A PUBLIC POLICY PRACTICE NOTE

Asset Adequacy Analysis

September 2017

Developed by the Asset Adequacy Analysis Practice Note Work Group
of the American Academy of Actuaries

American Academy of Actuaries
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The American Academy of Actuaries is a 19,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 50 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

ASSET ADEQUACY ANALYSIS PRACTICE NOTE

This practice note is not a promulgation of the Actuarial Standards Board, is not an actuarial standard of practice (ASOP), is not binding upon any actuary and is not a definitive statement as to what constitutes generally accepted practice in the area under discussion. Events occurring subsequent to this publication of the practice note may make the practices described in this practice note irrelevant or obsolete.

This practice note was prepared by a work group organized by the Life Valuation Committee of the American Academy of Actuaries (Academy). The work group was charged with updating the 2004 practice note (which itself replaced the original 1995 practice note) regarding asset adequacy analysis practices used by appointed actuaries in the United States.

The practice note represents a description of practices believed by the work group to be commonly employed by actuaries in the United States. The purpose of the practice note is to assist actuaries who are faced with the requirement of asset adequacy analysis by supplying examples of some of the common approaches to this work. In addition, references have been made to other relevant and readily available literature. However, no representation of completeness is made, nor is there an assertion as to whether the practices discussed herein constitute best practice; other approaches may also be in common use.

This practice note reflects the results of a survey of actuaries who practice in jurisdictions in which the model Standard Valuation Law (SVL) of the National Association of Insurance Commissioners (NAIC) applies. To the extent that the laws of a particular state differ from the NAIC model, practices described in this practice note may not be appropriate for actuarial practice in that state.

Comments are welcome as to the appropriateness of this practice note, desirability of periodic updating, validity of substantive disagreements, etc. Comments should be sent to lifepolicyanalyst@actuary.org.

ASSET ADEQUACY ANALYSIS PRACTICE NOTE

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Section A: Introduction and Background

Q1. What current practices are the basis of this practice note?

Starting in 1986, actuaries have been performing asset adequacy analysis for certain annuity and other interest-rate-sensitive lines of business under the requirements of New York Regulation 126. The types of business subject to asset adequacy analysis expanded into all other product lines because of the adoption of the Actuarial Opinion and Memorandum Regulation (AOMR) and the release of several Actuarial Guidelines requiring stand-alone asset adequacy analysis. Many practices have been developed in response to these regulations and guidelines.

To better understand current practice, the Society of Actuaries Smaller Insurance Company section sponsored a survey in 2012 (in a manner similar to the survey referenced in the 2004 version of this practice note) on the practices followed by appointed actuaries. These survey results are incorporated into this practice note. Below is a breakdown of the survey respondents by company size (level of reserves):

Level of Reserves	Responses	% of Total
More than $25B	24	13%
$10B–$25B	17	9%
$5B–$10B	16	9%
$1B–$5B	39	21%
Less than $1B	88	48%
TOTAL	184	100%

It should be noted that, where appropriate, we have used certain results from the 2004 survey.

Q2. Is this practice note expected to become a standard that actuaries must follow?

No. This practice note documents what is understood to be current practice at the time of publication and is based upon the knowledge gained from surveys and supplemental discussions held by members of the work group. It is a reference guide to aid appointed actuaries and other members of the Academy. The work group assumes no responsibility for any action taken as a result of using the information contained in this practice note.

There are several reasons why an actuary could elect to use methods other than those documented within this practice note, including:

- The actuary could be aware of special circumstances pertaining to a particular company or block of business that warrant the use of other methods.

- The economic conditions that exist at the time the actuarial opinion is to be made may warrant practices and/or methodologies not contemplated in this note.

- The actuary may have developed other acceptable testing methods.

- While the practice note was prepared and reviewed by actuaries familiar with the topic of the practice note, and these actuaries have concluded that the practice note represents approaches that fall within current practice, other approaches that could properly be termed "current practices" may not be documented here.

Q3. What is the goal of asset adequacy analysis?

The goal of asset adequacy analysis is to ascertain the ability of a block of assets to support a corresponding block of liabilities, taking into account the cash flows associated with the assets and liabilities, as well as interactions among the cash flows (e.g., asset returns may impact liability crediting rates)..

Some actuaries may view the value of asset adequacy analysis to be limited to the satisfaction of regulatory requirements. Other actuaries may value asset adequacy analysis additionally for its ability to inform management of actual or possible problems that may arise due to the underlying characteristics or current management of the business. In fact, many regulators take a keen interest in how the asset adequacy results are communicated to management. The regulatory asset adequacy issues summary (RAAIS)—refer to Q102—is used by some actuaries for communication with management as well as regulators.

There are a number of regulations and guidelines that require asset adequacy analysis, including but not limited to:

- 2001 Actuarial Opinion and Memorandum Regulation (2001 AOMR)
- Valuation of Life Insurance Policies Model Regulation
- New York Regulation 126
- 2001 CSO Model Regulation
- Actuarial Guideline XXXVIII (Application of the Valuation of Life Insurance Policies Model Regulation)
- Actuarial Guideline XLIII for Variable Annuities (AG43)

Q4. How is an asset (reserve) adequacy analysis different from a solvency test?

The 2001 AOMR (Section 6B(6)) asks an actuary to opine, in certain circumstances, that

> the reserves and related items, when considered in light of the assets held by the company with respect to such reserves and related actuarial items … make adequate provision, according to presently accepted actuarial standards of practice,

for the anticipated cash flows required by the contractual obligations and related expenses of the company.

Thus, the 2001 AOMR opinion is an opinion related to the ability of the assets backing reserves to meet policyholder obligations and expenses. There are two key differences between asset adequacy analysis and a solvency test:

- A solvency test is more inclusive, as all of the assets (including capital) and liabilities of the company are included in a solvency test.

- A solvency test typically requires a higher degree of certainty (e.g., 95%) than what may be necessary for asset adequacy analysis (e.g., 67%–83%, refer to Q91 and other material in Section J: Analysis of Results).

There is no requirement in either the ASOPs or the model SVL to test for a company's solvency in connection with the actuarial opinion that is filed with the statutory annual statement. However, as reserves are typically the largest liability of a life insurance company, asset adequacy analysis may be one of the tools used in assessing the overall financial health of life insurance companies. Risk-based capital (RBC) ratios also serve as a leading indicator of overall financial health.

Q5. What resources are available to assist the appointed actuary in understanding the requirements of asset adequacy analysis?

Actuarial firms, associations, and regulatory bodies have developed and maintained numerous resources to assist the appointed actuary in understanding the requirements of asset adequacy analysis. The primary providers of these resources include the Society of Actuaries (SOA), the Academy, the NAIC, and state regulatory bodies.

Valuation Actuary Symposium: The SOA sponsors the Valuation Actuary Symposium. This annual meeting provides the appointed actuary with practical information about anticipated regulatory changes that will impact the asset adequacy analysis process. The symposium also provides the appointed actuary with a forum to discuss issues with groups of peers or with recognized experts. These meetings are recorded to provide a useful resource for those not attending the symposium. The SOA also sponsors periodic continuing education sessions on specific topics related to asset adequacy analysis, including modeling. Other available resources include SOA section newsletters such as *The Financial Reporter* and recordings of SOA meetings.

Actuarial Standards of Practice (ASOPs) / Actuarial Compliance Guideline (ACG) No. 4: The Academy, through select ASOPs adopted by the Actuarial Standards Board, provides resources to assist the appointed actuary in asset adequacy analysis. In addition, ACG No. 4 focuses on statutory statements of opinion not including an asset adequacy analysis (Section 7 of the 1991 AOMR / New York Regulation 126).

Among the current ASOPs that discuss considerations for the appointed actuary performing asset adequacy analysis are:

- ASOP No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*
- ASOP No. 11, *Financial Statement Treatment of Reinsurance Transactions Involving Life or Health Insurance*
- ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*
- ASOP No. 23, *Data Quality*
- ASOP No. 41, *Actuarial Communications*

Life and Health Valuation Manual: The Academy also publishes a Life and Health Valuation Manual each year. This publication provides a state-by-state summary of valuation standards and provides a one-stop source for model laws and Actuarial Guidelines pertaining to valuation requirements.

National Association of Insurance Commissioners: The NAIC maintains information on model law adoption, as well as drafts of proposed legislation on its website. This information is intended to be an up-to-date source that can be used by the appointed actuary to determine whether new requirements that may impact the analysis process have been approved. In particular, the NAIC recently adopted a Valuation Manual that includes new requirements and guidance for the appointed actuary. The NAIC also provides educational information to state insurance department personnel regarding the work done by the appointed actuary. In addition, the *Accounting Practices and Procedures Manual* contains information useful for the appointed actuary.

State Regulatory Bodies: A few state regulatory bodies (New York and California, for example) currently provide the appointed actuaries of companies licensed in those states an annual letter describing specific considerations, requirements, and expectations related to asset adequacy analysis.

The remainder of this practice note is intended to be a resource to the appointed actuary by providing information regarding current practices in asset adequacy analysis.

Section B: Procedures for Accepting/Resigning the Position of Appointed Actuary

Q6. What are procedures that an actuary follows in accepting or resigning a position as appointed actuary?

The AOMR (Section 5B) defines a "qualified actuary." Section 5C identifies certain steps in the appointment process: "Assuming the actuary is qualified, the regulation states that a company shall give the commissioner of insurance timely written notice of the name of the appointed actuary, title (and, in the case of a consulting actuary, the name of his or her firm), and manner of appointment. … If an appointed actuary replaces a previously appointed actuary, the notice shall so state and give the reasons for replacement."

The AOMR does not contain procedures for the actuary to follow when accepting or resigning the position; however, some states (for example, New York and Ohio) have additional requirements in their versions of the regulation.

According to the *Code of Professional Conduct*, Annotation 10-5, when an actuary consults with a previous appointed actuary, the previous actuary "shall cooperate in furnishing relevant information, subject to receiving reasonable compensation for the work required to assemble and transmit pertinent data and documents."

Section 3.2 of ASOP No. 22 instructs a prospective appointed actuary to determine that he or she meets the requirements of the Academy's *Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States*. According to Section 3 of the Qualification Standards, this includes the Specific Qualification Standards, as well as the General Qualification Standard. Section 3.2 of ASOP No. 22 also requires that the acceptance of, or withdrawal from, the position be in writing.

VM-30 *Actuarial Opinion and Memorandum Requirements* of the NAIC's Valuation Manual (VM-30) includes some changes to the AOMR. There are additional requirements when the appointed actuary is replaced by action of the board. According to Section 2A(2), the insurer will be required to notify the insurance department in the state of domicile within five business days of the event. According to Section 2A(3), within 10 business days, the insurer is also required to provide a separate letter stating whether in the 24 months preceding such event there were any material disagreements with the former appointed actuary regarding the content of the opinion, and cites additional steps to be taken.

Q7. What information may the appointed actuary wish to obtain from the previous appointed actuary?

Prior to accepting the position as appointed actuary, some actuaries believe that it is prudent to meet with the most recent appointed actuary of the company to review: (1)

reasons for the appointed actuary's termination and (2) the most recent actuarial opinion and supporting memorandum and documentation. This may inform the actuary of any items of concern to the previous appointed actuary (e.g., inadequate access to management or the board of directors, the qualifications of the persons or firms providing major reliance, or adverse scenarios in the cash flow testing (CFT) performed). Such a meeting could take place even if not required by a particular state.

Q8. What is the relationship between the appointed actuary and the board of directors?

The AOMR states that either the board of directors or an executive officer of the company acting under the board's authority is responsible for choosing the appointed actuary. The following is a list of questions that some actuaries consider prior to accepting the position as appointed actuary:

- Will the actuary be permitted to appear before the board of directors to present the statement of actuarial opinion and supporting memorandum, if the actuary wishes to do so?
- If the statement of actuarial opinion and supporting memorandum are presented to the board by a person other than the appointed actuary, is there assurance that the opinion and supporting memorandum will be presented in their entirety and will not be amended or edited by the third party?
- Will the actuary be permitted to meet with the board of directors at such other times as the actuary believes appropriate in order to communicate problems that may emerge between the annual statements of opinion?
- Will the board of directors agree to keep the actuary informed of certain transactions or conditions specified by the actuary via an agreed-upon process (e.g., attendance at board meetings, copies of board minutes and agendas)?
- Will the actuary have access to information, records, and members of company management as necessary to perform the duties of the appointed actuary?
- Will the resources required to fulfill the actuary's duties (e.g., electronic data processing, support staff) be made available?
- Will the board (or its designee) agree to make available such persons or officers identified by the actuary that the actuary may need to rely upon to form the opinion (e.g., the investment officer or the administrative officer)? If the requested persons or firms refuse to be relied upon or are found to be unqualified, will the actuary be permitted to consult with the board of directors regarding alternative resources?

Some appointed actuaries inform the board of directors and/or senior management of the results from asset adequacy analysis. According to the 2012 survey, asset adequacy analysis results are presented to the following:

Chief Actuary	65%
Chief Financial Officer	70%
Other Senior Management	77%
Board of Directors	55%

In addition, VM-Appendix G, *Corporate Governance Requirements for Principle-Based Reserves* of the NAIC's Valuation Manual (VM-G), covers corporate governance guidance for valuations performed under principle-based reserves (PBR). Section 2 provides guidance for the board of directors, Section 3 provides guidance for senior management, and Section 4 provides guidance for qualified actuaries, including the appointed actuary. All three parties mentioned will have responsibilities with regard to corporate governance for PBR valuations, and communication among the parties will be essential.

Q9. What documentation is provided with regard to the appointed actuary's personal qualifications?

Qualification requirements are addressed in the Academy's *Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States*. The Qualification Standards include basic education requirements, experience requirements, and continuing education requirements; Section 6 of the Qualification Standards includes requirements to keep timely records of continuing education. In addition to those requirements, the actuary may wish to document his or her personal breadth and depth of knowledge regarding the products, markets, and strategies of the particular company and, in doing so, identify areas where support or reliance may be needed to allow the actuary to perform his or her duties as appointed actuary.

Section C: General Considerations for Performing Asset Adequacy Analysis

Q10. How does the actuary decide what to test?

According to the 2010 AOMR, Section 5E, the opinion "shall apply to all in force business on the statement date." According to Section 3, the opinion must be based on asset adequacy analysis. So, it follows that asset adequacy analysis applies to virtually all policyholder reserves and claims liabilities, subject to the following considerations.

According to ASOP No. 22 (Section 3.3.4.c.), "For a reserve or other liability to be reported as not analyzed, the actuary should determine that the reserve or other liability amount is immaterial." (Section 6A(2) of the AOMR still identifies items not analyzed.) Guidance on materiality is provided in Section 7 of the Preamble to Statutory Accounting Principles (i.e., "Is this item large enough for users of the information to be influenced by it?").

A possible measure of materiality a percentage of total reserves. Five percent is mentioned in a letter to appointed actuaries dated Nov. 3, 1994, from the Illinois Department of Insurance. Another possible measure is a fixed dollar limit in determining materiality, considering other financial information of the company. In addition, the actuary may want to do a closer inspection of any product with an immaterial reserve to confirm that the reserve properly reflects the significant risks of the product, if any. Actuaries could evaluate materiality at a product level and/or in aggregate. In the final analysis, the actuary may exercise professional judgment to confirm that inclusion of "immaterial" amounts that have been excluded from the analysis would not result in different findings in his or her actuarial opinion, report, or recommendation.

In the 2012 survey of appointed actuaries, approximately 80 percent of the respondents indicated that they exclude 5 percent or less of the general account liabilities from testing. For separate account liabilities, about 67 percent of the respondents that have separate account liabilities exclude 1 percent or less of those liabilities. Specific lines that have been excluded by survey respondents are listed below, mostly due to the relative immateriality in the context of the respondent's book of business:

- Group business
- Accident and health
- Supplementary contracts
- Accidental death benefit
- Waiver of premium and disability riders
- Other supplemental benefits
- Claim reserves

Q11. What methods are used when performing asset adequacy testing?

As indicated by the responses to the 2012 survey of appointed actuaries, the most commonly used method in asset adequacy analysis is CFT (see ASOP No. 7).

The survey responses exhibited the following percentage breakdown of average tested reserves by asset adequacy method:

Cash flow testing	86%
Gross premium valuation	6%
Demonstration of conservatism	2%
Risk theory techniques	1%
Loss ratio	1%
Other	4%

Although asset adequacy analysis does not necessarily imply CFT, the actuary, exercising professional judgment, may decide that CFT is the most appropriate methodology for certain lines of business. For instance, the product design of universal life and deferred annuity lines of business generally renders their reserves sensitive to fluctuations in interest rates. According to ASOP No. 22, Section 3.3.2, "cash flow testing is generally appropriate where cash flows of existing assets, policies, or other liabilities may vary, or where the present value of combined asset, liability, or other cash flows may vary under different economic or interest-rate scenarios." For certain purposes, such as to aggregate results of several lines of business, it may be useful to cash flow test certain non-interest-sensitive lines of business, such as term life insurance, in a manner consistent with interest-sensitive lines. There could also be a desire for consistency under X-factor testing (e.g., sensitivity test mortality on a consistent basis for universal life and traditional life). If the appointed actuary aims to treat results in aggregate, such as using positive cash flow from a non-interest-sensitive line of business to offset a deficit in an interest-sensitive line of business or incorporating overhead expenses at a company level, a consistent CFT approach across all lines may be the preferred method to determine asset adequacy.

However, as is indicated in the above table, CFT is not the only acceptable method for testing the adequacy of reserves. ASOP No. 22, Section 3.3.2, goes on to say that "asset adequacy test methods other than cash flow testing may be appropriate in other situations." The actuary may also wish to consider Sections 3.2.1 and 3.2.2 of ASOP No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*, which address the relative appropriateness of CFT in various situations.

Section 3.3.2 of ASOP No. 22 lists several alternative approaches that may be appropriate methods, depending on the circumstance. These include the following:

Gross Premium Valuation. A gross premium valuation (GPV) involves a projection of the liability premiums, benefits, and expenses. It determines the value of a book of business based on the present value of the benefits and expenses less gross premiums. A liability model is necessary, along with a projection based on that model and reasonable

assumptions, but an asset projection is not needed. (See Q21 for discussion of setting the discount rate.) The appointed actuary may have already developed liability models, or may have access to models that others in the company have developed for pricing or other internal purpose. A GPV may be appropriate where the policy and other liability cash flows are sensitive to moderately adverse deviations in the actuarial assumptions underlying these cash flows but are not sensitive to changes in interest rates (see ASOP No. 22 for an example).

Demonstration of Conservatism. Some actuaries demonstrate asset adequacy through the conservatism found in some reserves, that is, where the actuary considers the degree of conservatism in the reserves to be so great that moderately adverse deviations in the actuarial assumptions underlying the policy cash flows are covered. For example, this type of method may be appropriate for a block of older life insurance if that block is reserved using conservative valuation interest rates and mortality/morbidity tables. In this case, demonstration of conservatism could be observed as the valuation rate being moderately lower than the ultimate reinvestment rate in any scenarios that might be considered. Another example that may be appropriate for this type of method is with respect to policies reserved for using a Principle-Based Approach (PBA). In this case, the assumptions used in the valuation (including interest rate paths of a stochastic scenario path) or the method (e.g. CTE70) used to determine the reserve may be judged by the actuary to meet a moderately adverse degree of conservatism. (See Section L for further discussion.) Nevertheless, if there is any doubt about the level of conservatism not being at least moderately adverse, most actuaries may prefer to use one of the other methods described herein.

Risk Theory Techniques. If the liability under consideration is short term in nature, risk theory techniques may be sufficient to demonstrate asset adequacy. For instance, risk theory might be appropriate for a short-term disability coverage that is supported by short-term assets. Probabilities of continuance of disability claims can be calculated based on a distribution developed from historical claim experience. The parameters of the function associated with this probability distribution can be varied to develop the sensitivities under moderately adverse deviations. Given the short-term nature of the assets assigned to back their liabilities, it may be appropriate to ignore the effect of interest.

Loss Ratio Methods. Loss ratio methods may be appropriate for short-term health insurance business, assuming that the supporting assets are also short term. Aggregate incurred health claims could be estimated by applying estimated loss ratios to earned premiums. Again, various moderately adverse deviation sensitivity tests can be developed to ascertain asset adequacy.

Q12. What are the primary differences between cash flow testing and gross premium valuation?

GPV is described in Q11. In a GPV, the value of the liability is calculated as the present value of the projected benefits and expenses less gross premiums. The projection of these

liability cash flows is generally the same as in CFT, with the complexity of modeling depending on the material risks in the liability. However, unlike CFT, a projection of asset cash flows is not developed. As the asset cash flows are implicitly provided for through the use of discount rates in the calculation of present values, GPV models tend to be somewhat simpler than those used for CFT. So, they may be set up and managed on a less structured platform, such as a simple spreadsheet model.

A GPV may be appropriate when the liabilities are not interest sensitive and when the asset cash flows are either not interest sensitive or can be reasonably represented by varying the discount rate. Term life, whole life, disability income, long-term care, major medical, Medicare supplement, and accidental death and dismemberment are examples of insurance products for which GPV has been used to test asset adequacy. CFT may be more appropriate where cash flows vary significantly under different economic or interest rate scenarios. A simple GPV typically cannot indicate when there are interim cash flow or duration mismatches in the portfolio.

A GPV is generally validated in the same manner as is CFT. The 2004 survey of appointed actuaries indicated that most appointed actuaries do a static validation of a GPV, where opening balances of the models are checked against actual inforce. About half also conduct certain dynamic validations (refer to Q19 for further information), where projections from the model are compared against financial forecasts.

Approaches taken to reflect reinsurance generally apply to GPV as they would for CFT.

Q13. Are different lines of business aggregated for purposes of asset adequacy analysis?

The board of directors for each company names one appointed actuary for that company. In general, the appointed actuary opines on the adequacy of the company's reserves in the aggregate. Thus, lines of business, such as life insurance, annuities, and health, may be combined. As a practical matter, actuaries commonly perform tests by groupings, such as major product lines or business units. These product or business units may not necessarily correspond with annual statement lines of business.

The 1991 AOMR allowed aggregation of reserves and assets before analyzing the adequacy of the combined assets to support the combined liabilities. It also allowed aggregation of the results of separate asset adequacy analyses if the appointed actuary has determined that the results are developed under consistent economic scenarios and the business is subject to mutually independent risks. Specifically, it allowed redundancies in one line to offset deficiencies in another, provided that either (1) the results have been developed using consistent economic scenarios, or (2) the lines involve mutually independent risks.

The 2001 AOMR (which is in effect in most states as of the date of this practice note) does not give precise guidance on aggregation, although it refers to "aggregate reserve"

and "aggregate surplus." Some states have different requirements related to aggregation across major lines of business, some of which require approval for aggregation, or do not permit aggregation in certain circumstances.

Because there is no uniform guidance regarding aggregation across lines of business for determining reserve adequacy, aggregation practices vary. The following table summarizes responses to the 2012 survey of appointed actuaries regarding aggregation for modeling purposes and to determine reserve adequacy:

	Measurement of Reserve Adequacy		
Model Runs	In Aggregate	By Line of Business	Smaller Blocks
In Aggregate	√		
By Line of Business	√	√	
Smaller Blocks	√	√	√

Product lines often subject to stand-alone reserve adequacy included long-term care, certain types of UL with secondary guarantees, separate account products, life insurance, group life, annuities, and health (due to the gross premium floor). Stand-alone testing is now required for certain products or lines of business in many states.

When reviewing interim (year-by-year) results, 80 percent of the 2012 survey respondents indicated that they aggregate reserves in the same manner as they do when reviewing terminal (end of projection horizon) results. Among those who aggregate differently, 14 percent aggregate at the major line of business level, 4 percent aggregate at the total company level, and 2 percent aggregate at the block of business level.

When aggregating the results of asset adequacy analysis of various lines of business, many actuaries believe it is usually desirable to have consistency among the economic scenarios used for each of the lines of business. If different projection periods are used for the lines being combined, then the results typically can be aggregated at a common valuation point. For this aggregation approach, some actuaries project each line separately and discount the excess of the ending market value of assets less liabilities back to the projection date, in order to get results that may be combined on a consistent, scenario-by-scenario basis.

If different analysis methods are used to determine the asset adequacy for various lines of business (e.g., GPV for some and CFT for others), it may be inappropriate to combine results unless consistent economic scenarios are used. GPV results usually can be aggregated with CFT results when consistent economic scenarios are used for each of the lines of business, even if different projection periods are used.

Q14. How are assets allocated among lines if cash flow testing is done separately for each line?

Many states require that any assets contractually allocated to a specific line for a special purpose (such as by reinsurance treaty or separate account) be allocated to that line for CFT. Beyond that, if the company has segmented assets by line of business (formally or notionally), then the allocation of assets to these segments may represent one good place to start. Similarly, some states require that "pledged" or "encumbered" assets be excluded from the assets available to support reserves. Assets cannot be allocated to multiple liabilities at the same time.

To the extent that the actuarial opinion covers all lines of business, it may be appropriate to assign assets differently from how they were allocated under an asset segmentation arrangement. However, to be prudent, the actuary would usually confirm that the same assets are not used for multiple liabilities.

Some actuaries take a pro-rata slice of each asset in proportion to the reserves of each line, although this method may not be preferred if the characteristics (e.g., effective duration) of the liabilities differs materially between lines.

Actuaries may also use different methods of asset allocation at different levels of modeling or testing. For example, while a company may have a single formal asset segment for interest-sensitive business, the actuary may choose to refine the allocation within the segment by duration for universal life, deferred annuities, and payout annuities.

Thus, the 2012 survey of appointed actuaries allowed respondents to specify more than one method for allocating assets by line of business:

Formal segmentation	67%
Pro-rata of all assets	37%
Other	15%

The most common "other" method is to allocate assets specifically to achieve a better matching of asset and liability cash flows. Also, many companies use some combination of these three methods at different levels.

Many actuaries maintain reasonable consistency from year to year in the method of allocating the assets to product lines. If a significant change in allocation method is made, the appointed actuary may consider documentation of the change and related impact on the asset adequacy results.

Q15. Can the actuary use a testing date prior to Dec. 31 for the purpose of the year-end actuarial opinion?

Because it can be difficult to complete an asset adequacy analysis in time for the March 1 deadline using year-end data, it may be common to use data from a prior date. ASOP No. 22 (Section 3.3.4) gives guidance for using data prior to year-end in an asset adequacy analysis, and states that "The actuary should document the reasonableness of such prior period data, studies, analyses, or methods; that key assumptions are still appropriate; and that no material events have occurred prior to the valuation date that would invalidate the asset adequacy analysis on which the actuary's opinion is based."

Approximately 60 percent of the respondents to the 2012 survey of appointed actuaries indicated they base their testing on a liability as-of date earlier than Dec. 31, with 93 percent of those using a date of Sept. 30 and the remainder using a later date. Comparable responses were provided regarding the as-of date for assets, and there is evidence of occasional differences between the valuation dates of inforce assets versus liabilities.

When an actuary chooses a testing date earlier than the valuation date, the actuary may wish to provide a demonstration that there have been no material changes between the two dates. To make this demonstration, an actuary may compare assets by asset category for the testing date versus year-end, considering the mix of assets and the nature of assets (e.g., duration, yield, type). Similarly, an actuary may compare the size of the liabilities by type and the nature of the liabilities (e.g., average size, policy counts, mix) as of the two dates. Some actuaries consider changes in the interest rate curve, equity movements, and the level of investment reserves between the testing date and year-end. Also, some may use additional sensitivity scenarios where the Dec. 31 yield curve is applied to earlier data.

From the 2012 survey of appointed actuaries, following is a summary of the percentage of respondents who use the respective methods to demonstrate whether there have been material changes between the testing date and the valuation date:

Change in liability volume	73%
Change in liability mix of business	69%
Change in asset volume	56%
Change in asset mix	79%
Changes in AVR, IMR, or DTA	27%
Change in yield curve	87%
Other (including spreads)	12%

With respect to the issue of changes in the yield curve, about one-third of the respondents indicated they use the year-end yield curve, while most of the rest use the yield curve for an earlier date. However, 40 percent of the respondents said they "look at yield curves as of the annual statement date," while 30 percent of the respondents said they "look at yield curves as of the opinion signing date." Of that 70 percent of the respondents, most indicated that they use some combination of interpolation, sample testing, sensitivity

testing, or full retesting to calculate the impact of the change in yield curve, depending on the materiality of the change and other circumstances.

Q16. How do actuaries interpret "moderately adverse conditions" in asset adequacy analysis for purposes of compliance with ASOP No. 22?

Item 3.4.2 of ASOP No. 22 states the following:

> When forming an opinion, the actuary should consider whether the reserves and other liabilities being tested are adequate under moderately adverse conditions, in light of the assets supporting such reserves and other liabilities. To hold reserves or other liabilities so great as to withstand any conceivable circumstances, no matter how adverse, would usually imply an excessive level of reserves or liabilities.

Item 2.15 of ASOP No. 22 defines "moderately adverse conditions" as follows:

> Conditions that include one or more unfavorable, but not extreme, events that have a reasonable probability of occurring during the testing period.

Some actuaries believe this item implies that asset adequacy analysis would ordinarily be performed with at least one scenario or set of conditions that are more adverse than current conditions. Although ASOP No. 22 does not call for reserves to be adequate under extreme or worst-case conditions, some actuaries would say that reserves have not been adequately tested if testing conditions assume that all situations will get less adverse and no situation will be more adverse than the present. Many actuaries consider moderately adverse conditions applicable to several assumptions within a scenario, not just one assumption.

Also, some actuaries consider the current economic environment when determining what constitutes "moderately adverse conditions." For example, in a period of very low interest rates, some actuaries would view several of the decreasing scenarios required by New York Regulation 126 (such as the falling scenario and the pop-down scenario) as going beyond the definition of "moderately adverse conditions." This is particularly true when considering a long projection period, such as 20 years or more. But in times of high interest rates, some actuaries would view these decreasing scenarios as an appropriate level of moderately adverse conditions.

Finally, some actuaries interpret moderately adverse conditions by looking at the conditions and assumptions used for each scenario, rather than by looking at the financial results coming out of the scenarios. The same conditions can produce adverse results for one type of business or risk profile and favorable results for another, and two types of business might offset each other to some extent.

Section D: Modeling Considerations – General

Q17. What modeling platforms are used to model liabilities?

Based on the results of the 2012 survey, there were 15 commercial software packages used by the respondents for the liability projections. The 2012 survey responses also indicate that internally developed systems or internally developed spreadsheets are commonly used by companies to model a portion of the liability cash flows.

See Q41 for a discussion of platforms used to model assets.

Q18. How long are the projection periods used by actuaries?

ASOP No. 22 (Section 3.3.4.b) states the following: "Asset adequacy should be tested over a period that extends to a point at which, in the actuary's professional judgment, the use of a longer period would not materially affect the analysis."

Approximately 52 percent of the respondents in the 2012 survey indicated that they do not establish a projection period using criteria based solely on the extent of the original liabilities that are expected to mature. Of the 48 percent who responded that they do use a materiality level to determine the length of the projection period, 75 percent use a materiality level of 90 percent.

Approximately 45 percent of the 2012 survey respondents indicated they use the same projection period for all products. Relative to these respondents, 50 percent use a projection period of 21–30 years, 12 percent use a projection period of 31–40 years, and 23 percent use a projection period of more than 40 years.

The 55 percent of 2012 survey respondents who use different periods by product responded offered additional usage details, summarized in the following. Percentages noted are based on the responses that indicated different projection periods by product:

- The most common period for individual traditional life products is 21–30 years, including term insurance and permanent insurance, whether par or nonpar (39 percent). However, 28 percent of the respondents used a period longer than 40 years.

- For individual fixed deferred annuities, 41 percent use between 21 and 30 years, while 32 percent use 11–20 years. Of group annuities, 50 percent use 20 years or less, but about one-third use greater than 40 years. Fixed payout annuities and structured settlements had longer periods. Of payout annuities, 39 percent use more than 40 years, although 33 percent use 21–30 years. Of structured settlements, 73 percent use more than 40 years. In the 2004 survey, in contrast, 70 years was the most common projection period for structured settlements.

- For universal life with secondary guarantees, 46 percent of companies use more than 40 years.

- For other universal life, 85 percent use 21 years or more, but were fairly evenly divided among the 21–30-, 31-40-, and greater-than-40-year groupings.

- Health products other than long-term care and disability tend to use shorter periods, with 75 percent being 30 years or less and fairly evenly divided among the less than 20, 11–20 and 21–30 time periods for other health. Disability insurance is somewhat longer, with 41 percent using greater than 40 years and 27 percent using 21–30 years.

- Long-term care had longer periods as well, with 63 percent of respondents using more than 40 years.

Q19. What types of model validation do appointed actuaries perform?

In the 2012 survey of appointed actuaries, 88 percent of the respondents stated that they perform static validations, such as comparing opening balances, policy counts, and other key metrics against actual amounts.

Dynamic validations are performed by 51 percent of the respondents. In a dynamic validation, the actuary compares projections coming from current models against recent actual results (retrospective) or financial forecasts, such as company plan. Furthermore, some actuaries compare actual results with the prior year's models in order to improve current models.

In addition to static and dynamic validations, some actuaries perform attribution analysis, during which the actuary performs a step-by-step analysis of the change from the prior year's models to the current year to confirm that the model appropriately reacts to changes in inforce, actuarial assumptions, and/or macroeconomic conditions. Depending on the use, attribution analysis is performed using either deterministic or stochastic scenarios.

Q20. How is the discount rate determined that is used to calculate the present value of ending surplus at the valuation date?

There are currently several methods used to determine a discount rate. One is to use the pre- or after-tax earnings rate (i.e., the average investment earnings rate) over the projection period used in each scenario, either including or excluding the impact of policy loan interest. Another method is to rerun the scenario adding $1,000 (or 1 percent) to the initial assets. The change in the ending difference can be used to determine the discount rate for that scenario. Another alternative is to use the pre- or after-tax Treasury spot rates for the length of the projection period—e.g., 20 years—which is generated under each scenario. Although outlier discount rates may distort the present values, only 22 percent of actuaries use floors, caps, or other methods to minimize such distortions.

From the 2012 survey of appointed actuaries, approximately 15 percent of the respondents indicated they do not calculate a present value of ending surplus. Of those who do, below is a summary of the methods used to determine the discount rate:

After-tax earnings rate, including policy loan interest	36%
After-tax earnings rate, excluding policy loan interest.	24%
After-tax Treasury spot rates for the length of projection period	4%
Pre-tax earnings rate, including policy loan interest	6%
Pre-tax earnings rate, excluding policy loan interest	4%
Pre-tax Treasury spot rates for the length of projection period	6%
Rerun the scenario with additional initial assets, determine discount factor based on change in surplus	4%
Other	16%

In the above table, "other" methods include such items as:

- A single specified rate
- Pre- or after-tax new money rates

Q21. How does the actuary set the discount rates for a gross premium valuation?

The discount rate used in determining the present values of a given scenario is generally consistent with the expected earned rate on the assets backing the liabilities for that scenario. Some actuaries use a level net earned rate based on a recent average portfolio yield of the assets (use of pre-tax or after-tax rates may relate to treatment of taxes within the model). Another method in use is to derive the discount rate curve from the projected after-tax net earned rate of the actual assets in the portfolio and purchased based on the investment strategy. For conservatism, some actuaries set the earned rate used for discounting purposes lower than the rate earned by the company's assets.

Sometimes a single-level discount rate will be used for a given scenario. However, if new money rates have recently moved or are expected to change going forward within the scenario being tested, some actuaries consider a change in the discount rate over time. If future new money rates are expected to be lower than the rate currently earned on the current assets, then the discount rate generally could be assumed to decline over time as the liabilities increase or as assets roll over and earn future new money rates due to maturities, calls, or prepayments. The discount rate may also be subject to a floor (e.g., 0 percent) determined by the actuary. If the scenario has new money rates rising, the discount rate might be increased over time. If changes in asset yield for a material block of business cannot be adequately modeled through the use of discount factors, some actuaries consider using CFT instead of GPV.

Some actuaries test the option risk in assets (e.g., calls) by assuming an immediate drop in the discount rate used in the GPV. The drop test is often set as severe as needed to represent a drop in earned rate that would occur if all options were exercised.

Q22. The AOMR states that the interest maintenance reserve (IMR) should be used in asset adequacy analysis. Why?

The IMR is part of the total reported statutory reserves. The IMR typically defers recognition of the portion of realized capital gains and losses resulting from changes in the general level of interest rates. These gains and losses are amortized into investment income over the expected remaining life of the investments sold, rather than being recognized immediately. This amortization is after tax.

The purpose of the IMR usually is to maintain the original matching between assets and liabilities that might be weakened by the sale of an asset. Originally, it was anticipated that the IMR would be allowed to become negative, as long as the asset adequacy analysis showed that the total statutory reserves, including the negative IMR, were sufficient to cover the liabilities. However, a negative IMR is not an admitted asset in the annual statement. So, some actuaries do not reflect a negative value of IMR in the liabilities used for asset adequacy analysis.

In the 2012 survey of appointed actuaries, more than 80 percent of the respondents indicated they include the IMR in their testing. Some actuaries use a starting IMR of zero if IMR is negative. Other actuaries use negative IMR to adjust starting assets and therefore model future lower asset yields than if zero IMR were assumed. Half of the respondents who indicated they used IMR in testing also indicated they lower assets by the absolute value of a negative IMR balance; the other half indicated they use a value of zero for the starting IMR if it is negative at the beginning of the projection period. There is no prohibition regarding the use of negative IMR within asset adequacy analysis. So, a number of actuaries allow the IMR to fall below zero within the testing period. About 60 percent of actuaries responding to the survey indicated they do not have to deal with a negative IMR.

Q23. How does the actuary determine which portion of the IMR can be used to support certain products? How is the portion of the IMR used?

If the actuary allocates the assets and IMR by line, then one possible approach is line of business-level inclusion of starting assets in the amount of the unamortized portion of the IMR relating to those assets that were owned by the line prior to being sold. Another possible approach is the allocation of company-level IMR proportionately to starting assets. An advantage of this second approach is that it is generally simpler, while a disadvantage is that longer liabilities probably have longer assets, which usually produce higher capital gains when sold, after a given drop in interest rates, than shorter assets do,

leading to an overallocation of IMR to the shorter liabilities. Another approach may be to allocate based upon reserve balance and effective duration within each segment.

Respondents to the 2004 survey indicated the following methods of allocating starting IMR by line:

In proportion to total assets by line	56%
In proportion to unamortized IMR for each line	16%
In proportion to asset types within each line	10%
Other	20%

If the actuary has software that can be used to model the development of the IMR itself, then he or she could start with assets equal to reserves plus the portion of the IMR and model the changes to IMR as assets are sold during the projection.

Q24. How is the asset valuation reserve treated in cash flow testing?

From the 2012 survey of appointed actuaries, 45 percent of the respondents indicated they do not include the Asset Valuation Reserve (AVR) in testing. Those respondents who indicated they do include AVR (55 percent of the total) reported three issues they typically consider regarding the use of the AVR:

1. The amount of assets to include at the beginning of the projection;

2. Whether to model the change in the AVR during the projection; and

3. How to treat any AVR remaining at the end of the projection.

The AOMR states that AVR may be used to provide for default risks but that it cannot be used for other risks. Many actuaries (in the 2012 survey of the appointed actuaries, 51 percent of those who model the initial AVR) believe that it is preferable for the beginning assets supporting the AVR to be no more than the present value of defaults. There are several choices in using beginning AVR assets, including the following.

1. For each scenario, develop two sets of projections: (1) without defaults and (2) with defaults. Discount the difference in ending surplus back to the projection date at an appropriate sequence of interest rates for the scenario. The maximum present value of this difference for all specified scenarios is the present value of defaults. If it is less than the pro-rata portion of the AVR described in Q25, then the actuary may run the projections without the AVR assets and without defaults (under the assumption that the AVR covers the cost of defaults).

2. If the pro-rata share of AVR is not sufficient to cover the present value of the cost of defaults for all scenarios, then for each scenario the actuary typically adds assets equal to the pro-rata AVR and runs the projections with defaults modeled.

3. A conservative, simple choice is to model defaults but exclude the AVR.

Effective in April 2014, the NAIC adopted a proposal to limit the inclusion of AVR in the calculation of total adjusted capital to the amount not used in asset adequacy analysis in support of the actuarial opinion. As such, the appointed actuary may consider consultation with others in the company to ensure appropriate treatment in the actuarial opinion and the company's annual statement.

In addition to the above choices concerning beginning assets, if the actuary can model the development of the AVR itself, then the actuary usually can start with assets equal to the liability reserves, plus the full pro-rata AVR (limited to the amount of present value of defaults), and model the contributions to AVR, as well as project defaults. While some actuaries prefer more complex models that use defaults and AVR, others prefer the simpler models without AVR.

See Q26 for how actuaries usually treat any remaining AVR at the end of the projection.

Q25. How does the actuary determine the portion of the AVR that can be used to support a certain business unit?

Some actuaries use a pro-rata share of the default component of the AVR to help support the obligations of a specific business unit, based on the assets chosen to back the line from page 29 (the first AVR page) in the annual statement,[1] with the following variables (note that the page and line references in this answer are from the 2015 NAIC annual statement format):

ratio (maximum value of 1)	actual current bond and preferred stock component (line 8) maximum current bond and preferred stock component (line 9) or comparable lines for the mortgage or other components
Factor	reserve factor by investment-grade group (page 30 or 31 of the annual statement)
statement value	amount in Schedule D, Part 1, Column 11 (book/adjusted carrying value) of the assets equal to reserves backing the particular line of business by investment grade

If this approach is used, the pro-rata share of the AVR for the assets backing the line is equal to the sum over all investment-grade groups (ratio × factor × statement value). In addition, the appointed actuary may consider including the AVR on the assets that are assumed to back AVR (i.e., the AVR on the AVR).

[1] Annual statement references in this practice note are based on the NAIC Life/Health blank as of Dec. 31, 2015.

Other approaches used are to (1) allocate the default component of the AVR in aggregate to each line of business, and (2) allocate each asset category of the default component of the AVR separately to each line of business.

Respondents to the 2004 survey who used AVR reported the following methods for allocating beginning AVR:

In proportion to total assets by line	62%
In proportion to default component by line	19%
In proportion to asset types within each line	7%
Other	12%

Q26. If products with relatively short durations are cashed out at the end of the projection period, and the IMR and AVR are being modeled, what happens to the IMR and AVR at the end of the period?

The IMR may be positive (or negative) when there are no policies left inforce that need to have interest maintained. When the IMR is included in testing, some actuaries believe it is preferable to include the value of the ending IMR in the value of ending surplus.

The AOMR requires that AVR be used only to cover default risk. If there are still assets left at the end of the projection period, the AVR could be considered when determining the value of those assets. Some actuaries believe that only method 1 below is appropriate. Others believe that methods 2 and 3 below are more conservative and are therefore also appropriate.

1. Reflect value of ending AVR in determining ending surplus;

2. Exclude value of ending AVR in determining ending surplus; or

3. Add value of ending AVR only to the extent that assets are sold at a loss at the end; otherwise, exclude ending AVR.

Some actuaries consider it appropriate to reflect ending AVR only in the calculation of book surplus, with market surplus calculated by subtracting ending AVR from the otherwise ending market surplus. Some actuaries believe that releasing the AVR, if assets run out, is not consistent with using AVR only for default risk.

Q27. What are some methods for reflecting any net deferred tax asset (DTA) or net deferred tax liability (DTL) in the asset adequacy determination?

Some actuaries use CFT models that specifically project taxable income (e.g., tax reserves different from statutory reserves, deferred acquisition cost (DAC) tax accruals, and amortization). Some actuaries believe that the DTA and DTL (the admitted portion in the case of DTA) are analogous to the IMR and include the appropriate allocated portion in the modeling. In the case of DTAs, the DTA is usually part of the assets backing the reserves, replacing other assets. In the case of a DTL, additional assets may be assigned to back the DTL. Of course, in the case of a DTL, one conservative alternative would be to not reflect it in the modeling. Explicit modeling of projected future DTAs and DTLs may or may not be performed, depending on whether the appointed actuary believes there is a significant effect on interim results that may affect the opinion on adequacy.

Alternatively, some actuaries use CFT models that do not specifically project taxable income (e.g., taxable income is assumed to equal statutory income). In the most common situation where there is a DTA (whether admitted or not), this kind of projection is generally conservative with regard to projection of total taxes paid, so it would generally be appropriate to not take into account the DTA. In the situation where there is a net DTL, the projection usually would be understating future taxes, and some actuaries consider it appropriate to include a provision for additional taxes as indicated by the DTL.

In the 2012 survey of appointed actuaries, a small number of the respondents indicated that they project DTA and DTL balances (e.g., tax reserves, DAC tax accruals). The majority of respondents (85 percent) do not model initial DTA balances, with about half of those not modeling DTA balances because they are immaterial.

Q28. How are shareholder dividends treated?

ASOP No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*, Section 3.10.4 states the following: "The actuary should consider how applicable law, and other external requirements relating to such things as financial statements and operating ratios, federal income taxes, insurer capitalization, and distribution of an insurer's earnings to policyholders or shareholders are likely to affect future cash flows or constrain the range of possible scenarios. These factors should be appropriately reflected in the analysis."

Based on the results of the 2012 survey, 51 percent of the respondents indicated that shareholder dividends are excluded because shareholder dividends are not applicable. Of the remaining 49 percent, about 10 percent explicitly include shareholder dividends in their model.

Given the small percentage of respondents who currently consider shareholder dividends in their testing, it is difficult to define common practice for modeling shareholder dividends. The actuaries who do model shareholder dividends typically do so based on company expectations.

Q29. How are policyholder dividends treated?

Some actuaries treat policyholder dividends as fixed over all scenarios when modeling future cash flows, using the projected dividends under the current dividend scale. Other actuaries model policyholder dividends dynamically over the projection period, varying them by scenario based on changes in interest rates, expenses, or other parameters during the projection period. Because companies declare dividends for a year at a time, some actuaries build in a lag factor between experience changes and the time it takes to recognize and reflect those experience changes through changes in dividends.

Based on the 2012 survey of appointed actuaries, below is a summary of how policyholder dividends are modeled for those companies with policyholder dividends:

Modeled to approximate actual dividend policy	71%
Modeled in a simplified way	15%
Ignored as not material	12%
Other	2%

If the current dividend scale provides for an allocation of surplus to be paid out as dividends, some actuaries include the expected future allocation of surplus in the testing, clearly disclosing this in the actuarial memorandum. Others use dividends lower than their current dividend scale, reducing the dividends for the amount contributed from surplus.

Q30. Do actuaries reflect reinsurance in modeling?

ASOP No. 7, Section 3.8 states the following:

> The actuary should consider whether reinsurance receivables will be collectible when due, and any terms, conditions, or other aspects that may be reasonably expected to have a material impact on the cash analysis.

ASOP No. 11, Section 3.2 states:

> When preparing, reviewing, or analyzing financial statement items that reflect reinsurance ceded or reinsurance assumed, the actuary should consider potential cash flows that may, in the actuary's professional judgment, have a material impact under the reinsurance agreement.

In the 2012 survey of appointed actuaries, 64 percent of the respondents indicated they model reinsurance in a way meant to approximate treaty terms.

ASOP No. 7, Section 4.3.g.(8), also states that the characteristics of any reinsurance agreements and how they were reflected in the analysis should be documented in the memorandum.

Q31. How is modified coinsurance treated in asset adequacy analysis?

The AOMR focuses on whether reserves are included or excluded from the analysis. However, in the case of modified coinsurance, the risks and the potential profits and losses may not accrue to the same statutory entity that holds the reserves on its balance sheet. Many actuaries believe it is preferable for the asset adequacy analysis to occur in the statutory entity where the risks are present. This might mean performing CFT on assumed modified coinsurance, even though the assuming company does not hold the reserve balance or the assets on its balance sheet. Conversely, it might mean not performing CFT on ceded modified coinsurance even though the reserves and assets are reported on the ceding company's balance sheet. Nevertheless, this does not necessarily mean that those reserves are excluded from asset adequacy analysis. They might be reported in the opinion as being included in the analysis but as representing minimal asset risk (because the risks have been ceded to another company). Although the ceding company may not have to perform CFT on ceded modified coinsurance, some actuaries do review the rating and the CFT work done by the assuming company to confirm that the risk to the ceding company is indeed minimal.

Section E: Modeling Considerations—Scenarios

Q32. What approaches to modeling economic scenarios are currently included in appointed actuaries' practice when doing asset adequacy analysis?

Economic scenarios used for asset adequacy analysis usually incorporate interest rates and/or equity returns as key variables, as they are the most important economic variables for many lines of business. Other economic scenario variables that may be included, if material to the results, include separate account fund returns, inflation rates, asset spreads, and asset default rates. In fact, some actuaries limit their economic scenarios to interest rates and/or equity returns, and treat other economic variables through sensitivity tests, if appropriate.

Approaches currently used to represent interest rate and/or equity return scenarios in actuarial models may be categorized broadly as deterministic and stochastic. In a deterministic approach, one or more handpicked scenarios of future rates/returns are used. An example of this is the seven required interest rate scenarios described in New York Regulation 126, often referred to as the New York 7 scenarios. These scenarios are determined each year so that the initial values are set to the current interest rate yield curve. The New York Department of Financial Services has released bulletins that describe the manner of constructing the interest scenarios.[2] Past bulletins have included direction on use of a maximum rate of 25 percent, a floor of one-half of the starting five-year Treasury rate, and yield curve shifts. Some actuaries also add inverted yield curve scenarios to the basic seven. In the 2012 survey of appointed actuaries, when testing with the New York 7, 32 percent of the respondents indicated that they floor the rates at half the initial rate for each maturity, 39 percent at the initial rate less half of the initial five-year Treasury rate, 12 percent at half of the initial five-year Treasury rate, and 3 percent at a specified rate, while 6 percent indicated that they do not apply a floor and 7 percent indicated they use some other floor. Another example of a deterministic interest-rate scenario would be based on the company's best estimate, commonly the forward curve that can be observed from the yield curve as of the valuation date.

Stochastic methods generally fall into two categories: realistic (real-world) scenario models and option-pricing (risk-neutral) models. Real-world scenario models use probability distributions of future scenarios based on a combination of historical experience, current economic conditions, and future expectations (e.g., economists' predictions). Risk-neutral scenario models have scenario probabilities or rates calibrated to replicate existing asset values and are not necessarily representative of realistic future expectations. Some actuaries believe that risk-neutral scenarios are especially appropriate for multi-scenario CFT. In the 2012 survey, 47 percent of the respondents reported they use stochastic interest rate scenarios, of which 72 percent use only realistic scenarios, 14

[2] At the time this practice note was published, the insurance industry hub of the New York Department of Financial Services website was at http://www.dfs.ny.gov/insurance/dfs_insurance.htm.

percent use risk-neutral scenarios, and 14 percent use a combination of realistic and risk-neutral scenarios. When generating stochastic scenarios, some actuaries consider correlations among variables, such as short- and long-term interest rates, or interest rates and equity returns. The survey results reflect that most actuaries incorporate such correlation in scenario generation, primarily by use of historical data or leveraging what has been produced by the American Academy of Actuaries.[3]

Q33. Which of the above approaches are appropriate if asset adequacy analysis is required, and how many and what types of scenarios are tested?

ASOP No. 7 (Section 3.10.1) contains the following statements:

> Depending on the purpose of the analysis, more than one scenario may be used.

and

> Scenarios may be generated by either deterministic or stochastic methods.

Section 3.10.1.b also states:

> [T]he actuary should consider a sufficient number of scenarios to reasonably represent the underlying variability of the asset, policy, or other liability cash flows.

Asset adequacy analysis seeks to determine whether the reserves and other liabilities are adequate under moderately adverse conditions. Any approach that provides sufficient information to make this determination is generally appropriate. Testing of the New York 7 scenarios had been required by many states, and some actuaries believe that these provide a sufficient variety of scenarios for their analysis. The 2001 AOMR, which has been adopted in most states, no longer requires that the New York 7 scenarios be tested. Nevertheless, some actuaries believe there is an expectation either to continue testing these scenarios as a useful benchmark or to treat them as the minimum required scenarios.

In the 2012 survey of appointed actuaries, 87 percent of the respondents indicated they test at least the New York 7 scenarios; 14 percent test the "modified" New York 7 (the New York 7, plus one or two additional deterministic scenarios, which may be an inverted yield curve and/or a best estimate based upon the forward curve). More than nine deterministic scenarios are tested by 50 percent of the respondents, and 16 percent test 20 or more. Some respondents test fewer than seven scenarios. In the same survey, 66 percent of the respondents said that the New York 7 scenarios are used for the asset adequacy opinion, 10 percent said they are not used, and 24 percent said they had made "other changes" to their reserve adequacy criteria.

[3] See http://www.actuary.org/content/economic-scenario-generators.

As noted above, 47 percent of the respondents indicated they test stochastically generated interest rate scenarios, with the median number of scenarios tested being 100. Some actuaries generate a large number of stochastic scenarios (e.g., 1,000 or 10,000) but then select a smaller, representative subset (e.g., 50 or 100) that is actually used in the testing. The representative subset is usually chosen so that such metrics as the mean, median, range, and variance of the subset approximate the distribution of the full set of scenarios. Relative to the 47 percent of the respondents indicating they test stochastically generated interest rate scenarios, 16 percent use stochastic testing for assumptions other than interest rates. The vast majority of this group use it for separate account equity returns, although a few respondents indicated its use for mortality or morbidity.

Some actuaries who base their conclusions on the results of stochastic scenarios still find the New York 7 useful for model validation. Those who take this position generally believe the New York 7 scenarios have clear movements (e.g., pop-up and pop-down) that allow the user to inspect whether the results of the model are reasonable, given such rate changes. For example, the pop-down scenario would generally be expected to show larger asset prepayments; the pop-up scenario, to show larger cash surrenders (assuming the existence of such interest-sensitive assets and liabilities).

Approximately one-third of the respondents indicated they include separate account equity return scenarios in testing. Of the respondents who include separate account equity return scenarios in testing, 40 percent use deterministic scenarios only, while 60 percent use stochastic scenarios. When using stochastic equity return scenarios, the survey results indicated that the number of equity indices modeled range from one to six or more, with the most common number of indices being one or four.[4]

Q34. Is there any time when a single interest rate scenario path may be appropriate?

For products that have little or no exposure to interest rate risk, such as short-term health insurance backed by short-term assets, some actuaries believe it may be appropriate to use a single interest rate path across all scenarios that vary other assumptions.

Q35. What types of stochastic scenario models are included in current actuarial practice?

There are several types of stochastic scenario models commonly used. One approach is to use a binomial lattice to generate future rates, although this typically is limited to risk-

[4] Actuaries wishing to follow research in this area may choose to refer to an ARCH 2004.1 article, "Modeling of Economic Series Coordinated with Interest Rate Scenarios: A progress report on research sponsored by the Casualty Actuarial Society and the Society of Actuaries," by K. Ahlgrim, S. D'Arcy, and R. Gorvett.

neutral models, while another is to use a Monte Carlo approach to calculate period-to-period changes in interest rates.

Sometimes, changes in long- and short-term interest rates are calculated separately (i.e., using distinct distribution functions), and an interpolation procedure is used to approximate a yield curve. The lognormal probability distribution is also commonly used. However, some actuaries believe, especially if the tails of the probability distribution are a concern, that the lognormal distribution does not necessarily produce enough extreme scenarios. One approach that produces results with so-called fat-tailed distributions is the regime-switching model. The regime-switching model has been used, for example, in recent Academy proposals for scenarios associated with setting RBC and reserve requirements for variable annuity guarantees and the analysis of guarantees provided by segmented fund products (similar to variable annuities) in Canada. The Academy's proposals include calibration criteria that may be applied to results of other scenario generators. If the parameters of these scenario generators are adjusted so that their results meet the criteria, then these scenario generators may be an appropriate alternative to other methods.

There is a large amount of literature available regarding stochastic scenario generators. Lists of references may be found in the specialty guides, *Asset-Liability Management BB-1-03* and *U.S. Statutory Financial Reporting and the Valuation Actuary I-2-97*. These guides are available on the SOA website.

Q36. What is reversion to the mean?

Reversion to the mean is a tendency, built into a model, for random values to move toward a target value (mean) over time. For stochastic scenario models, this is accomplished by modifying the output of the sampling procedure, perhaps by multiplying by a reversion factor that, in turn, is a function of a parameter called the strength of mean reversion. If the strength is zero, no mean reversion occurs; if it is unity, the interest rate is immediately set to the target value. Mean reversion accomplishes two things: It reduces longer-term volatility and it pushes the average of the scenarios toward a desired target.

For interest rate scenarios, various choices of target rates have been used, including the initial rate, a historical average, a rate based on the forward rates in the initial yield curve, and economists' projections. Mean reversion may have more effect on pricing (where the mean of the scenario results is used) or the amortization pattern of an amount of capitalized expenses than on asset adequacy analysis (where the concern is on adverse scenarios), but the actuary may choose to consider the extent to which the existence of mean reversion in the scenarios might contribute to volatility across scenarios that is not as large as expected or desired.

In the 2012 survey of appointed actuaries, more than 90percent of the respondents who indicated they test stochastic interest scenarios for fixed interest rate instruments use mean reversion, with more than 70 percent of them using a mean reversion target based on

historical averages. Several actuaries said they use the assumptions embedded in the Academy generator or the RBC-200 model. For those using mean reversion, there was considerable diversity in the time period used to revert to historical rates, with time periods ranging from 90 days to 50 years and a slight concentration at 10 years. One-third of the respondents answered "not applicable" to this question even though they do use mean reversion, while 17 percent said simply that they use the Academy generator.

The 2012 survey did not ask about mean reversion for equity scenarios, but it did ask about the expected annual (compound) return of large-cap U.S. stocks. Most responses were in the range of 5.0-9.0 percent, with a median of 7.5 percent.

Q37. How can an economic scenario generator be validated?

A risk-neutral generator can usually be validated by testing that the assets valued using the scenarios replicate existing market values. A realistic scenario generator can typically be validated by testing various statistics (e.g., distribution of rates, percentage of inverted yield curves) against historical distributions.

Q38. If some elements of a set of stochastic scenarios are clearly unreasonable, can these be ignored or replaced?

Some actuaries believe in using each element within a set of stochastic scenarios, without replacement or de-emphasizing, based upon a statistical argument. They reason that throwing out selected scenarios in a random sample could destroy the randomness of the sample. In addition, they reason that recent history is not necessarily a safe guide to judge what is reasonable within a set of stochastic scenarios.

For example, the high interest rates of the early 1980s were unforeseen in the 1970s; similarly, the current low interest rates were not forecast in the 1980s. However, if the set of resulting interest rates as a whole appears to exhibit more than expected numbers of extreme scenarios (however defined by the actuary—e.g., negative or almost zero interest rates, or rates in excess of 30 percent), it implies that either the model parameters are incorrect (wrong distribution) or the model is insufficiently robust to produce an accurate sample for that number of scenarios. Under those conditions, many actuaries would consider modifying the parameters and generating another set. In addition, an actuary could introduce constraints, such as no negative interest rates or no rates less than 10 basis points. According to the 2012 survey of appointed actuaries, about two-thirds of those using stochastically generated interest rates impose a floor of zero percent or higher, while 31 percent of this same group impose a cap on the maximum interest rate, generally ranging from 18 to 28 percent. Similarly, 16 percent of all respondents said they apply some sort of yield curve normalization if the initial yield curve is unusually sloped.

Some actuaries, based upon the "moderately adverse" testing framework of asset adequacy analysis, believe that there are some situations where unreasonable scenarios

can be excluded or de-emphasized when analyzing results (i.e., when those scenarios cause the overall result to include more margin than necessary to cover conditions that are considered moderately adverse).

Section F: Modeling Considerations—Assets

Q39. What types of assets are used by actuaries in asset adequacy analysis?

The actuary may need to select certain assets for testing from a total portfolio of available assets. For example, assets backing a product are typically greater than the product liabilities, due to existence of surplus, although assets equal to liabilities are used for testing. When faced with a choice, some actuaries select assets with reasonably predictable cash flows and lower market value volatility, rather than assets with highly uncertain cash flows or very volatile market values, such as securities with equity characteristics. Thus, some actuaries regard cash and fixed-income securities in good standing as the preferred choices. Fixed-income securities include most bonds, preferred stock, and mortgages, as well as various types of securitized and structured obligations. Equity real estate with stable rental income characteristics also typically has the attractive features of a fixed-income security, although its market value may be volatile. Nonperforming collateralized instruments such as mortgages in foreclosure generally have predictable cash flows and market values (at least on a portfolio basis). Other asset classes that may be reflected include bank loans, securities lending, emerging market debt, and mutual funds.

While common stocks usually have fairly predictable cash flows in the form of dividends (on a portfolio basis), these cash flows are generally not the primary reason investors hold these instruments. Common stocks are usually held for their potential gain in market value, and most of the benefit of holding common stocks is realized when they are sold for a capital gain. Due to their substantial volatility in market value, even on a portfolio basis, and the possibility of extended periods of depressed valuations, many actuaries consider these instruments less suitable as investments to support most types of insurance liabilities, with the exception being designated funds for which the risk is passed on to policyholders on a transparent basis. As a result, many actuaries generally do not include common stocks in asset adequacy analysis. To the extent that common stocks are utilized, care should be taken to include additional scenarios that focus on the volatility of these investments.

Actuaries may choose to consider using derivatives in their analysis if the company holds such instruments to hedge risk arising from certain product designs, such as equity-indexed annuities, guaranteed benefits associated with variable annuities, payout annuities with guaranteed minimum interest rates, or other products with long-term interest rate guarantees (e.g., long-term care). This can be especially appropriate where such derivatives are integral to managing the risks for these products. From the 2012 survey of appointed actuaries, between 12 and 24 percent of the respondents indicated that they use the following derivatives in their models: hedge funds, floating rate notes, options, swaps, swaptions, and caps/floors.

When determining what asset types to include in their reinvestment models, the survey respondents indicated that they employed a similar rationale to that described above. Most

typically, combinations of fixed-income securities are used in relative proportion to the makeup of the existing portfolio with heavier emphasis placed on the makeup of recent purchases. This reinvestment assumption would typically be discussed with the company's investment managers.

Q40. How are policy loans treated in asset adequacy analysis?

Approximately 70 percent of the survey respondents indicated they model policy loans by assuming the loan balances remain proportional to the cash value throughout the projection. Approximately 10 percent assume policy loan balances reflect the interest rate scenario dynamics, and approximately 10 percent do not include policy loans in their testing. The remaining 10 percent use other approaches.

Q41. What software platforms are used by appointed actuaries to model assets?

From the 2012 survey of appointed actuaries, nearly 20 different types of software purchased from outside vendors were listed as being used for at least a portion of their asset portfolio. For the majority of asset classes, 45 percent used the same software to project existing asset cash flows that is used to project liability cash flows, with 52 percent stating that existing asset cash flows are projected externally and then brought into the liability projection system as fixed-scenario-dependent cash flows. Many actuaries use a combination of software purchased from multiple vendors and/or purchased software plus internally developed spreadsheet systems to project assets depending on the type of asset being projected.

When using purchased software to project asset cash flows, actuaries often check the parameters set by the vendor to ascertain whether the parameters are reasonable relative to the company's experience and asset characteristics, which can vary materially by company. If the actuary determines that the default software parameters are not appropriate for the company, the actuary may exercise professional judgment and make discretionary adjustments to them.

Q42. How is asset management strategy modeled for asset adequacy analysis?

Asset management strategy varies significantly from one company to another. Some companies use a fairly passive strategy, holding securities they purchase for lengthy periods of time. Others might take advantage of capital gain opportunities to earn additional returns, at least in the short term. The actuary generally determines whether and to what extent to reflect the company's asset management strategy in the cash flow model. Considerations may include identifying how consistently the stated strategy has been followed in the past and how recently the strategy has been reviewed and approved by senior management, coupled with actuarial judgment as to the likelihood that the strategy will be followed under the scenarios being projected.

Most insurers adhere to a predetermined investment strategy, stated in terms of allocation to various classes of assets, quality rating of securities purchased, sector allocations, and duration of the portfolio. If the overall strategy is followed consistently and the liability structure remains the same, securities sold will generally be replaced by instruments of similar characteristics, except for temporary deviations to take advantage of market opportunities. However, if the future asset management strategy is expected to vary significantly from the past and the portfolio composition is likely to be affected significantly as a result, many actuaries believe it is preferable to reflect this in the model.

Some actuarial software permits the modeling of specific investment strategies, such as duration matching. In this case, the allocation of assets to various instruments within the generic reinvestment portfolio usually is determined dynamically, based on the durations of the assets and liabilities. Dynamic allocations may be made to achieve a desired mix of assets after the period's purchases are made.

Where static allocations are used, the actuary typically considers certain potential resultant problems. For example, the regular purchase of a constant mix of short and long assets may result in holding what would appear to be an excessive percentage of long assets, because maturing short assets are replaced with this constant mix of short and long assets while the long assets held have not yet matured.

Q43. How is the reinvestment strategy modeled?

Net positive cash flows arise from future premiums and deposits, interest earnings, asset maturities and sales, and other cash inflows, net of policy or contract benefits, expenses, taxes, and other cash outflows.

Net positive cash flows are generally invested in the model. The most common practice is to construct a simple "reinvestment" portfolio consisting of a small number of securities that collectively represent the quality, duration, and asset class characteristics reflecting the company's investment strategy.

The yields on these instruments generally are determined dynamically based on the interest rate scenario, using yield spreads reflecting the credit quality and embedded options of these instruments , with the intention that yields produced reflect the economic conditions within the scenarios tested.

In terms of the asset classes modeled, approximately 60 percent of the 2012 survey respondents said they model non-callable public corporate bonds. Other asset classes that were commonly modeled (where 20–25 percent of the survey respondents indicated they model these asset classes) are Treasuries, non-callable private corporate bonds, Government National Mortgage Association (GNMA) and Federal National Mortgage Association (FNMA) securities, common/preferred stock, and commercial/agricultural mortgages.

The 2012 survey results indicated that 90 percent of the respondents employ a consistent reinvestment strategy across scenarios. (For purposes of the survey, a strategy that can be expressed regardless of economic environment, such as duration match or target portfolio mix, was considered consistent. A strategy that is different simply because rates are high or rising, rather than low or falling, was not considered consistent.)

Q44. What spread assumptions (i.e., spreads to Treasuries) are used to model reinvestments of fixed-income securities?

Approximately 50 percent of the 2012 survey respondents indicated they use current spreads grading to historical spreads, while approximately 25 percent use current spreads and approximately 15 percent use historical spreads. About 5 percent aligned spreads to the default assumption basis (e.g., if historical defaults were used, so were historical spreads).

Some actuaries believe it is appropriate to set spreads on a basis that is consistent with the default assumptions, which means if historical defaults are used, then perhaps historical spreads might be used. Similarly, if current defaults are used, then perhaps current spreads might be used.

During the 2008 financial crisis, spreads widened considerably, which prompted some actuaries to rethink the use of current spreads for CFT purposes. Other actuaries considered the widened spreads created by the crisis as consistent, given the increased uncertainty relative to Treasuries, and as an appropriate spread to maintain while higher levels of defaults are being considered in the projections.

Q45. How is disinvestment modeled?

When negative cash flow arises in the model, actuaries use a number of different approaches. Most actuaries model a disinvestment strategy that is largely consistent with company practice, as modeling limitations or the requirement to exclude new business in asset adequacy analysis may make an exact replication of the company's policy difficult to implement.

For small shortfalls, many actuaries assume the shortfall can be covered by short-term borrowing at the prevailing short-term rate applicable to the company, based on its credit standing. The actuary might then assume that all subsequent positive cash flows would be used first to repay the loans.

Many actuaries believe that large shortfalls are best modeled by selling assets. One common assumption is that sales will occur from liquid investments with low bid-ask spreads, consistent with the actual practice of most investors. If no consistent pattern of liquidation practices exists at the company, a pro-rata liquidation of all liquid investments

might be assumed. Many companies use a pro-rata approach on asset sales because it is difficult to predict specific assets that will be sold, and a pro-rata portion would leave the asset makeup (duration, etc.) consistent with the makeup prior to sale. Another common assumption is a prioritized liquidation: For example, one possible order of priority might be money-market investments and T-bills first, followed by Treasury notes, Treasury bonds, agency issues, high-quality corporate bonds, high-yield issues, and real estate.

In reviewing results that combine reinvestment and disinvestment strategies, many actuaries believe it is appropriate to examine any distortion of results due to unrealistically large amounts of borrowing or unrealistically large concentrations in certain asset categories.

In instances where there is a large amount of borrowing, the actuary would typically consider estimating the impact of any unintended arbitrage advantage on margins or adjusting the reinvestment or disinvestment assumption to reduce the borrowing. For example, the actuary may want to check that the rates are consistent with the market scenarios so that the projections are not benefiting from an unintended arbitrage advantage. For instance, when separate projections are run for two lines of business and one generates positive cash flows while the other generates negative cash flows, it may make sense to borrow at the average reinvestment rate (which implicitly assumes that the loan is being made from one line to the other and reduces arbitrage advantage). Another alternative is to presume "internal borrowing," in the case where cash flows are computed separately for several lines of business, and one line forecasts negative cash flows but the rest show consistently positive cash flows.

Q46. What are the sources of guidance on how to select assumptions for asset modeling?

The ASOPs provide the most authoritative professional guidance on the general considerations to take into account in selecting assumptions but do not address specifics. The practice notes are also helpful, especially from the perspective of providing information on what other actuaries facing similar issues are doing. *The Dynamic Financial Condition Analysis Handbook*, prepared by the SOA, offers valuable information. SOA professional actuarial specialty guides on asset-liability management and life insurance company investments are useful references.

Rules and requirements set by regulators (e.g., the NAIC and New York Regulation 126) may provide more specific guidance and, due to their binding legal nature, may supersede guidance derived from other sources. Historically, regulatory guidance and rules have covered assumptions on default rates for various types of assets and conditions under which the AVR might be used. For example, New York Regulation 126 indicates that, in the absence of credible data, default losses of not less than 10 percent of AVR maximums may be assumed.

Where the data appear to be credible and it can be reasonably expected that the experience will continue in the future, many actuaries rely upon internal company experience in selecting assumptions. The historical patterns might be adjusted for anticipated economic conditions (e.g., the economy is heading for a downturn) and expected future changes in company practices. It may also be appropriate to grade company experience into industry- or economy-wide experience, particularly in those cases where the company experience has been substantially better than industry average, unless the actuary has determined that the reasons for the superior experience are expected to continue.

In those cases where the company's own data are not credible or are unavailable, many actuaries use an industry- or economy-level assumption. Data from credit rating agencies are commonly used. Current credit loss experience is frequently studied in the academic literature, and current data can be obtained from a literature search. Credit spreads, historical interest rates and yield curves, and other economic data (inflation, employment, gross domestic product) are widely available data series. Actuaries often select their modeling assumptions based on this data.

In the case of highly complex instruments such as collateralized mortgage obligations (CMOs), actuaries frequently rely on models and assumptions constructed by vendors. Investment professionals with expert knowledge of assets construct vendor models that are generally proprietary (i.e., the details are not available to the user). Many actuaries believe it is appropriate to examine the results of these models to evaluate their reasonableness.

From the 2012 survey of appointed actuaries, a little more than half (51 percent) indicated they use published experience as a primary source of information for asset default, while about one-fifth (22 percent) use their own company experience. One-third of those surveyed (33 percent) use a blend of the two. Of the respondents, 13 percent use information from external advisers (such as investment banks), which is commonly proprietary to the adviser and nonpublic. Only 3 percent of survey respondents use the AVR contribution factor as an asset default source, likely reflecting the increased availability of relevant published asset default data and the fact that the AVR contribution factor is not revised to reflect dynamic market conditions.

Q47. What are the main asset-specific characteristics that affect cash flows?

Fixed-income securities have contractually promised cash flows. However, the amount and timing of the cash flows can be impacted by credit losses and options embedded in the securities. Among other considerations, credit losses are related to the current and anticipated future creditworthiness of the issuer and the degree and quality of collateral. Credit losses, particularly for issues of lower quality, are generally correlated with business cycles.

The extent of the impact of options on the amount and timing of fixed-income cash flows generally depends on realization of conditions under which it is attractive for the debtor to

exercise the options and the behavioral characteristics of the debtor with respect to the exercise. Common options encountered allow the early or delayed repayment of some or all of the principal; the attractiveness of exercising these options generally depends on the interest rates at the time when the options become exercisable and the availability of economically favorable refinancing options for the debtor. Prepayment behavior is difficult to model and depends on a number of factors other than the relationship between the coupon rate on the debt and the prevalent market rate.

For equity-type assets, which might include equity in physical or financial assets, there are often no contractually predetermined cash flows. Nevertheless, certain cash flows occur with some predictability, such as payment of dividends on stocks. The bulk of the cash flows on most equity securities is realized as capital gains or losses upon sale, and the central issue in modeling these instruments usually is the pattern of change in market values, which drives the capital gains and losses. Many factors impact stock values, including overall market movements and the beta of the stock. The Academy report to the NAIC, *Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Products with Guarantees (Excluding Index Guarantees)*, presented in 2002,[5] includes significant analysis of stock market movements. In addition, equity modeling approaches described in AG43 may also provide helpful guidance for asset adequacy analysis purposes.

Cash flows on derivatives are mathematically related to the value of the underlying instrument or index and the terms of the derivative contract.

Q48. What types of asset-embedded options are modeled for cash flow testing?

The 2004 survey of appointed actuaries had indicated that more than 80 percent of the respondents model asset optionality in at least one asset type. The 2012 survey asked appointed actuaries what were the primary sources of information for asset calls and prepayments, the two critical assumptions for modeling asset optionality. A plurality of companies (37 percent) use software algorithms from third-party software vendors as their primary source of asset calls and prepayments. An additional 32 percent of companies use either company experience (10 percent), published experience (8 percent), or a combination of the two (14 percent. Another 16 percent of appointed actuaries use judgment of investment experts in the company as their primary source of call and prepayment information.

In addition, the 2012 survey indicated that 11 percent of the respondents model asset prepayments stochastically.

[5] Located at http://www.actuary.org/pdf/life/rbc_16dec02.pdf.

Q49. How are bond options modeled?

Options commonly found in bonds include calls, conversions, and puts.

A callable bond allows the issuer of the bond to prepay the bond under certain conditions by paying a call premium to the company. The likelihood of exercise generally depends on the relationship of the call price (and associated expenses to execute the call) to the present value of remaining coupon and principal payments, based upon the characteristics of the bond and other economic factors.

Generally, a call option "at the money" is not exercised due to the cost that an issuer might incur to refinance the debt. It is a common practice to model calls only if the option is "in the money" by a certain amount. This level is generally based on internal studies.

Many bonds are callable at a "make-whole" premium, which means the issuer will pay the holder an amount to compensate for any loss when the bond is called. It is a common practice to model these bonds as noncallable.

If callable bonds are an insignificant part of the portfolio, the impact of the call feature is usually excluded from consideration. What constitutes "insignificant" usually depends on the size of the callable bond portfolio in relation to the total portfolio, the characteristics of the callable bonds, and the size of the potential gain or loss if the bonds are called.

As a practical matter, it is difficult to model conversions, and it is usually conservative to treat a bond as if it were not convertible.

Not many bonds have put options, which give the bondholder the right to put the bond back to the issuer for cash. Some actuaries take the conservative approach of not modeling put options.

Q50. How are expected credit losses on bonds modeled?

A significant majority (93 percent) of the respondents to the 2012 survey of appointed actuaries indicated that they use available quality ratings of a security as a factor in varying the credit loss assumption. It is a common practice to model each bond issue separately. An annual default loss is usually assumed, based on the current quality rating.

Some actuaries take business cycles into account by increasing the assumed default loss for the next few years if it appears that the economy is about to enter a recession or is in the middle of one, and grading down to a long-term average thereafter. Some actuaries also reflect quality rating movements over time, using default loss assumptions that change with these changes in rating. These "rating transitions" are studied extensively by rating agencies, with the results generally published annually. For high-quality bonds, this transition effect will increase default losses over time. For low-quality bonds, default loss rates may actually decrease over time for the remaining bonds that survived the higher

default rates of the earlier years of a projection.

In the 2012 survey, approximately 17 percent of survey respondents indicated they model transition of asset quality ratings over time.

With respect to private placement bonds, default losses by quality are available from regularly published SOA studies. To date, these studies have shown private placement loss experience to be similar to that of public bonds at the same quality rating. The latest study showed private placements with somewhat higher default probabilities, but somewhat lower loss severities, with a similar overall loss by quality.

With respect to mortgage loans, default losses by rating are available from published studies. Approximately 69 percent of the 2012 survey respondents indicated they had mortgage loans in their companies' investment portfolios that require modeling. Of those with mortgage loans, approximately two-thirds changed their default assumptions for mortgages since 2007. The changes varied, but the most common change was methodology that increased defaults following the financial crisis, then decreased defaults following the economic recovery to historical averages or current experience.

Default losses involve lost interest and principal (net of recovery). Interest loss can be modeled as a reduction to coupon cash flow. Anticipated loss of principal can be modeled as an adjustment to the carrying value of the bond at the time of default. Actuaries also model these two components together by assuming a net reduction to yield as a result of default losses.

For bonds in default, no coupon payments are typically included in CFT. The market value of bonds in default is indicative of the recovery expected and reflects the expected amount of recovery, as well as the uncertainty in the recovery amount, through the implied discount rate. For practical purposes, a defaulted instrument is akin to an equity investment and is subject to the modeling difficulties that are present in equities—factors that are reflected in the volatility of market values for defaulted bonds and their sensitivity to economic conditions. For the same reasons that many actuaries do not include equities in their CFT (see Q39), they sometimes do not include defaulted bonds.

In the 2004 survey, about one-third of the respondents indicated that they reflect their own company's experience in setting the default assumptions. The remaining respondents reported a variety of sources, with Moody's being the most common (50 percent), and others being Standard & Poor's, the Altman Z-score, data from investment advisers, and AVR contributions. In the 2012 survey of appointed actuaries, such historical experience was utilized by the respondents in a number of ways, including the following:

- Use historical defaults for all asset categories for the entire projection (38 percent)

- Use current default rates but grade to historical averages (20 percent). Grading periods varied from two to five years.

- Use historical defaults but make adjustments to reflect default cycles related to the economic environment, such as the 2008 financial crisis (19 percent)

- Use current default rates based on recent company or industry experience, rather than historic average experience (9 percent).

Q51. Do bond credit losses vary by interest rate scenario?

It is a common practice to assume that default rates and recoveries do not vary by interest rate scenario, because studies have not established a strong link between the shape or level of yield curves and credit losses. There is usually a stronger link between yield spreads, defaults, and economic conditions, which is the reason some actuaries model higher default losses when weaker economic conditions are expected. Only 2 percent of survey respondents reported that they model asset defaults stochastically.

Q52. How are variable rate bonds modeled?

In practice, most variable rates are based on an index other than Treasury yield rates (on which CFT is usually based), such as the London Interbank Offered Rate (Libor). If variable rate bonds are material to the portfolio, it may be appropriate to devise a method to determine the reset coupons based on Treasury yields. Linear regressions of Libor vs. Treasuries often produce a good fit and are appropriate in many instances, though it should be noted that the Libor will be phased out in 2021. Any minor distortions are usually not a problem, especially if variable rate assets and liabilities are modeled consistently.

The considerations used in modeling prepayments on variable rate bonds, in general, are somewhat different from those for fixed-rate bonds. For example, prepayments may be more closely related to absolute interest rate levels than relative interest rates. In addition, bond issuers may be looking to refinance at fixed rates for a longer term than that of the variable rate bond.

Q53. What are the relevant aspects of residential mortgages and securities collateralized by them (CMO/MBS)?

While direct ownership of individual residential mortgage loans by insurance companies does exist, companies more commonly hold such assets in the form of a securitized arrangement. These arrangements pool multiple loans, the cash flows of which collateralize the security. The two main types of securitized arrangements are mortgage-backed securities (MBSs) and collateralized mortgage obligations (CMOs). About three-quarters of the 2012 survey respondents included CMOs and MBSs in asset adequacy analysis.

The holder of an MBS investment receives the actual principal and interest payments from the underlying residential loans in the pool as a direct pass-through (net of servicing and other similar deductions). Some MBSs (e.g., GNMA, FNMA, and Federal Home Loan Mortgage Corporation (FHMLC) pools) contain guarantees on the principal and interest payments, backed by the respective agency. Losses are generally more significant on nonagency issues, and may warrant incorporation into the model so as to reflect the potential impact of such credit losses in the analysis. While the agency issues are very highly rated and not as subject to losses, it is still common to assume a nominal basis point reduction.

CMOs are structured securities that break up the total principal and interest payments from the pooled loans into components, or "tranches," with each tranche sold as a separate investment. There are many types of CMOs, with various levels of risk, depending on the type of tranche. Types of tranches include, but are not limited to, sequential pay, accrual, floater, planned amortization class (PAC), PAC support, target amortization class principal only, and interest only.

Q54. What are the key risks associated with CMOs and MBSs?

MBS and CMO investments exhibit cash flow uncertainty due to both defaults and cash flow variation, as payments to the insurance company are directly impacted by the prepayment activity of the underlying pool of mortgages.

Prepayment and Extension Risk

In general, as interest rates decline, there exists *prepayment risk,* a specific type of reinvestment risk that cash flows will arrive earlier than planned (due to higher prepayments), and the proceeds are subject to reinvestment in lower-yielding assets. As rates rise, there exists *extension risk,* wherein cash flows arrive later than planned (due to fewer prepayments) and the insurance company cannot reinvest to take advantage of the higher rate environment. Prepayment speeds for an MBS depend on many factors, including the differential between the coupon rate of the underlying mortgages and current market rates and seasoning of the mortgage pool, among others. CMO cash flow variations can be impacted by these factors, as the prepayment activity of a particular tranche depends upon the prepayment activity of all the higher-priority tranches. Future cash flows on MBSs and CMOs typically are critically affected not only by the interest rate paths in the future, but also by the entire history of interest rates and cash flows since initiation of the underlying pool of mortgages.[6]

Due to the large impact this can have on a company with a significant investment in these securities, and the complexity of many of these instruments, regulators are often

[6] For more discussion of the factors that impact prepayment speeds, see *The Handbook of Fixed Income Securities,* by Frank J. Fabozzi.

particularly sensitive to the proper modeling and evaluation of the risk of MBS and CMO investments.

Default Risk/Credit Losses

If a company holds a large portfolio of unsecuritized residential mortgages, modeling the default effect in some detail may be appropriate. As a result of the 2008 financial crisis, loss of principal became a more significant concern, even for residential mortgages that were adequately collateralized, due to widespread foreclosures. Historically, for GNMA or FNMA/FHLMC issues, one common practice was to assume a zero default rate, due to the guarantee of principal and interest by these agencies, which are considered to have direct or indirect government support. The same applied for structured securities such as CMOs, which generally have AAA ratings and may also be supported by credit enhancements. The 2008 financial crisis brought plausibility to the notion of default of these assets, and as such, actuaries have included nonzero default rates (especially FNMA/FHLMC), either in the base asset adequacy projections, or have layered on for sensitivity purposes. A substantial drop in market value of the underlying property can occur in certain economic scenarios and in some locations, which could impact asset adequacy results if the company's disinvestment strategy involves asset sales.

Q55. What typically constitutes an adequate CMO model?

The desired sophistication and accuracy of a CMO model used for cash flow projections generally depends on the materiality of the CMO holdings in the portfolio and the expected volatility of the CMOs held. A suitable model generally will have, as a minimum, the following model features:

- Cash flows of the modeled tranche are dependent (if appropriate) on cash flows of other tranches; and

- Prepayment rates are dynamic over time and vary as interest rates change.

A significant challenge in modeling CMOs is the lack of readily available data on CMO structures after issue, as a company may not have the ability to see all tranches. Therefore, it is common for actuaries—particularly those at companies that have a large exposure to CMO issues—to obtain CMO cash flows for each interest rate scenario from an independent vendor.

Cash flows supplied by recognized vendors generally satisfy both of the above features for a suitable model. Specifically, because of the dependency of a tranche's cash flows to preceding tranches, it is often necessary to model not only the tranches a company owns but also the preceding tranches. This, combined with the additional complexity that is required to model appropriately cash flows from CMOs, makes obtaining a high level of robustness generally not feasible without subscribing to the databases of a recognized vendor that covers a comprehensive universe of CMO issues. Because the modeling

algorithms utilized by these companies are typically proprietary, it is often difficult to get the necessary information to review the cash flows or adequately describe them for summary documents.

However, use of a vendor does not guarantee that a particular tranche can be modeled directly. As a result, the cash flows for CMO holdings may be generated for each individual security (when available) or for representative CMO securities based on groupings of CMO assets with similar cash flow characteristics (when individual security modeling is not available). The actuary may choose to use grouping methods for CMO assets that are not included in the system's database of CMOs. Also, vendor systems may not include all Committee on Uniform Securities Identification Procedures (CUSIPs) numbers in their databases. An approach to take these into account is to assume these nonincluded assets have like characteristics (including paydowns) similar to other tranches in the portfolio.

Validation techniques are available to companies using an internally generated model. One method of testing the suitability of an internally generated model is to compare results over different scenarios for a sample of assets, with the results projected by CMO databases and systems operated by broker-dealers or independent vendors. A second method that can provide insight is to compare the cash flows that would have been used in testing one year ago with the actual cash flows received in the past year from the CMOs.

Q56. What are some considerations for modeling prepayment assumptions for securities collateralized by residential mortgages?

Following is a list of some of the items that the actuary may choose to check for reasonableness.

- The prepayment rate generally rises as interest rates decrease, and such changes typically follow an S curve or arctangent-curve (likewise, the prepayment rate typically slows as interest rates increase).

- Prepayments are generally slower for lower coupon collateral and faster for higher coupon collateral.

- Prepayment rates usually vary by type of collateral (GNMA versus FNMA/FHLMC; 15-year versus 30-year; new versus seasoned mortgages, fixed versus floating rate[7]).

[7] Base prepayment rates on floating-rate mortgages appear to be higher than those on fixed-rate mortgages, perhaps because some floating-rate mortgage holders may be waiting for the most efficient time to convert to a fixed-rate mortgage or they are more sensitive to or aware of changes in interest rates. The actuary may

- Prepayment rates are usually consistent across CMOs with comparable collateral.

- Prepayment rates for the level-interest-rate scenario bear a reasonable relationship to street median PSAs or historical PSAs (PSAs are those from the Public Security Association Standard Prepayment Model[8]).

- Prepayments may slow due to the "burn-out" factor—those mortgage holders who watch interest rates closely tend to prepay when interest rates are first lowered, while those remaining may not react as much to subsequent interest rate changes.

The validity of the cash flow analysis relative to CMOs and MBSs typically depends, to a large extent, on the validity of the prepayment model. Typically, the actuary generally is not trying to predict a specific prepayment rate as much as trying to correlate prepayment rates with changes in interest rates and other economic variables. The actuary's primary objective typically is to ensure that the correlations are reasonable. Validation techniques employed in practice are to compare the results of the model of a sample of mortgages under various interest scenarios, to confirm the direction and magnitude of movement. Also, comparing the relative sensitivity of several mortgages under a particular scenario, both using the model that is generating cash flow for asset adequacy as well as outside systems, is prevalent.

In order to understand the sensitivity of cash flow models to changes in parameters, the actuary may choose to evaluate the sensitivity of results to the prepayment function. If the company has a material exposure to CMOs, sensitivity testing with respect to the prepayment function may be appropriate in order to evaluate the sensitivity. Some actuaries alter the base prepayment rates in their models as a result of this sensitivity testing.

Q57. What are some common methods for determining the market value of CMOs and MBSs at a future point in time?

For fixed-income securities, the current market value is the present value of anticipated cash flows (discounted at a rate reflecting the current yield curve and the credit quality of the instrument), plus the value of the embedded options. The options available in the underlying pool of mortgages can have a significant impact on CMO/MBS values, and

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choose to evaluate the sensitivity of indexed tranches with regard to the link of the index to the scenario interest rate.

[8] These rates represent an assumed monthly rate of prepayment that is annualized to the outstanding principal balance of a mortgage loan. The PSA model is one of several models used to calculate and manage prepayment risk. The PSA model acknowledges that prepayment assumptions will change during the life of the obligation and affect the yield of the security. The model assumes a gradual rise in prepayments, which peaks after 30 months. The standard model, called "100 percent PSA," starts with an annualized prepayment rate of 0 percent in month zero, with 0.2-percentage-point increases each month until peaking at 6% after 30 months.

valuing these options is difficult. In addition, calculating market values for future points in time may be appropriate if a significant amount of CMOs and MBSs are modeled as being available for sale over the projection period.

Actuaries who model the market value of these assets may use different methods. The following are three such approaches that involve projection and discounting of future cash flows:

- An option pricing approach involving stochastic projections for each market value calculation. Some types of actuarial modeling software support this method, although their use can result in slow run times. Hence, some actuaries only use this approach if it is important to the assessment of asset adequacy, if alternative methods are unsuitable, and perhaps only for judiciously chosen scenarios.

- Similar to a stochastic method, but using just one scenario. It assumes that the interest rates remain level from the point being valued.

- Using the cash flows generated for the CFT scenario, so no additional projection of CMO cash flows is made.

Q58. What are the relevant aspects of commercial mortgages?

Commercial mortgages are loans collateralized by income-producing commercial properties, such as apartment buildings, shopping centers, hotels, or office buildings. While pooling and considering the risk and cash flow characteristics on a portfolio basis is common procedure in the case of *residential* mortgages, a case-by-case analysis is sometimes preferable for *commercial* mortgages because the large size of an individual loan and the unique features of the properties have an important effect on the risk and cash flow. However, some actuaries use the conclusions of the analysis at an aggregate level in CFT.

There are three important aspects in which commercial mortgages generally differ from residential mortgages. First, commercial mortgages usually have some level of call protection or “make whole” provisions. These can take the form of prepayment lockout periods, defeasance provisions, prepayment penalty points, or yield maintenance charges. The second major difference is that commercial loans are usually not fully amortized over the duration of the loan term. As a result, there typically is a significant balloon (or extension) risk at the end of the term. The implications of this risk for modeling purposes will be addressed in the following question. Lastly, a higher percentage of commercial mortgages tend to be adjustable rate when compared to residential mortgages.

Components of commercial mortgages can be restructured into commercial mortgage-backed securities, as either pass-throughs or pay-throughs, with the latter having tranches that redistribute cash flows in a variety of patterns and create a variety of credit risk levels.

Q59. What are the risks associated with commercial mortgages?

As with most types of fixed-income securities, many actuaries believe that the key risks can be categorized in the following ways:

- *Credit quality (tenant quality, occupancy rates)*

  Given the case-by-case nature of commercial mortgages, often the actuary will examine trends in cash flow and occupancy, lease terms, and profitability of underlying tenants prepared by the company's investment department to gain better understanding.

- *Reinvestment risk or extension risk*

  While there is usually more prepayment protection for commercial mortgages than for residential mortgages (due to prepayment lockout periods and make-whole provisions), there might be extension risk to be considered, with restructuring at below-market-yield rates. Evaluating restructuring risk based upon company and overall experience may help to ascertain reinvestment risk.

- *Concentration risk (location, number of properties, use)*

  Actuaries typically evaluate documentation provided by the company's investment department.

- *Interest rate risk*

  Because many commercial mortgages are adjustable rate, companies run the risk of loss of coupon income as a result of falling interest rates.

- *Liquidity risk*

  While yield degradation assumptions can provide an adequate measure of the amount of expected losses, actuaries providing services to companies with significant mortgage holdings or with a significant need for liquidity may choose to consider incorporating additional sensitivity tests in their CFT. For example, some studies have shown that the time from initial default to ultimate disposition is around three years. In a depressed environment, it may be reasonable to assume either a longer time period or a lower price at disposition.

Q60. What are some approaches used to model default losses on mortgages?

The *Mortgage Loan Portfolio Profile*, published quarterly by the American Council of Life Insurers (ACLI), has extensive information on a high percentage of the life insurance industry's mortgage loans, including commercial, one- to four-family, and agricultural loans. Property type and geographical distributions are shown, as are delinquencies, loans in process of foreclosure, restructured loans, and completed foreclosures. The actuary may choose to refer to this profile to evaluate industry experience and as a basis for comparison to company experience.

Spreads to Treasuries for commercial mortgages are available on a monthly basis from the Barron's/John B. Levy & Company National Mortgage Survey. Spreads wider than historical averages may be indicative of anticipated unfavorable experience. In this case, the actuary may choose to make some upward adjustments to default loss assumptions, perhaps grading to long-term averages over a reasonable period.

Research done in the course of development of mortgage RBC factors found default experience typically to be most closely related to a contemporaneous loan-to-value ratio. This ratio differs from a typical loan-to-value ratio in that the loan is valued at current interest rates before being compared to its current property value. Debt-service-coverage ratios are also usually a significant factor in estimating mortgage losses. An actuary who uses this type of ratio in projecting default losses may also choose to develop and use a mortgage quality rating system.

About two-thirds of those responding to the 2012 survey reported using their company's own experience in selecting the default loss assumption for mortgages. Some reported using a combination of company and external data. A variety of published external sources related to the mortgage sector were used by respondents, such as ACLI, Bloomberg, and Moody's. The most common factors by which the survey respondents varied mortgage losses were quality of the investment, year of projection, performing vs. nonperforming asset, and yield spread.

Q61. How is existing foreclosed real estate modeled?

Most actuaries exclude real estate due to the higher volatility of rental income. If real estate is included, many actuaries prefer to analyze foreclosed real estate on a property-by-property basis. While the results of such analysis typically may be summarized at an overall level that can be used for asset adequacy analysis, possible variations in the risk characteristics by property may be too great to make the use of broad-based assumptions feasible. This can be more important if the amount is expected to have a material effect on results. Because of the inherent difficulties and limitations in analyzing foreclosures, often these assets are excluded from asset adequacy analysis, if possible.

Q62. How might limited partnerships be evaluated?

Limited partnerships can serve different purposes. Some limited partnerships are designed such that complex or capital-intensive assets (energy, commodity, real estate) are placed into special purpose vehicles potentially to provide potential capital relief, with an income stream based upon the underlying assets. Others may relate to an equity interest in an entity.

The varied nature of limited partnerships may lead some actuaries to consider whether inclusion is practical for asset adequacy analysis, or even appropriate for asset adequacy analysis. As an example, some actuaries believe that equity interests are best placed in surplus, and are therefore excluded from asset adequacy analysis. In some cases, because of the inherent difficulties and limitations in analyzing limited partnerships or the complex underlying assets, assets are removed from asset adequacy analysis due to practicality. If they are included, one method actuaries use to evaluate limited partnerships is to be consistent with the evaluation of such assets under RBC; i.e., to look through the limited partnership package to the underlying assets. Each asset would then be evaluated on its own merits.

Q63. What are the relevant considerations for asset-backed securities?

As with MBSs and CMOs, it is common for actuaries providing services to companies with material holdings of asset-backed securities (ABSs) to use a vendor package to project cash flows. While certain types of ABSs do not have the interest rate sensitivity of other ABSs, MBSs, and CMOs, the data needed to track and project the underlying collateral often make using a vendor package a practical option.

As noted earlier in this practice note, even the best vendor packages may not cover 100 percent of a company's invested assets. The actuary may choose to map those assets not modeled to a similar asset, or the entirety of modeled holdings may be scaled up to approximate nonmodeled assets. Many actuaries prefer that the percentage of nonmodeled assets be small.

Q64. Are derivatives included in asset adequacy analysis, and if so, how are they typically modeled?

Actuaries may choose to consider using derivatives in their asset adequacy analysis if the company holds such instruments to either hedge risk arising from certain product designs or to hedge risk arising from adverse macroeconomic or microeconomic outcomes. Consideration for inclusion of derivatives in asset adequacy testing may depend on the extent to which such derivatives are integral to managing the asset-liability risk profile for these products. Examples of product designs that may necessitate use of hedge instruments are equity-indexed annuities, guaranteed benefits associated with variable annuities, or fixed annuities with guaranteed minimum interest rates. In order to hedge

macroeconomic and/or microeconomic risks, companies utilize interest rate swaps, swaptions, caps and floors, credit default swaps, and other options and futures. An example could be the use of swaps and swaptions to back interest rate risk on a block of long-term care business or immediate annuities.

Inclusion of derivatives in asset adequacy analysis varies in practice. For those companies that hold derivatives in their portfolio, 75 percent of the 2012 survey respondents included those derivatives held as of the testing date in asset adequacy analysis, and a subset of this group modeled future derivative purchases. Consequently, 25 percent of the companies that held derivatives as of the testing date did not incorporate those derivatives in asset adequacy analysis, possibly due to modeling difficulties.

If derivatives are deemed to be appropriate for inclusion in asset adequacy analysis, decisions need to be made on both a point-in-time (testing date) and projected basis. As of the testing date, a carrying value that is consistent with statutory values is desired, and would appropriately reflect various interest rate scenarios.

With regard to the projection, derivatives are typically modeled on a seriatim basis to recognize the timing of cash flows as well as each asset's characteristics. Some companies elect to use external vendor software to model derivatives. Testing is typically performed on deterministic scenarios for cash flow testing, although in some cases, and depending on the type of derivative, stochastic analysis is used. The underlying mechanics typically utilize various underlying models to price the optionality including Black-Scholes, the Black formula, other lognormal forward models, and similar approaches. The complexity of the models can vary significantly and typically are reliant on an actuary's input, comfort level with the formulae, and input from investment analysts. Materiality is another key consideration as to whether derivatives are included.

Finally, concerning documentation, some states may require detailed descriptions, modeling methodology, and output relative to derivatives included in asset adequacy analysis.

Section G: Modeling Considerations—Policy Cash Flow Risk

Q65. What is policy cash flow risk?

Policy cash flow risk, as defined in both ASOP No. 7 and ASOP No. 22, is as follows:

> The risk that the amount or timing of cash flows under a policy or contract will differ from expectations or assumptions for reasons other than a change in investment rates of return or a change in asset cash flows.

This risk is commonly referred to as C-2 risk, or pricing risk.

Q66. How might the appointed actuary typically decide on the scope of policy cash flow risk testing?

A good first step usually is to identify the material or most significant policy cash flow risks. These risks may be identified through a review of sensitivity analyses from prior pricing and/or projection work, combined with the appointed actuary's general knowledge of the product line(s). In deciding on the scope of testing, many actuaries consider the potential volatility of future experience, the significance of any anticipated variance in terms of its effect on results (i.e., ending surplus), the existence of any known repricing capability for nonguaranteed elements, and any known interrelationships with asset, investment rate-of-return, or other policy cash flow risks.

The policy cash flow risks considered generally include mortality, morbidity, lapse, and expense risks, as well as any significant options held by the policyholder, such as interest rate guarantees, policy loan utilization, the flexibility to pay or not pay premiums, guaranteed minimum death benefits (GMDB), guaranteed minimum withdrawal benefits (GMWB), or guaranteed minimum income benefits (GMIBs).

While both favorable and unfavorable deviations in future experience are possible, given the "moderately adverse" framework of asset adequacy analysis, many actuaries believe the appointed actuary's primary focus regarding any policy cash flow risk is the potential for adverse deviation.

Q67. What is meant by "sensitivity testing" for policy cash flow risk?

Sensitivity testing for policy cash flow risk involves the testing of non-asset-related variables under various scenarios to demonstrate the adequacy of reserves. After the completion of the testing of the adequacy of assets supporting specified liabilities under a basic set of scenarios (each scenario involving different economic assumptions that focus

primarily on asset and/or investment rate-of-return risk), the appointed actuary choosing to do such sensitivity testing may perform additional tests. These tests incorporate, for each significant type of policy cash flow risk (where significant is defined by the appointed actuary), a range of variations from the base policy cash flow assumption. The range in value for each assumption is generally determined based on the actuary's judgment of the reasonable possibility that such variations will occur. The basic economic scenarios generally are then rerun to determine the impact of such variation in the policy cash flow variables.

Certain sensitivity tests also can be run in order to evaluate the impact of adverse experience of more than one variable at a time.

Q68. What type of sensitivity testing is commonly done?

New product designs and benefits, and an increased recognition of the materiality of certain risks, have brought more focus on sensitivity testing, from both appointed actuaries and regulators. In the 2012 survey, respondents cited examples that have generated increased focus for sensitivity testing, including dynamic lapse parameters, interest or equity rates, reinvestment spreads, and payout annuity mortality.

From the 2012 survey of appointed actuaries, the following table gives the top 10 items most frequently sensitivity tested:

Lapse	91%
Life insurance mortality	80%
Expenses	71%
Asset defaults	57%
Payout annuity mortality	38%
Morbidity	36%
Interest or equity rates	36%
Reinvestment spreads	30%
Dynamic lapse parameters	27%
Premium persistency	20%

Q69. What policy cash flows are typically sensitivity tested under a gross premium valuation?

Sensitivity testing is usually performed for a GPV. Most respondents to the 2012 survey of appointed actuaries indicated that they perform sensitivity tests on the key variables for policy cash flows (e.g., expenses, lapses, mortality, and morbidity).

Q70. Do actuaries use their company's own experience to set modeling assumptions for policy cash flow risk?

Most actuaries use their own company's experience, wherever possible, to establish the key assumptions related to policy cash flow risk. The following table summarizes the percentage of respondents to the 2012 survey of appointed actuaries who reported setting their key assumptions by either company experience, industry experience, both, or actuarial judgment. A response of "Not applicable" was also included to capture responses where an assumption was not considered relevant:

Assumption	Company	Industry	Both	Actuarial Judgment	Not Applicable
Lapse	66%	2%	20%	4%	7%
Mortality	42%	11%	38%	2%	7%
Disability and recovery	16%	15%	17%	1%	51%
Morbidity	24%	8%	19%	1%	48%
Dynamic policyholder behavior	19%	4%	11%	42%	25%

Q71. When may the use of dynamic lapse assumptions be appropriate?

Several factors can affect lapse rates for a product, including attained age, policy duration, level of surrender charges, sophistication of the market, qualified vs. nonqualified status, distribution system, and the difference between the rate credited on the policy versus rates that could be earned on other similar products in the marketplace. Certain products are known to have increased lapses when interest rates increase. When the product being tested is known to be interest-sensitive (e.g., fixed deferred annuities), the actuary may choose to consider the use of dynamic lapse assumptions—i.e., to vary the lapse rates from scenario to scenario and from year to year—based on the dynamics involved. For policies that are not interest-sensitive (e.g., disability income), actuaries would not typically use dynamic lapse assumptions.

In the 2012 survey of appointed actuaries, roughly 72 percent of those surveyed responded that they use dynamic lapse assumptions for interest-sensitive products that allow surrender, 7 percent responded that they do not use a dynamic lapse assumption, and 22 percent responded that the assumption was not applicable.

Q72. How might the actuary address longevity risk in the setting of mortality and mortality improvement assumptions?

Longevity risk is the risk related to the increasing life expectancy of policyholders, which may translate to higher-than-expected cash flows. As with most assumptions, the extent to

which an actuary considers longevity risk in asset adequacy analysis depends upon the underlying products being tested, though products such as payout annuities, pension risk transfer business, and longevity swaps typically would be materially impacted by longevity risk.

A possible approach to setting assumptions for asset adequacy analysis may be to incorporate both a mortality table and a mortality improvement scale. Q70 references current practice in selecting mortality assumptions, focused more on base table assumptions. For improvement scales, there are standard industry tables available, both with and without margin. Some actuaries may choose to develop their own assumptions. Also, the actuary could include mortality improvement through a reduction in the base mortality rates.

The actuary may consider applying a margin to mortality tables and mortality improvement scales. There are available reference points for each. In selecting margins to apply to the mortality table, the actuary may consider the 10 percent margin generally included in annuity valuation tables. Larger margins may be appropriate for very small blocks of business, and smaller margins may be appropriate for larger blocks of business. For mortality improvement, Canadian valuation guidance[9] calls for a 50 percent margin for 25 years from the valuation date and zero percent thereafter.

Other considerations in addressing longevity risk in asset adequacy analysis are correlation of assumptions and sensitivity testing. Regarding correlation, the actuary may consider the relationship of margins on the base mortality table and the margins on the mortality improvement scale. Depending on the risks to be covered by these margins, the margins could adjusted for correlation. For example, if the margin is intended to cover random fluctuation risk, there is likely not any correlation. However, if the margin is intended to cover the risk of a severe mortality event such as a pandemic, correlation may be considered.

On sensitivity testing, such scenarios may incorporate all types of risk with simple increases/decreases to base assumptions. Another approach is to evaluate specific components of the risk (e.g., pandemic, etc.) as described above. Sensitivity testing could help identify assumptions that are relatively more significant to the results and contain more variability, and therefore may involve relatively more analysis to develop.

At the time this practice note was published, additional information on longevity risk was located at https://www.actuary.org/committees/dynamic/LRTF.

[9] *Guidance for the 2016 Valuation of Insurance Contract Liabilities of Life Insurers*; Canadian Institute of Actuaries; August 2016, page 7.

Q73. What are "secondary guarantees" and what additional policy cash flow risks are associated with them?

An account balance product is an insurance or annuity product that has an explicit visible account balance upon which surrender and other benefits depend. Typical account balance products include fixed and variable universal life and deferred annuities. For traditional account balance products, the continuation of benefits other than surrender depends entirely on the continuing existence of a positive account balance, as the costs for those benefits are charged directly against the account balance and the benefit is no longer available after the account balance drops to zero. A secondary guarantee may be extended to a benefit whose amount and/or duration may exceed that supported by the account balance. Examples of secondary guarantees include no-lapse guarantees on universal life insurance, and death benefits, maturity benefits, withdrawal benefits, and income benefits on annuities. Thus, the secondary guarantee adds the risk that the account balance will be insufficient to fund the guaranteed benefit. Therefore, secondary benefits require testing over various scenarios of interest rates and/or equity returns to ascertain whether the reserve is sufficient to fund the secondary guarantees.

Q74. What methods are used to perform asset adequacy analysis for products with secondary guarantees?

ASOP No. 22 (Section 3.3.1) states the following in determining the approach for asset adequacy analysis:

> The actuary should consider the type of asset, policy, or other liability cash flows, and the severity of risks associated with those cash flows, including the investment rate-of-return risk.

CFT methodologies are often used for products where future cash flows may vary under different economic or interest rate scenarios. For example, CFT may be used for a variable annuity with a fixed account option, or for one with a guaranteed minimum benefit design that varies materially by economic scenario, or for variable life business with significant death benefit guarantees or other secondary benefits in the general account.

Over the past decade, new minimum reserve regulations and guidelines for products with secondary guarantees have been introduced requiring multi-scenario projections and dynamic analysis to set the minimum reserve, replacing the deterministic formulaic approach for these products. This subject is addressed in more detail in Section L of this practice note.

Section H: Modeling Considerations—Expenses

Q75. What kinds of expenses are modeled for asset adequacy analysis?

In ASOP No. 22, gross premium reserves (Section 2.9), other liability cash flows (Section 2.16), and policy cash flows (Section 2.18) are all defined to reflect expenses.

The expenses to be considered typically include maintenance expenses, commissions, investment expenses, and overhead expenses associated with the liabilities to be tested.

ASOP No. 22, Section 3.3.4.c, states the following:

> The asset adequacy analysis should take into account anticipated material cash flows such as renewal premiums, guaranteed and nonguaranteed benefits, **expenses**, and taxes [emphasis added].

Q76. Must acquisition expenses be considered?

ASOP No. 22 focuses on the cash flows arising from inforce business, which does not typically include acquisition expenses. Nevertheless, it is possible that a business in its first policy year may still have acquisition expenses associated with it, which would, therefore, usually be considered expenses related to the business being tested.

Q77. How are expense assumptions checked for reasonableness?

In the 2012 survey of appointed actuaries, nearly all responding actuaries indicated they set unit expenses based on their own company's experience. Other approaches used by responding actuaries included the use of pricing expenses or industry data (e.g., expenses from LOMA (formerly, Life Office Management Association), SOA studies, or the Generally Recognized Expense Table (GRET).

A majority of respondents stated that they reconcile modeled expenses to the income statement. At least one state (California) requires an annual reconciliation of modeled expenses to the annual statement.

Q78. Some pricing actuaries assume that expenses will decrease over time, as economies of scale are reached. May this be reflected in testing?

Appointed actuaries sometimes reflect possible changes in future expense levels by splitting the expenses into fixed and variable components, with different assumptions for each. Another practice in use is to use pricing assumptions. If pricing assumes a decline in unit costs, a sensitivity test that assumes the level of expenses remains at the current level

(i.e., does not decrease) may be performed.

ASOP No. 7, Section 3.5.2, states the following:

> Considerations that might affect the projection include ... expense-control strategies...

Q79. Are insurance expenses generally adjusted for inflation?

Eighty-one percent of the respondents in the 2012 survey stated that they adjust expenses for inflation. A common way to do this is to have per-unit expenses and/or per-policy expenses—i.e., those that relate to fixed expenses—increase with the level of inflation appropriate to each scenario. Of those in the survey who model inflation, approximately 45 percent indicated they use a flat inflation assumption for all scenarios and 55 percent indicated they vary the inflation rate by scenario. Certain expenses, such as those that vary as a percentage of reserves or account values, would automatically change as the level of reserves per policy changes over time. The level of inflation appropriate to a given scenario may be related to consideration of the long-term average real returns on the projected comparable investments.

Q80. Do actuaries perform sensitivity tests on the expense levels assumed in testing?

ASOP No. 7 (Section 3.10.2) states that the appointed actuary

> should consider and appropriately address the sensitivity of the model to the effect of variations in key assumptions.

For some products and/or companies, expenses may be considered a key assumption. In the 2012 survey of appointed actuaries, 71 percent of the respondents indicated they do some sensitivity testing on expenses. Those respondents further indicated that additional sensitivity tests are performed on inflation and investment expense assumptions.

Q81. How are overhead expenses commonly reflected in testing?

There are many definitions of overhead expenses in use. Additionally, there are many opinions as to proper reflection of overhead to tested lines of business.

With respect to definition of overhead, some overhead expenses, such as management salaries, are typically viewed as recurring expenses. Other overhead expenses are extraordinary or nonrecurring. For example, some appointed actuaries would view expenses associated with the attempt to acquire a new block of business as extraordinary in nature, not as obligations of the inforce business being tested, but rather as being an

obligation of the new block of business after it is acquired. Other actuaries point out that a similar level of extraordinary expense occurs each year and therefore include it as part of the maintenance expenses used in CFT.

With respect to reflection of overhead, the 2012 survey showed a fairly wide range of practices with respect to the allocation of overhead in testing models. The majority (73 percent) of appointed actuaries let unit expenses fully reflect all policy-related maintenance and overhead expenses. Others let unit expenses reflect the policy related expenses only and reflect overhead through a separate model or an on-top adjustment to the results. Still others do not reflect the overhead in the unit expenses at all.

Q82. How are investment expenses typically handled in cash flow testing?

There are several practices that have been observed:

- Develop investment expenses as part of their analysis of their company's total expenses and therefore do not explicitly model them.
- Develop formulas that only allocate such expense at acquisition and disposition of an asset.
- Develop a formula of investment expenses as a number of basis points per year, which are deducted from the earned rate for each asset type.
- Reflect investment expenses explicitly or use, in the projections, an earned rate that is already reduced by the investment expense assumption.

Regardless of the approach used, some actuaries check the reasonableness of their modeled investment expenses by reconciling to the annual statement or to other company data.

Section I: Reliance on Other Parties

Q83. What is the relationship between the appointed actuary and those on whom the actuary relies?

Prior to accepting the position of appointed actuary, or as soon as practicable thereafter, the actuary may choose to meet with the persons or firms upon whom the actuary intends to rely. The following documents contain guidance on reliance:

- ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*, Sections 4.3 and 4.4;
- 2010 AOMR, Sections 6B(3)-(5) and 6E; and
- ASOP No. 23, *Data Quality*, Sections 3.5 and 3.6.

Respondents to the 2012 survey of appointed actuaries indicated that reliance statements are typically received from the following:

- Company investment staff: 63%
- Senior company management: 47%
- IT or administrative staff: 46%
- Line of business actuaries: 34%
- External investment advisers: 15%
- Consultants: 7%
- Other (mostly third-party administrators, reinsurers, or accountants): 21%

Sensibly, the actuary will typically not rely upon a person for whom the actuary has a high degree of oversight and control of work product (e.g., an actuarial student who reports to him or her). Also, the actuary will typically not rely upon the company's external auditor, as per a Notice to Practitioners dated February 1991 from the American Institute of Certified Public Accountants:

> The auditor should not consent to be referred to in an actuarial opinion in which the actuary expresses reliance on the auditor for the accuracy of the underlying data. If the auditor becomes aware that an actuary has expressed such reliance on the auditor, the auditor should advise the actuary that he or she does not consent to such reference, and the auditor should consider other actions that may be appropriate and may also wish to consult with legal counsel.

Q84. What data reliability tests might the appointed actuary perform?

The statement of actuarial opinion applies to all inforce business on the statement date. Tests of data reliability will typically depend upon the method used for asset adequacy analysis and whether the appointed actuary has relied upon others in developing data, procedures, or assumptions.

AOMR-recommended language varies with respect to what is included in the reliance as well as with respect to the extent of the actuary's review (refer to Q85). Tests of data reliability may include evaluation of data for reasonableness and consistency and reconciliation of the underlying records to applicable exhibits and schedules of the annual statement (e.g., Exhibits 5, 6, and 7; claim liabilities in Exhibit 8, Part 1; and equivalent items in the separate account statement).

Other references for tests of data reliability are:

- ASOP No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*;
- ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*; and
- ASOP No. 23, *Data Quality*.

Q85. Upon whom may the appointed actuary rely for substantial accuracy of records and information?

Many actuaries believe that the person they are relying upon should have the necessary breadth and depth of knowledge with respect to the related subject matter. Section 6A(3) of the AOMR allows the appointed actuary to rely on other experts in developing data, procedures, or assumptions, supported by a statement of each such expert in the form prescribed by Section 6E. Section 6E states the following:

> If the appointed actuary relies on the certification of others on matters concerning the accuracy or completeness of any data underlying the actuarial opinion, or the appropriateness of any other information used by the appointed actuary in forming the actuarial opinion, the actuarial opinion should so indicate the persons the actuary is relying upon and a precise identification of the items subject to reliance. In addition, the persons on whom the appointed actuary relies shall provide a certification that precisely identifies the items on which the person is providing information and a statement as to the accuracy, completeness or reasonableness, as applicable, of the items. This certification shall include the signature, title, company, address and telephone number of the person rendering the certification, as well as the date on which it is signed.

Two types of reliance are mentioned in the AOMR:

- Reliance on other experts to develop certain portions of the analysis.

- Reliance on others with respect to the underlying asset and liability records.

Regarding the first type of reliance, if the appointed actuary has relied on other experts to develop certain portions of the analysis, Section 6B(3) of the AOMR provides language for the actuarial opinion. This reliance should be accompanied by a statement by each of the experts in the form prescribed by Section 6E. The appointed actuary may wish to take particular note of the sentence included in the recommended language: "I have reviewed the information relied upon for reasonableness."

Regarding the second type of reliance, two alternatives for recommended language are provided, depending on the extent of the actuary's review:

1. The appointed actuary has the option of personally reviewing the underlying basic records. In that case, recommended language is presented in Section 6B(4). Some actuaries are reluctant to take this responsibility unless they are also qualified auditors.

2. If the appointed actuary chooses not to review the underlying records and has relied upon data prepared by others, Section 6B(5) offers recommended alternative language for the actuarial opinion. This reliance would typically be accompanied by a statement by each person relied upon in the form prescribed by Section 6E. The appointed actuary may wish to take particular note of the following from the recommended language:

   I evaluated that data for reasonableness and consistency. I also reconciled that data to [exhibits and schedules to be listed as applicable] of the company's current annual statement. In other respects, my examination included review of the actuarial assumptions and actuarial methods used and tests of the calculations I considered necessary.

Regardless of the type of reliance, the accuracy and comprehensiveness of data supplied by others are the responsibility of those who supply the data.

See Q86-Q88 on the level of detail used by actuaries to review the underlying data records. Both ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers* (Section 4.3), and ASOP No. 23, *Data Quality* (Section 3.5) contain guidance governing the actuary's obligations to satisfy herself or himself that data and analyses provided by third parties are reasonable and consistent. Other guidance and state regulations may also apply.

Q86. What level of detail is used to review the underlying liability inforce records from a third party?

From the 2004 survey of appointed actuaries, 131 respondents answered this question as follows:

No review, just reliance from third party	14%
A limited, cursory review looking for glaring discrepancies	11%
A moderate review of reasonableness and consistency	73%
An in-depth analysis (audit level)	2%

Within the "moderate review" category, one or more of the following methods was used:

Verify inforce against company work papers	92%
Compare data with prior year for consistency	84%
Perform test to identify questionable values	45%
Other	1%

Q87. What level of detail is used to review the underlying asset inforce records from a third party?

From the 2004 survey of appointed actuaries, 130 respondents answered this question as follows:

No review, just reliance from third party	18%
A limited, cursory review looking for glaring discrepancies	26%
A moderate review of reasonableness and consistency	53%
An in-depth analysis (audit level)	3%

Within the "moderate review" category, one or more of the following methods was used:

Verify inforce against company work papers	90%
Compare data with prior year for consistency	85%
Perform tests to identify questionable values	60%

Q88. What level of detail is used to review assumption support from a third party?

From the 2004 survey of appointed actuaries, 117 respondents answered this question as follows:

No review, just reliance from third party:	8%
A limited, cursory review looking for glaring discrepancies	11%
A moderate review of reasonableness and consistency	79%
An in-depth analysis (audit level)	3%

Within the "moderate review" category, one or more of the following methods was used::

Compare data with prior year analysis	87%
Compare assumptions with company data studies and analysis	80%
Other	3%

Section J: Analysis of Results

Q89. What measures are commonly used to test reserve adequacy for the actuarial opinion?

Among the respondents to the 2012 survey of appointed actuaries, 42 percent indicated they use the present value of ending surplus as the primary basis to determine reserve adequacy, while 50 percent focus on accumulated value. Still another 8 percent use other present values (such as present value of profits) as the primary basis to determine reserve adequacy.

Of the 92 percent who use either present value or accumulated value of surplus, 47 percent of survey respondents rely primarily on book value of surplus to determine reserve adequacy, 32 percent rely primarily on market value, and 13 percent use market value of assets minus book value of liabilities as their definition of surplus for this purpose.

One basis used by many actuaries is the estimated "ending net market value," calculated by estimating the market value of assets at the interest rates in effect at the end of the scenario, and deducting the present value (as of the end of the projection, at the same interest rates) of the remaining projected benefits and expenses. This gives an estimate of the market value of ending surplus. Some actuaries assume that the remaining liabilities are lapsed for cash value with the liquidation of assets at market value to cover the cash surrender.

When asked how market value of liabilities (MVL) were determined, 35 percent of survey respondents answered that MVL was not relevant to their work. Of those for whom MVL was relevant, some respondents gave different answers for different lines of business, such that the following percentages add to more than 65 percent: 26 percent used cash surrender value, 20 percent used the present value of future cash flows (as of the end of the projection), and 4 percent used a gross premium reserve. Also, 32 percent said that they used the book value of liabilities or the statutory reserves as their proxy for MVL.

Some actuaries project the book values (as opposed to market values) until the remaining liabilities are not material, with positive book value of surplus at the end of the test period considered acceptable. Some regulators require that ending value of surplus results be presented on a market value basis.

Q90. How do actuaries define the criteria used to determine reserve adequacy?

The 2012 survey asked, "What is your current criteria for establishing reserve adequacy?" Of those who responded, 70 percent chose answers suggesting use of a predetermined rule or guideline. Their answers broke down as follows:

- Thirty-six percent indicated that their criterion was "Enough to pass a specified number of New York 7 scenarios, but not necessarily all of them."
- Nineteen percent indicated that their criterion was "Enough to pass all of the New York 7 scenarios."
- Eleven percent answered "Enough to pass a specified percentage of the stochastic scenarios"
- Three percent answered "Enough to pass the level interest scenario."

The remaining 30 percent gave answers indicating that they were applying some kind of additional judgment. Of the total respondents, 6 percent indicated that they opined based on their own alternate deterministic scenarios. Others gave written answers describing a series of (or combinations of) diverse tests. For example, passing a specified number (but not all) of the New York 7 and a specified percentage of stochastic scenarios was the choice of 8 percent of the respondents.

In interpreting these survey results, it is important to consider the low-interest-rate environment that existed when the survey was taken (fall 2012). One might expect that the responses may have been different if interest rates were closer to historical levels.

Q91. What factors are considered in setting the criteria for reserve adequacy?

Some actuaries believe that the development of appropriate criteria for reserve adequacy is heavily dependent on the degree of conservatism used to establish the assumptions for each scenario. Some actuaries use a criteria of positive surplus in all scenarios tested for the reserve to be deemed adequate if all of the scenarios in the study represent moderately adverse or more favorable conditions (refer to Q16 for a definition of "moderately adverse conditions"). On the other hand, some actuaries believe that if stochastic approaches were used (generating scenarios that represent the universe of possible outcomes, including extremely adverse conditions "in the tail"), additional reserves would not usually be necessary if a specified small percentage of the scenarios produced negative surplus.

ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*, states that failing any particular scenario does not necessarily require additional reserves. If many scenarios were considered, failure of a small percentage of them would not necessarily indicate that the reserves are deficient. In judging the results of a multi-scenario test, the actuary will typically bear in mind that the surplus generated by any scenario typically is subject to a number of assumptions used in the testing (e.g., investment strategy, interest crediting strategy, and dynamic lapse formula). The liberalism or conservatism of these various assumptions can influence the interpretation of the results.

Additionally, to the extent the actuary considers mandatory scenarios (such as the New York 7), certain of these scenarios may be considered beyond moderately adverse, depending on the current economic environment. ASOP No. 22 gives guidance in this area. Section 3.4.2 states that "the actuary should consider whether reserves … are

adequate under moderately adverse conditions." Actuarial judgment may indicate that certain mandatory scenarios exceed this requirement. In such cases, testing similar, but less severe, scenarios may be appropriate in reaching a determination.

Although the criteria for establishing reserve adequacy are generally better understood now than they were 20 years ago, one article that is still a useful general reference is "Zen and the Art of Reserve and Asset Adequacy," by D. Becker, M. Smith, and M. Zurcher. This article was first published in Lincoln National's *Reinsurance Reporter* (3rd quarter, 1993), which is now published by Swiss Re Life & Health America.

For sets of randomly generated scenarios, some actuaries consider what percentage of scenarios failed and by how much. As noted above in Q4, an actuarial test of reserve adequacy is not a solvency test. While a test of solvency generally would involve the passing of a very large percentage of scenarios (and a reasonable limit to the severity of a failure), a reserve typically may be considered adequate as long as a reasonable percentage of scenarios, including a high percentage of moderately adverse scenarios, is passed.

In establishing adequacy criteria, some actuaries consider whether the guidelines apply at the line of business (or product) level or for the entire company. Some actuaries believe that the tolerance for adverse results will be lower at the aggregate than at a line of business level.

Ultimately, the decision to establish additional reserves depends on the actuary's judgment, regardless of the chosen criteria. The basis of the judgment is typically documented in the supporting memorandum. If additional reserves are recommended and management decides not to strengthen reserves, then the appointed actuary may issue an opinion other than a nonqualified opinion. See Q97 for a discussion of other types of opinions.

To get some indication of the impact of deliberate conservatism in asset adequacy analysis, the following question was included in the 2012 survey: "If you intentionally hold implicit or explicit margins of conservatism, by how much do these impact overall results?" Eighteen percent of respondents estimated the impact of conservatism on results at zero to 5 percent; 31% chose the range 6-10 percent; 9% selected an impact of 11 percent or more. Twenty-one percent answered "Not applicable" and 21% answered "Don't know."

Q92. How often have actuaries established additional reserves as a result of asset adequacy analysis?

Approximately 45 percent of those responding to this question in the 2012 survey of appointed actuaries reported that they have increased reserves as a result of asset adequacy analysis at some point in the past.

Of those who answered yes to this question, 50 percent established additional reserves for year-end 2011.

Q93. To what extent do actuaries look at interim results to determine reserve adequacy?

In the 2012 survey of appointed actuaries, 74 percent of the survey respondents indicated they consider projected results in interim periods as "important" (67 percent) or "critically important" (7 percent). The remaining respondents said that such interim results are either "not very important" (18 percent) or "unimportant" (8 percent).

Consistent with the above responses, 75 percent of all respondents look at the projected results in interim periods and 7 percent look at the year-by-year present value of those interim results. Of all respondents, 58 percent use book value of surplus when examining interim results, while 11 percent use market values and 6 percent use market values of assets less book value of liabilities.

With regard to the scenarios that are considered, 63 percent of the respondents look at all of the New York 7 scenarios, 16 percent look at New York 7 scenario No. 1 only, while the remaining respondents look at (i) subsets of the New York 7 scenarios Nos. 1 to 7, (ii) all deterministic scenarios, or (iii) all deterministic and stochastic scenarios.

Of those who strengthened reserves based on interim results, the method used to release the strengthened reserves generally varied based on the reasons the reserves were strengthened. For example, some reserves are released over the life of the business (e.g., to reflect mortality deterioration or low interest rates) while others are released over a fixed period (e.g., to cover a short-term period of higher asset defaults).

The AOMR (2001 and later) requires the preparation of a regulatory asset adequacy issues summary (RAAIS). The RAAIS requests commentary on any interim results that may be of significant concern to the appointed actuary. Such commentary may generally include, at a minimum, discussion of large negative values, early negative values, and protracted periods of negative value. Refer to Q102 for further discussion of the RAAIS.
Some states may impose additional requirements with respect to interim results. As an example, California specifically requires that "[i]f negative interim or ending surplus results are of no significant concern to the Appointed Actuary, explain why".

Q94. If, based on asset adequacy analysis, the reserves are judged to be inadequate, how does the actuary decide upon the amount of additional reserves?

Approximately one-half of the respondents to this question in the 2012 survey indicated that they never had to set up additional reserves. Of the remainder, 65 percent indicated that they calculate the present value necessary to eliminate the deficiency based on the same criteria they use for establishing reserve adequacy, and 18 percent indicated that, in

addition to using present values, they also make adjustments to reflect deficiencies in interim results. The remaining 17 percent reported use of a variety of techniques, including conditional tail expectation measures, gross premium reserves, amounts necessary to keep results positive for a predetermined length of time, and professional judgment.

Q95. When additional reserves are established or released, does the change in reserve go through the gain from operations, or is it booked directly to the surplus of the company?

Information may be found in the NAIC *Accounting Practices and Procedures Manual*:

Appendix A-822 states:

> If the appointed actuary determines as the result of asset adequacy analysis that a reserve should be held in addition to the aggregate reserve held by the company and calculated in accordance with methods set forth in the Standard Valuation Law, the company shall establish the additional reserve. (Section 5E(2))
>
> Additional reserves established … above and deemed not necessary in subsequent years may be released. … The release of such reserves would not be deemed an adoption of a lower standard of valuation. (Section 5E(3))

Statement of Statutory Accounting Principles (SSAP) No. 51R—*Life Contracts*, states the following:

> The difference between the policy reserve for life contracts at the beginning and end of the reporting period shall be reflected as a change in reserves in the summary of operations, except for any difference due to a change in valuation basis (paragraph 35). A change in valuation basis (except for those required by AG43) shall be defined as a change in the interest rate, mortality assumption, or reserving method (e.g., net level, preliminary term, etc.) or other factors affecting the reserve computation of policies in force and meets the definition of an accounting change as defined in SSAP No. 3—Accounting Changes and Corrections of Errors (paragraph 36).

Based on this, some actuaries believe that the change in reserves resulting from asset adequacy analysis, including any subsequent release of the reserve, would typically be recorded through the gain from operations, rather than directly to surplus.

Q96. What might the appointed actuary do if notified of a material reserve misstatement?

In the 2013 NAIC's *Annual Statement Instructions* for Life, Accident and Health Insurers (Instruction 12 of the Actuarial Opinion section therein), the following is noted:

> The insurer required to furnish an actuarial opinion shall require its appointed actuary to notify its board of directors or its audit committee in writing within five (5) business days after any determination by the appointed actuary that the opinion submitted to the domiciliary Commissioner was in error as a result of reliance on data or other information (other than assumptions) that, as of the balance sheet date, was factually incorrect. The opinion shall be considered to be in error if the opinion would have not been issued or would have been materially altered had the correct data or other information been used. The opinion shall not be considered to be in error if it would have been materially altered or not issued solely because of data or information concerning events subsequent to the balance sheet date or because actual results differ from those projected.

and

> No appointed actuary shall be liable in any manner to any person for any statement made in connection with the above paragraphs if such statement is made in a good faith effort to comply with the above paragraphs.

Recent NAIC *Annual Statement Instructions* do not include such language, but such language may inform a path for the appointed actuary to take, including communication with the board of directors and the state of domicile.

Section K: Preparing the Opinion and Memorandum

Q97. How do actuaries define "qualified opinion"?

The 2001 AOMR does not define what constitutes a "qualified opinion," so the appointed actuary has been required to make that determination.

VM-30 of the NAIC's Valuation Manual, which is currently being adopted by states, includes changes to the AOMR. As part of those changes, the terms "adverse opinion," "qualified opinion," and "inconclusive opinion" are defined. The appointed actuary will need to identify whether the opinion is unqualified, adverse, qualified, or inconclusive in the table of key indicators. If the opinion is adverse, qualified, or inconclusive, the appointed actuary should explicitly state the reason for such an opinion (Section 3A(10)).

Q98. What determines whether a reserve is in the formula reserve, additional reserve, or other amount column of the reserve table that appears in the scope paragraph of the actuarial opinion?

The AOMR includes a reserve table in Section 6B(2) that gives a suggested format for listing reserves that are to be included in the actuarial opinion. Footnotes (a) and (b) of that table describe additional actuarial reserves and analysis methods used, respectively. However, other than the headings on the columns, it does not provide a detailed description of how to prepare the remaining columns. One possible approach to preparing this table follows:

- Column (1) - Formula Reserves: This is for reserves that are subject to asset adequacy analysis. Formula reserves consist of reserves calculated by application of a statutory formula. However, formula reserves also include any reserves that do not have a specified statutory methodology but are calculated by a standard methodology or procedure each year.

- Column (2a) - Additional Actuarial Reserves: Footnote (a) of the reserve table states that the additional actuarial reserves are the reserves established in accordance with the results of the asset adequacy analysis. These additional reserves are addressed under Paragraph (2) of Section 5E of the AOMR.

- Column (2b) - Analysis Method: Footnote (b) of the reserve table states that this is the method used for asset adequacy analysis determined in accordance with the standards for asset adequacy analysis referred to in Section 5D of the AOMR. The appointed actuary may choose to list more than one method for each line in the table (e.g., CFT, GPV), with the corresponding reserve amounts for each method. The appointed actuary may refer to ASOP No. 22 in doing this.

- Column (3) - Other Amounts: This column is for reserves that were not subject to asset adequacy analysis. A common reason for not analyzing certain business is that the business is not material.

- Column (4) - Total Amount: This is the total of columns (1), (2), and (3). Many actuaries believe that Section 5E(1) of the AOMR requires that these amounts reconcile with the respective reserves of Exhibits 5, 6, and 7 and claim liabilities in Exhibit 8, Part 1, and equivalent items in the separate account statement or statements.

VM-30 of the NAIC's Valuation Manual, which has been adopted by many states, includes changes to the AOMR. One change is to add a column for "Principle-Based Reserves" between Formula Reserves and Additional Actuarial Reserves in the reserve table. It also includes the table as prescribed wording. If changes are made to the scope section, which includes the table, the appointed actuary may indicate that the table does not follow prescribed wording.

To see a discussion of the testing methods and the survey results on the use of these methods by appointed actuaries, refer to Q11.

Q99. What types of actuarial reports do actuaries prepare in connection with asset adequacy analysis?

All states require the preparation of an actuarial opinion that is filed with the annual statement. The SVL requires that an actuarial memorandum be prepared, which provides details of the analysis to support the actuarial opinion. However, most states do not require that the actuarial memorandum be filed along with the actuarial opinion. A few states require that the actuarial memorandum, or an executive summary of the actuarial memorandum, be filed.

New York Regulation 126 requires that an actuarial memorandum be submitted by all licensed insurers (not only domestic companies). However, if the nondomestic company receives a letter from an accredited state that has reviewed the company's actuarial opinion and memorandum from the prior year and the letter indicates the documentation was found acceptable, the memorandum is only filed if requested by the New York Commissioner.

The 2001 AOMR and VM-30 require that the RAAIS, an executive summary of the memorandum, be submitted by the appointed actuary, typically by March 15 of each year (refer to Q102).

In addition to regulatory reports, many actuaries prepare reports for other audiences such as internal management, external auditors, the board of directors, and rating agencies. Management reports typically include an executive summary of the memorandum rather than the entire memorandum. Some actuaries use the same executive summary for

management that is used for regulators, while others prepare a modified summary that may contain information not included in the regulatory summary. External auditors typically request copies of both the memorandum and the executive summary for management, along with supporting analysis and documentation. Rating agencies typically request copies of both the actuarial opinion and memorandum.

Q100. What level of detail is typically included in the actuarial memorandum?

Below is a table giving the responses from the 2012 survey of appointed actuaries for the general type of information respondents include in the memorandum. The percentages represent the percentage of respondents that include the respective item in the memorandum:

Description of scenarios used	99%
Description of sensitivity tests	98%
Description of company and markets in which products are sold	92%
Product description of each product modeled	89%
Products subject to asset adequacy	89%
Breakdown of modeled reserves by line and by type of reserve	88%
Description of reinsurance	87%
Aggregation methods used	83%
Description of reserves not tested	79%
Results by each line of business	79%
Breakdown of modeled assets by line and by asset type	79%
Interim results in the aggregate	72%
Interim results by line of business	56%
Definition of moderately adverse conditions	53%
Factors causing better or worse results in each line of business	48%
Reconciliation between Sept. 30 and Dec. 31	41%

Responses from the survey regarding the level of detail for liability assumptions by line of business:

Detailed listing of key assumptions, high-level description for others	64%
Detailed description and/or listing of assumption factors used	60%
Only high-level description of assumptions	17%

Responses from the survey regarding the level of detail for asset assumptions by portfolio:

Asset segmentation/allocation description	75%
Detailed listing of key assumptions, high-level description for others	56%
Detailed description and/or listing of assumption factors used	43%
Only high-level description of assumptions	23%

Q101. What is typically contained in the executive summary for management?

The information included in the executive summary for management differs widely, depending on the types of items that are of interest to company management. Many actuaries include a description of the asset adequacy methods used, a description of the major changes in assumptions and/or methods from the prior year, a description of the criteria used to determine asset adequacy, and a summary of the asset adequacy results. Some executive summaries give a brief history of the objectives of asset adequacy analysis, the areas that contributed to the study, a description of the scenarios used, and results that highlight the particular concerns of management. Other items that are sometimes included are projections of RBC levels at certain future points, interim results during the projection period, and breakdowns of CFT results by major product line. In any event, discussion of the conditions that pose a risk to asset adequacy and how the company could manage under such conditions might be valuable.

Q102. What is discussed in the regulatory asset adequacy issues summary (RAAIS)?

The 2001 AOMR lists the following items to be included in the RAAIS:

- Descriptions of the scenarios tested (including whether those scenarios are stochastic or deterministic) and the sensitivity testing done relative to those scenarios;
- Whether there are ending surplus results that are negative, and the amount of any additional reserve established to eliminate the negative surplus at the end of the testing period;
- Any material differences in assumptions from the year before;
- The reserves subject to asset adequacy the year before, but not subject in the current opinion;
- Comments on any interim results that may be of significant concern;
- The method used to recognize the impact of reinsurance; and
- Whether the actuary recognized all options embedded in assets.

Some states, including New York and California, require additional disclosures within the RAAIS.

Q103. What are regulators' suggestions for improvement in actuarial opinions and memoranda?

A group of insurance regulators who are actuaries responded to an open request for comments in 2003 concerning actuarial opinions and memoranda. Some areas they identified for improvement, which should not be interpreted to be an exhaustive list, are:

Reliance statements: Adding clarity to identify who developed and took responsibility for certain assumptions. (Sources of information for reliance statements now include ASOP

No. 23, *Data Quality* and ASOP No. 41, *Actuarial Communications*; the topic is addressed most directly in the 2001 AOMR).

Assumption detail. Adding detail and discussion of analysis performed. Paragraph 3.2—Actuarial Report, of ASOP No. 41, *Actuarial Communications*, states the following:

> In the actuarial report, the actuary should state the actuarial findings, and identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary's work as presented in the actuarial report.

Reinsurance. Additional documentation regarding the inclusion / exclusion of reinsurance cash flows, and if included, commentary on model fit.

Off-balance-sheet items. Additional documentation regarding the inclusion / exclusion of off-balance-sheet items (such as derivatives) is sought.

Sensitivity testing. Expanding sensitivity testing and including in memorandum. One regulator opined that professional practice includes due attention to those risks that the business is most sensitive to, not simply the risks most commonly addressed by a particular analysis method. For example, sensitivity testing of morbidity, lapse rates, or claim termination rates may be considerably more instructive for some lines of business than testing the impact of changes in the interest rate environment. For example, reasonable limits on rate increases in accident and health insurance would typically be applied in order to realistically analyze C-2 risks.

Investment assumptions. Providing support for investments assumptions used in model.

Expense. More discussion and demonstration were desired to show that expenses used in the model are reasonable and appropriate. There was interest in demonstration that separate account fees cover all expenses allocated to the separate account and cover any general account expense allowances for separate account reserves.

Clarity. Some regulators desired a clear discussion of actual or potential problem areas, with adequate attention to interim results and a clear statement to indicate if an opinion is "qualified." Others were concerned that executive summaries were too long and did not always include clear descriptions of potential problems.

Section L: Impact of AG43, PBR, and Other Nonformulaic Valuation Standards

Q104. What is the "history" of statutory valuation and how is the role of asset adequacy analysis changing?

Elizur Wright established minimum reserve standards for Massachusetts insurance companies in 1858. These reserves were based on a formulaic method with prescribed assumptions such as mortality and valuation interest rate. Later, some companies tested their reserves using a GPV, but, as late as 1985, neither regulators nor the actuarial profession mandated use of CFT. With the introduction of interest-sensitive products having a flexible crediting rate closely related to the rate earned on assets backing the reserves, it became apparent that simplified formula reserves might become inadequate if the company could not earn the guaranteed minimum crediting rate. This situation was exacerbated by the inflationary and unstable interest rate experience in the 1980s, which caused further mismatch between assets and liabilities.

In response to this experience, regulators have gradually introduced more dynamic and flexible valuation requirements. The commissioners' annuity reserve valuation method (CARVM) was introduced in 1980, requiring multi-scenario analysis of deferred annuities, with the scenarios depending on lapse and mortality experience, rather than interest rate paths. CARVM was further clarified in 1998 with Actuarial Guideline XXXIII (AG33). Dynamic valuation interest rates were introduced in 1982. The Academy drafted "Recommendation #7" requiring CFT, and in 1985, New York incorporated this draft language into Regulation 126; this was the first U.S. regulatory requirement for asset adequacy analysis. Since then, the regulatory requirement for asset adequacy analysis has grown to include almost all products and companies. In the early 1990s, the first version of the AOMR was adopted, bringing a level of standardization to asset adequacy analyses performed throughout the industry.

Flexible mortality assumptions for calculation of deficiency reserves were introduced in 2000 in the Valuation of Life Insurance Policies Model Regulation commonly known as "Regulation XXX." Its successor, Actuarial Guideline XXXVIII (AG38), followed as new product designs were introduced. The year 2009 saw the introduction of AG43 for variable annuities, requiring a stochastic projection of interest rate and equity return scenarios, along with lapse and mortality assumptions that were fully responsive to varying economic conditions in different scenarios. (The need for AG43 followed more than 10 years of research and committee work by the Academy, which was unable to find an appropriate simplified valuation method for valuing variable annuities with GMIBs.) Around the same time, it became apparent that ordinary life insurance and other products were also moving in the same direction, with multiple options and dynamic crediting rates embedded in these products. Meanwhile, it was apparent that AG38 and Regulation XXX sometimes produced reserves that were well in excess of those reasonably required for regulatory purposes. This led to increased focus on a principle-based reserve (PBR)

concept for valuation, wherein reserve calculation methods and assumptions are fully dynamic and flexible, following actuarial principles rather than prescribed formulas or assumptions, and result in reserve levels that are already deemed to be adequate based on how they are calculated. Because this theoretical concept had not yet proved its reliability, the emerging standards took on a diverse mixture of old (formulaic, prescriptive) and new (experience-based, company-specific, actuarial professionalism) guidance. Consequently, new reserving methods following a principle-based approach (PBA) have been introduced in recent years, and these continue to evolve (refer to Q105).

Q105. Which emerging standards follow the principle-based approach?

Recently introduced PBA reserve requirements include AG43 for variable annuities and Actuarial Guideline XXXVIII, Section 8D (AG38 8D) for some blocks of universal life policies with secondary guarantees. In addition, some requirements exist for stand-alone asset adequacy reserve analysis, such as for life insurance business subject to AG 38 Section 8C (AG38 8C). Most recently, the revised Valuation Manual (currently adopted by most states) contains Section VM-20—*Requirements for Principle-Based Reserves for Life Products* (VM-20), which addresses life product reserving (even prior to adoption, AG38 8D referred to the VM-20 approach). AG43 is incorporated into the Valuation Manual as VM-21. All of these analyses resemble the asset adequacy analysis required by the AOMR in that they involve projections of asset and liability cash flows. Differences appear, though, in the level of prescription of assumptions and the testing requirements (e.g., scenarios), as well as the scope and issue date range of the business included.

Beyond statutory reserves, there are also capital requirements such as RBC C-3 Phase 1 for fixed annuities and single-premium life insurance and RBC C-3 Phase 2 for variable annuities. These, too, can involve projections of asset and liability cash flows, with differences in the level of prescription of assumptions and the testing requirements (e.g., scenarios), as well as the scope of the business included.

Q106. Does meeting the requirements of a PBA reserve simultaneously satisfy the requirements of AOMR?

All inforce business is subject to AOMR, regardless of the method used to determine the reserve. However, while the AOMR requirements are commonly met via a method such as CFT, other methods are possible (refer to Q11).

Some actuaries believe that a reserve determined via a PBA automatically meets the "moderately adverse conditions" associated with AOMR, and thus include such business in the analysis via the method of Demonstration of Conservatism. Some actuaries will substantiate this through simplified testing or sensitivity analysis. Other actuaries will continue to include PBA-reserved business in CFT or other analysis as part of AOMR.

ASSET ADEQUACY ANALYSIS PRACTICE NOTE

In considering whether the PBA reserve meets the AOMR requirements, an actuary may wish to take the following into account:

- An actuary might consider product-specific aspects (optionality, volatility of experience, sensitivity to various assumptions, etc.) as well as distribution of results (where available) under different financial conditions. Indeed, with varying financial conditions, as well as possible differing product characteristics at different policy durations, it is possible that the decision made by the actuary could be different on different valuation dates.

- There is a further complication in that, under the Valuation Manual, only some of a company's reserves are subject to PBA methods, rendering the AOMR aggregate comparisons incomplete.

Given these many facets, it is not surprising that a wide range of practice currently exists:

- From the 2012 appointed actuary survey, 16 percent of responding actuaries defined AG43 as meeting the AOMR requirement, some with additional sensitivity testing, while 23 percent continued to include the business in a CFT or other analysis. It is noted that 61 percent of the survey respondents indicated that AG43 was not applicable to their business (i.e., the business does not have variable annuities in force).

- From the 2012 appointed actuary survey, 33 percent of responding actuaries indicated that they would likely consider PBA (VM-20) requirements for life products as meeting AOMR, while 42 percent indicated that they would likely continue with CFT or some other analysis, at least until more of the inforce business was subject to the PBA. It is noted that 25 percent of the survey respondents indicated that the PBA was not applicable or that they were undecided on their approach.

- From the 2012 appointed actuary survey, 27 percent of responding actuaries indicated that they would likely consider PBA requirements for fixed annuities as meeting AOMR, while 35 percent indicated that they would likely continue with CFT or some other analysis, at least until more of the inforce business was subject to the PBA. It is noted that 38 percent of the survey respondents indicated that the PBA was not applicable or that they were undecided on their approach.

With the advent of PBR and the Valuation Manual for life insurance, optionally effective on Jan. 1, 2017 for new business, it is likely that practice in this area will continue to evolve.

Q107. How does AOMR interact with AG43 / VM-21?

Like all inforce business, reserves for variable annuities determined under AG43 / VM-21 are subject to AOMR. Given the PBA nature of AG43 / VM-21, some actuaries believe that the reserve determined automatically meets the "moderately adverse conditions" associated with AOMR and thus include it in the analysis via the method of Demonstration of Conservatism. While such a reserve may be considered conservative at a particular valuation date, margins may deteriorate in the future under the same calculation method and assumptions. Thus, some actuaries will perform a simplified analysis (perhaps a single scenario) to satisfy themselves that the AG43 / VM-21 reserve remains adequate.

Alternatively, some actuaries take the approach of continuing to fully incorporate the AG43 / VM-21 business in the AOMR through a method such as CFT. In doing so, any elements of excess conservatism included in the AG43 reserve calculation (for example, a standard scenario amount significantly exceeding the corresponding conditional tail expectation (CTE) amount might be considered excessive conservatism) may become available as additional sufficiency in AOMR (and alternatively, any insufficiency would also be reflected).

From the 2012 appointed actuary survey, 45 percent of the survey respondents reporting AG43 / VM-21 reserves defined AG43 as meeting the AOMR requirement, some with additional sensitivity testing, while 55 percent included the business in a CFT analysis.

Where the results of variable annuity product projections are included in the aggregate company results, it is necessary to first determine the reserve requirement under AG43 / VM-21, as this serves as the initial reserve tested under AOMR.

Q108. How does AOMR interact with AG38?

There are currently two sections in AG38 that may interact with AOMR: Sections 8C and 8D. Both sections scope in universal life with secondary guarantees issued during certain periods. Section 8C includes all universal life with secondary guarantees issued between Jan. 1, 2007, through Dec. 31, 2012, and Section 8D includes universal life with secondary guarantees with multiple sets of charges issued between July 1, 2005, and Dec. 31, 2012. Section 8C includes a stand-alone asset adequacy analysis that tests the formulaic reserve used for products subject to this requirement. Section 8D is a reserve calculation using a PBA method. There is potential overlap between Sections 8C and 8D, resulting in some policies being subject to both of these requirements, as well as AOMR.

AG38 8C:

Like all inforce business, reserves determined under AG38 are subject to AOMR. In completing AOMR, many actuaries make use of various models, each representing different blocks of business, that are then summed to determine the aggregate results for

the company. In such cases, the AG38 8C asset adequacy analysis may represent one of these subset blocks of the company. Alternatively, some actuaries may combine the AG38 8C policies with other policies of the company in completing AOMR. In such cases, the aggregate result may not be equal to what otherwise would have been the "sum of the parts." Alternatively, an actuary could choose to consider the AG38 8C business as "tested": in such case, any sufficiency found within the AG38 8C block would effectively not be included in the aggregate company results. (Note: If the AG38 8C result is a potential insufficiency, an additional reserve may be established to achieve adequacy. Such additional reserve would become part of the initial reserve tested for the AG38 8C business under AOMR. Hence, it would not be expected that there could be a situation where an "insufficiency" could be ignored when choosing not to include the AG38 8C results in the aggregate AOMR.)

AG38 8D:

Like all inforce business, reserves determined under AG38 are subject to AOMR. Given the PBA nature of AG38 8D, some actuaries believe that the reserve determined meets the "moderately adverse conditions" associated with AOMR and thus these actuaries include the reserve in the analysis via the method of Demonstration of Conservatism. While such a reserve may be considered conservative at a particular valuation date, there may be changes in conditions or other factors that affect the margins. Thus, some actuaries will perform a simplified analysis (perhaps a single scenario) to satisfy themselves that the AG38 8D reserve remains adequate under the requirements of asset adequacy analysis.

Alternatively, some actuaries take the approach of continuing to fully include the AG38 8D business in AOMR through a method such as CFT. In doing so, elements of conservatism included in the AG38 8D reserve calculation may become available as additional sufficiency in AOMR.

Where the results of the AG38 8D products are included in the aggregate company results, it is necessary to first determine the reserve requirement under AG38 8D, as this serves as the initial reserve tested under AOMR.

Q109. How does AG38 8C interact with AG38 8D, and in turn with AOMR?

There are three combinations of the AG38 8C and AG38 8D policies to consider:

a) Policies that are subject to AG38 8C, but not to AG38 8D:

Most actuaries would calculate the AG38 8C formulaic reserve and use this as the initial reserve in the stand-alone asset adequacy analysis. If an additional stand-alone asset adequacy analysis is indicated, this reserve would become part of the initial reserve for AOMR. Some actuaries would then perform AOMR, possibly with this block as a subset of the total, or possibly combined with other business. Alternatively, some actuaries would consider AOMR to have already been met.

b) Policies that are subject to AG38 8D, but not to AG38 8C:

Most actuaries would first calculate the AG38 8D reserve. Some actuaries would then consider this reserve to meet the requirements of AOMR via the method of Demonstration of Conservatism, possibly confirming this through a simplified analysis or other approach. Alternatively, some actuaries would include the AG38 8D business in the AOMR models, with its contribution to the sufficiency (or insufficiency) reflected in the company's aggregate result.

c) Policies that are subject to both AG38 8C and AG38 8D:

Most actuaries would first calculate both the AG38 8C formulaic reserves and the AG38 8D reserves, and determine the higher to be the appropriate initial reserve for the policy. If the AG38 8D reserve is higher, some actuaries would consider this reserve to automatically meet the "moderately adverse conditions" associated with AOMR. Alternatively, some actuaries would complete a stand-alone asset adequacy analysis to determine whether any additional reserve were required. If an additional stand-alone asset adequacy analysis is indicated, this reserve would become part of the initial reserve for AOMR. Some actuaries would then perform AOMR, possibly with this block as a subset of the total, or possibly combined with other business. Alternatively, some actuaries would consider AOMR to have already been met.

It is noted that some of the aforementioned blocks may be combined, for example, AG38 8D that is also AG38 8C, with AG38 8C that is not also AG38 8D, in performing the AG38 8C asset adequacy analysis. Such approaches may vary given practical modeling and materiality considerations.

Q110. If an actuary establishes an additional reserve, is this additional reserve included in subsequent analyses?

Asset adequacy analysis is a test of the "initial reserve" for inforce policies as reported in the current statement. Thus, if an "additional reserve" is part of the initial reserve, it is generally included in the analysis.

For example, AG38 8C may result in an additional asset adequacy analysis reserve established. This becomes part of the reported reserve of the AG38 8C business. When the AG38 8C block is then tested under AOMR, the entire initial (reported) reserve is included (i.e., tested) in AOMR.

Q111. What differences exist between completing the asset adequacy analysis required under AOMR versus that required under AG38 8C?

Asset adequacy analysis methods described earlier in this practice note apply under both aggregate analysis (AOMR) and stand-alone analysis (AG38 8C). Thus, methods and approaches will be similar. Scope (business included) obviously differs. Assumptions and scenarios considered would generally not differ. However, some actuaries may include larger margins in stand-alone analyses given that natural offsets with other blocks of business are unavailable. Similarly, for stand-alone analysis, it may be that some scenarios otherwise considered for the total company are not applicable. Documented substantiation of differences applied to the policies that fall under these two requirements may be valuable.

Q112. What differences exist in establishment of additional reserves under AOMR versus AG38 8C stand-alone asset adequacy analysis?

Many actuaries would use the same models, assumptions, scenarios, etc., in completing both of these requirements for the same block of business. As such, results of the analyses would be expected to be the same. However, some difference could exist if the AG38 8C business is combined with other business of the company in completing AOMR. Regardless, the actuary will establish any additional reserve based on the results. Consistency in analytic approach (refer to Q11) is generally desired. However, some actuaries believe that a more stringent standard should be applied when reviewing stand-alone testing results that do not have the opportunity for offset in the aggregate with other business of the company.

Q113. What differences exist in the reporting requirement of AOMR versus other regulatory analyses?

The specific reporting requirements for AOMR, AG38 8C, AG38 8D, AG43, VM-20, etc., are found in the respective model regulation or guidelines. Many analyses require that a "stand-alone report" be prepared. As there can be substantial repetition of information among related reports, some actuaries will create a "base" report and then reference it in other reports where necessary. Some actuaries will create common report "chapters" or "appendices" that can be combined in different ways to meet the multiple reporting requirements. Some actuaries will create a single "giant report" that includes all requirements. Other actuaries will create separate, distinct reports, potentially with significant repetition of data. Often the exact structure of the reports will vary depending on the relative importance of each block of business (materiality), the degree of complexity of the analysis, and/or in response to preferences expressed by the company's domestic regulator or other recipient of the report. See also Q99 and Q100.

Appendix A: Acronym Definitions

ABS	Asset-Backed Security
Academy	American Academy of Actuaries
ACG	Actuarial Compliance Guideline
ACLI	American Council of Life Insurers
AG38 8C	Actuarial Guideline XXXVIII, Section 8C
AG38 8D	Actuarial Guideline XXXVIII, Section 8D
AG43	Actuarial Guideline XLIII for Variable Annuities
AOMR	Actuarial Opinion and Memorandum Regulation
ASOP	Actuarial Standard of Practice
AVR	Asset Valuation Reserve
CFT	Cash Flow Testing
CMO	Collateralized Mortgage Obligation
DAC	Deferred Acquisition Cost
DTA	Deferred Tax Asset
DTL	Deferred Tax Liability
FHLMC	Federal Home Loan Mortgage Corporation
FNMA	Federal National Mortgage Association
GMIB	Guaranteed Minimum Income Benefit
GNMA	Government National Mortgage Association
GPV	Gross Premium Valuation
IMR	Interest Maintenance Reserve
Libor	London Interbank Offered Rate
MBS	Mortgage-Backed Security
MVL	Market Value of Liabilities
NAIC	National Association of Insurance Commissioners
PAC	Planned Amortization Class
PBA	Principle-Based Approach
PBR	Principle-Based Reserve
PSA	Public Securities Association Standard Prepayment
RAAIS	Regulatory Asset Adequacy Issues Summary
RBC	Risk-Based Capital
Regulation XXX	Valuation of Life Insurance Policies Model Regulation
SOA	Society of Actuaries
SSAP	Statement of Statutory Accounting Principles
SVL	Standard Valuation Law
VM-20	Valuation Manual-20
VM-30	Valuation Manual-30
VM-G	Valuation Manual-Appendix G