ASSET ADEQUACY ANALYSIS PRACTICE NOTE – DECEMBER 2004

AMERICAN ACADEMY *of* ACTUARIES

This practice note was prepared by a work group organized by the Life Valuation Subcommittee of the American Academy of Actuaries. The work group was charged with updating the initial practice notes written in 1995 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 in 2004. The purpose of the practice note is to assist actuaries who are faced with the requirement of asset adequacy testing by supplying examples of some of the common approaches to this work. However, no representation of completeness is made, nor whether these constitute best practice at the time they are read; other approaches may also be in common use.

It should be recognized that the information contained in this practice note provides guidance, but is not a definitive statement as to what constitutes generally accepted actuarial practice in this area. Moreover, this practice note reflects the results of a survey of actuaries who practice in jurisdictions in which the model Standard Valuation Law 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. The Actuarial Standards Board has not promulgated this practice note, and the note is not binding on any actuary.

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Comments are welcome as to the appropriateness of the practice notes, desirability of annual updating, validity of substantive disagreements, etc. They should be sent to the Academy's Senior Life Policy Analyst, Steve English, at english@actuary.org.

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A. Introduction and Background

Q1. WHAT CURRENT PRACTICES IS THE PRACTICE NOTE BASED ON?

A1. Since 1986, actuaries have been performing asset adequacy analysis for certain annuity and other interest-sensitive lines of business under the requirements of New York Regulation 126. More recently, the types of business subject to asset adequacy analysis have been expanded into all other product lines as a result 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 that have been developed were in response to these regulations and guidelines. Reviews of these practices have been published from time to time in industry publications (e.g., *Proceedings of the Valuation Actuary Symposium, Financial Reporter*).

The current[1] Actuarial Standards and Actuarial Compliance Guidelines (ACGS) related to when asset adequacy analysis is necessary and what the appointed actuary considers during the testing process are:

- ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*,
- ASOP No. 7, *Analysis of Life, Health & Property Casualty Insurance Cash Flows*;
- ASOP No. 23, *Data Quality*, pertaining to reliance on data provided and guidance on reviewing such data, and
- Actuarial Compliance Guideline (ACG) No. 4, *Statutory Statements of Opinion Not Including an Asset Adequacy Analysis by Appointed Actuaries for Life or Health Insurers* (pertaining to Section 7 opinions under the 1991 AOMR).

A survey was taken in early 2004 on the practices followed by appointed actuaries for year-end 2003 (the "survey"). The results have been incorporated into this practice note. The survey was sponsored jointly by the Society of Actuaries and the American Academy of Actuaries. There were 169 responses to the survey. Below is a breakdown of the survey respondents by company size (in terms of total assets) for the 168 respondents to that question:

[1] All references to "current" in this practice note are as of the date of this writing, July 2004.

Company size (assets) of respondents	Number of respondents
$25 billion or more	20
$5 - $25 billion	31
$1 - $5 billion	47
$500 million - $1 billion	23
$100 million - $500 million	27
$100 million or less	20
Total	168

Q2. IS THIS PRACTICE NOTE EXPECTED TO BECOME A *STANDARD* THAT ACTUARIES MUST FOLLOW?

A2. Absolutely not. This practice note documents what is believed to be *current practice.* There are a number of reasons an actuary might choose to use methods other than those described in this practice note:

- 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 actuary may have developed other acceptable testing methods
- This practice note may not sufficiently include current practices that are relevant and appropriate. It may not have captured the total range of current practice in all areas (although the practice note was reviewed by actuaries familiar with the topics of the practice note, and these actuaries have concluded that the practice note represents approaches that fall within current practice.) Even though comments were solicited from the actuarial community, it is quite possible that other approaches that could properly be termed *current practices* have not been documented here.

Q3. WHAT IS THE GOAL OF ASSET ADEQUACY ANALYSIS?

A3. The goal of asset adequacy analysis normally is to ascertain the ability of a block of assets to support a corresponding block of liabilities. As reported in the survey, most actuaries believe the primary use of asset adequacy testing is to satisfy regulatory requirements.

There are a number of regulatory requirements that necessitate asset adequacy analysis, including:

2001 AOMR. The National Association of Insurance Commissioners (NAIC) adopted the AOMR in 1991. Asset adequacy analysis was required for certain, but not all, companies, based on a defined set of criteria. Effective in 2001, the NAIC amended the AOMR. Key to this revision was the elimination of an opinion based on the formula-derived reserves without consideration of the assets backing the reserves (formerly referred to as a "Section 7 opinion" under the 1991 AOMR). Under the 2001 AOMR provisions, all companies must perform an asset adequacy analysis in forming the required opinion.

States have been slow to enact the new regulation but eight states have already adopted it (as of the date of this note development, July 2004), with other states strongly considering it. Companies domiciled in a state that has adopted the 2001 AOMR must submit an opinion based on asset adequacy analysis. Companies domiciled in other states that would otherwise satisfy Section 7 criteria, but licensed in states that have passed the 2001 AOMR, may choose to contact those states to see if an opinion based on asset adequacy analysis is required

Codification. The NAIC Statutory Accounting Practices Group has incorporated certain provisions of the AOMR into codification. Codification requires the disclosure of any material differences between the reserves reported in the annual statement reserves and the reserves that would have been developed had asset adequacy analysis been performed. Since codification applies to business written on or after January 1, 2001, asset adequacy analysis may be required to the extent that this business is material and the company is not already performing asset adequacy analysis.

"Regulation XXX." The Valuation of Life Insurance Policies regulation (Regulation XXX) is in effect in the majority of states. As part of this regulation, companies may apply prescribed factors less than 100% ("X-factors") to the valuation mortality table to reduce the deficiency reserve burden of their life insurance policies. To take advantage of this feature of the regulation, a company must have an asset adequacy actuarial opinion and memorandum prepared annually in conformance with the requirements of the AOMR.

New York Regulation 127. New York's reserving of Market Value Adjusted Annuities that are held in a market-value separate account requires that the assets in the separate account make good and sufficient provision for the company's liabilities with respect to these policies.

Actuarial Guideline 34 and 39. The NAIC has adopted Actuarial Guideline 34 (AG 34) (Variable Annuity Minimum Death Benefit Reserves) and Actuarial Guideline 39 (AG39) (Reserves for Variable Annuities with Guaranteed Living Benefits). AG34 states that, "the appointed actuary shall perform a standalone asset adequacy analysis of the total reserve held for all of the contracts falling within the scope of this Guideline". AG39 also requires a standalone asset adequacy analysis of the VAGLB reserve. (See Practice Note for the Application of Actuarial Guideline XXXIX, December 2002.)

2001 CSO. Regulatory action is moving at a far more rapid pace in the implementation of the 2001 CSO mortality table than on the AOMR revision: as of this writing (July 2004), 25 states have adopted the new table. The AOMR permits early recognition of the 2001 CSO table, but requires the preparation of an asset adequacy analysis opinion for the reserves of the business applied to if a company uses the table as the minimum reserve mortality standard for *any plan*. The Standard Valuation Law *requires* the use of the 2001 CSO table beginning January 1, 2009.

State Insurance Department Requests. Even if an asset adequacy opinion is not required for any of the reasons listed above, under Section 3 of the 1991 AOMR, a state insurance department may request that one be prepared based on the circumstances of any company. Beginning with year-end 2002, the New York State Insurance Department made this request for Category C companies (those with admitted assets between $100 million and $500 million, which by regulation were required to prepare asset adequacy opinions only every third year if they met certain exemption eligibility tests). In their request letter, the New York Department specifically cited concerns about the continued low interest rate environment, the recent period of high default experience, and the depressed stock market as reasons for the request. Given the universality of these problems for all companies doing business in the United States, other states may follow New York's lead in requesting such asset adequacy analyses, possibly on an individual company basis.

Regulatory requirements notwithstanding, some actuaries believe that the primary purpose of asset adequacy analyses is to inform management of actual or possible problems that may arise due to the current management of the business (e.g., due to the current crediting or investment strategies) through at least one report resulting from the analysis, such as an executive summary for management. Many regulators take a keen interest in how the asset adequacy results are communicated to management, and one state, New York, requires that the appointed actuary inform management of the results. The Regulatory Asset Adequacy Issues Summary (see Q101) is used by some actuaries for communication with management as well as regulators.

Q4. WHAT RESOURCES ARE AVAILABLE TO ASSIST THE APPOINTED ACTUARY IN ASSET ADEQUACY ANALYSIS?

A4. Numerous support resources have been developed and maintained by actuarial firms, associations and regulatory bodies to assist the appointed actuary in asset adequacy analysis. The primary providers of these resources include the Society of Actuaries (SOA), the American Academy of Actuaries (the Academy), the NAIC, and state regulatory bodies.

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

The Academy, through the ASOPs of the Actuarial Standards Board, Practice Notes and the Life and Health Valuation Manual, is also a resource to assist the appointed actuary in asset adequacy analysis. Among the current ASOPs and ACGs that discuss when cash flow testing is appropriate and considerations for the appointed actuary performing asset adequacy analysis are:

ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*;

ASOP No. 7, *Analysis of Life, Health & Property Casualty Insurance Cash Flows*;

ACG No. 4, *Statutory Statements of Opinion Not Including an Asset Adequacy Analysis by Appointed Actuaries for Life or Health Insurers*; and

ASOP No. 23, *Data Quality*, pertaining to reliance on data provided and guidance on reviewing such data.

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 testing.

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.

The NAIC maintains information on model law adoption, as well as drafts of proposed legislation on their 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. The NAIC also provides educational information to State Insurance Department personnel regarding the work done by the appointed actuary.

A few state regulatory bodies provide the appointed actuary for companies approved for writing business within that state with a letter each year, describing specific considerations and requirements related to asset adequacy analysis. As of year-end 2003, these states included New York and California.

Q5. HOW IS AN ASSET (RESERVE) ADEQUACY ANALYSIS DIFFERENT FROM A SOLVENCY TEST?

A5. According to ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*:

> "The actuary performs asset adequacy analysis on the underlying asset, policy, or other liability cash flows. In performing an asset adequacy analysis, the actuary should choose a block of assets such that the book value of those assets is no greater than the book value of the reserves and other liabilities being tested. If the actuary determines that additional assets are needed to support these reserves and other liabilities being tested, then the actuary should establish an additional reserve equal to the book value of those additional assets."

Normally new business is not included in the projections of an asset adequacy analysis, and only assets equal to statutory liabilities are included. Some actuaries believe that the main objective of an asset adequacy test is to determine whether the liabilities and reserves are likely to be deficient and whether it would be prudent to establish an additional reserve.

A *solvency test* is more inclusive than an asset adequacy analysis, as all of the significant assets and liabilities of the company are included in a solvency test, and a projection of new business is usually included. Some actuaries believe that the main objective of a solvency test is to determine whether the surplus of the company is likely to be sufficient to support the current operations of the company.

The AOMR 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 AOMR opinion is an asset adequacy opinion on reserve adequacy, as opposed to a solvency opinion.

The actuary is not currently required by either the ASOPs or the model Standard Valuation Law 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 testing may be one of the tools used in assessing the overall financial health of life insurance companies.

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?

A6. The AOMR defines a "qualified actuary." Assuming the actuary is qualified, the regulation states that a company shall give the commissioner of insurance timely written notice of the name, title (and, in the case of a consulting actuary, the name of his/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 have additional requirements in their versions of the regulation. For example, New York's Regulation 126 instructs the newly appointed actuary to consult with the previous appointed actuary, if only to determine whether there are any reasons not to accept the appointment. If there are any such reasons, either the situation should be rectified to the new actuary's satisfaction or the appointment should not be accepted. Ohio's Actuarial Opinion and Memorandum regulation goes further than New York's regulation in that it requires a statement of consultation signed by both the previous appointed actuary and the newly appointed actuary that includes an inventory of items described in 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 Prescribed Statements of Actuarial Opinion*. It also requires that the acceptance of, or withdrawal from, the position be in writing.

Q7. WHAT INFORMATION MAY THE APPOINTED ACTUARY WISH TO OBTAIN FROM THE PREVIOUS APPOINTED ACTUARY?

A7. Even if not required by a particular state, 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, and adverse scenarios in the cash flow testing performed).

Q8. WHAT IS THE RELATIONSHIP BETWEEN THE APPOINTED ACTUARY AND THE BOARD OF DIRECTORS?

A8. The AOMR states that either the board of directors or an executive officer of the company acting under the board's authority shall choose 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, not amended or edited by a 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 actuarial 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 delegate) 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 contemplated 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?

Q9. WHAT DOCUMENTATION IS PROVIDED WITH REGARD TO THE APPOINTED ACTUARY'S PERSONAL QUALIFICATIONS?

A9. Qualification issues are addressed in the Academy's *Qualification Standards for Prescribed Statements of Actuarial Opinion*. 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 of his or her duties as appointed actuary. The *Qualification Standards* also describe continuing education requirements for practicing actuaries.

C. General Considerations for Performing Asset Adequacy Analysis

Q10. HOW DOES THE ACTUARY DECIDE WHAT TO TEST?

A10. According to ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers*, virtually all policyholder reserves and claims liabilities are covered:

> 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.

A standard of materiality used by some actuaries is less than 5% of total reserves (this is also the percent mentioned in a letter to appointed actuaries dated November 3, 1994 from the Illinois Department of Insurance). Other actuaries establish a fixed dollar limit in determining materiality, considering other financial information of the company. Most actuaries prefer to evaluate materiality both individually as well as in aggregate. In the final analysis, the actuary usually exercises professional judgment to confirm that inclusion of "immaterial" amounts that have been left out of the analysis would not result in significantly different findings in her or his actuarial opinion, report, or recommendation. Guidance on materiality is provided in the Preamble to Codification (i.e. "Is this item large enough for users of the information to be influenced by it?")

In the 2004 survey of appointed actuaries, approximately 90% of survey respondents indicated that they exclude 5% or less of the general account liabilities from testing. For separate account liabilities, about 80% of the respondents that have SA liabilities exclude 1% or less of those liabilities. Specific lines that have been excluded by survey respondents are listed below, most due to the relative immateriality of their reserves:

- Group business;
- Accident and health;
- Supplemental contracts;
- Accidental death benefit;
- Waiver of premium and disability riders;
- Claim reserves.

Q11. WHAT METHODS ARE USED TO TEST THE ADEQUACY OF RESERVES?

A11. As indicated by the responses to the 2004 survey of appointed actuaries, the most commonly used method to test the adequacy of reserves is cash flow testing (see ASOP No. 7).

The survey responses exhibited the following percentage breakdown of 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 connote cash flow testing, the actuary, exercising professional judgment, may decide that cash flow testing 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 extremely sensitive to fluctuations in interest rates. Cash flow testing may be a particularly good way to consistently analyze the full impact of the interest sensitivity of the asset and liability cash flows.

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 desires to use positive cash flow from a non-interest sensitive line of business to offset a deficit in an interest-sensitive line of business or to more confidently treat overhead expenses for an entire company, a consistent cash flow testing approach across all lines may be the preferred method to determine asset adequacy.

However, cash flow testing is not the only acceptable method for testing the adequacy of reserves. The actuary may 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 addresses reasons for and against cash flow testing, and ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life or Health Insurers,* which clearly states that asset adequacy analysis encompasses many approaches in addition to cash flow testing.

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

Gross Premium Valuation. A gross premium valuation 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. 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 gross premium valuation 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 Extreme Conservatism. If the appointed actuary considers the reserves for a particular line of business to be at an extremely conservative level (under *any* moderately adverse scenario), it would be reasonable to demonstrate this degree of conservatism rather than perform cash flow testing analysis. This might be appropriate with an older block of life insurance business that assumes an extremely conservative interest rate and mortality assumption. For instance, an actuary might consider the valuation interest rate to be extremely conservative if it were moderately lower than the ultimate reinvestment rate in any falling scenarios that might be considered. Nevertheless, if there were any doubt about the level of conservatism not being extreme, most actuaries would use one of the other methods described above in such a case.

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. For short-term health insurance business that tends to be supported by short-term assets, loss ratio methods may be appropriate. 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?

A12. Gross premium valuation (GPV) is described in Q11. A GPV involves a projection of the liability based on the present value of the benefits and expenses less gross premiums. The projection of these liability cash flows is generally the same as in cash flow testing (CFT), with the complexity of modeling ranging from being as complex as a full-blown CFT or as simple as a spreadsheet model. However, unlike cash flow testing, 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.

A gross premium valuation 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. Cash flow testing 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 flows or duration mismatches in the portfolio.

A GPV is normally validated in the same manner as 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 (see 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?

A13. The Board of Directors for each company appoints one appointed actuary for that company. 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 (which is in effect in most states as of the date of this practice note) allows aggregation of reserves and assets before analyzing the adequacy of the combined assets to mature the combined liabilities. It also allows 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 allows 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 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.

Since there is no uniform guidance regarding aggregation across lines of business for determining reserve adequacy, it is not surprising that aggregation practices vary.

The following table summarizes responses to the 2004 survey of appointed actuaries regarding aggregation across lines of business to determine reserve adequacy:

Only consider results in the aggregate (i.e., allow positive surplus from one line to cover negative surplus in another)	65%
Require acceptable results for each major product line or line of business on a "stand-alone" basis	21%
In addition to results in the aggregate, also require acceptable results for certain product lines	12%
Other variations of the above	2%

Product lines mentioned in the survey for stand alone reserve adequacy included long-term care, separate account products, life, group life, annuities, and health (due to the gross premium floor).

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 the ending present value of 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., gross premium valuation for some and cash flow testing for others), some actuaries believe it is normally inappropriate to combine results unless consistent economic scenarios are used. Gross premium valuation results can usually be aggregated with cash flow testing results when economic scenarios used for each of the lines of business are consistent, even if different projection periods are used. One method used in practice is to calculate present values at the valuation date in the gross premium valuations using the interest rates of each scenario, and to combine these results with cash flow testing present values at the valuation date for the same scenarios.

Q14. HOW ARE ASSETS ALLOCATED AMONG LINES IF CASH FLOW TESTING IS DONE SEPARATELY FOR EACH LINE?

A14. 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 cash flow testing. 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.

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, the actuary is usually prudent to confirm that the same assets are not used for different 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 preferable if the duration of the liabilities differs materially between lines.

Responses to the 2004 survey of appointed actuaries regarding the methods used to allocate assets by line of business were:

Formal segmentation	37%
Pro-rata all assets	22%
Notional segmentation	16%
Select appropriate assets for each liability type	10%
Other	15%

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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 is made, it may be useful to document the impact of the change on the asset adequacy results.

Q15. CAN THE ACTUARY USE A TESTING DATE PRIOR TO DECEMBER 31 FOR THE PURPOSE OF THE YEAR-END ACTUARIAL OPINION?

A15. Since it can be difficult to complete an asset adequacy analysis in time for the March 1 deadline using year-end data, many actuaries use data through a prior date. ASOP No. 22 gives guidance for using data prior to year-end to be used in the analysis, provided that significant changes have not occurred.

Approximately two-thirds of the respondents to the 2004 survey of appointed actuaries based their testing on a date earlier than December 31, with 95% of those using at least a date of September 30.

When an actuary chooses a testing date earlier than the valuation date, it is usually advisable for the actuary to provide a demonstration that there have been no material changes between the two dates. To make this demonstration, some actuaries 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, they 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 also consider changes in the interest rate curve, equity movements and the level of investment reserves between the testing date and year-end. Some actuaries also use additional sensitivity scenarios where the December 31 yield curve is applied to earlier data.

From the 2004 survey of appointed actuaries, the following is a summary of the percent 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 size of liabilities	92%
Change in nature of liabilities	74%
Change in mix of assets	80%
Change in nature of assets	56%
Change in interest rates	66%
Change in equity movements	11%

Q16. HOW DO ACTUARIES INTERPRET "MODERATELY ADVERSE CONDITIONS" IN ASSET ADEQUACY ANALYSIS FOR PURPOSES OF COMPLIANCE WITH ASOP NO. 22?

A16. Item 3.4.2 of ASOP No. 22 says:

> 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:

> 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 implies asset adequacy analysis ordinarily would be performed with at least one scenario or set of conditions that is 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 the 1991 AOMR (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. Thus, some actuaries exercise professional judgment to determine what constitutes "moderately adverse conditions" relative to the current economic environment, rather than assuming that a consistently defined set of scenarios are appropriate for all economic environments.

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 economic assumptions might offset each other to some extent.

D. Modeling Considerations - General

Q17. WHAT MODELING PLATFORMS ARE USED TO MODEL LIABILITIES?

A17. Based on the 2004 survey of appointed actuaries, 15% use exclusively a homegrown platform, 70% use exclusively a platform purchased from a commercial vendor, and 15% use a combination of both. The platforms mentioned most often in the survey are TAS, PTS and MG-ALFA. See Q40 for a discussion of modeling platforms used to model assets.

Q18. HOW LONG ARE THE PROJECTION PERIODS USED BY ACTUARIES?

A18. From the 2004 survey of appointed actuaries, approximately two-thirds of the respondents use the same projection period for all products. Of these, 46% use a projection period of 20 years, 38% use a projection period of 30 years, and 6% use a projection period of 40 years or more. The longest projection period used was 100 years (one company).

For the one-third of the respondents who use different periods by product, the following is a summary of the results of the survey:

- 30 years was the most common period for individual life products (63%).
- The period used for individual deferred annuities averaged about 20 years, but were fairly evenly divided between 10, 20 and 30 years.
- Individual immediate annuities and structured settlements had the longest periods, with the former averaging 45 years, and the latter averaging 53 years (70 years being the most common).
- Projection periods for group annuities averaged 25 years, with 20 years being the most common.
- 20 years was also the most common for health products (individual and group DI, LTC, Medicare, and other individual health).

ASOP No. 22 states that:

> [a]sset adequacy should be tested over a period which extends to a point at which reserves on a closed block are immaterial in relation to the analysis.

Approximately 40% of the respondents to the 2004 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 60% who responded that they do use a materiality level to determine the length of the projection period, 75% use a materiality level of 90% or more while the lowest materiality level used that was cited was 65%.

Q19. WHAT TYPES OF MODEL VALIDATION DO APPOINTED ACTUARIES PERFORM?

A19. In the 2004 survey of appointed actuaries, almost 90% of respondents stated that they performed static validations such as checking opening balances of the model against actual inforce. Dynamic validations were performed by 70% of respondents. In a dynamic validation, the actuary compares projections coming from models against actual results or financial forecasts. Some actuaries compare actual results with the prior year's models in order to improve current models.

Q20. HOW IS THE DISCOUNT RATE DETERMINED THAT IS USED TO CALCULATE THE PRESENT VALUE OF ENDING SURPLUS AT THE VALUATION DATE?

A20. There are currently several methods used to determine a discount rate.

The method suggested by the New York Insurance Department is to run a scenario, and then rerun the scenario adding $1,000 of existing assets. The ratio of the ending differences can be used to determine the discount rate for that scenario.

There are several other methods currently being used by actuaries. One is to use the 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 use the 1-year Treasury forward rates that are generated in each scenario. Another alternative is to use the Treasury spot rate for the length of the projection period, e.g., 20 years, which is generated under each scenario.

From the 2004 survey of appointed actuaries, approximately 1/3 of the respondents do not calculate a present value of ending surplus. Of those that do, below is a summary of the methods used to determine the discount rate:

After-tax earnings rate, including policy loan interest	46%
After-tax earnings rate, excluding policy loan interest.	11%
After-tax Treasury spot rates for the length of projection period	11%
After-tax 1-year Treasury forward rates	6%
New York method (described above)	5%
Other	21%

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

- Pre-tax net earned rate;
- After-tax interest rate used for reinvesting cash flows;
- Pre-tax 10-year Treasury rate;
- Company hurdle rate;
- A fixed rate every year to facilitate comparison of results between years;
- A low valuation-type interest rate.

Q21. HOW DOES THE ACTUARY SET THE DISCOUNT RATES FOR A GROSS PREMIUM VALUATION?

A21. The discount rate used in determining the present values of a given scenario is normally consistent with the expected earned rate on the assets backing the liabilities for that scenario. Some actuaries use a level after-tax net earned rate based on a recent average portfolio yield of the assets. 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. Some actuaries set the earned rate used for discounting purposes lower than the rate earned by the company's assets, where both rates are on an after-tax basis.

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. 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 cash flow testing instead of gross premium valuation.

Some actuaries test the option risk in assets by assuming an immediate drop in the discount rate used in the gross premium valuation. 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 TESTING. WHY?

A22. The IMR is part of the total reported statutory reserves. The IMR normally defers recognition of the 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 if they had not been sold.

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 testing 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 testing.

In the 2004 survey of appointed actuaries, over 80% of the appointed actuaries responding 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, in order to conservatively model future lower asset yields. In the 2004 survey, 46% of respondents lowered assets by the absolute value of a negative IMR balance, and 48% used a value of zero for the starting IMR if it was 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 go negative within the testing period.

Q23. HOW DOES THE ACTUARY DETERMINE WHICH PORTION OF THE IMR CAN BE USED TO SUPPORT CERTAIN PRODUCTS, AND HOW IS THE PORTION OF THE IMR USED?

A23. If the actuary allocates the assets and IMR by line, then one possible approach is to increase the starting assets by the amount of the unamortized portion of the capital gains for those assets that are allocated to a certain product or business unit. Another possible approach is to directly allocate the 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.

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 gains 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 typically start with assets equal to reserves plus the portion of the IMR, and model the changes to IMR as assets are called and sold during the projection.

Q24. HOW IS THE ASSET VALUATION RESERVE (AVR) TREATED IN CASH FLOW TESTING?

A24. From the 2004 survey of appointed actuaries, 45% do not include the AVR in testing. Of the 55% who do, there are three issues that are normally considered 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 cannot be used for other risks. Many actuaries 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 below, then the actuary runs the projections without the AVR assets and without defaults (under the assumption that the AVR covers the cost of defaults).

2. If this 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 normally adds assets equal to the pro-rata AVR, and run the projections with defaults modeled.

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

In addition to the above choices concerning beginning assets, if the actuary can model the development of the AVR itself, then the actuary could usually start with assets equal to the liability reserves plus the full pro-rata AVR, and model the contributions to AVR, as well as project defaults. Some actuaries prefer a realistic model using defaults and AVR, while others prefer the simpler models without AVR. In the 2004 survey, 2/3 of those that include the AVR in their testing, model the AVR development year by year.

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 IN ASSET ADEQUACY TESTING?

A25. 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 35 (the first AVR page) in the annual statement,[2] with the following variables:

[2] Annual statement references in this practice note are based on the NAIC Life/Health blank as of December 31, 2003.

ratio = [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 36 of the annual statement); and

statement value = amount in Schedule D, Part 1, Column 9 (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 of (ratio × factor × statement value). If it is desired to increase precision, this result may be increased for the AVR on the assets that are assumed to back AVR (i.e., the AVR on the AVR).) Other approaches used are: 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 LIVES 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?

A26. 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 IMR in the value of ending surplus.

The AOMR requires that 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. Add value of ending AVR to assets minus liabilities to determine ending surplus;
2. Ignore 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, ignore 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?

A27. Shortly after deferred tax assets and liabilities (DTA/DTL) were added to the statutory statements, an informal survey was taken of a small group of chief actuaries about how they were handling these DTA/DTLs. The following are the significant variations in subsequent practice:

- Whether the basic cash flow testing modeling explicitly models tax items such as tax reserves, or whether it simply applies a tax rate to projected statutory income;
- Whether the deferred tax asset is admitted;
- Whether any deferred tax liabilities exist;
- Whether the appointed actuary views the DTA/DTL as items outside the scope of the actuarial opinion or an integral part of the reserves to which the opinion applies.

Some actuaries use cash flow testing models that specifically project taxable income (e.g., tax reserves different than statutory reserves, DAC tax accruals and amortization). Some actuaries believe that the DTA/DTL (the admitted portion in the case of DTA) is analogous to the IMR, and include the appropriate allocated portion in the modeling. In the case of DTA, the DTA is usually part of the assets backing 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 ignore it. Explicit modeling of projected future DTA/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 cash flow testing 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 normally be appropriate to ignore the DTA. In the situation where there is a net DTL, the projection would usually be understating future taxes, and some actuaries consider including a provision for additional taxes as indicated by the DTL.

In the 2004 survey, approximately 40% of respondents stated that they did not project the items needed to calculate DTA/DTL balances (e.g., tax reserves, DAC tax accruals), but many of these responses may have been attributable to these items not being material. The majority of respondents (78%) did not model initial DTA/DTL balances, either because they had none, they were immaterial, or because they simply chose not to consider them for asset adequacy purposes.

Q28. HOW ARE SHAREHOLDER DIVIDENDS TREATED IN ASSET ADEQUACY ANALYSIS?

A28. Based on the results of the 2004 survey, 20% of the respondents were mutual companies that don't pay shareholder dividends. Of the remaining 80%, only 10% explicitly include shareholder dividends in their model.

Some actuaries believe that it is not necessary to consider shareholder dividends since such dividends are a function of surplus, which is outside the scope of reserve adequacy testing. However, ASOP No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*, section 3.10.4 states:

> 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.

As such, the belief of some actuaries that it is not necessary to consider shareholder dividends may be untenable if the impact of the dividends is material.

Given the small percentage of respondents who currently consider shareholder dividends in their testing, it is difficult to define common practice for modeling the shareholder dividends. Many actuaries model the dividends as a fixed expense, either based on the historically paid amounts or as a fixed percentage of statutory gains. Others do not explicitly model them; rather, they examine the historical pattern of payment and demonstrate that prior dividend payments do not erode the surplus position of the company. Some reflect shareholder dividends as part of their sensitivity testing.

Q29. HOW ARE POLICYHOLDER DIVIDENDS TREATED IN ASSET ADEQUACY ANALYSIS?

A29. 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 changes for any dividend changes.

Based on the 2004 survey of appointed actuaries, below is a summary of how policyholder dividends are modeled for those companies with either participating life or health products (heath products include experience refunds):

	Life	Health
As a fixed expense	34%	23%
As a dynamic assumption that varies by scenario	54%	5%
Ignored as not material	8%	67%
Other	4%	5%

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?

A30. ASOP No. 7 states that:

> 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 flows.

In the 2004 survey of appointed actuaries, nearly 80% of the respondents model reinsurance when it is material. Of those who model reinsurance, 52% of the respondents do so at the cell level, 21% at the plan level, and 19% model reinsurance at the aggregate level.

ASOP No. 7 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?

A31. 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 cash flow testing 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 cash flow testing 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 (since the risks have been ceded to another company).

E. Modeling Considerations - Scenarios

Q32. WHAT APPROACHES TO MODELING ECONOMIC SCENARIOS ARE CURRENTLY INCLUDED IN APPOINTED ACTUARIES' PRACTICE WHEN DOING ASSET ADEQUACY TESTING?

A32. Economic scenarios used for asset adequacy testing usually incorporate interest rates as key variables, as they are the most important economic variable 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 broadly categorized as deterministic and stochastic. In a deterministic approach, one or more "hand-picked" scenarios of future rates are used. An example of this is the seven required interest rate scenarios described in the 1991 version of the AOMR.

Note: The seven scenarios were first specified in New York Regulation 126, so some actuaries refer to them 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 Insurance Department has released bulletins that describe the manner of constructing the interest scenarios. See web address http://www.ins.state.ny.us/. Past bulletins have included guidance of a maximum rate of 25%, a floor of one-half of the starting 5-year treasury rate, and the use of parallel or proportional yield curve shifts. Some actuaries also add inverted yield curve scenarios to the basic seven.

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 cash flow testing.

Q33. WHICH OF THE ABOVE APPROACHES ARE APPROPRIATE IF ASSET ADEQUACY ANALYSIS IS REQUIRED, AND HOW MANY AND WHAT TYPES OF SCENARIOS ARE TESTED?

A33. ASOP No. 7 contains the following statements:

- Depending on the purpose of the analysis, more than one scenario may be used. Scenarios may be generated by either deterministic or stochastic methods.

- [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 is required by many states, and some actuaries believe that these provide a sufficient variety of scenarios for their analysis. Although the current AOMR no longer requires that the New York 7 scenarios be tested, the 1991 AOMR is still effective in many states, and some actuaries are expected either to continue testing these scenarios as a useful benchmark or to treat them as the minimum required scenarios.

In the 2004 survey of appointed actuaries, 39% of respondents only tested the New York 7 scenarios, and an additional 32% tested the New York 7 plus one or two additional deterministic scenarios (typically, an inverted yield curve and/or a yield curve with normal slope). More than 9 deterministic scenarios were tested by 21% of respondents. Some respondents tested fewer than 7 scenarios.

43% of respondents tested stochastically generated interest rate scenarios with the median number of scenarios tested being 100. Some actuaries generate a large number of stochastic scenarios (i.e. 1,000 or 10,00) but then select a smaller, representative subset (e.g., 50 or 100) that are actually used in the testing. The representative subset is usually chosen so that such things as the mean, median, range and variance of the subset approximate the distribution of the full set of scenarios.

Some actuaries who base their conclusions on the results of stochastic scenarios still find the New York 7 useful for model validation. Those that take this position generally believe the New York 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 normally be expected to show greater asset prepayments, and the pop-up scenario to show greater cash surrenders (assuming the existence of such interest-sensitive assets and liabilities).

Approximately 1/3 of the respondents include separate account equity return scenarios in testing. These respondents were evenly divided in using deterministic scenarios only, stochastic scenarios only, and both deterministic and stochastic scenarios. The deterministic scenarios used were generally fewer than 10. (Several respondents tested only one scenario.) The median number of stochastic scenarios tested was 125. According to the survey, 50% use separate account equity return scenarios that are correlated with interest rates. Actuaries wishing to follow research in this area may choose to refer to an ARCH 2004.1 article entitled, "*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 R. Gorvett, K. Ahlgrim and S. D'Arcy.

The number of stochastic scenarios that an actuary would normally use to have confidence in the probability of the results in the tails of the distribution would typically be much greater than the median numbers of scenarios reported in the survey, but some actuaries find these numbers acceptable for the purpose of assessing the adequacy of reserves.

Q34. IS THERE ANY TIME WHEN A SINGLE INTEREST RATE SCENARIO PATH MAY BE APPROPRIATE?

A34. For products which 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?

A35. There are several types of stochastic scenario models commonly used. One type of model uses a binomial lattice to generate future rates, although this typically is limited to risk-neutral models. A common method 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. Other distributions are sometimes used.

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 proposals by the Academy of Actuaries for scenarios associated with setting risk-based capital 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 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 other scenarios 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 web site.

Q36. WHAT IS REVERSION TO THE MEAN?

A36. Reversion to the mean is a tendency, built into a model, for random values to move toward a target value (mean) over time as the number of trials increases. 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 set to the target value. Mean reversion accomplishes two things – it reduces longer-term volatility, and it pushes the average of the scenarios towards a desired target.

For interest rate scenarios, various choices of target have been used, including the initial rate, an 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 testing (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 2004 survey of appointed actuaries, over 80% of the respondents who tested stochastic interest scenarios for fixed interest rate instruments used mean reversion, with a majority of these using a mean reversion target based on historical averages ranging from 10 to 50 years, and with a significant minority using the forward rates embedded in the initial yield curve. Only a few respondents stated that they used the initial rates.

The 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 7.0% - 9.9%, with a median of 8.0%.

Q37. HOW CAN AN ECONOMIC SCENARIO MODEL BE VALIDATED?

A37. A risk-neutral model can usually be validated by testing that the assets valued using the scenarios replicate existing market values. A realistic scenario generator can normally 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?

A38. Some actuaries believe this practice is inappropriate. First, throwing out selected scenarios in a random sample usually destroys the randomness of the sample. In addition, recent history is not necessarily a safe guide to judge what is reasonable. 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 appear to exhibit more than expected numbers of quite extreme scenarios (e.g., negative or almost zero interest rates or rates in excess of 30%), 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 rates less than ten basis points.

However, some actuaries believe that there are some situations where unreasonable scenarios can be excluded or de-emphasized when analyzing results (i.e., when these scenarios represent conditions that are worse than "moderately adverse").

F. Modeling Considerations - Assets

Q39. WHAT TYPES OF ASSETS ARE USED BY ACTUARIES IN ASSET ADEQUACY ANALYSIS?

A39. The actuary may be faced with the option of selecting 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. Non-performing collateralized instruments such as mortgages in foreclosure generally have predictable cash flows and market values (at least on a portfolio basis).

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. They 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 avoid including common stocks in asset adequacy analysis.

From the 2004 survey of appointed actuaries, only 15% of respondents include equity investments in their general account model.

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 or fixed annuities with guaranteed minimum interest rates. This can be especially appropriate where such derivatives are integral to managing the risks for these products.

Q40. WHAT SOFTWARE PLATFORMS ARE USED BY APPOINTED ACTUARIES TO MODEL ASSETS?

A40. From the 2004 survey of appointed actuaries, approximately 50% use the same modeling platform for assets that is used to model liabilities. For those that use a different modeling platform for assets, nearly 80% use BondEdge for asset modeling. Very few actuaries use a homegrown software platform for modeling; 95% use software purchased from an outside vendor for at least a portion of their asset portfolio, and 87% use purchased software for their entire portfolio.

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 software parameters are not appropriate for the company, the actuary may exercise professional judgment and make discretionary adjustments to them.

Q41. HOW IS ASSET MANAGEMENT STRATEGY MODELED FOR ASSET ADEQUACY ANALYSIS?

A41. 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 normally determines whether and to what extent to reflect the company's asset management strategy in the cash flow model.

Most insurers adhere to a pre-determined 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. If the interest maintenance reserve (IMR) is modeled for securities carried at book value, the replacement of securities with ones at a lower yield is not usually a material concern. Hence, many actuaries believe it is unnecessary to take account of whether their company has a high turnover of assets in asset adequacy modeling. However, if the future asset management strategy is expected to vary significantly from the past and the portfolio composition is likely to be significantly affected as a result, many actuaries believe it is preferable to reflect this in the model.

Q42. HOW IS THE REINVESTMENT STRATEGY MODELED?

A42. Net positive cash flows are normally invested. 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. It is a common practice 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 dynamically determined based on the interest rate scenario, using yield spreads reflecting the credit quality and embedded options of these simple instruments. It is a common practice to use simplified instruments to model the reinvestment portfolio. For example, if Collateralized Mortgage Obligations (CMOs) are modeled for reinvestment, simple structures and tranches – capturing the essence of the cash flow characteristics desired without the complicating details – would typically be utilized. However, the improving capabilities in asset modeling software may be changing the simplified approach.

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 dynamically determined, 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 normally 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, since 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 DISINVESTMENT MODELED?

A43. When negative cash flow arises in the model, actuaries use a number of different approaches. 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 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. Another common assumption is a prioritized liquidation; for example, one possible order of priority might be: money-market investments and T-bills first, Treasury notes next, Treasury bonds, agency issues, high-quality corporate bonds, high-yield issues, and real estate.

In reviewing results of the combination of reinvestment and disinvestment strategies, many actuaries believe that it is usually appropriate to examine whether unrealistically large amounts of borrowing or unrealistically large concentrations in certain asset categories are expected.

Q44. WHAT ARE THE SOURCES OF GUIDANCE ON HOW TO SELECT ASSUMPTIONS FOR ASSET MODELING?

A44. The Actuarial Standards of Practice provide the most authoritative professional guidance on the generally 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 Company Investments are useful references.

Rules and requirements set by regulators (e.g., the NAIC and New York's 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's Regulation 126 indicates that, in the absence of credible data, default losses of not less than 10% of AVR maximums may be assumed. However, the New York Insurance Department has indicated that this is not a "safe harbor." In addition, the AVR has been restructured to include "basic contributions," which are intended to represent expected losses. In most cases, these basic contributions exceed 10% of the AVR maximums, often by a significant percentage.

Where the data appears 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. Regulators generally expect the actuary to reflect company performance relative to the industry if it is worse than industry average.

In those cases where the company's own data is not credible or is unavailable, many actuaries use an industry-level or economy-level assumption. Data from credit rating agencies is 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, GDP) are widely available data series. Actuaries often select their modeling assumptions based on this data.

In the case of highly complex instruments such as CMOs, actuaries frequently rely on models and assumptions constructed by vendors. Investment professionals with expert knowledge of assets construct available 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 with a certain healthy skepticism to evaluate their reasonableness.

Q45. WHAT ARE THE MAIN ASSET-SPECIFIC CHARACTERISTICS THAT AFFECT CASH FLOWS?

A45. 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 normally depends on realization of conditions under which it is attractive 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 current 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 pre-determined cash flows. Nevertheless, certain cash flows occur with some predictability, such as payment of dividends on stocks. The bulk of the cash flows on equity securities are 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 AAA Report to the NAIC, "*Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Products with Guarantees,"* September 2003, includes significant analysis of stock market movements.

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

Q46. WHAT TYPES OF ASSET EMBEDDED OPTIONS ARE MODELED FOR CASH FLOWING TESTING?

A46. From the 2004 survey of appointed actuaries, over 80% of respondents model asset optionality in at least one asset type. Approximately 75% of respondents reported modeling calls on bonds, 65% of respondents reported modeling prepayments on residential mortgages, mortgage-backed securities, and CMOs, and 68% reported modeling prepayments on commercial mortgages. It is likely that for the other respondents, these types of securities are not a material part of their asset portfolio.

Nearly 2/3 of the respondents vary prepayment and calls by interest rate scenario.

Q47. HOW ARE EXPECTED CREDIT LOSSES ON BONDS MODELED?

A47. A significant majority of respondents to the 2004 survey of appointed actuaries indicated that they use quality rating of the 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.

AVR "basic contributions" are intended to represent expected levels of default losses, and can represent a reasonable starting point for default loss assumptions. These basic contributions were developed from long-term average credit loss experience, averaged over a period of about seven years. 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 quality. 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.

Approximately 25% of survey respondents varied default losses by projection year. Only 17% varied default losses by term to maturity, and only 9% varied default losses by yield spread.

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.

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. In the 2004 survey, respondents were evenly divided between these two approaches.

For bonds in default, no coupon payments are normally included. Their market value 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 cash flow testing (see Q39), they sometimes do not include defaulted bonds.

In the 2004 survey, about one-third of respondents indicated that they reflected 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%), and others being S&P, Altman's, data from investment advisors, and AVR contributions.

Q48. DO BOND CREDIT LOSSES VARY BY INTEREST RATE SCENARIO?

A48. It is a common practice to assume that default rates and recoveries do not vary by interest rate scenario, since studies have not established a strong link between the shape or level of yield curves and credit losses. Only about 5% of survey respondents reported varying credit losses by interest rate scenario. 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.

Q49. HOW IS THE RISK OF FLUCTUATION IN BOND CREDIT LOSSES EVALUATED?

A49. The approach taken by some actuaries to model bond default losses is similar to the approach taken to model death benefits, i.e., it is based on a decrement rate applied to various classes of risks (the classes are defined by bond rating and issuer creditworthiness). Hence, the evaluation of the risk from fluctuation in bond losses can be done in a manner similar to actuarial evaluation of mortality fluctuation risk. The website http://www.defaultrisk.com/ includes a wealth of references describing additional modeling considerations and approaches. Although many of the models described there are geared to determination of capital requirements, the same models can often be used to model defaults at "moderately adverse" levels, in addition to the more extreme levels appropriate for capital determination.

Factors often considered include concentration risk, extent of diversification, trends in credit quality of certain significant holdings in the portfolio, impact of an overall increase in credit losses in the economy, relationship between company and industry experience, and trends in this relationship. The current structure of the RBC requirements offers some simplified ways to deal with some of these items. For instance, the "top 10" adjustment described in the RBC instructions essentially doubles the required capital for a company's 10 largest holdings. The "issuer count" adjustment increases the required capital by as much as 150% for a portfolio with only a small number of issuers. More sophisticated approaches, as found in some of the references mentioned earlier, often involve extensive Monte Carlo modeling. The results of this type of modeling may be used to refine the parameters of the simple types of adjustments incorporated into RBC.

In assessing the risk of credit loss fluctuation, many actuaries note that the analysis is intended to ensure the adequacy of assets under "moderately adverse" conditions. Thus, concentration risk with respect to asset holdings with AAA ratings may not be a material factor for moderately adverse conditions, but might be important with respect to high-risk holdings. A moderate overall increase in losses for a three- to five-year period followed by a return to historical averages might fall within the range of "moderately adverse" conditions, since business cycles are a fact of life. Persistence of such losses for an indefinite period would probably fall outside such a range.

In evaluating differences between company and industry experience, actuaries usually seek to determine the causes of such differences and whether these causes can be expected to continue over time.

Q50. HOW ARE BOND OPTIONS MODELED?

A50. 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 normally depends on the cost of refinancing, i.e., whether it will be worth the effort for the issuer. This usually depends on the call premium, the differential coupon rate and the term to maturity. Some actuarial software will calculate the economic attractiveness of call for the issuer based on these parameters, and make a projection as to whether a bond will be called in a particular scenario. Another way to measure whether it is worth the effort to take into account the impact of calls is to compare the PV of remaining cash flows to the redemption value (called the "ratio method").

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 company an amount to compensate the company for any loss when the bond is called. It is a common practice to model these bonds as non-callable.

If callable bonds are an insignificant part of the portfolio, their impact 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 company the right to put the bond back to the issuer for cash. Some actuaries take the conservative approach of not modeling put options.

Q51. HOW ARE VARIABLE RATE BONDS MODELED?

A51. In practice, most variable rates are based on an index other than Treasury yield rates (on which cash flow testing is usually based), such as 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 on Treasuries often produce a good fit and are appropriate in many instances. 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 are normally somewhat different than 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.

Q52. WHAT ARE THE TYPICAL RISKS ASSOCIATED WITH RESIDENTIAL MORTGAGES AND SECURITIES COLLATERALIZED BY THEM?

A52. Residential mortgages held by insurance companies can be in the form of non-partitioned individual loans directly owned, or more commonly, in some sort of securitized arrangement where multiple loans are pooled together and then sold to investors. There are two main types of securitized arrangements: mortgage-backed securities (MBS) and collateralized mortgage obligations (CMO).

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 FHMLC pools) contain guarantees on the principal and interest payments, backed by the respective agency.

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. The types of tranches include sequential pay, accrual, floater, planned amortization class (PAC), PAC support, principal only, and interest only.

The most important risk associated with MBS and CMO investments is usually that of prepayment or extension. Under any scenario, there is an underlying rate of prepayment due to sale resulting from relocation, etc. There is also normally an underlying default risk associated with overall credit deterioration. However, in most cases the major risk is associated with the economic condition in which interest rates drop, resulting in an increase in prepayments due to refinancing activity. The degree to which a mortgage pool is vulnerable to this effect usually depends on the coupon rate of the underlying mortgages, the degree of seasoning, the nature of the mortgage (i.e., fixed or variable coupons such as through adjustable rate mortgages, or ARMs), etc. In the case of CMOs, these cash flow variations can be greatly intensified, depending on the characteristics of the tranche. 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 particularly sensitive to the proper modeling and evaluation of the risk of MBS and CMO investments.

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. A significant challenge in modeling CMOs is the lack of readily available data on CMO structures at points in time after issue.

Loss of principal is usually not a significant concern for residential mortgages if they are adequately collateralized, although a substantial drop in market value of the underlying property that can occur in certain economic scenarios and in some locations. If big drops in market value are combined with a significant increase in defaults, there can be lengthy delays in foreclosure and liquidation. If a company holds a large portfolio of unsecuritized residential mortgages, modeling the default effect in some detail may be appropriate. In addition, modeling a significant concentration of such mortgages in a geographical area whose housing values are seriously depressed may also be advisable. Grouping the mortgages appropriately for this purpose can allow for an effective use of a portfolio approach, and possibly the use of vendor databases to deduce the cash flows, by identifying a mortgage-backed security (MBS) that closely mimics the group of mortgages. In this case, the dynamic cash flows obtained from the vendor would usually be adjusted for default losses. It may also be prudent to evaluate the sensitivity of cash flow testing results to these default losses. Other questions in this practice note address these issues in more detail.

Most residential mortgages are securitized, so the more significant issue is normally the potential for credit losses on the securitized instruments. If they are GNMA or FNMA/FHMLC issues, one common practice is to assume they are default-free, due to the guarantee of principal and interest by these agencies, which are considered to have direct or indirect government support. Within the realm of "moderately adverse" conditions, this is usually a reasonable assumption. The same applies for structured securities such as CMOs, which generally have AAA ratings and may also be supported by credit enhancements.

Q53. WHAT TYPICALLY CONSTITUTES AN ADEQUATE CMO MODEL?

A53. The desired sophistication and accuracy of a CMO model used for cash flow projections normally 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.

It is common for actuaries – particularly those at companies that have a large exposure to CMO issues – to obtain CMO cash flows for each scenario of interest from an independent vendor such as INTEX or BondEdge. Cash flows supplied by major vendors satisfy both of the above features that are essential for a suitable model. Because of the great variety of tranches and the complexity of some of them, it is common to model not only the tranches a company owns, but several other tranches as well, and also maintain a live history of cash flows for all of these tranches in order to accurately project future cash flows. This is generally impractical without subscribing to the databases of a recognized vendor that covers a comprehensive universe of CMO issues.

The cash flows for CMO holdings may be generated for each individual security or for representative CMO securities based on groupings of CMO assets with similar cash flow characteristics. The actuary may choose to use grouping methods for CMO assets that are not included in the BondEdge or INTEX database of CMOs.

One method of testing the suitability of an internally generated model is to compare results over different scenarios with the results projected by CMO databases and systems operated by broker/dealers or independent vendors, such as BondEdge or INTEX. 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.

Q54. WHAT ARE SOME CONSIDERATIONS FOR MODELING PREPAYMENT ASSUMPTIONS FOR SECURITIES COLLATERALIZED BY RESIDENTIAL MORTGAGES?

A54. 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. Following is a list of some of the items that the actuary may choose to check for reasonableness:

1. The prepayment rate generally rises as interest rates decrease, and such changes typically follow an S curve[3] (likewise, the prepayment rate typically slows as interest rates increase;

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

3. Prepayment rates usually vary by type of collateral (GNMA versus FNMA/FHLMC; 15-year versus 30-year; new versus seasoned mortgages);

4. Prepayment rates are usually consistent across CMOs with comparable collateral;

5. 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); and

6. Prepayments may slow due to the "burn-out" factor – those mortgage holders who watch interest rates 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. Hence, 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 pre-payment 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.

[3] I.e., some additional prepayments associated with small changes in interest rates form the bottom of the curve; then prepayments accelerate as the difference between the original coupon rates and current market rates widens, with prepayments eventually leveling off at some rate.

Q55. WHAT ARE SOME ADDITIONAL CONSIDERATIONS IN MODELING SECURITIES COLLATERALIZED BY RESIDENTIAL MORTGAGES?

A55. 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 "right" time to convert to a fixed-rate mortgage or they are more sensitive to or aware of changes in interest rates. Therefore, some actuaries model dynamic prepayments on floating-rate mortgages based on changes in the coupon rates of 15- or 30-year fixed-rate mortgages. The actuary may choose to evaluate the sensitivity of indexed[4] tranches with regard to the link of the index to the scenario interest rate.

For a CMO that is not agency-backed, a default assumption is normally selected.

Q56. WHAT ARE SOME COMMON METHODS FOR DETERMINING THE MARKET VALUE OF CMOS AT A FUTURE POINT IN TIME?

A56. Generally speaking, for fixed income securities 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 values, and valuing these options is difficult. In addition, calculating market values for future points in time may be appropriate if a significant amount of CMOs are modeled as being sold at a certain point in the future.

Actuaries who model the market value of CMOs currently use different methods. Three methods that involve projection and discounting of future CMO cash flows are as follows:

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

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

3. Using the cash flows generated for the cash flow testing scenario, so no additional projection of CMO cash flows is made.

[4] e.g., the floating-rate tranches indexed to the London Interbank Offering Rate (LIBOR)

These methods are illustrated by a cash flow testing scenario where interest rates start at 5%, drop to 3%, and then increase back to 5%. When the projection reaches the duration at which interest rates are 3%, Method 1 would value the CMO based on a set of stochastic scenarios that start with the 3% rate, Method 2 would assume that rates stay at 3%, and Method 3 would assume that rates go back to 5%.

Q57. WHAT ARE THE RELEVANT ASPECTS OF COMMERCIAL MORTGAGES?

A57. 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, for *commercial* mortgages, a case-by-case analysis is sometimes preferable since 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 cash flow testing.

There are two important aspects in which commercial mortgages generally differ from residential mortgages. First, commercial mortgages usually have various levels of call protection. 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 normally 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.

Components of commercial mortgages can be re-structured into commercial mortgage-backed securities (CMBS), either as 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.

Q58. HOW DO ACTUARIES ASSESS THE RISK WITH RESPECT TO COMMERCIAL MORTGAGES?

A58. As with most types of fixed income securities, many actuaries believe that the key risks can be categorized with respect to credit quality, reinvestment risk, concentration risk and liquidity risk.

- With respect to *credit quality*, risk assessment normally is very closely related to the economic characteristics of the property in question – its uses, location, tenant characteristics, and occupancy rates, as well as how they are affected by the overall economic conditions in their region of the country. Trends in cash flow and occupancy, lease terms and profitability of underlying tenants might be examined. The actuary might choose to rely upon the professional judgment and opinion of analysts in the investment department of the company or external investment advisors for this assessment. It is common for investment professionals to perform various stress tests on commercial mortgage investments. If the company's investment department performs these tests, the actuary may choose to examine their reports in order to develop a better understanding of the underlying credit risk.

- The essence of *reinvestment risk* is the potential for change in projected cash flow resulting from changes in the future interest rate environment. While there is usually more prepayment protection for commercial mortgages than for residential mortgages, there might be considerably more extension risk, with any restructuring needed being for lengthy terms at below-market yield rates. The actuary may choose to evaluate trends in restructuring in the economy and those in the company's portfolio. The credit quality of the company's portfolio (through the analysis described in the previous paragraph) and anticipated economic conditions (e.g., growth or recessionary) are also usually relevant. To the extent that these conditions have a significant probability of occurring and the results are expected to be adverse, they might fall within the range of "moderately adverse" conditions that need to be evaluated in asset adequacy testing.

- With respect to *concentration risk*, if the company has a large percentage of assets in mortgages and real estate, there are various areas of concentration that an actuary may choose to consider in determining the adequacy of assets in relation to the liabilities. These may include having a large percentage of the company's assets in a few properties or developments, in a few cities or geographic locations (e.g., subject to hurricane risk or local economic condition), and/or being undiversified across asset types (e.g., hotels).

- With respect to *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 cash flow testing. 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.

For interest-only and balloon-payment loans, it may be difficult for a company to find another lender for refinancing at maturity, especially in a weak economy. One may assume that under such conditions, a company will likely have to refinance a large percentage of loans. Reasonable credit charges typically will provide for a certain percentage of these loans, which may have to be refinanced at below-market rates. However, the actuary may determine that the size of the maturity payments make it appropriate to incorporate this refinancing risk explicitly in the model if these payments are important for meeting the cash needs of the business being tested.

Q59. WHAT ARE SOME APPROACHES USED TO MODEL DEFAULT LOSSES ON MORTGAGES?

A59. As with bonds, many actuaries believe the basic AVR contributions are a reasonable starting point for development of expected default loss assumptions. For mortgages, these factors are usually adjusted based on individual company experience relative to industry averages. These adjustments are spelled out in the AVR instructions, and industry experience averages are available on the NAIC website http://www.naic.org/. Note that the company experience factors only consider the incidence of mortgage defaults and not the severity of loss when defaults occur. Thus, an actuary providing services to a company with a high incidence of problems but low levels of losses may choose to make use of somewhat lower factors. In addition to adjustments for company experience relative to industry averages, the actuary may choose to make adjustments for recent or anticipated industry experience relative to longer-term historical averages.

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, 1-4 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," or CLTVR. This ratio differs from a typical loan-to-value (LTV) ratio in that the loan is valued at current interest rates before being compared to its current property value. Debt-service-coverage (DSC) 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. The use of such a system is addressed in the next question.

In the 2004 survey of appointed actuaries, about 2/3 of respondents 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. Some based their assumption on AVR contribution factors.

The most common factor by which the 2004 survey respondents varied mortgage losses was quality of the investment (50% of the respondents). Other commonly cited factors were year of projection (20%), performing vs. non-performing asset (20%), and yield spread (10%).

Q60. HOW MIGHT THE APPOINTED ACTUARY USE THE COMPANY'S INTERNAL RATING SYSTEM?

A60. If a company has had an internal rating system long enough to perform an experience study by rating, many actuaries believe it is usually appropriate to use these results. (Note: These results are *required* to be used in New York if the results are worse than the charges suggested in New York Regulation 126.) If, however, the internal rating system is fairly new or has undergone recent refinements, many actuaries believe it is normally appropriate to estimate how the mortgage ratings correspond to bond ratings. The actuary generally then uses the resulting charges suggested in New York Regulation 126 for bonds. If the resulting weighted average charge is less than the overall charge required for mortgages, the actuary may choose to proportionately increase the charge used for each specific rating.

Q61. HOW IS EXISTING FORECLOSED REAL ESTATE MODELED?

A61. Many actuaries prefer to analyze foreclosed real estate on a property-by-property basis. While the results of such analysis normally 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.

Q62. HOW MIGHT LIMITED PARTNERSHIPS BE EVALUATED?

A62. 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 (ABS)?

A63. As with MBSs and CMOs, it is common for actuaries providing services to companies with material holdings of 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 the use of a vendor package a particularly practical option.

Even the best vendor packages may not cover 100% 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 non-modeled assets. Many actuaries prefer that the percentage of non-modeled holdings be small.

G. Modeling Considerations – Policy Cash Flow Risk

Q64. WHAT IS POLICY CASH FLOW RISK?

A64. Policy cash flow risk, as defined in both ASOP No. 7 and ASOP No. 22, is

> the risk that the amount or timing of items 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.

Q65. HOW MIGHT THE APPOINTED ACTUARY TYPICALLY DECIDE ON THE SCOPE OF POLICY CASH FLOW RISK TESTING?

A65. 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 non-guaranteed 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, guaranteed minimum death benefits (GMDB), or guaranteed minimum income benefits (GMIB). While both favorable and unfavorable deviations in future experience are possible, many actuaries believe the appointed actuary's primary concern regarding any policy cash flow risk is normally the potential for adverse deviation.

Q66. WHAT IS MEANT BY "SENSITIVITY TESTING" FOR POLICY CASH FLOW RISK?

A66. 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 test of the adequacy of assets underlying 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 typically performs additional tests that vary – for each significant type of policy cash flow risk – 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 can also be tested in order to evaluate the impact of adverse experience of more than one variable at a time.

Q67. WHAT TYPE OF SENSITIVITY TESTING IS COMMONLY DONE?

A67. 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 2004, examples that have generated increased focus for sensitivity testing include dollar-for-dollar withdrawals on variable annuities as well as additional premium dump-ins and the relatively low interest rate environment to test interest rate guarantee risk.

From the 2004 survey of appointed actuaries, the following table give the "top ten" items most frequently sensitivity tested:

Lapse	91%
Mortality	88%
Expenses	59%
Asset Defaults	38%
Morbidity	32%
Asset Credit Spreads	23%
Premium persistency	22%
Investment Strategies	20%
Asset Prepayments	15%
Interest Crediting Strategies	12%

Q68. HOW IS SENSITIVITY TESTING DONE UNDER GROSS PREMIUM VALUATION?

A68. Sensitivity testing can usually be performed for a gross premium valuation. Most respondents to the 2004 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).

Q69. DO ACTUARIES USE THEIR COMPANY'S OWN EXPERIENCE TO SET MODELING ASSUMPTIONS FOR POLICY CASH FLOW RISK?

A69. Most actuaries use their own company's experience to establish the key assumptions related to policy cash flow risk. From the 2004 survey of appointed actuaries, the following table summarizes the percent of the respondents who set their key assumptions by either company experience, industry experience, or both:

Assumption	Company	Industry	Both
Lapse	89%	2%	9%
Mortality	63%	12%	25%
Morbidity	65%	19%	16%
Disability/Recovery	49%	34%	17%
Other	97%	2%	1%

Q70. WHEN MAY THE USE OF DYNAMIC LAPSE ASSUMPTIONS BE APPROPRIATE?

A70. Several factors can affect lapse rates for a product, including policy duration, level of surrender charges, sophistication of the market (e.g., corporate versus personal), 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., varying 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 normally use dynamic lapse assumptions.

In the survey, roughly three-fourths of the appointed actuaries used dynamic lapse assumptions for at least one of the products tested.

Q71. WHAT INSURER RISKS ARE ASSOCIATED WITH VARIABLE ANNUITIES?

A71. Except for the risks associated with fixed account options and ancillary benefits, most of the investment risk (i.e., C-1 and C-3) associated with a variable annuity is usually borne by the contractholder. The insurer's most significant risk is generally based on the level and timing of asset-based fees and surrender charges compared to those expected in pricing. The level and timing of asset fees are normally a function of the performance of the funds supporting the product and the mix of assets among the funds. The level and timing of surrender charges are mainly a function of contractholder behavior, fixed interest rates, and variable fund performance.

Another risk an insurer often takes with respect to variable annuity contracts is the risk that actual expenses exceed those assumed in pricing.

Variable annuities that include fixed and market value adjusted account options typically have the added investment risks typically associated with those options. In addition, the distribution of funds between these options and the variable funds can impact the level of insurer risk.

Ancillary benefits may also add risks to a variable annuity. These include annuitization benefits (which are usually guaranteed and may be subsidized), free partial withdrawals, bail-outs, GMDBs, guaranteed living benefits (GLBs) and waiver of surrender charge due to events such as death, disability or nursing home confinement. Some products also waive or modify the surrender charge for funds invested in a particular fund. All of these benefits can add a level of both investment and "decrement" (e.g., mortality) risk. In addition, anti-selection risk may be result from the utilization of contractual options in GLBs (i.e., the contractholder may be more likely to exercise contractual options when it is more costly to the company offering the option).

Typically, the investment risk is minimal when compared with the investment risk associated with comparable fixed annuities.

Q72. WHAT METHODS ARE USED TO PERFORM ASSET ADEQUACY ANALYSIS FOR VARIABLE LIFE AND ANNUITY BUSINESS?

A72. ASOP No. 22 states that in determining the approach for asset adequacy testing, "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 risks."

One approach currently used by some actuaries is to demonstrate that the risk associated with the book of variable life or variable annuity business is highly risk-controlled or that the degree of conservatism in the reserves is so great that it provides for reasonably anticipated deviations from current assumptions. This approach is used most often for variable annuities with a smooth surrender charge pattern, without a fixed account option or without significant ancillary benefits, or for variable life business with limited death benefit guarantees or other secondary guarantees in the general account.

Cash flow testing methodologies are often used for products where future cash flows may vary under different economic or interest rate scenarios. For example, cash flow testing may be used for a variable annuity without a smooth surrender charge pattern, for one with a fixed account option, or with a GMDB or GLB 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.

From the 2004 survey, the most common methods cited for reflecting variable annuity business in an asset adequacy analysis include:

1. Using a level equity return with deterministic fixed interest scenarios; and

2. Using a set of uncorrelated deterministic and equity return scenarios.

It is not uncommon for a variable annuity asset adequacy test to be based on a greater number of deterministic scenarios than used to test fixed annuities, or to use a set of stochastic scenarios. More information regarding testing consideration for variable annuities can be found in the Practice Note, *Special Issues for Variable Annuities* (PN31/L99-06).

The survey indicated that companies with variable life business were more likely to exclude this business from their asset adequacy testing on the grounds that they perceive minimal risk to the company. For those companies who included the variable life business in their asset adequacy testing, the projections were most likely done using a level equity return with deterministic fixed interest scenarios or a set of uncorrelated deterministic and equity return scenarios.

There are currently several task forces of the American Academy of Actuaries that are working with the NAIC to develop new Risk-Based Capital and reserve requirements for variable annuities. At the time this note was written, those requirements were still being developed, but they could have some ramifications for asset adequacy analysis. Generally, these requirements involve stochastic models; however alternative factor-driven methods will probably be allowed for GMDBs.

H. Modeling Considerations – Expenses

Q73. WHAT KINDS OF EXPENSES ARE MODELED FOR ASSET ADEQUACY ANALYSIS?

A73. In ASOP No. 22, policy cash flows (section 2.18), other liability cash flows (section 2.16) and gross premium reserves (section 2.9) are all defined to include expenses.

The expenses to be considered normally include maintenance expenses, investment expenses, and overhead expenses.

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 non-guaranteed benefits, expenses, and taxes."

Q74. MUST ACQUISITION EXPENSES BE CONSIDERED?

A74. ASOP No. 22 focuses on the cash flows arising from in-force business, which does not normally include acquisition expenses. Nevertheless, it is possible that a business in its first year of testing may still have acquisition expenses associated with it, which would, therefore, usually be considered expenses related to the business being tested.

Q75. HOW ARE EXPENSE ASSUMPTIONS CHECKED FOR REASONABLENESS?

A75. In the 2004 survey of appointed actuaries, nearly all responding actuaries 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 the Life Office Management Association (LOMA), SoA studies or the GRET table).

In the 2004 survey, 90% of respondents stated that they reconcile modeled expenses to the annual statement.

In 2003, regulators indicated that expense assumptions are one of their most significant areas of concern. (See Q103) At least one state (California) requires an annual reconciliation of modeled expenses to the annual statement.

Q76. SOME PRICING ACTUARIES ASSUME THAT EXPENSES WILL DECREASE OVER TIME, AS ECONOMIES OF SCALE ARE REACHED. MAY THIS BE REFLECTED IN TESTING?

A76. One way that some appointed actuaries reflect possible changes in future expense levels is to split the expenses into fixed and variable components, with different assumptions for each. Fixed expenses would normally be increased to account for general price inflation. When pricing assumes a decline in unit costs another practice is to use pricing assumptions, but to also do a sensitivity test that assumes that the level of expenses remains at the current level.

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

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

Q77. ARE INSURANCE EXPENSES GENERALLY ADJUSTED FOR INFLATION?

A77. In the 2004 survey of appointed actuaries, 79% of the respondents stated that they adjust expenses for inflation. A common way to do this is to have per-unit expenses – i.e., those that relate to fixed expenses as defined above – increase with the level of inflation appropriate to each scenario. Of those in the survey that model inflation, approximately 40% use a flat inflation assumption for all scenarios, and 60% vary the inflation rate by scenario. Certain expenses, such as those that vary as a percentage of reserves, would automatically increase as the level of reserves per policy increases 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.

Q78. DO ACTUARIES PERFORM SENSITIVITY TESTS ON THE EXPENSE LEVELS ASSUMED IN TESTING?

A78. ASOP No. 7 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. The survey of appointed actuaries showed that roughly one-half of those responding did some sensitivity testing on expenses. Roughly 10% included a sensitivity test for inflation.

Q79. HOW ARE OVERHEAD EXPENSES COMMONLY REFLECTED IN TESTING?

A79. There are many definitions of overhead expenses ("overhead") in use. Additionally, there are many opinions as to proper allocation of overhead to tested lines of business.

Certain overhead expenses, such as management salaries, are typically recurring expenses. The survey showed a fairly wide range of practices with respect to the allocation of overhead. A number of appointed actuaries assign these expenses to lines of business in proportion to the direct expenses of each line. Others perform studies to further break down the overhead expenses into *acquisition expenses*, which are not normally included in the actuary's asset adequacy testing, and *maintenance expenses*, which are usually included.

Certain overhead expenses are extraordinary or non-recurring. For example, some appointed actuaries argue that some expenses, such as those associated with the attempt to acquire a new block of business, are extraordinary in nature, and are not obligations of the in-force business being tested, but rather 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 cash flow testing.

Q80. HOW ARE INVESTMENT EXPENSES TYPICALLY HANDLED IN CASH FLOW TESTING?

A80. Some companies develop investment expenses as part of their analysis of their company's expenses, so the actuary can then reflect these values in cash flow testing. Some companies develop formulas that only allocate such expense at acquisition and disposition of an asset. Some companies develop a formula of investment expenses as a number of basis points per year for each asset type. Some appointed actuaries reflect investment expenses explicitly; others project an earned rate that is already reduced by the investment expense assumption. Some actuaries check the reasonableness of their modeled investment expenses by reconciling to the annual statement or to other company data.

I. Reliance on Other Parties

Q81. WHAT IS THE RELATIONSHIP BETWEEN THE APPOINTED ACTUARY AND THOSE ON WHOM THE ACTUARY RELIES?

A81. 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 for Life or Health Insurers*, sections 4.3 and 4.4;
- 2001 AOMR, sections 6(B) (3-5) and 6(E); and
- ASOP No. 23, *Data Quality*.

Q82. WHAT TESTS OF DATA RELIABILITY DOES THE APPOINTED ACTUARY PERFORM?

A82. The statement of actuarial opinion applies to all in-force business on the statement date. According to the scope paragraph of the AOMR, the appointed actuary is required to reconcile the reserve table in that paragraph with the reserves of Exhibits 5, 6, and 7, and claim liabilities in Exhibit 8, Part 1 and equivalent items in the separate account statement and to identify the method of asset adequacy analysis used (e.g., cash flow testing, gross premium valuation). 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.

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 and Health Insurers*; and
- ASOP No. 23, *Data Quality*.

Q83. MAY THE APPOINTED ACTUARY RELY UPON THE COMPANY'S EXTERNAL AUDITOR FOR THE SUBSTANTIAL ACCURACY OF RECORDS AND INFORMATION?

A83. The AOMR does not specifically address possible reliance or non-reliance upon the company's external auditor. However, a Notice to Practitioners, dated February 1991 from the American Institute of Certified Public Accountants (AICPA), states, in part, the following:

> 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.

Based on this, many actuaries do not rely upon the company's external auditor for the accuracy of underlying data.

Q84. UPON WHOM MAY THE APPOINTED ACTUARY RELY FOR SUBSTANTIAL ACCURACY OF RECORDS AND INFORMATION?

A84. Many actuaries believe that the person they are relying upon should have the necessary breadth and depth of view with respect to the related subject matter. Section 6A(3) of the 2001 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:

> 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.

It is useful to compare the language of the 1991 AOMR reliance statement to that in the new 2001 AOMR.

The reliance statement in the 1991 AOMR included the language:

> . . . the listings and summaries . . . and other liabilities prepared for and submitted to [name of appointed actuary] were prepared under my direction and, to the best of my knowledge and belief, are substantially accurate and complete . . .

By comparison, the above wording in the 2001 AOMR requires:

> a precise identification of the items subject to reliance.

The reliance statement is now required to describe in detail the items subject to reliance. The use of qualifying language, such as reviewing things only "to the extent practicable," is not accepted by some states even though similar wording may be used in the ASOPs (e.g., *Data Quality*).

Two types of reliance are mentioned in the 2001 AOMR:

- Reliance on other experts to develop certain portions of the analysis.
- Reliance on others to examine the underlying asset and liability records.

Depending on the type of reliance, the AOMR offers alternative recommended language for the actuarial opinion.

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 offers recommended alternative 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 should take particular note of the sentence included in the recommended language:

> I have reviewed the information relied upon for reasonableness

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

Regarding the second type of reliance, 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 normally be accompanied by a statement by each person relied upon in the form prescribed by Section 6E. The appointed actuary should take particular note of the third sentence from the recommended language:

> I evaluated that data for reasonableness and consistency. The accuracy and comprehensiveness of data supplied by others are the responsibility of those who supply the data. However, the appointed actuary should review the data for reasonableness and consistency.

Thus, this first type of reliance requires the appointed actuary to evaluate the data for "reasonableness," whereas the second type of reliance requires that the information be reviewed for "reasonableness and consistency."

See A86 - A88 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 and Health Insurers* (section 6.3), and ASOP No. 23, *Data Quality* (section 5.3) contain specific guidance governing the actuary's obligations to satisfy herself or himself that data and analyses provided by third parties are reasonable and consistent. Most appointed actuaries are familiar with these obligations and with applicable state law.

Q85. WHAT LEVEL OF DETAIL IS USED TO REVIEW THE UNDERLYING LIABILITY INFORCE RECORDS FROM A THIRD PARTY?

A85. From the 2004 survey of appointed actuaries, 131 respondents answered this question as follows:

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

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

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

Q86. WHAT LEVEL OF DETAIL IS USED TO REVIEW THE UNDERLYING ASSET INFORCE RECORDS FROM A THIRD PARTY?

A86. From the 2004 survey of appointed actuaries, 130 respondents answered this question as follows:

- No review, just reliance from third party: 18%
- An in-depth analysis (audit level): 3%

- A limited, cursory review looking for glaring discrepancies: 26%
- A moderate review of reasonableness and consistency: 53%

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

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

Q87. WHAT LEVEL OF DETAIL IS USED TO REVIEW ASSUMPTION SUPPORT FROM A THIRD PARTY?

A87. From the 2004 survey of appointed actuaries, 117 respondents answered this question as follows:

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

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

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

J. Analysis of Results

Q88. WHAT MEASURES ARE COMMONLY USED TO TEST RESERVE ADEQUACY FOR THE ACTUARIAL OPINION?

A88. Among the respondents to the 2004 survey of appointed actuaries, 40% indicated they use the present value of ending surplus as the primary basis to determine reserve adequacy, while 47% focus on accumulated value. 3% use interim results as the primary basis to determine reserve adequacy.

Regarding the use of market value versus book value of surplus, 41% of survey respondents rely primarily on book value of surplus to determine reserve adequacy, 31% rely primarily on market value, and 28% of the respondents rely on both equally.

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 (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.

As part of the determination of the market value of surplus, several approaches are used to calculate the market value of liabilities. Of the survey respondents who calculate a market value of liabilities, 55% use the cash surrender value as a proxy for market value, while 20% use a discounted present value of liability cash flows. Others use statutory reserves, or a combination of different approaches depending on the product.

There are some actuaries that 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. There are, however, several regulators who strongly prefer testing on the basis of the ending value of surplus stated on a market value basis.

Q89. HOW DO ACTUARIES DEFINE THE CRITERIA USED TO DETERMINE RESERVE ADEQUACY?

A89. Practices vary widely regarding the criteria for reserve adequacy. Based on the responses from the 2004 survey, roughly 50% of the respondents do not follow any specific rule or guideline, but rely primarily on professional judgment. Of those that use a pre-determined rule or guideline, there is a wide range of practice. Some actuaries consider reserves adequate if positive surplus is generated in at least five of the seven New York scenarios, while other actuaries set up additional reserves if *any* scenario produces a negative surplus result. Some actuaries that utilize a large number of scenarios have established a criterion that reserves are adequate if a predetermined percentage of scenarios generate positive surplus. Based on the 2004 survey, most actuaries that have established this type of criterion require this percentage to be 80% or more.

Q90. WHAT FACTORS ARE CONSIDERED IN SETTING THE CRITERIA FOR RESERVE ADEQUACY?

A90. 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 believe that 100% of the scenarios should generate positive surplus for the reserve to be adequate if all of the scenarios in the study represent "moderately adverse" or better conditions (see Q16 for a definition of "moderately adverse.") 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 percent 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 a large number of 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, it is usually prudent for the actuary to 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.

Dr. David N. Becker, Michael S. Smith and Michael L. Zurcher, proposed a useful approach to establishing and applying adequacy criteria in an article entitled, "*Zen and the Art of Reserve and Asset Adequacy.*" This article was first published in Lincoln National's Reinsurance Reporter (3d quarter, 1993), which is now published by Swiss Re Life & Health America.[5] The article established eight criteria (the "eightfold way") the authors developed in order for the asset adequacy decision to be made. These criteria addressed issues including whether positive retained earnings for the block at the end of a projection are expected; whether there are scenarios that ultimately "passed" but that encountered serious stress during the projection period; the effect of sensitivity testing results; and the effect of aggregating groups of business.

[5]For more information on this article, please contact Steve English at the Academy.

For sets of randomly generated scenarios, some actuaries consider what percentage of scenarios failed and by how much. As noted above, 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, 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.

In the end, it is the actuary's judgment as to the need to establish additional reserves subject to the chosen criteria. The basis of any judgment is typically documented in the supporting memorandum.

Q91. HOW OFTEN HAVE ACTUARIES ESTABLISHED ADDITIONAL RESERVES AS A RESULT OF ASSET ADEQUACY TESTING?

A91. Approximately 25% of those responding to the 2004 survey of appointed actuaries reported that they had increased reserves as a result of cash flow testing at some point in the past.

Q92. TO WHAT EXTENT DO ACTUARIES LOOK AT INTERIM RESULTS TO DETERMINE RESERVE ADEQUACY?

A92. In the 2004 survey of appointed actuaries, over 80% of the respondents stated they look at interim results to determine reserve adequacy. Of that 80%, roughly half look at interim results only at the total company level, and half look at interim results by major line of business.

The 2001 AOMR requires the preparation of a Regulatory Asset Adequacy Issues Summary (RAAIS). Among other things, the RAAIS requests commentary on any interim results that may be of significant concern to the appointed actuary. Such commentary would generally include, at a minimum, discussion of large negative values, early negative values, and protracted periods of negative value. See Q101 for further discussion of the RAAIS.

Q93. IF, BASED ON ASSET ADEQUACY TESTS, THE RESERVES ARE JUDGED TO BE INADEQUATE, HOW DOES THE ACTUARY DECIDE UPON THE AMOUNT OF ADDITIONAL RESERVES?

A93. Approximately one-third of the respondents to the 2004 survey indicated that they never had to set up additional reserves and/or do not know what method they would use. Of the remainder, 70% indicated that they relied on professional judgment to determine how much additional reserves are needed to achieve asset adequacy, and 23% have used preset rules or guidelines in order to determine the amount of additional reserves. Nearly all of the respondents who use some sort of preset rule or guideline set up an additional amount at the level that eliminates the deficit from all or a significant majority of the scenarios tested.

Q94. 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?

A94. Guidance may be found in the NAIC Statutory Accounting Practices and Procedures Manual:

Appendix A-822 states:

> If the company determines as the result of asset adequacy analysis that a reserve should be held in addition to the aggregate reserve held and calculated in accordance with methods set forth in [the SVL] the company shall establish the additional reserve.
>
> 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.

Statement of Statutory Accounting Principles No. 51 (SSAP 51) – Life Contracts, states:

> 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. A change in valuation basis 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.

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

Q95. WHAT MUST THE APPOINTED ACTUARY DO IF NOTIFIED OF A MATERIAL RESERVE MISSTATEMENT?

A95. The NAIC's Annual Statement Instructions for Life and Accident and Health Insurers—Actuarial Opinion (Instruction 12 of Actuarial Opinion Section) set forth the procedure that should be followed if the appointed actuary discovers that his or her opinion would not have been issued or would have been materially altered had the actuary known that certain data or other information was factually incorrect as of the balance sheet date.

Instruction 12 includes the following two paragraphs, which summarize the content of the Instruction:

> 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 not have been issued or would have been materially altered had the correct data or other information been used. The opinion shall not be considered 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 qualified 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.

The appointed actuary may choose to refer to the entire Instruction 12 in the event of such a situation.

K. Preparing the Opinion and Memorandum

Q96. HOW DO ACTUARIES DEFINE "QUALIFIED OPINION"?

A96. Responses to the 2004 survey of appointed actuaries regarding whether an opinion would be considered "qualified" were:

Only when the analysis indicates a reserve deficiency exists and additional reserves are not established	65%
Reserves for certain items are in question because they cannot be reasonably estimated and they are material	64%
The opinion is based on incomplete data, analysis, or assumptions, even though the results obtained indicate reserves are adequate	56%
Significant events have taken place since 12/31 of the current year that may have a material impact on the results.	49%
Only when the actuary is unable to form an opinion, for whatever reason	39%
The reserves meet the minimum requirements of the state of domicile, but do not meet the minimum requirements of the state of filing, and no additional reserves are set up	32%
Adequacy depends on the continuation of an assumption or event that the actuary is not qualified to judge (e.g., continuation of a reinsurance treaty)	29%
Whenever additional reserves are established, for whatever reason	6%

Q97. 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?

A97. The AOMR contains 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 Reserves and Analysis Methods used. However, other than the headings on the columns, it does not provide a detailed description of how to prepare the remaining columns. One way to prepare this table is as follows:

Column (1) Formula Reserves—This is for formula reserves that are subject to asset adequacy analysis. Obviously, 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 reserve formula but are calculated by a standard methodology or procedure each year.

Column (2) Additional 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 showing 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., cash flow testing, gross premium valuation), 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 particularly common reason for not analyzing certain business is because it is not material.

Column (4) Total amounts—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.

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

Q98. WHAT TYPES OF ACTUARIAL REPORTS DO ACTUARIES PREPARE IN CONNECTION WITH ASSET ADEQUACY ANALYSIS?

A98. All states require the preparation of an actuarial opinion that is filed with the annual statement. The Standard Valuation Law (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 it be filed along with the actuarial opinion. A few states require that the actuarial memorandum or an executive summary of the actuarial memorandum be submitted.

New York's Regulation 126 requires that an actuarial memorandum be submitted by all licensed insurers (not only domestic companies), unless the company gets a letter from an accredited state that has reviewed the company's actuarial memorandum from the prior year.

The 2001 AOMR requires that an executive summary of the memorandum, called the "Regulatory Asset Adequacy Issues Summary" (RAAIS) be submitted by March 15 of each year (see Q101). The RAAIS should be signed and dated by the actuary rendering the actuarial opinion.

In addition to regulatory reports, many actuaries prepare reports for other audiences such as internal management, external auditors, 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.

Q99. WHAT LEVEL OF DETAIL IS TYPICALLY INCLUDED IN THE ACTUARIAL MEMORANDUM?

A99. Below is a table giving the responses from the 2004 survey of appointed actuaries for the general type of information included in the Memorandum. The percentages represent the percent of companies that include the respective item in the Memorandum:

Description of scenarios used	99%
Description of sensitivity tests	93%
Product description of each product modeled	90%
Description of reinsurance	86%
Aggregation methods used	84%
Description of reserves not tested	79%
Breakdown of modeled reserves by line and by type of reserve	79%
Results by each line of business	68%
Interim results in the aggregate	66%
Products formerly subject to asset adequacy	61%
Asset segmentation/allocation description	56%
Allowable IMR and AVR by line	51%
Interim results by line of business	50%
Definition of moderately adverse conditions	41%
Factors causing better or worse results in each line of business	35%
Reconciliation between September 30 and December 31	32%
Breakdown of modeled assets by line and by asset type	6%

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	57%
Detailed description and/or listing of factors used	27%
Only high level description of assumptions	14%
Not included in memorandum	1%

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

Detailed listing of key assumptions, high level description for others	48%
Only high level description of assumptions	25%
Detailed description and/or listing of factors used	21%
Not included in memorandum	5%

Responses from the survey regarding the types of tables included:

Yield curves	81%
Lapse rates	71%
Expense factors	70%
Asset default rates	70%
Mortality rates	41%
Asset prepayment rates	29%
Asset seriatim listing	29%
Asset projected prepayments	10%
Other	8%

"Other" items in the above table include the following:

Asset summary by type, quality, maturity, coupon
PSA speed
Assets allocated by line, split by type and quality
Annual statement exhibits 5-8
Morbidity tables
Portfolio yield with sensitivity tests
Credited rates, spreads and reinvestments
Static validation

Q100. WHAT IS TYPICALLY CONTAINED IN THE EXECUTIVE SUMMARY FOR MANAGEMENT?

A100. 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 testing, 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 risk-based capital levels at certain future points; interim results during the projection period; and breakdowns of cash flow testing results by major product line. In any event, any likely conditions that constitute a risk of lack of asset adequacy and how the company could manage under such conditions would be worthwhile.

Q101. WHAT IS DISCUSSED IN THE REGULATORY ASSET ADEQUACY ISSUES SUMMARY (RAAIS)?

A101. 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.

Q102. WHAT MAY THE ACTUARY DO IF THE ACTUARY THINKS A CONFLICT EXISTS BETWEEN THE RESPONSIBILITIES TO NOTIFY THE COMMISSIONER AND THE ACTUARY'S RESPONSIBILITIES TO HIS OR HER EMPLOYER?

A102. In carrying out his or her responsibilities, the actuary may perceive a conflict of interest between the responsibility to notify the Commissioner (as set forth in the NAIC Instruction) and the actuary's responsibility to his or her client or employer. In recognition of this concern, the NAIC Instruction allows the actuary to provide, in place of the required notification, "such other notification [as] recommended by the actuary's attorney." In order to minimize the likely effects of any such conflict of interest, the actuary may find it prudent to have the client or employer specify in the letter of appointment that the procedure described in this Annual Statement Instruction is to be carried out by the appointed actuary if circumstances require such a notification.

Q103. IN WHAT WAYS DO REGULATORS FEEL THAT ACTUARIAL OPINIONS AND MEMORANDA COULD BE IMPROVED?

A103. A group of actuarial insurance regulators responded to an open request for comments in 2003 concerning actuarial opinions and memoranda in recent years. Some areas they identified for improvement are as follows:

Reliance statements. Some opinions and memoranda were not clear as to who developed and took responsibility for certain assumptions. (Sources of guidance for reliance statements now include ASOP No. 23 on *Data Quality*, ASOP No. 41 on *Actuarial Communications*, and more explicitly in the 2001 AOMR).

Assumption detail. Details and analysis provided by the actuary in the actuarial memorandum were not always as expected. Paragraph 3.3.3 of ASOP No. 41, *Actuarial Communications*, states:

> Actuarial Report - In addition to the actuarial findings, an actuarial report should identify the data, assumptions, and methods 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 actuary's report. To the extent the data, assumptions, and methods used have been described in a previous actuarial report that is available to the intended audience, the actuary may, if appropriate under the circumstances, incorporate this information by reference into the actuarial report.

Reinsurance. In several cases, reinsurance assumed or ceded did not appear to be modeled in appropriate detail.

Off-balance sheet items. Some actuaries did not appropriately model off-balance sheet items, such as derivatives.

Sensitivity testing. Some actuaries either did not perform sensitivity testing or did not include the results in their 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 should be applied in order to realistically analyze C-2 risks.

Investment assumptions. Some regulators expressed concern that certain investment assumptions were not realistic. Some states (NY) are issuing guidance on this topic.

Expense. Some regulators were concerned that some actuaries do not seem to pay enough attention to having reserves cover not only benefits, but the related expenses as well. More discussion and demonstration were desired to show that expenses used in the model are reasonable and appropriate. There was concern for demonstration that separate account fees cover all expenses allocated to the separate account, as well as 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.