ACTUARIAL STANDARDS BOARD

● **EXPOSURE DRAFT** ●

Proposed Revision of
Actuarial Standard
of Practice
No. 38

Catastrophe Modeling
(for All Practice Areas)

Comment Deadline:
December 30, 2013

Developed by the
Catastrophe Modeling Task Force of the
General Committee of the
Actuarial Standards Board

TABLE OF CONTENTS

APPENDIX

September 2013

TO: Members of Actuarial Organizations Governed by the Standards of Practice of the Actuarial Standards Board and Other Persons Interested in Catastrophe Modeling (for All Practice Areas)

FROM: Actuarial Standards Board (ASB)

SUBJ: Proposed Revision of Actuarial Standard of Practice (ASOP) No. 38

This document contains the exposure draft of a proposed actuarial standard of practice, *Catastrophe Modeling (for All Practice Areas)*, intended to replace the current ASOP No. 38, *Using Models Outside the Actuary's Area of Expertise (Property and Casualty)*. Please review this exposure draft and give the ASB the benefit of your comments and suggestions. Each written response and each response sent by e-mail to the address below will be acknowledged, and all responses will receive appropriate consideration by the drafting committee in preparing the final document for approval by the ASB.

The ASB accepts comments by either electronic or conventional mail. The preferred form is e-mail, as it eases the task of grouping comments by section. However, please feel free to use either form. If you wish to use e-mail, please send a message to **comments@actuary.org**. You may include your comments either in the body of the message or as an attachment prepared in any commonly used word processing format. **Please do not password protect any attachments.** Include the phrase "ASB COMMENTS" in the subject line of your message. Please note: Any message not containing this exact phrase in the subject line will be deleted by our system's spam filter. Comments will be posted in the order that they are received. **Comments received after the deadline will not be posted.**

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

Catastrophe Modeling (for All Practice Areas)
Actuarial Standards Board
1850 M Street, NW, Third Floor
Washington, DC 20036

The ASB posts all signed comments received to its website to encourage transparency and dialogue. Anonymous comments will not be considered by the ASB nor posted to the website. The comments will not be edited, amended, or truncated in any way. Comments will be posted in the order that they are received. Comments will be removed when final action on a proposed standard is taken. The ASB website is a public website, and all comments will be available to the general public. The ASB disclaims any responsibility for the content of the comments, which are solely the responsibility of those who submit them.

Deadline for receipt of responses in the ASB office: December 30, 2013

Background

The ASB first began work on a standard for modeling in the late 1990s. Motivated primarily to address the role catastrophe modeling of earthquakes and hurricanes played in casualty ratemaking, this work was focused on the use of specialized models where the actuary would have to rely on a model that was developed by professionals other than actuaries. As a result of this work, the ASB approved ASOP No. 38, *Using Models Outside the Actuary's Area of Expertise*, in June of 2000 with the scope of the standard limited to the Property/Casualty area of practice. Currently, this is the only ASOP that specifically addresses modeling.

Recently, the number and importance of modeling applications in actuarial science has increased, with the results of actuarial models often entering financial statements directly. Recognizing this trend, the ASB asked the Life Committee in 2010 to begin work on an ASOP focused on modeling. The Life Committee formed a task force to address this issue and, in February of 2012, a discussion draft titled *Modeling in Life Insurance and Annuities* was released. Nineteen comment letters were received.

Based upon this feedback and numerous other discussions on the topic of modeling, in December of 2012 the ASB created two multidisciplinary task forces under the direction of the General Committee: i) a general Modeling Task Force, charged with developing an ASOP to address modeling applications in all practice areas, and ii) a Task Force to consider expanding ASOP 38 to all practice areas while focusing exclusively on using catastrophe models.

An exposure draft titled *Modeling* was released in June 2013 with a scope that provides guidance to actuaries when selecting, designing, building, modifying, developing, or using models when performing professional services. The comment deadline was September 30, 2013.

The exposure draft that follows this transmittal memorandum is the work of the ASOP No. 38 Modeling Task Force, whose membership has experience in life insurance, health insurance, property/casualty insurance, and enterprise risk management. The task force would especially like to point out that much of this document is drawn from the work of prior ASOP No. 38 Task Forces and thank prior task force members for their work.

At the direction of the ASB, this standard was developed to apply to all practice areas and all forms of catastrophe models, both natural catastrophes such as hurricanes, earthquakes, and tornados, and other catastrophes such as terrorist acts and pandemics.

Request for Comments

The task force would appreciate comments on all areas of this proposed ASOP revision and would like to draw the readers' attention to the following questions in particular:

1. The definition in section 2.2 includes natural perils such as hurricanes, earthquakes, and tornados as well as other perils such as terrorist acts and pandemics. Is the inclusion of these other perils sufficiently clear and appropriate?

2. The proposed revision applies only to the selection or use of models that are built specifically to address catastrophes. It does not apply to models that have, as part of their output, extreme events such as hyper-inflation or a stock market collapse. Is the scope of the ASOP and definition of catastrophe model sufficiently clear?

3. The proposed ASOP does not apply when the actuary is only designing, building, modifying, or developing a catastrophe model (or a portion of a catastrophe model). Is this sufficiently clear and appropriate?

4. The proposed ASOP now applies to all practice areas. Is that clear and appropriate?

5. The proposed ASOP is intended to maintain the same level and quality of guidance as the current ASOP No. 38 in regards to property/casualty actuarial work involving the use of catastrophe models. Does the proposed ASOP meet that intent?

6. Is the proposed standard sufficiently flexible to allow for new developments in practice?

Catastrophe Modeling Task Force

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The ASB establishes and improves standards of actuarial practice. These ASOPs identify what the actuary should consider, document, and disclose when performing an actuarial assignment. The ASB's goal is to set standards for appropriate practice for the U.S.

EXPOSURE DRAFT—September 2013

PROPOSED REVISION OF ACTUARIAL STANDARD OF PRACTICE NO. 38

CATASTROPHE MODELING (FOR ALL PRACTICE AREAS)

STANDARD OF PRACTICE

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

1.1 Purpose—This actuarial standard of practice (ASOP) provides guidance to actuaries selecting or using **catastrophe models** when performing professional services.

1.2 Scope—This ASOP applies to actuaries in all practice areas performing professional services when selecting or using **catastrophe models**. This standard applies to the selection or use of **catastrophe models**, whether or not they are proprietary in nature.

This standard does not apply to models of operational or economic risks that deal with instances of extreme events such as hyper-inflation or a stock market collapse. This standard also does not apply when the actuary is only designing, building, modifying, or developing a catastrophe model (or a portion of a catastrophe model).

ASOP No. XX, *Modeling* (currently an exposure draft), applies to the actuary when designing, building, modifying, or developing catastrophe models as well as when selecting or using catastrophe models.

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 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.

1.4 Effective Date—This ASOP will be 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—A type of input to a **catastrophe model** that represents expectations or possibilities based on professional judgment.

2.2 Catastrophe Model—A representation of relationships among events based on statistical, financial, economic, or mathematical concepts and equations used to explain a system, to study the effects of different components, and to derive estimates based upon the future occurrences of large-scale, low-frequency, high-severity events such as hurricanes, earthquakes, tornados, terrorist acts, and pandemics.

2.3 Data—A type of input to a **catastrophe model** that represents facts or information usually collected from records, experience, or observation.

2.4 Expert—One who is qualified by knowledge, skill, experience, training, or education to render an opinion concerning the matter at hand.

2.5 Parameters—Mathematical, financial, economic, or statistical input to **catastrophe models**. Examples include expected values and the coefficients of variables in mathematical distributions or regression formulae. As input to a **catastrophe model**, **parameters** are sometimes considered **assumptions** and are sometimes considered **data**, but are named separately in this standard.

2.6 Principal—A client or employer of the actuary.

2.7 Project's Objective—The specific goal or question the actuary is addressing when selecting or using a **catastrophe model** to meet the needs of the **principal**.

Section 3. Analysis of Issues and Recommended Practices

3.1 Introduction—In performing actuarial services, an actuary may find it appropriate to select and use **catastrophe models**. When selecting or using such a model, the actuary should:

a. determine the appropriate level of reliance on **experts**;

b. have a basic understanding of the **catastrophe model**;

c. evaluate whether the **catastrophe model** is appropriate for the **project's objective**;

d. determine that appropriate validation has occurred; and

e. determine the appropriate use of the **catastrophe model** and its results.

The actuary's level of effort in understanding and evaluating a model should be consistent with the **project's objective** and the model output's materiality to the results of the actuarial analysis.

3.2 Appropriate Reliance on Experts—An actuary may rely on **experts** in the fields of knowledge used in the development of the **catastrophe model**. In determining the appropriate level of reliance, the actuary should consider the following:

a. whether the individual or individuals upon whom the actuary is relying are **experts** in the applicable field;

b. the extent to which the **catastrophe model** has been reviewed or opined on by **experts** in the applicable field, including any known significant differences of opinion among **experts** concerning aspects of the model that could be material to the actuary's use of the model; and

c. whether there are industry or regulatory standards that apply to the **catastrophe model** or to the testing or validation of the model, and whether the model has been certified as having met such standards.

3.3 Understanding of the Catastrophe Model—The actuary should be familiar with the basic components of the model and understand both the user input and the model output, as discussed below.

3.3.1 Model Components—The actuary should be familiar with the basic components of the model and have a basic understanding of how such components interrelate within the model. In addition, the actuary should identify which fields of expertise were used in developing or updating the model and should make a reasonable effort to determine if the model is based on generally accepted practices within the applicable fields of expertise. The actuary should also be familiar with how the model was tested or validated and the level of independent **expert** review and testing.

3.3.2 User Input—Certain user input may be required to produce model output for the specific application. User input can include **assumptions**, **data**, or **parameters**. If the model requires user input, the actuary should evaluate the reasonableness of

the user input and should have a reasonable understanding of the relationship between the model's input and output. The actuary should take reasonable steps to confirm that the precision and accuracy of the user input are consistent with the **project's objective**. With respect to the quality and availability of the user input to be used in the model, the actuary should refer to ASOP No. 23, *Data Quality*.

3.3.3 Model Output—The actuary should determine that the model output is consistent with the **project's objective**.

3.4 Appropriateness of the Catastrophe Model for the Project's Objective—The actuary should evaluate whether the model is appropriate for the **project's objective**. When using the model output, the actuary should also consider limitations of the model, modifications to the model output, and the **assumptions** needed.

Some additional considerations include the following:

a. Applicability of Historical Data—To the extent historical **data** are used in the development of the model or the establishment of model **parameters**, the actuary should consider the adequacy of the historical **data** in representing the range of reasonably expected outcomes consistent with current knowledge about the phenomena being analyzed.

b. Developments in Relevant Fields—The actuary should make a reasonable effort to be aware of significant developments in relevant fields of expertise. The actuary should evaluate whether such developments are likely to materially affect the current actuarial analysis.

3.5 Appropriate Validation—The actuary should evaluate the reasonableness of the model output, considering the input and the **project's objective**, taking into account factors such as the following:

a. how historical observations, if applicable, compare to results produced by the model;

b. the consistency and reasonableness of relationships among various output results; and

c. the sensitivity of the model output to variations in the user input.

3.6 Appropriate Use of the Catastrophe Model and Its Results—The actuary should use professional judgment to determine whether it is appropriate to use the model results to develop the actuarial work product. The actuary should also use professional judgment to determine whether any adjustments to the model output are needed to meet the **project's**

objective. The actuary should disclose any such adjustments in accordance with section 4.1.

3.7 Reliance on Another Actuary—The actuary may rely on another actuary who has selected or used the **catastrophe model**. However, the relying actuary should be satisfied that the other actuary's use of the **catastrophe model** was performed in accordance with this ASOP and is appropriate for the **project's objective**. The actuary should document the extent of such reliance in accordance with section 4.1.

Section 4. Communications and Disclosures

4.1 Actuarial Communications—When issuing actuarial communications incorporating catastrophe modeling within the scope of this ASOP, the actuary should disclose the following, as appropriate:

a. the model used and the **project's objective**;

b. a description of the user input that was incorporated into the model, as discussed in section 3.3.2;

c. a description of adjustments made to the model results, as discussed in section 3.6.; and

d. the extent of any reliance placed upon the work of another actuary, as discussed in section 3.7.

4.2 Documentation—This standard requires documentation whether or not a legal or regulatory requirement exists. The actuary should maintain appropriate documentation of the evaluation of the **catastrophe model** and the use of the model output in the analysis. The documentation should demonstrate how the actuary has met the requirements of sections 3.1–3.7 above.

4.3 Proprietary Information—If the **catastrophe model** has proprietary aspects or contains proprietary information, the actuary should document the steps taken to comply with this standard in light of the proprietary aspects or information.

4.4 Deviation from Guidance in the Standard—If the actuary departs from the guidance set forth in this standard, the actuary should include the following where applicable:

a. 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);

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.

EXPOSURE DRAFT—September 2013

Appendix

Background and Current Practices

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

Background

Hurricane Andrew in 1992 and the Northridge Earthquake in 1994 led actuaries involved in evaluating hurricane and earthquake exposures to recognize the severe inadequacy of the traditional, empirical actuarial methods used for ratemaking for these exposures. Recognizing the need to replace these methods, many actuaries began using stochastic computer simulation models for their actuarial analysis of hurricane and earthquake exposure. Computer simulation models had been commonly used for some time by actuaries and others for the purpose of evaluating probable maximum loss but had not been widely used for ratemaking.

Over time, the output from catastrophe models became commonly used by property/casualty actuaries in developing rates for catastrophic perils as well as many other risk management purposes.

Current Practices

Catastrophe models are now widely used by actuaries in all practice areas for risk management analyses and calculating expected losses due to hurricane, earthquake, and terrorist acts. More recently, catastrophe models have also been developed to simulate wild fires, tornados, tsunamis, and pandemics.

In addition, due to changes in regulations and financial reporting requirements, the number and importance of modeling applications in actuarial science has increased, with the results of actuarial models often entering financial statements directly.

Lastly, due to the evolution of enterprise risk management (ERM) practices and regulations, there has been increased use of catastrophe modeling as part of insurer stress testing and risk management across all practice areas. This trend is likely to continue to evolve.