



## **ACTUARIAL STANDARDS BOARD**

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**Actuarial Standard  
of Practice  
No. 40**

**Compliance with the NAIC Valuation of Life Insurance Policies  
Model Regulation with Respect to Deficiency Reserve Mortality**

**Developed by the  
Task Force on XXX Regulation of the  
Life Committee of the  
Actuarial Standards Board**

**Adopted by the  
Actuarial Standards Board  
December 2000  
Updated for Deviation Language Effective May 1, 2011**

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**(Doc. No. 157)**

## TABLE OF CONTENTS

Transmittal Memorandum	iv
<b>STANDARD OF PRACTICE</b>	
Section 1. Purpose, Scope, Cross References, and Effective Date	1
1.1 Purpose	1
1.2 Scope	1
1.3 Cross References	1
1.4 Effective Date	2
Section 2. Definitions	2
2.1 Anticipated Mortality	2
2.2 Antiselection	2
2.3 Appointed Actuary	2
2.4 Basic Reserves	2
2.5 Contract Segmentation Method	2
2.6 Credibility	2
2.7 Deficiency Reserves	2
2.8 Full Credibility	2
2.9 <i>Model</i> Select Mortality Factors	2
2.10 Policy	2
2.11 Ten-Year Select Factors	2
2.12 X Factor Class	3
2.13 X Factors	3
2.14 1980 CSO Valuation Tables	3
Section 3. Analysis of Issues and Recommended Practices	3
3.1 Regulatory Requirements	3
3.2 Actuarial Opinion	3
3.3 X Factor Requirements	3
3.4 Creation of X Factor Classes	4
3.5 Selection of X Factors	4
3.5.1 Relevant Company Experience	5
3.5.2 Deriving Anticipated Mortality	5
3.6 Periodic Assessment of Anticipated Mortality	6
3.7 Adjustments to X Factors	6
3.8. Basis of Exposure	6
Section 4. Communications and Disclosures	6
4.1 Required Communications	6
4.1.1 Opinion	7
4.1.2 Actuarial Report	7
4.1.3 Additional Disclosures	8

4.2	Documentation	8
4.3	Reliance on Data Supplied by Others	9

## **APPENDIXES**

Appendix 1—	Background and Current Practices	10
	Background	10
	Current Practices	10
Appendix 2—	Comments on the Second Exposure Draft and Task Force Responses	13

December 2000

**TO:** Members of Actuarial Organizations Governed by the Standards of Practice of the Actuarial Standards Board and Other Persons Interested in the Valuation of Life Insurance Policies

**FROM:** Actuarial Standards Board (ASB)

**SUBJ:** Actuarial Standard of Practice (ASOP) No. 40

This booklet contains the final version of ASOP No. 40, *Compliance with the NAIC Valuation of Life Insurance Policies Model Regulation with Respect to Deficiency Reserve Mortality*.

### Background

In March 1999, the National Association of Insurance Commissioners (NAIC) adopted a revised version of the Valuation of Life Insurance Policies Model Regulation (hereinafter the *Model*), often referred to as “Regulation XXX.” The *Model* specifies an effective date of January 1, 2000, and does not apply to policies issued prior to the effective date. Certain types of plans are not subject to the *Model*.

The *Model* specifies that the 1980 Commissioners’ Standard Ordinary mortality tables (hereinafter the 1980 CSO valuation tables) are to be used as the minimum mortality standard for basic reserves. The *Model* also includes several tables of select factors that may be applied to the 1980 CSO valuation tables during the first segment, as defined in the *Model*, for both basic reserves and deficiency reserves. In addition, the *Model* allows the appointed actuary to apply certain percentages (hereinafter X factors) to these select factors to modify the mortality basis for deficiency reserves for the first segment. The choice of the X factors is subject to certain limiting parameters and tests that are specified in the *Model*.

The *Model* specifies that if any X factor for any policy in a company is less than 100%, then the standard actuarial opinion and memorandum for the company must be based on asset adequacy analysis, and, in addition, the appointed actuary must annually opine, for all policies subject to the *Model*, as to whether the mortality rates resulting from application of the X factors meet the requirements of the *Model*. The *Model* provides that this additional opinion shall be supported by an actuarial report, subject to appropriate actuarial standards of practice promulgated by the Actuarial Standards Board.

### Critical Issues

A key issue for the appointed actuary is ensuring that the X factors comply with the limiting parameters and tests specified in the regulation, based on anticipated mortality during the first

segment. This task is complicated by the number of different underwriting classes and plans for which X factors may be determined. There is an additional danger that current X factors would need to be increased at some future date, with the possibility of resultant large reserve increases and shocks to surplus.

Sources of experience mortality data used as the basis for anticipated mortality are very important, especially for smaller companies and for newer products or mortality classes with no significant mortality experience upon which to draw. The appointed actuary will need to consider how to treat data from different sources. Section 3.5.2 includes guidance as to the hierarchy of preference for experience on which to base anticipated mortality. Data from reinsurers are included as an acceptable source of data, among others, if the data are relevant and needed to develop a credible basis for anticipated mortality.

The goal of demonstrating confidence in the anticipated mortality underlying the X factors is very important. There are no specific rules to follow in the preparation of this demonstration. However, approval of X factors by some state regulators will likely depend on their satisfaction with these demonstrations and the implied amount of professionalism used in making the X factor determinations. The form and content of the supporting actuarial report can be significant to the regulator in considering approval of the X factors.

The use of mortality experience net of reinsurance was considered. The task force reached the conclusion that a company's own mortality experience on direct plus assumed business should be used before any reduction of exposure or claims on reinsurance ceded. This conclusion is stated in section 3.4.

### Exposure Drafts

The first exposure draft of this standard was issued in September 1999 with a comment deadline of March 31, 2000. The Task Force on XXX Regulation carefully considered the fifteen comment letters received. A summary of the substantive issues contained in these comment letters and the task force's responses are in appendix 2 of the second exposure draft of this standard.

The second exposure draft was issued in June 2000 with a comment deadline of October 15, 2000. Four comment letters were received. The Task Force on XXX Regulation carefully considered these comment letters and made the following changes to the final ASOP:

1. In section 3.4, Creation of X Factor Classes, the task force split the paragraph dealing with reinsurance into two paragraphs to clarify the guidance with respect to reinsurance assumed and reinsurance ceded. On reinsurance assumed, the task force clarified that separate X factor classes should be considered if anticipated mortality on assumed business is materially different from that on direct business.

2. In section 3.5.2, Deriving Anticipated Mortality, the task force clarified that reinsurance should be considered in deriving anticipated mortality and that the anticipated mortality on reinsured business should exclude the effect of experience refunds or other adjustments contained in the reinsurance agreements.
3. In appendix 1, under the section on assessment of anticipated mortality, the cautionary language associated with the discussion on hypothesis testing was rewritten and moved to the end of the section as general guidance to the appointed actuary in applying any approach.

For a summary of the substantive issues contained in these comment letters, please see appendix 2. The task force and Life Committee thank all those who commented on the first and second exposure drafts.

The ASB voted in December 2000 to adopt this standard.

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# ACTUARIAL STANDARD OF PRACTICE NO. 40

## COMPLIANCE WITH THE NAIC VALUATION OF LIFE INSURANCE POLICIES MODEL REGULATION WITH RESPECT TO DEFICIENCY RESERVE MORTALITY

### STANDARD OF PRACTICE

#### Section 1. Purpose, Scope, Cross References, and Effective Date

1.1 Purpose—The purpose of this actuarial standard of practice (ASOP) is to provide guidance to appointed actuaries with respect to annual opinions and supporting actuarial reports as to whether certain mortality rates for minimum reserves used to determine deficiency reserves meet the requirements of the National Association of Insurance Commissioners (NAIC) *Valuation of Life Insurance Policies Model Regulation*, as amended by the NAIC in March 1999 (hereinafter the *Model*). On plans of life insurance elected by the company, the *Model* allows the appointed actuary to adjust certain mortality rates to reflect anticipated mortality, without recognition of mortality improvement beyond the valuation date, for use in calculating deficiency reserves. This standard provides guidance to the appointed actuary in selecting the adjustments to these mortality rates and in assessing whether the rates meet the requirements of the *Model*.

1.2 Scope—This standard applies to appointed actuaries complying with the regulatory requirements governing the mortality rates used for purposes of calculating deficiency reserves on certain plans of insurance prepared in accordance with the *Model*.

The scope of this standard does not include compliance with state regulations that differ materially from the *Model* with regard to the issues addressed in this standard. Appointed actuaries complying with requirements of a regulation that differs materially from the *Model* should consider the guidance in this standard to the extent that it is appropriate.

If the actuary departs from the guidance set forth in this standard in order to comply with applicable law (statutes, regulations, and other legally binding authority), or for any other reason the actuary deems appropriate, the actuary should refer to section 4.

1.3 Cross References—When this standard refers to the provisions of other documents, the reference includes the referenced documents as they may be amended or restated in the future, and any successor to them, by whatever name called. If any amended or restated document differs materially from the originally referenced document, the appointed actuary should consider the guidance in this standard to the extent it is applicable and appropriate.

- 1.4 Effective Date—This standard will be effective for all statements of actuarial opinion provided for reserves with a valuation date on or after May 1, 2001.

## Section 2. Definitions

The terms below are defined for use in this actuarial standard of practice.

- 2.1 Anticipated Mortality—The appointed actuary’s assumption about the mortality to be experienced in the future on a group of policies.
- 2.2 Antiselection—The actions of individuals, acting for themselves or for others, who are motivated directly or indirectly to take financial advantage of the risk classification system.
- 2.3 Appointed Actuary—Any individual who is appointed or retained in accordance with the requirements set forth in the model NAIC *Actuarial Opinion and Memorandum Regulation*.
- 2.4 Basic Reserves—Reserves calculated in accordance with section 5 of the model NAIC *Standard Valuation Law*.
- 2.5 Contract Segmentation Method—The method of dividing the period from issue to mandatory expiration of a policy into successive segments, with the length of each segment being defined as set forth in section 4 of the *Model* and using the assumptions as set forth in section 4 of the *Model*.
- 2.6 Credibility—A measure of the predictive value in a given application that the actuary attaches to a particular body of data (predictive is used here in the statistical sense and not in the sense of predicting the future).
- 2.7 Deficiency Reserves—The excess, if greater than zero, of minimum reserves calculated in accordance with section 8 of the model NAIC *Standard Valuation Law* over basic reserves.
- 2.8 Full Credibility—The level at which a particular body of data is assigned full predictive value based on a selected confidence interval.
- 2.9 Model Select Mortality Factors—The select mortality factors in the appendix of the *Model*.
- 2.10 Policy—Any life insurance policy subject to the *Model*.
- 2.11 Ten-Year Select Factors—The select factors adopted with the 1980 amendments to the model NAIC *Standard Valuation Law*.

- 2.12 X Factor Class—A group of policies under one or more plans of insurance to which a single set of X factors applies. An example of an X factor class could be a male preferred nonsmoker underwriting class, having one set of X factors covering all issue ages and durations for several plans of insurance.
- 2.13 X Factors—For durations in the first segment (only), as determined under the contract segmentation method, the percentages that may be applied to the *Model* select mortality factors for the purpose of calculating deficiency reserves. Subject to the requirements set forth in section 5 of the *Model*, the X factors may vary by policy year, policy form, underwriting classification, issue age, or any other policy factor expected to affect mortality experience.
- 2.14 1980 CSO Valuation Tables—The Commissioners’ 1980 Standard Ordinary Mortality Table without ten-year select factors, incorporated in the 1980 amendments to the model NAIC *Standard Valuation Law*, and variations of the 1980 CSO valuation tables approved by the NAIC, such as the smoker and nonsmoker versions approved in December 1983.

### Section 3. Analysis of Issues and Recommended Practices

- 3.1 Regulatory Requirements—Section 5 of the *Model* contains the requirements governing the mortality rates to be used for the purpose of calculating deficiency reserves. The appointed actuary should be familiar with the *Model* and any significant state variations, and should be satisfied that applicable actuarial requirements have been met.
- 3.2 Actuarial Opinion—The *Model* contains requirements regarding the selection and continued use of X factors to adjust certain mortality rates for purposes of calculating deficiency reserves. If any X factor is less than 100% at any duration for any policy, the appointed actuary should annually prepare an opinion and supporting actuarial report, as required by the *Model* and in accordance with section 4 of this standard.
- 3.3 X Factor Requirements—The X factors may be used only for durations in the first segment, as determined by the contract segmentation method. In determining compliance with each requirement, the appointed actuary should take into account only the applicable durations in the first segment. Certain requirements are relatively straightforward; for example, no X factor can be less than 20%. Others call for professional judgment, particularly requirements that involve an assessment of anticipated mortality.

Two requirements contain tests that directly or indirectly compare valuation mortality rates, as adjusted by X factors, to a variant of anticipated mortality. The appointed actuary should demonstrate that the X factors adopted satisfy these tests.

- a. Section 5.B(3)(d) of the *Model* requires that, for the first segment, the actuarial present value of future death benefits calculated using the mortality rates resulting from the application of the X factors be greater than or equal to the actuarial

present value of future death benefits calculated using anticipated mortality without recognition of mortality improvement beyond the valuation date. The actuarial present values should be calculated using the valuation interest rate used for basic reserves and the appropriate mortality for each situation.

- b. Section 5.B(3)(e) of the *Model* requires that, for the first segment, the mortality rates resulting from the application of the X factors be at least as great as anticipated mortality, without recognition of mortality improvement beyond the valuation date, in each of the first five years after the valuation date.

- 3.4 Creation of X Factor Classes—The appointed actuary should consider the composition and characteristics of the policies issued under a plan of insurance in determining the appropriate X factor classes that will be applicable within that plan. The policies that comprise an X factor class generally should have similar underwriting or experience characteristics. When X factor classes are similar across various plans of insurance, these X factor classes may be combined into a common single X factor class.

The appointed actuary should consider the presence of reinsurance in creating X factor classes. Anticipated mortality should be assessed and X factor classes should be created on a gross basis (i.e., direct business plus reinsurance assumed, before deducting reinsurance ceded). To the extent that anticipated mortality on reinsurance assumed is materially different from that on direct business, the appointed actuary should consider creating separate X factor classes.

With respect to reinsurance ceded, the anticipated mortality on ceded business should not be materially different from the anticipated mortality of the X factor class from which the business is ceded. If the difference is material, the appointed actuary should consider creating separate X factor classes.

When creating X factor classes, the appointed actuary should be satisfied that mortality studies of company experience for each X factor class and for all classes combined are available, to the extent experience exists, or will be available as experience emerges in the future.

- 3.5 Selection of X Factors—The *Model* allows the company to adjust the *Model* select mortality factors by X factors for the purpose of calculating deficiency reserves for specified plans of insurance elected by the company. The appointed actuary should select the X factors for each X factor class, based on anticipated mortality for each class, without recognition of mortality improvement beyond the valuation date. As uncertainty concerning the level of anticipated mortality increases, the appointed actuary should consider providing a margin for conservatism, such as by selecting higher X factors.

Anticipated mortality may, for some X factor classes, exceed the 1980 CSO valuation tables with *Model* select mortality factors applied, resulting in X factors greater than 100%.

In determining anticipated mortality and in selecting X factors, the appointed actuary

should be guided by the following considerations:

- 3.5.1 Relevant Company Experience—The appointed actuary should take into account the level and trend of actual company mortality experience in assessing anticipated mortality for each X factor class. However, in accordance with the *Model*, no recognition should be made of mortality improvement beyond the valuation date.

The appointed actuary should use the most recent relevant company experience that is practicably available. Consideration should be given to the length of the observation period, recognizing the tradeoff between having insufficient data if the period is too short and having data no longer relevant if the period is too long. The results of the mortality studies should be reviewed for reasonableness.

- 3.5.2 Deriving Anticipated Mortality—If relevant company experience for a particular X factor class is available and has full credibility, the appointed actuary should use that experience as the basis for deriving anticipated mortality.

In situations where relevant company experience for a particular X factor class is not available or does not have full credibility, the appointed actuary should derive anticipated mortality in a reasonable and appropriate manner from actual experience and past trends in experience of other similar types of business, either in the same company, in other companies (including reinsurance companies), or from other sources, generally in that order of preference.

If the relevant company experience for a particular X factor class and other relevant experience are insufficient to form an assumption, the appointed actuary should use professional judgment in assessing anticipated mortality, taking into account where, in the spectrum of mortality experience, such business would be expected to fall relative to the mortality experience for other X factor classes.

The appointed actuary should take into account the effect that lapsation or nonrenewal activity has had or would be expected to have on mortality. The appointed actuary should specifically take into account the adverse effect of any anticipated or actual increase in gross premiums on lapsation, and the resultant effect on mortality due to antiselection. The appointed actuary should also take into account any known positive and negative changes in mortality due to the environment in which the company operates and the possible net adverse impact on mortality associated with those changes.

The appointed actuary should consider the presence of reinsurance in deriving anticipated mortality, as noted in section 3.4. The anticipated mortality on reinsured business, both assumed and ceded, should pertain to that on the reinsured lives and exclude the effect of experience refunds or other adjustments, however characterized in the reinsurance agreements.

- 3.6 Periodic Assessment of Anticipated Mortality—The appointed actuary should annually review relevant emerging experience for the purpose of assessing the appropriateness of anticipated mortality for each X factor class and, in aggregate, for all X factor classes combined. If the appointed actuary chooses to continue to use the prior anticipated mortality assumptions, then the appointed actuary should determine whether the prior anticipated mortality assumptions are appropriate in light of any relevant emerging experience. Statistical analyses may be useful in making this determination. Other quantitative analyses may be used provided the appointed actuary can satisfactorily support such analyses as being sufficient to assess the appropriateness of anticipated mortality.

If the results of statistical or other testing indicate that previously anticipated mortality for a given X factor class is inappropriate, then the appointed actuary should set a new anticipated mortality assumption for the X factor class.

After analyzing the appropriateness of the anticipated mortality for each X factor class in isolation and adjusting anticipated mortality as necessary, the appointed actuary should analyze the appropriateness of the anticipated mortality assumptions at the aggregate level. If analysis at the aggregate level indicates that aggregate anticipated mortality is inadequate, then the appointed actuary should adjust the anticipated mortality assumption for one or more X factor classes until the appointed actuary is satisfied that the anticipated mortality assumptions are adequate at the aggregate level.

- 3.7 Adjustments to X Factors—The appointed actuary should use the anticipated mortality (without recognition of mortality improvement beyond the valuation date) for each X factor class, as adjusted for relevant emerging experience, for the purpose of determining whether the X factors for the class meet the requirements of the *Model*. If any requirement of the *Model* is not satisfied, the appointed actuary should adjust the X factors for the class to the extent necessary to meet such requirement.

The appointed actuary should consider the trend in mortality when deciding whether to adjust X factors, as permitted by the *Model*. The level and trend of mortality experience on similar types of business in other companies, or from other sources, if available, would be an important consideration in making this decision.

- 3.8 Basis of Exposure—The appointed actuary should analyze the level and trend of actual mortality experience primarily by using exposures based on amounts or units of insurance. These measures are most meaningful from the standpoint of financial impact on the company. Other measures of exposure, such as number of lives, can also be useful in analyzing experience.

#### Section 4. Communications and Disclosures

- 4.1 Required Communications—The opinion required by section 3.2 applies to all policies on specified plans of insurance for which the company has elected to apply *Model* select

mortality factors for purposes of calculating deficiency reserves. For policies (on such specified plans) without X factors applied, the opinion should reflect implied X factors of 100%.

4.1.1 Opinion—The opinion should indicate, as of the valuation date, whether the mortality rates resulting from the application of the company’s X factors meet the requirements of the *Model*. If the mortality rates do not meet all the requirements, a qualified opinion should be rendered, disclosing those requirements that are not met.

4.1.2 Actuarial Report—An actuarial report should be prepared in support of the opinion. The report should include at least the following items:

- a. Purpose—The report should indicate its purpose and refer to the specific opinion that it supports.
- b. Specified Plans—The report should identify the specific plans of insurance for which the company has elected to apply *Model* select mortality factors for the purpose of calculating deficiency reserves. The report should briefly describe each plan, including its markets and underwriting bases, and indicate for each X factor class of business on the plan the amount in force on the valuation date in terms of policy or rider count, face amount, basic reserves, and deficiency reserves.
- c. X Factor Compliance—The report should describe the process and key results which demonstrate that the X factors for the specified plans of life insurance comply with each of the requirements of the *Model*. The report should describe, to the extent applicable, each of the following:
  1. company experience studies, industry experience, and other sources of information concerning relevant experience used as a basis for determining anticipated mortality, including a summary of the findings and results;
  2. analyses performed to evaluate the credibility of relevant, historical company experience when establishing anticipated mortality for each X factor class, including a description of related experience or a statement that professional judgement had been used;
  3. mortality projections made and reflected in anticipated mortality, if any, from the period of exposure of relevant experience studies to the valuation date;
  4. statistical or other quantitative analyses performed in assessing the continued appropriateness of the anticipated mortality assumption

for each X factor class and for all X factor classes in aggregate, in light of relevant emerging company experience, and a summary of changes made as a result of the analyses;

5. anticipated mortality, without recognition of mortality improvement beyond the valuation date, for each X factor class and for all X factor classes in aggregate;
  6. results of the tests of X factors required by the *Model*, any adjustments made to the X factors as a result of these tests, and the effect on deficiency reserves resulting from any such adjustments; and
  7. any changes made in the approach or parameters applied to the statistical analyses or tests performed compared to those performed at the last annual valuation.
- d. **Schedule of X Factors**—The report should include a schedule showing for the specified plans of life insurance the X factors for each X factor class as of the valuation date, with an indication as to which X factors are new or have been changed since the last annual valuation.

4.1.3 **Additional Disclosures**—The actuary should include the following, as applicable, in the actuarial report or statement of actuarial opinion:

- a. the disclosure in ASOP No. 41, *Actuarial Communications*, section 4.2, if any material assumption or method was prescribed by applicable law (statutes, regulations, and other legally binding authority);
- b. the disclosure in ASOP No. 41, section 4.3, if the actuary states reliance on other sources and thereby disclaims responsibility for any material assumption or method selected by a party other than the actuary; and
- c. the disclosure in ASOP No. 41, section 4.4, if, in the actuary's professional judgment, the actuary has otherwise deviated materially from the guidance of this ASOP.

4.2 **Documentation**—The appointed actuary should create records and other appropriate documentation supporting the opinion required by section 3.2 and, to the extent practicable, should take reasonable steps to ensure that this documentation will be retained for a reasonable period of time (and no less than the length of time necessary to comply with any statutory regulatory, or other requirements). The appointed actuary need not retain the documentation personally; for example, it may be retained by the appointed actuary's employer. Such documentation should identify the data, assumptions, and methods used by the appointed actuary with sufficient clarity that another actuary qualified in the same practice area could evaluate the reasonableness of the appointed

actuary's work. Unless the actuarial report required by section 4.1.2 reasonably satisfies the need for documentation, such documentation should also be available to the appointed actuary's employer or client.

- 4.3 Reliance on Data Supplied by Others—The appointed actuary may rely on data supplied by other persons. In doing so, the appointed actuary should disclose such reliance in the opinion. The accuracy and completeness 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 to the extent practicable. For further guidance, the appointed actuary is directed to ASOP No. 23, *Data Quality*.

## Appendix 1

### Background and Current Practices

*Note:* This appendix is provided for informational purposes, but is not part of the standard of practice.

#### Background

On plans of life insurance elected by the company, the National Association of Insurance Commissioners (NAIC) Valuation of Life Insurance Policies Model Regulation (*Model*) allows the use of *Model* select mortality factors to be applied to the 1980 CSO valuation tables for purposes of calculating deficiency reserves. The *Model* select mortality factors do not reflect the underwriting classes that have evolved since the period of underlying experience. In light of this consideration, the *Model* allows the appointed actuary to adjust the select factors via X factors to reflect anticipated mortality, without recognition of mortality improvement beyond the valuation date, taking into account relevant emerging experience. However, the *Model* requires the appointed actuary to opine annually that the adjusted mortality rates meet certain requirements set forth in the *Model*, and that such opinion be supported by an actuarial report, subject to appropriate actuarial standards of practice promulgated by the Actuarial Standards Board.

#### Current Practices

Although there is no established current practice for complying with the requirements of the *Model*, there are several current analytical procedures that the appointed actuary may find useful in developing and reviewing anticipated mortality.

#### Developing Anticipated Mortality

The process of using a company's relevant experience of the recent past to set an assumption for future mortality experience can, when the exposure is large enough, proceed by using the average level of the past experience, as modified by trend factors and known changes in the environment. But often the exposure may not be large enough, either because the company is small or because a small or newer segment of a large company is the subject of the assumption. In such cases, actuaries frequently turn to the experience of other companies or other segments (appropriately modified) to help set the assumption. Such procedures are specifically recommended for forming mortality assumptions to be used in testing sales illustrations, as specified in Actuarial Standard of Practice (ASOP) No. 24, *Compliance with the NAIC Life Insurance Illustrations Model Regulation*.

Often the appointed actuary finds it necessary to blend the experience from two or more sources in order to set the assumption. Sometimes a life actuary will consider the guidance, to the extent

relevant, set forth in ASOP No. 25, *Credibility Procedures Applicable to Accident and Health, Group Term Life, and Property/Casualty Coverages*, even though that standard is not specifically applicable to individual life actuarial practice.

For some purposes, such as selecting a valuation mortality rate that will stand up in the face of moderate future fluctuations in mortality, the appointed actuary may wish to select an X factor that yields a mortality rate higher than the appointed actuary's assumption for anticipated mortality, i.e., a level of assumed mortality that has a reasonably high probability of exceeding the actual mortality that may emerge in the future. To accomplish this, the appointed actuary needs an understanding of the underlying distribution of potential mortality results.

When mortality studies are based on lives or policies exposed, either the Normal distribution (with 35 or more deaths) or the Poisson distribution (with fewer than 35 deaths) can provide a satisfactory approximation of the distribution of deaths. However, neither of these approximations accounts for varying experience across different policy sizes.

Monte Carlo methods overcome concerns about whether the experience contains a large enough data set for the Poisson or Normal approximations to be sufficiently accurate, and are particularly useful for analyses that are based on amounts of insurance or units of insurance exposed. These methods produce results that converge to the underlying distribution given enough trials.

### Assessment of Anticipated Mortality

There are several methods for analyzing the appropriateness of anticipated mortality in light of emerging company experience.

Hypothesis testing is one useful technique. The appointed actuary should be aware of two types of errors associated with hypothesis testing. A Type I error is the false rejection of a correct null hypothesis, while a Type II error is the failure to reject an incorrect null hypothesis. In terms of the *Model*, the null hypothesis would presumably state that anticipated mortality is consistent with emerging experience and would only be rejected if statistically significant data indicated otherwise. In this setting, the Type I error is a company increasing anticipated mortality when it is in fact adequate, while a Type II error is a company failing to increase anticipated mortality when it is in fact inadequate. The Type I error rate can be controlled by the choice of significance level. Type II error rates are largely beyond the control of the statistician and difficult to assess, but are influenced by the choice of significance level, the amount of data available, and the magnitude of the difference between the assumed and true values.

Another approach to analyzing anticipated mortality is to treat each review of the mortality assumption as if it were the original development of the mortality assumption, making use of the now more extensive experience base. For example, the appointed actuary could use the emerging experience, plus any other experience considered relevant, to set a new assumption, and use that, or a higher level based on selecting a high probability of adequacy, as the new assumption.

Credibility procedures are also available. Such procedures may be useful when blending data from two or more sources. By extension, credibility procedures may be useful for incorporating emerging experience into an existing body of experience.

This appendix does not provide an exhaustive list of possible approaches to analyzing anticipated mortality. Actuarial literature and other sources of information provide specific guidance to the appointed actuary on various analyses that may be useful in analyzing anticipated mortality. The appointed actuary should be aware of the limitations of applying any statistical procedure to a body of data. The appointed actuary should use reasonable judgment and consider modifying the X factors if the level of emerging mortality experience is substantially greater than expected, regardless of whether the anticipated mortality for the X factor class is deemed acceptable through statistical testing. As current practices evolve, the appointed actuary should consider whether the techniques used in prior analyses continue to be appropriate or can be improved.

## Appendix 2

### Comments on the Second Exposure Draft and Task Force Responses

The second exposure draft of this actuarial standard of practice was issued in June 2000, with a comment deadline of October 15, 2000. (Copies of the exposure draft and second exposure draft are available from the ASB office.) Four comment letters were received. The Task Force on XXX Regulation of the Life Committee of the ASB carefully considered all comments received. Summarized below, printed in standard type, are the significant issues and questions contained in the comment letters. The task force's responses to these issues and questions appear in **boldface**.

#### Section 3. Analysis of Issues and Recommended Practices

Section 3.4, Creation of X Factor Classes—One commentator found the additional language in this section regarding reinsurance to be helpful, clear, and provided uniformity of application, while another commentator believed further clarification was necessary. **The task force added clarification with respect to reinsurance.**

Section 3.5.2, Deriving Anticipated Mortality—One commentator believed that a reference in this section to ASOP No. 25, *Credibility Procedures Applicable to Accident and Health, Group Term Life, and Property/Casualty Coverages*, would be appropriate. **The task force disagreed, based on the fact that ASOP No. 25 is not specifically applicable to life insurance. ASOP No. 25 is mentioned in appendix 1.**

One commentator felt that clarification is needed with respect to experience refunds and other adjustments under reinsurance agreements. **The task force agreed and provided clarification at the end of section 3.5.2.**

Section 3.6, Periodic Assessment of Anticipated Mortality—One commentator made a general comment about the need to apply actuarial judgment when evaluating the anticipated mortality assumption. **Although this is a general statement, the task force changed the second sentence in the first paragraph to clarify that the appointed actuary is making a decision whether to continue using the existing anticipated mortality assumption.**

#### Appendix 1. Background and Current Practices

One commentator noted that cautionary language was part of the discussion of hypothesis testing but not used in the discussion of other possible approaches for analyzing anticipated mortality. This commentator also mentioned that the appointed actuary needs to use professional judgment regarding methods and data. **The task force agrees with these comments. The cautionary language was rewritten and moved from the hypothesis testing discussion to the last paragraph of this appendix. At the same time, the task force made some additional wording changes to provide more consistency and readability with respect to the terminology used in the appendix.**