator in line 3, but call for reserve as the denominator in line 6. Doesn't this produce inconsistent numbers?

    A. Following the published instructions will produce an inconsistent result. For 2006, a consistent denominator will be required. Companies are encouraged to use Cash Value as the denominator for both ratios this year. This will produce a higher ratio for beginning of year, and therefore a higher smoothed number, resulting in higher required capital, but one that is internally consistent and consistent with the requirements for 2006.

15. What are the "reported statutory reserves for the same contracts for year-end 2004"? Are they just the separate account Exhibit 3 and general account Exhibit 5 CARVM reserves or do they also include the general account Exhibit 5 GMDB and GLB reserves?

    B. Based on the all inclusive nature of the definition of the TAR, the "reported statutory reserve" includes the Variable Annuity reserves held in SA Exhibit 3 and the general account Exhibit 5, including any reserve for GMDB and GLB.

16. Can a company elect not to smooth? Can the decision to smooth or not smooth be changed in future years?

    A. For year-end 2005 companies can elect whether or not to smooth. For companies who are using a dynamic hedging process, a significant amount of smoothing of results will occur from that process. The issue of changing in future years will be reviewed in 2006. A future change in the company's decision as to smoothing may include a requirement to obtain prior approval from the domiciliary commissioner.

17. The sum of the above 2004 amounts is converted to a percentage of the 2004 cash surrender value and then assigned an 80% weight in determining the 2005 ratio to be applied to the 2005 cash surrender value. Why then is the 2005 equivalent of the 2004 amounts still being calculated in 2005? In particular, why does page 54 of the RBC instructions still stipulate the same

calculation with respect to unitized separate account business with guarantees provided via guaranteed living benefits?

A. The retention of the instruction on page 54 was an oversight. That entire instruction should be ignored.

Tax Adjustment:

18. Should the Tax Adjustment (step 5 of the calculation) be done prior to smoothing (step 3)? When the Standard Scenario RBC exceeds that produced by the stochastic projection, the Tax Adjustment will always be included in step 5 and never smoothed. There may also be inconsistent results if in one year the TAR is based on the Standard Scenario, while in the immediately preceding or subsequent year it is based on a stochastic projection which includes a directly projected tax reserve.

    B. For 2005 the instructions should be followed, which means the Tax Adjustment will not be smoothed. Companies that project the tax reserve directly will not apply the Tax Adjustment and therefore for those companies, the smoothed value will be after tax. The order of the steps will be reviewed for 2006.

19. Is the Tax Adjustment appropriate for the 2004 values?

    A. No, the Tax Adjustment is not applied to the 2004 values.