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● **DISCUSSION DRAFT** ●

Modeling in Life Insurance and Annuities

Developed by the
Modeling Task Force of the
Life Committee of the
Actuarial Standards Board

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

FROM: Task Force on Modeling of the Life Committee of the ASB

SUBJ: Discussion Draft regarding Modeling in Life Insurance and Annuities

This document contains a discussion draft of potential language that could ultimately be included in a proposed ASOP, *Modeling in Life Insurance and Annuities*. The purpose of this discussion draft is to share a portion of that work in order to collect input from interested parties as the Modeling Task Force of the Life Committee of the ASB continues drafting the standard. Please note that since this is a work in progress, many changes and additions are likely.

The ASB has neither reviewed nor approved this discussion draft. This is not an exposure draft and there is no particular deadline for comments. However, the Task Force of the Life Committee is proceeding apace on this project, so earlier comments are more likely to affect the contents of the eventual exposure draft. Interested parties will have an additional opportunity to comment once the formal exposure draft is issued.

The Life Committee and its Task Force expect to create an exposure draft that will draw on the ideas in this discussion draft, modified by discussions with and comments received from interested parties and unfolding events. The exposure draft will go through the normal ASOP process:

1. The Life Committee will submit the Exposure Draft (ED) to the ASB.
2. The ASB will revise the ED and release it to all actuaries and other interested parties for comment.
3. Following the end of the exposure period, the Life Committee will revise the ED based on comments received and produce a proposed ASOP or a second ED (depending on the extent of changes). This document will follow the same process as the original ED (and even if submitted as a proposed ASOP may be changed to a second ED by the ASB).
4. The ASOP will become effective only after final approval by the ASB.

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Background

In the recent few years in the banking industry, there were concerns expressed when assets were “marked to model” versus “marked to market.” This is just one illustration of issues that can arise when the results of models are used directly in financial reporting. Increasingly it appears that models will be used for life insurance company financial reporting, so the ASB and its Life Committee believe it is appropriate to set a standard for actuarial modeling, **at least in certain high importance and reliance situations, such as where the results of the model directly enter the financial report or are relied upon by at least one party in a merger, acquisition, securitization or other financial transaction.**

Request for Comments

The Modeling Task Force of the Life Committee of the ASB appreciates comments on all areas of this possible standard and would like to draw the readers’ attention to the following areas in particular:

1. The current draft scope is restricted to life insurance and annuities to see if an appropriate standard can be developed in a manageable process. Once that is done, the ASB may consider whether comparable standards should be developed for other areas of actuarial practice, or whether the scope of the life practice standard could be expanded to these other practice areas without requiring major change to the substance of the life practice standard. We welcome comments on how the discussion draft, if it were a standard, would need to be changed if the scope were expanded to other actuarial practice areas.
2. The current draft scope covers all models, both those that are critically important (such as those mentioned above) and those that are less critically important, but the actuary has to decide which aspects of the guidance in the standard do or do not apply to less critical models (and to disclose when some aspect of the guidance in the standard is judged not to apply). This can be thought of as a middle ground between two alternative extremes: (a) The first alternative approach would have been to limit the scope of the standard to only critically important models if a dividing line could be defined between situations requiring models to be in scope and situations better served by the models being out of scope. (b) The second alternative approach would have been to apply the standard to all models, but expect actuaries to disclose their deviation from the guidance in the standard on a blanket basis in the case of less critical models.

An argument for the first alternative would be the possibility of giving firmer guidance on critical models by removing many of the exceptions to guidance allowed when the standard requires something unnecessary for “the intended use of the model.” We welcome comments on how the scope dividing line could be defined if the first alternative were adopted, as well as what additional guidance, if any, should be added to the standard if such a narrow scope were adopted.

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Going in the other direction, the second alternative removes the thought of allowing exceptions to guidance item by item and provides for only a simple decision of “in scope” or “out of scope.” This has the effect of reducing the many mentions of exceptions to a single mention of a global exception. We welcome comments on whether and why the second alternative might be superior, and whether there are problems with the current draft (and with the first alternative) such that the second alternative should be adopted.

3. Distinctions have been drawn between guidance that “the actuary should” and guidance that “the actuary should consider.” Is the right guidance given in the right situations? For example, section 3.3.5(d) says the **actuary should document the assumptions** and parameters used in the model, but section 3.5 says the **actuary should consider** whether documentation of a broader range of material (“modeling aspects mentioned in this ASOP”) should be prepared and retained, given the intended purpose of the model.
4. The definitions in section 2 include words (such as realization) not always used in the US because the words most commonly used in the US (such as “scenario” and “run”) may not always be used with the same meaning by different people. This approach is still being reviewed, but suggestions are welcome for appropriate words to distinguish among the stages of modeling.
5. Section 3.3.6(c) suggests consideration of peer review for modeling. Does section 3.3.6(c) belong in the standard on modeling or is the guidance too onerous?

Please review this discussion draft and give the Task Force the benefit of your comments and suggestions. Comments will not be posted to the ASB website and will not receive individual responses; however, they all will receive appropriate consideration by the Task Force in preparing the exposure draft for approval by the ASB. Comments can be sent to discussion@actuary.org. Comments will be reviewed as they are received, but it is suggested that they be sent by May 15, 2012.

If you wish to use conventional mail, please send comments to the following address:

Modeling Discussion Draft
Actuarial Standards Board
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MODELING IN LIFE INSURANCE AND ANNUITIES

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

- 1.1 Purpose—This actuarial standard of practice (ASOP) provides guidance to actuaries when performing professional services that require the use of models.
- 1.2 Scope—This ASOP applies to actuaries when performing professional services designing, developing, modifying or using models with respect to life insurance and annuity policies, which produce results or opinions relied upon by the principal.

The scope includes the use of models for services related to the following:

- a. insurance companies directly insuring or assuming such policies by reinsurance (for example: services could be valuation, pricing, testing illustrations or appraisals);
- b. agencies or brokerages (for example: services could be valuing the commissions or other compensation they receive on such policies);
- c. benefit plans owning or funded by such policies;
- d. life settlement companies buying or owning such policies;
- e. securitizations involving such policies;
- f. mergers and acquisitions involving such policies;
- g. class action litigation involving such policies; or
- h. other comparable situations.

If the actuary departs from the guidance set forth in this ASOP 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 ASOP 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 actuary should consider the guidance in this ASOP to the extent it is applicable and appropriate.

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- 1.4 Effective Date—This ASOP is effective for work performed on or after [four] months after adoption by the Actuarial Standards Board.

Section 2. Definitions

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

- 2.1 Assumptions—Input other than data, whether parameters or rates or anticipated future policyholder choices such as premium paid on a flexible premium product.
- 2.2 Data—Facts or information usually collected from records or from experience or observation. (Examples might include policy, policyholder or insured data, asset and investment data, operating data such as benefit definitions and policy terms and conditions, or historical experience data.)
- 2.3 Granularity—The degree to which an asset or liability cash flow model contains separate components such as cells, or assumptions that vary by cell. Models with a higher degree of granularity (more cells or assumption variations) may provide more accurate projections, but may require greater effort and greater expense to run.
- 2.4 Implementation—The formulas and algorithms of a model in a form that will perform the calculations required by the specification. In many cases an implementation is a computer program, database, spread sheet or a combination of these, but other types of implementation are possible – for example, manual calculations are often used for simple models.
- 2.5 Input—Assumptions, data, or parameters used in a model.
- 2.6 Model—A representation of some aspect of the world which is based on assumptions or relationships, perhaps simplifying the actual complexity. A model is defined by (1) a *specification* that describes the matters that should be represented and the *inputs* and the relationships among them, (2) an *implementation* through a set of mathematical formulas and algorithms, and (3) a *realization* to produce a set of outputs from *inputs*.
- 2.7 Neutral—Without margin; anticipated experience; most likely.
- 2.8 Parameter—Form of input that some would distinguish from data and assumptions, but similar to either.
- 2.9 Principal—A client or employer of the actuary.

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- 2.10 Realization—An implementation together with a set of inputs and the corresponding outputs.
- 2.11 Reproducible—When realizations assuming identical inputs will produce essentially identical outputs, each time the model is run.
- 2.12 Specification—A description of a model that describes the matters to be represented, the inputs and their interactions with each other, and the outputs to be produced.

Section 3. Analysis of Issues and Recommended Practices

- 3.1 Model Importance, and Resources and Controls Appropriate to the Task—The amount of resources committed to, and the extent of the controls applied to, a model should relate to the combination of the degree of reliance on model results and the financial importance of the results.
 - 3.1.1 Primary Focus—This ASOP provides guidance that is meant to be applicable to actuaries using models that provide output which will be heavily relied upon by the principal or that have material financial impact.
 - 3.1.2 Guidance Not Always Applicable—The actuary should consider whether or not aspects of this ASOP are appropriate with respect to models used in less important situations of less reliance or smaller financial impact. For example, the specifications, development, documentation and controls for models used in less critical situations may not need to be so rigorous as stated in this ASOP because the guidance given might not be practical, nor appropriate to the intended purpose of the less important model. Such less critical situations could include one in which only a preliminary investigation is needed, and final decisions do not depend on the model.
 - 3.1.3 Disclosure of Extent of Noncompliance with Guidance—The actuary should disclose whether, and the extent to which, the model does not comply with the guidance in this ASOP.
 - 3.1.4 Disclosure of Extent to Which Model Can Fulfill Its Intended Purpose—The actuary should consider and disclose whether, and the extent to which, the model can fulfill its intended purpose, given limited information, time constraints, and other practical difficulties.
- 3.2 Relation to Other ASOPs—The actuary should also comply with other ASOPs, including the following.

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- 3.2.1 ASOP Nos. 23 and 41—Important aspects of modeling covered by ASOP No. 23, *Data Quality*, and ASOP No. 41, *Actuarial Communications*, are not repeated here, but the actuary should comply with them, as appropriate.
- 3.2.2 Other ASOPs—Many other ASOPs provide specific modeling requirements, including setting assumptions.¹ The actuary designing, developing, modifying or using models should satisfy not only the requirements of this ASOP, but also any specific modeling requirements from an applicable ASOP. If such specific modeling requirements from an applicable ASOP are inconsistent with this ASOP, the requirements of such other guidance supersede the guidance of this ASOP. However, the guidance in this ASOP applies to the extent it is not inconsistent with such other guidance.
- 3.3 Development and Operation of the Model—The actuary should develop and operate the model to meet the intended purpose.
- 3.3.1 Select or Build to Intended Purpose—The actuary should select or build (that is, design, develop or modify) the model to meet the intended purpose. In particular, the capability of the model, including items such as the granularity of inputs, the causal relationships recognized, the ability to test stochastic situations and stress situations, the need to project asset or liability cash flows, and the ability to identify possible volatility around expected values, should be consistent with the intended purpose. The actuary’s responsibilities may include expressing an opinion or preparing documentation, as follows:
- a. The actuary expressing an opinion should understand important aspects of the model being used; and
 - b. The actuary should consider documenting how the model is a satisfactory representation for the intended purpose. The actuary should consider documenting and disclosing potential deficiencies or weaknesses, as well as strengths.
- 3.3.2 Operated for Intended Purpose—The actuary should operate the model to meet the intended purpose. The operation of the model, including the judgments, efforts to improve the model inputs and formulas, documentation, controls, validation, checking, and presentation of results, should be consistent with the intended purpose.

¹ Examples include ASOP No. 7, *Analysis of Life, Health, or Property/Casualty Insurer Cash Flows*, ASOP No. 19, *Appraisals of Casualty, Health, and Life Insurance Businesses*, ASOP No. 22, *Statements of Opinion Based on Asset Adequacy Analysis by Actuaries for Life and Health Insurers*, and any anticipated C3 Phase 3 or Principle Based Reserve standards.

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- 3.3.3 Asset and Liability Inventories and Other Inputs to the Model—The actuary should consider ASOP No. 23 in determining the sources for developing and establishing data, parameters and assumptions for the model.
- 3.3.4 Model Structure—The actuary should consider how to structure the model to meet its intended purpose. For example, where applicable and where appropriate for the model’s intended purpose:
- a. The actuary should judge which contractual provisions and risks specific to the contract are material and appropriate to reflect in the model;
 - b. The actuary should consider whether grouping asset or liability inventory data or other model inputs will produce reasonable results, given the model’s intended purpose. The actuary should consider whether the intended use of the model requires any particular level of granularity with respect to items such as: (i) term conversions (and mortality assumptions), (ii) policy loan utilization (and persistency assumptions), and (iii) the current nearness to triggering secondary guarantees (and the costs of embedded options). The actuary should consider documenting the rationale for grouping data;
 - c. The actuary should consider whether stochastic results are needed;
 - d. The actuary should consider company and management practices in projecting future non-guaranteed elements;
 - e. The actuary should consider policyholder behavior in projecting future cash flows; and
 - f. The actuary should consider having the model reflect the characteristics of assets previously purchased and to be purchased in the future.
- 3.3.5 Assumptions—The actuary should establish assumptions that are appropriate in light of the model’s intended purpose.
- a. Experience Used to Set Assumptions—The actuary should use experience to establish assumptions that is based on appropriate available data, given time or budget constraints, in light of the model’s intended purpose and in compliance with ASOP No. 23. For example, the actuary should consider the following when establishing assumptions:
 - 1. Underlying assumptions should be based on the insurer’s actual recent experience, if relevant and credible.

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2. The actuary should consider using other relevant and credible experience, such as industry experience that is properly modified to reflect the insurer's circumstances, if the insurer's actual experience is not sufficiently credible.
 3. If relevant and credible experience is not available, the actuary should use professional judgment in modifying available sources of information.
 4. The actuary should consider whether it would be appropriate to include a margin for an assumption where experience data are not fully credible and where a sensitivity test shows the assumption is material.
 5. Where appropriate, assumptions should vary with the underlying economic scenario assumed in the model.
 6. One or multiple scenarios of assumptions to be used in the model may be specified by the principal, by applicable law (statutes, regulations, and other legally binding authority), or by the actuary. The actuary should determine whether the scenarios analyzed (including the number of scenarios) reflect a range of conditions consistent with the intended purpose of the model.
 7. Where applicable, the actuary should establish assumptions according to any prescribed guidance.
- b. Consistency—The actuary should consider establishing assumptions for the model that are consistent with each other. If the purpose of a model is to calculate estimates in accordance with a regulation that requires inconsistent assumptions, the actuary should disclose the inconsistency and the reasons for the inconsistency, in accordance with the requirements of section 4.2.1 of this ASOP.
- c. Validation of Assumptions—The actuary should validate that the assumptions are appropriate for use in the current realization of the model. For example, models used in financial reporting offer repeating opportunities to compare assumptions to emerging experience, at least in aggregate.
- d. Documentation of Assumptions—The actuary should document the assumptions and parameters used in the model. The actuary should

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consider whether the documentation of assumptions should include:

1. identification of assumptions that have a material impact on the results, including changes in assumptions from the previous reporting period or presentation;
2. credibility of each assumption;
3. margin, if any, included in the assumption; and
4. results of sensitivity testing.

3.3.6 Model Validation and Analysis—The nature and degree of model validation and analysis may be specified by the principal, by existing law or regulation, or by the actuary. The nature and degree of analysis selected by the actuary should be sufficient in the actuary’s judgment for the model’s intended purpose and context, and in light of its complexity.

a. Model Integrity—For each realization the actuary should validate that the model properly represents the phenomenon being studied, and consider whether some or all of the following would be appropriate:

1. Static Validation—The actuary should reconcile any relevant inventory output values, such as face amount, reserves, or other basic statistics, to the company records. The actuary should address and document the differences appearing in the reconciliation.
2. Cell Testing—The actuary should determine the appropriate degree of checking of formulas and table mapping that is needed (for example, breadth, depth, complexity, etc.), given the intended purpose, context and nature of the model, including its operating environment and controls, and whether there may have been any changes to the model and its environment.
3. Dynamic Validation—Where applicable, the actuary should test the model against historical data to verify that modeled results bear a reasonable relationship to actual results over a given time period.

b. Analyzing the Output—The actuary should take appropriate steps to assure that the model results make sense, given the assumptions established. Depending on the purpose of the model, the actuary should consider whether some or all of the following would be appropriate:

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1. The actuary should perform analytical tests on model results to assess the reasonableness of the projection; for example, testing for the appropriate application of assumptions.
 2. The actuary should consider reconciling the results of a realization to prior realizations, given the changes in assumptions, data input, formulas or other aspects of the model since the prior realizations. If a reconciliation can be developed and would be appropriate to the intended purpose of the model, such reconciliations should be documented in the actuary's files.
 3. The actuary should consider running sensitivity tests on key assumptions to test that the model has been correctly developed with understandable impacts from changes in those assumptions.
- c. The actuary should consider a peer review, where practical, of both model construction and the reasonableness of model results.

3.3.7 Presentation of Results—As specified in section 3.2.1, the actuary should communicate results in an actuarial report which is in compliance with ASOP No. 41. The actuary should present results of a realization of the model in an understandable fashion, explaining methodology, key assumptions and any changes since a prior realization.

- a. If a final actuarial report includes information derived from models, the actuary should include explanations of the following:
 1. the design purpose of the models and how the users' needs are addressed by the models that have been used;
 2. any material limitations of the models that have been used and the implications of those limitations; and
 3. the degree of uncertainty in results.
- b. The actuary should consider including in the actuarial report at least a summary of a reconciliation from a prior actuarial report, if any. The actuary's documentation should contain a reconciliation from the prior, most comparable, realization, including an explanation of assumptions or methods that have changed from the prior realization.
- c. The terminology in a presentation of model results should fairly reflect the

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model input and methodology, with descriptions ranging from “prudent” to “most likely” to “aggressive” depending on the balance of measures, assumptions and judgments in relation to a neutral position, with a disclosure of the relationship to the neutral position by an appropriate quantitative, qualitative or directional means.

- d. If legislation, regulation or other legal obligation specifies that an estimate described as a “best estimate” or other similar term should be derived using methods, assumptions or judgments that are not neutral, paragraph 3.3.7.c cannot apply, but the actuary should refer to section 4.2.1 and should explain in the report what adjustments from neutral the estimate involves.

3.3.8 Appropriate Governance and Controls—The actuary should use appropriate model governance and controls to avoid the introduction or use of unintentional or untested changes and to maintain the integrity of the model.

- a. Implementations and realizations used in reports to a principal should be reproducible.
- b. For Monte Carlo simulations, the actuary should consider if similar inputs will produce similar outputs. For example, do different simulations or random number generator seeds produce similar distributions of results?

3.4 Reliance on Data or Other Information Supplied by Others—When relying on data or other information supplied by others, the actuary should refer to ASOP Nos. 23 and 41, for guidance. When relying on projections or supporting analysis supplied by others, the actuary should disclose both the fact and the extent of such reliance, and the actuary should refer to ASOP No. 23, deeming such projections or supporting analysis as data covered by ASOP No. 23. Similarly, the actuary should refer to ASOP No. 41 (including paragraphs 4.2 and 4.3) with respect to the disclosure of responsibility for data, assumptions and methods.

3.5 Documentation—The actuary should consider whether documentation of modeling aspects mentioned in this ASOP should be prepared and retained, given the intended purpose of the model. Where appropriate to the intended purpose of the model, the actuary may retain documentation or other file material, pursuant to section 3.8 of ASOP No. 41. The actuary should also prepare and retain documentation to demonstrate compliance with the disclosure requirements of section 4.

3.5.1 Substance of Documentation—All documentation required by this ASOP, if any, should:

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- a. contain enough detail for a technically competent person with no previous knowledge of the particular model being documented to understand the matters involved and assess the judgments made;
- b. include a statement of the purpose of the documentation; and
- c. be clear, unambiguous and complete for that purpose.

Section 4. Communications and Disclosures

4.1 Disclosures from This ASOP—When issuing actuarial communications relating to modeling, the actuary should disclose the following in such actuarial communications:

- a. Whether the model complies with all of the guidance in this ASOP with respect to aspects of modeling such as development, documentation and controls or whether, and the extent to which, the model does not comply with all of the guidance in this ASOP because the actuary has deemed full rigor to be inappropriate for the model's intended purpose in less critical situations, as required in section 3.1.3. The actuary should disclose what guidance has not been followed.
- b. If it may not, whether, and the extent to which, the model can fulfill its intended purpose, given limited information, time constraints, and other practical difficulties, as required in section 3.1.4.
- c. If it has any, whether the model has potential weaknesses, as discussed in section 3.3.1(b), if the actuary has decided that documentation and disclosure is required.
- d. The actuary should use terminology to disclose the proper meaning of numerical results, as required in sections 3.3.7(c)–(d).

4.2 Actuarial Communication—When issuing actuarial communications relating to modeling, the actuary should refer to ASOP Nos. 23 and 41 and should include the following where applicable:

- 4.2.1 the disclosure in ASOP No. 41, section 4.2, if any material assumption or method was prescribed by applicable law (statutes, regulations, and other legally binding authority);
- 4.2.2 the disclosure in ASOP No. 41, section 4.3, if the actuary disclaims responsibility for any material assumption or method in any situation not covered under section 4.2.1 above; and

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- 4.2.3 the disclosure in ASOP No. 41, section 4.4, if the actuary departs from the guidance set forth in this ASOP.

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Appendix

Background, Current Practices, and Documentation

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

Background

Current Practices

Documentation

Documentation of aspects of modeling is mentioned in this ASOP in sections 3.3.1(b), 3.3.4(b), 3.3.5(d), 3.3.6(a)(1), 3.3.6(b)(2), and 3.3.7(b). As stated in section 3.5, the actuary should consider whether documentation should be prepared and retained, if appropriate given the intended purpose of the model. One such purpose could be to simplify further developments and later comparisons. Documentation allows the actuary to re-use the model more easily, and documentation assists the next actuary to use the model.