



Exposure Draft

Exposure Draft for Standards of Practice – Use of Models

Actuarial Standards Board

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Memorandum

To: All Fellows, Affiliates, Associates and Correspondents of the Canadian Institute of Actuaries and Other Interested Parties

From: Ty Faulds, Chair
Actuarial Standards Board
Bob Howard, Chair
Designated Group

Date: October 5, 2015

Subject: **Exposure Draft for Standards of Practice – Use of Models**

Comment Deadline: December 5, 2015

Introduction

The exposure draft for Standards of Practice – Use of Models was approved for distribution by the Actuarial Standards Board (ASB) on August 31, 2015.

Background

The ASB created a designated group (DG) responsible for developing these revisions to the Standards of Practice. The DG consists of John Brierley, Richard Brown, Patrick Chamberland, David Hart, Bob Howard (Chair), Pat Johnston, Marthe Lacroix, and David Oakden.

A [notice of intent](#), Revised Notice of Intent Regarding Standards of Practice for the Use of Models (NOI), was issued on April 22, 2014.

Comments on the Reporting NOI were received from seven individuals and organizations and from two committees of the Canadian Institute of Actuaries (CIA), the Committee on Property and Casualty Insurance Financial Reporting (PCFRC) and the Committee on Actuarial Evidence (AEC).

Proposed Changes

The exposure draft includes proposed changes pursuant to the NOI, as follows:

- Addition of five definitions to subsection 1110 (Definitions) related to models;
- Revisions to subsection 1540 (Control) to cover the mitigation of model risk;
- Revisions to subsection 1560 (Documentation) to set out requirements for an actuary's documentation of the use of a model;

- Revisions to subsection 1710 (Needed Assumptions) to clarify terminology relating to models and the distinction between models and other calculations;
- Revisions to subsection 1720 (Selection of Assumptions) to clarify terminology relating to models;
- Addition of an item in paragraph 1820.01, of paragraph 1820.05.1 to deal with disclosure of limitations in models, and of paragraph 1820.05.2 for using third party models outside the domain of actuarial practice.

Major Comments on NOI and Designated Group Response

Scope

The DG asked for input on the appropriate scope within the standards of practice for the use of models. Several supported the scope appearing in the NOI. More commenters wanted a narrower scope, but none had any helpful suggestions on how the scope might be defined so that it would be clear which models were in scope and which models were out of scope.

Some of the comments concerned whether a particular method is a model. The DG agrees that further clarification would be helpful, but it does not agree that it is proper to characterize any method as a model. A method forms part of the model specifications, and, therefore, almost any method may appear within an actuarial model.

The DG concluded that it is appropriate to consider any calculation that uses the actuarial present value method (APVM) as a model for the purposes of the standards of practice. The main reason is that APVM does entail a significant simplification of a more complex reality. Consequently most actuarial calculations are to be considered models. The DG recognizes that the second example on page 2 of the NOI should have been called a model.

To clarify the definition of model, the DG decided to add the word “methods” and delete the word “algorithms”. Thus, “A model uses methods, assumptions, and data that simplify a more complex system.”

A distinction may be drawn for a calculation, such as a life expectancy or a commuted value, for which the elements of the calculation are determined by the client or by law. It might be said that there is no simplification in such a case because the calculation is the reality itself, and hence not a model. Although conceding that there are important considerations in this case, the DG believes that the public is better served by treating this case as a model. That is, the actuary would ensure that the model is appropriate to the purpose of the calculation, that the calculation is done accurately, that there would be sufficient documentation to permit another actuary to reproduce the values obtained, and that limitations would be disclosed, if needed. Of course, what an actuary would do in practice in such a case may well be the same whether the case is considered a model or not.

Model Construction

The DG asked for input on whether to include the construction of models in the scope. All but one commenter agreed with the approach taken in the NOI, to consider use of models only. The DG decided to continue as in the NOI.

Systemic Risk

Commenters were about evenly split about whether a reference to systemic risk was needed. One commenter said that systemic risk should be taken into account, but it may not be practical to do so. The DG agrees. Systemic risk does not appear in the exposure draft because systemic risk is not well understood and model specifications for systemic risk are very subjective.

Model Specification, Implementation, and Realization/Run

The DG asked for input on whether the terms “specification”, “implementation”, and “realization” were acceptable. Only one commenter wanted other terms in the English version but made no suggestions; suggestions were made for the French version.

The DG reviewed comparable UK and US documents. A standard of practice on modelling using these terms exists in the UK and an exposure draft with the same terms was issued in the US. The second exposure draft, issued in the US after our NOI, changed “realization” to “run”. The DG initially used “realization” for consistency but believes that “run” is more commonly used in Canada. Accordingly this draft continues to use “model specification” and “model implementation” but has changed “model realization” to “model run”.

1100.31.4

One commenter thought that model risk should not be defined as considering “adverse consequences or inappropriate decisions” but only inappropriate results of the model. The DG disagrees because risk is fundamentally about business consequences. There is no model risk for a model that is not used in any regard to manage or measure the business.

1540.01

Some commenters would like additional guidance on “strategies to mitigate model risk”. The DG agrees, but it believes that the additional guidance is better suited to an educational note than to a standard of practice.

1540.11

Some commenters objected to the wording on tail events. The DG agreed and has changed the text in this draft.

1560.09

One commenter thought this paragraph was too broad and cumbersome and inappropriate for a report. The DG believes that this issue is addressed in paragraph 1560.05 which clarifies that documentation refers to the actuary’s working papers, notes, memoranda, etc., and not to a report to a user.

Other

There were some comments about the difficulty of applying the draft standards in the case of third party black box models. The DG believes that the draft properly clarifies that the actuary is no less responsible for complying with the standards in the case of a black box model. Clearly the actuary will sometimes have greater difficulty in complying with standards for a black box model than for one the actuary has developed, but the key decision point remains the choice made by the actuary that a particular model is appropriate for a particular task. The actuary may be called upon to justify the choice. The DG agrees that further guidance would be helpful, but that guidance would be better as an educational note.

One commenter asked whether an Appointed Actuary, who used the work of a non-actuary that included the use of a model, would be required to verify that the model used by the non-actuary complied with our standards. The commenter is referred to section 1600, which the DG believes gives adequate guidance on the use of models, as well as on work more generally.

Comments on the Exposure Draft

The ASB is inviting comments on this exposure draft from members of the CIA and other stakeholders by **December 5, 2015**. Please send them, preferably in an electronic format, to Bob Howard at bob@howardfamily.ca, with a copy to Chris Fievoli at chris.fievoli@cia-ica.ca. The only forum planned for submitting comments regarding this exposure draft is the receipt of written comments at the above e-mail addresses.

Due Process

The ASB's Policy on Due Process for the Adoption of Standards of Practice was followed in the development of the exposure draft.

Timeline and Effective Date

It is the responsibility of the ASB to make final decisions regarding the revised standards of practice. The ASB hopes to adopt final standards in the first quarter of 2016, to be effective on July 1, 2016. Early adoption will likely be encouraged.

TF, BH

1100 Introduction

1110 Definitions

- .01 Each term set over dotted underlining has the meaning given in this section and has its ordinary meaning otherwise (e.g., external user).
- .02 Accepted actuarial practice is the manner of performing work in Canada in accordance with the Rules and these Standards of Practice. Standards of Practice are the responsibility of the Actuarial Standards Board and approval of standards and changes to standards is made through a process that involves consultation with the actuarial profession and other interested parties. Unless the context requires otherwise, references to accepted actuarial practice refer to accepted actuarial practice for work in Canada. [*pratique actuarielle reconnue*]
- .03 Actuarial cost method is a method to allocate the present value of a plan's obligations to time periods, usually in the form of a service cost and an accrued liability. [*méthode d'évaluation actuarielle*]
- .03.1 Actuarial evidence work is work where the actuary provides an expert opinion with respect to any area of actuarial practice in the context of an actual or anticipated dispute resolution proceeding, where such expert opinion is expected or required to be independent. A dispute resolution proceeding may be a court or court-related process, a tribunal, a mediation, an arbitration, or a similar proceeding. Actuarial evidence work may include the determination of capitalized values in respect of an individual, or the provision of an expert opinion with respect to a dispute involving an actuarial practice area, such as pensions or insurance, or questions of professional negligence. [*travail d'expertise devant les tribunaux*]
- .04 Actuarial present value method is a method to calculate the lump sum equivalent at a specified date of amounts payable or receivable at other dates as the aggregate of the present values of each of those amounts at the specified date, and taking into account both the time value of money and contingent events. [*méthode de la valeur actuarielle*]
- .04.1 Actuary, as it is used in these standards, means anyone bound by these standards for work in Canada. [*actuaire*]
- .05 Anti-selection is the tendency of one party in a relationship to exercise options to the detriment of another party when it is to the first party's advantage to do so. [*antisélection*]
- .06 Appointed actuary of an entity is an actuary formally appointed, pursuant to legislation, by the entity to monitor the financial condition of that entity. [*actuaire désigné*]

- .07 Appropriate engagement is one that does not impair the actuary's ability to conform to the rules. [*mandat approprié*]
- .08 Benefits liabilities are the liabilities of a plan in respect of claims incurred on or before a calculation date. [*obligations liées aux prestations*]
- .09 Best estimate means without bias, neither conservative nor unconservative. [*meilleure estimation*]
- .09.1 Bylaws means the bylaws of the Canadian Institute of Actuaries, as amended from time to time. [*Statuts administratifs*]
- .10 Calculation date is the effective date of a calculation; e.g., the balance sheet date in the case of a valuation for financial statements. It usually differs from the report date. [*date de calcul*]
- .11 Case estimate at a calculation date is the unpaid amount of one of, or a group of, an insurer's reported claims (perhaps including the amount of claim adjustment expenses), as estimated by a claims professional according to the information available at that date. [*évaluation du dossier*]
- .12 Claim adjustment expenses are internal and external expenses in connection with settlement of claims. [*frais de règlement des sinistres*]
- .13 Claim liabilities are the portion of insurance contract liabilities in respect of claims incurred on or before the balance sheet date. [*passif des sinistres*]
- .14 Contingent event is an event which may or may not happen, or which may happen in more than one way or which may happen at different times. [*éventualité*]
- .15 Contribution is a contribution by a participating employer or a plan member to fund a benefits plan. [*cotisation*]
- .15.01 Contribution principle is a principle of policyholder dividend determination whereby the amount deemed to be available for distribution to policyholders by the directors of a company is divided among policies in the same proportion as policies are considered to have contributed to that amount. [*principe de contribution*]
- .15.1 Credibility is a measure of the predictive value attached to an estimate based on a particular body of data. [*crédibilité*]
- .15.2 Credit spread, for a fixed income asset, is the yield to maturity on that asset minus the yield to maturity on a risk-free fixed income asset with the same cash flow characteristics. [*écart de crédit*]
- .16 Definitive means permanent and final. [*décision définitive*]
- .17 Development of data with respect to a given coverage period is the change in the value of those data from one calculation date to a later date. [*matérialisation*]

- .18 Domain of actuarial practice is the measurement of the current financial implications of future contingent events. [*domaine de la pratique actuarielle*]
- .19 Early implementation means the implementation of new standards before their effective date. [*mise en œuvre anticipée*]
- .20 Earnings-related benefit is a benefit whose amount depends on the recipient's earnings. [*régime salaire de carrière*]
- .21 External user is a user who is not an internal user. [*utilisateur externe*]
- .22 External user report is a report whose users include an external user. [*rapport destiné à un utilisateur externe*]
- .23 Financial condition of an entity at a date is its prospective ability at that date to meet its future obligations, especially obligations to policy owners, members, and those to whom it owes benefits. Financial condition is sometimes called "future financial condition". [*santé financière*]
- .24 Financial position of an entity at a date is its financial state as reflected by the amount, nature, and composition of its assets, liabilities, and equity at that date. [*situation financière*]
- .25 To fund a plan is to dedicate assets to its future benefits and expenses. Similarly for "funded" and "funding". [*provisionner*]
- .25.1 Funded status is the difference between the value of assets and the actuarial present value of benefits allocated to periods up to the calculation date by the actuarial cost method, based on a valuation of a pension plan or post-employment benefit plan. [*niveau de provisionnement*]
- .26 Going concern valuation is a valuation which assumes that the entity to which the valuation applies continues indefinitely beyond the calculation date. [*évaluation en continuité*]
- .27 Indexed benefit is a benefit whose amount depends on the movement of an index like the Consumer Price Index. [*prestation indexée*]
- .27.01 Indicated rate is the best estimate of the premium required to provide for the corresponding expected claims costs, expenses, and provision for profit. [*taux indiqué*]

- .27.1 Insurance contract is a contract under which one party (the insurer) accepts significant insurance risk from another party (the policyholder) by agreeing to compensate the policyholder if a specified uncertain future event (the insured event) adversely affects the policyholder. Insurance contract includes group insurance, third party contracts where the owner of the contract and the person who is compensated (the policyholder) differ, and all like arrangements substantively in the nature of insurance.¹ [*contrat d'assurance*]
- .27.2 Insurance contract liabilities in an insurer's statement of financial position are the liabilities at the date of the statement of financial position on account of the insurer's insurance contracts, including commitments, which are in force at that date or which were in force before that date. [*passif des contrats d'assurance*]
- .28 Insurer is the party that has an obligation under an insurance contract to compensate a policyholder if an insured event occurs. Insurer includes a fraternal benefit society and the Canadian branch of a foreign insurer, but does not include a public personal injury compensation plan.¹ [*assureur*]
- .29 Internal user is the actuary's client or employer. Internal user and external user are mutually exclusive. [*utilisateur interne*]
- .30 Internal user report is a report all of whose users are internal users. [*rapport destiné à un utilisateur interne*]
- .31 Margin for adverse deviations is the difference between the assumption for a calculation and the corresponding best estimate assumption. [*marge pour écarts défavorables*]
- .31.1 Model is a practical representation of relationships among entities or events using statistical, financial, economic, or mathematical concepts. A model uses methods, assumptions, and data that simplify a more complex system. A model is composed of a model specification, a model implementation, and one or more model runs. Calculations simple enough to be effectively performed manually would not be considered a model. [*modèle*]
- .31.2 Model implementation is one or more systems developed to perform the calculations for a model specification. For this purpose "systems" include computer programs, spreadsheets, and database programs. [*implémentation du modèle*]
- .31.3 Model run is a set of inputs and the corresponding results produced by a model implementation. [*exécution d'un modèle*]

¹ The wording of the first sentence of this definition is identical to the corresponding definition appearing in IFRS 4 Appendix A, as of November 2009. The second sentence is explanatory and not part of that definition.

- .31.4 Model risk is the risk of adverse consequences or inappropriate decisions made as a result of flaws or limitations in a model specification; an incorrect model implementation; faulty assumptions or data used in a model run; incorrect interpretation of model output; or choosing a model unsuitable to the purpose for which the model was intended. [risque de modélisation]
- .31.5 Model specification is the description of the components of a model and the interrelationship of those components with each other, including the types of data, assumptions, methods, algorithms, entities and events. [spécifications du modèle]
- .32 New standards means new standards, or amendment or rescission of existing standards. [nouvelles normes]
- .33 Periodic report is a report that is repeated at regular intervals. [rapport périodique]
- .34 Plan administrator is the person or entity with overall responsibility for the operation of a benefit plan. [administrateur d'un régime]

- .35 Policy liabilities in an insurer's statement of financial position are the liabilities at the date of the statement of financial position on account of the insurer's policies, including commitments, which are in force at that date or which were in force before that date. Policy liabilities consist of insurance contract liabilities and liabilities for policy contracts other than insurance contracts. [*passif des polices*]
- .35.1 Policyholder is a party that has a right to compensation under an insurance contract if an insured event occurs.² [*titulaire de police*]
- .36 Practice committee means the committee or committees of the Canadian Institute of Actuaries, either standing or ad hoc, to which the Practice Council of the Canadian Institute of Actuaries has assigned responsibility for the practice area or areas to which particular Standards of Practice apply. [*commission de pratique*]
- .37 Premium liabilities are the portions of insurance contract liabilities that are not claim liabilities. [*passif des primes*]
- .38 Prescribed means prescribed by these standards. [*prescrit*]
- .38.1 Property and casualty insurance is insurance that insures individuals or legal persons
- having an interest in tangible or intangible property, for costs arising from loss of or damage to such property (e.g., fire, fidelity, marine hull, warranty, credit, legal expense and title insurance), or
- for damages to others or costs arising from the actions of such persons (e.g., liability and surety bonds) and for costs arising from injury to such persons (e.g., automobile accident benefits insurance). [*assurances IARD*]
- .39 Provision for adverse deviations is the difference between the actual result of a calculation and the corresponding result using best estimate assumptions. [*provision pour écarts défavorables*]

² The wording of this definition is identical to the corresponding definition appearing in IFRS 4 Appendix A, as of November 2009.

- .40 Public personal injury compensation plan means a public plan whose primary purpose is to provide benefits and compensation for personal injuries,
- whose mandate may include health and safety objectives and other objectives ancillary to the provision of benefits and compensation for personal injuries, and that has no other substantive commitments.
- The benefits and compensation provided under such public plans are defined by statute. In addition, such public plans have monopoly powers, require compulsory coverage except for those groups excepted by legislation or regulation, and have the authority to set assessment rates or premiums. [*régime public d'assurance pour préjudices corporels*]
- .41 Recommendation means a recommendation in a box in these standards. Similarly for “recommend”. [*recommandation*]
- .41.1 Related experience includes premiums, claims, exposures, expenses, and other relevant data for events analogous to the insurance categories under consideration other than the subject experience and may include established rate levels or rate differentials or external data. [*expérience connexe*]
- .42 Report is an actuary's oral or written communication to users about his or her work. Similarly for “to report”. [*rapport*]
- .43 Report date is the date on which the actuary completes the report on his or her work. It usually differs from the calculation date. [*date du rapport*]
- .43.1 Reinsurance recoverables in an insurer's balance sheet are the assets at the balance sheet date on account of reinsurance treaties, including commitments, which are in force at that date or which were in force before that date. [*sommes à recouvrer auprès des réassureurs*]
- .44 Report pursuant to law is a report for which the law requires an actuary's opinion. [*rapport en vertu de la loi*]
- .45 Rule means a rule in the Canadian Institute of Actuaries' Rules of Professional Conduct. [*règle*]
- .46 Scenario is a set of consistent assumptions. [*scénario*]
- .47 Service cost is that portion of the present value of a plan's obligations which an actuarial cost method allocates to a time period, excluding any amount for that period in respect of unfunded accrued liabilities. [*cotisation d'exercice*]
- .48 Standard reporting language is standard language for an external user report. [*libellé du rapport type*]
- .48.1 Subject experience includes premiums, claims, exposures, expenses, and other data for the insurance categories under consideration. [*expérience visée*]

- .49 Subsequent event is an event of which an actuary first becomes aware after a calculation date but before the corresponding report date. [*événement subséquent*]
- .49.1 Trend is the tendency of data values to change in a general direction from one coverage period to a later coverage period. [*tendance*]
- .50 Use means use by the actuary, usually in the context of use of another person's work. [*utilisation*]
- .51 User means an intended user of the actuary's work. [*utilisateur*]
- .52 Virtually definitive means to become definitive upon completion of one or more actions which are seen as formalities. [*pratiquement définitive*]
- .53 Work means the actuary's work within the domain of actuarial practice and usually includes
- acquisition of knowledge of the circumstances of the case,
 - obtaining sufficient and reliable data,
 - selection of assumptions and methods,
 - calculations and examination of the reasonableness of their result,
 - use of other persons' work,
 - formulation of opinion and advice,
 - reporting, and
 - documentation. [*travail*]

1540 Control

.01 Control procedures that detect errors and decrease the effect of errors should be performed for calculations. [Effective July 1, 2011]

.01.1 To mitigate model risk, the actuary should perform model validation and employ other strategies appropriate for the complexity and financial significance of the model. [Effective Month XX, 201X]

.02 A calculation that is data-intensive, that is complex, that involves physically separate steps like manual and data processing steps or parallel data processing steps, or especially, a combination of them, is prone to error which appropriate control procedures may prevent or, failing prevention, detect. Appropriate control procedures also help to meet the need for consistency between the actuary's work and other related work; for example, a uniform cut-off date in the preparation of financial statements.

.03 Examples of control procedures are procedures to assure that
 all steps in the calculation are co-ordinated,
 all steps in the calculation have been performed and checked,
 the actuary's data processing does not corrupt the data supplied to the actuary,
 established procedures (for example, those for a prior period) are not changed inadvertently, and
 changes in established procedures are made in an orderly manner.

.04 Examples of control tools are
 random sampling,
 spot checks, and
 audit trails.

.05 The extent of the strategies to mitigate model risk would depend on the financial significance that an incorrect model run would have on the work. When the financial significance would be greater, more rigorous mitigating strategies would be developed. For some very simple models it may be sufficient to determine that calculations are accurate and that the data are correct.

.06 For models that are used more than once, strategies for mitigating model risk may require repetition. The actuary would determine the frequency with which the various mitigating strategies are repeated.

.07 The actuary would test that the model implementation uses the data and assumptions as intended by the model specification. The actuary would also verify that the algorithms used by the model implementation function as intended by the model specification. The reasonableness of the model run may be tested by using alternative models. Various components of a complex model may be compared to results obtained by separate models.

- .08 The actuary would validate that the model specification is suitable for its intended purpose. For example, a stochastic model may be more suitable than a deterministic model for the valuation of minimum guarantees in some life insurance policies.
- .09 Strategies to mitigate model risk are pertinent to all models, including those developed by third parties and those for which the actuary has limited access to intermediate results.
- .10 The work done to validate a model before using it would be more extensive when the financial significance of the results to be obtained or the decisions anticipated are greater, and less extensive otherwise.
- .11 In assessing a model's suitability the actuary would understand the model's basic operations, important relationships, major sensitivities, limitations, strengths, and potential weaknesses.
- .12 When a model is to be used for stress tests or is stochastic, the actuary would give appropriate consideration to the statistical distributions used, and the magnitude and behaviour of tail events in light of the nature of the work.

1560 Documentation

- .01 The actuary should use his or her best efforts to compile and secure the retention of appropriate documentation.
- .02 Where a successor actuary takes possession or control of documentation previously in the possession or control of a predecessor actuary, the successor actuary should use his or her best efforts to make such documentation available to the predecessor actuary, upon request by the predecessor actuary, if needed by the predecessor actuary to respond to queries about the related work.
- .03 Where a successor actuary or an employer or client, acting on behalf of a successor actuary, requests access to documentation in the possession or control of a predecessor actuary, in order to carry on work, the predecessor actuary should use his or her best efforts to comply with the request. [Effective December 1, 2002]
- .03.1 The actuary's documentation for a model should demonstrate:
the intended purpose of the model;
the appropriateness of the model specification for the intended purpose;
the limitations of the model specification relevant to the model's intended purpose;
the testing of the model implementation;
an understanding of the matters involved; and
the presence of appropriate mitigating strategies for model risk. [Effective Month XX, 201X]
- .04 Documentation is an integral part of work that affects the application of nearly all standards.
- .05 Documentation consists of letters of engagement, working papers, meeting notes, memoranda, correspondence, reports, copies or excerpts of company or plan data and documents, and work plans. Appropriate documentation describes the course of the work and the actuary's compliance with accepted actuarial practice.
- .06 Both professional and legal needs may affect the length of time during which documentation is to be retained.

- .07 An actuary who severs connection with a client or employer (for example, an actuary who retires or changes job) may seek to secure the retention of documentation of work for that client or employer by entrusting it to another actuary, who may be the successor actuary. Said other actuary would use his or her best efforts to make the documentation available to the predecessor actuary if his or her work is questioned or challenged.
- .08 In some circumstances, documentation may not be in the possession or control of an actuary, or an actuary may be unable to release the documentation, particularly in cases involving the proprietary interests of a third party (including a client or employer). In the face of such difficulties, the actuary would consider seeking further advice.
- .09 Model documentation would be detailed enough to permit, by another actuary knowledgeable in the matters at hand but with no previous knowledge of the particular model:
an assessment of the judgments made;
an assessment of the reasonableness of the model run; and
the re-performance of the model run in whole or in part.
- .10 The documentation of the work done to validate a model would be more extensive when the financial significance of the results to be obtained or the decisions anticipated are greater, and less extensive otherwise.
- .11 When a model is based in whole or in part on a model developed by a third party, the actuary would prepare additional documentation to describe the due diligence applied to the third party's model.

1710 Needed assumptions

- .01 The needed assumptions for a calculation-model specification consist of model assumptions, data assumptions, and other assumptions. [Effective Month XX, 201X]
- .02 There is a model assumption for each of the matters that the actuary's model takes into account. Those matters should be sufficiently comprehensive for the model reasonably to represent reality.
- .03 Data assumptions are the assumptions, if any, needed to relieve insufficiency or unreliability in the obtainable data.
- .04 The other assumptions are the assumptions about the legal, economic, demographic, and social environment upon which the model and data assumptions depend. [Effective December 1, 2002]

.04.1 Throughout the standards, the word "calculation" appears, but not as a defined term. It can imply a mathematical operation as simple as adding two numbers or as complex as a scenario of dynamic capital adequacy testing. "Calculation" does not necessarily imply that a model is used. The word "calculation", when used in the context of a model, emphasizes the result of a model run; however the model specification and model implementation are also important.

Model assumptions

- .05 The model assumptions are quantitative assumptions about
contingent events,
 investment return and other economic matters, such as price and wage indices,
 and
 numerical parameters of the environment, such as the income tax rate.
- .06 A calculation-model, whether simple or complex, requires a model, simple or complex, into which assumptions are set. The actuary's model depends on the purpose of the report work and the sensitivity of the calculation's results model run to the various matters about which assumptions could be made. The actuary would strike a balance between the complexity needed for reasonable representation of reality and the simplicity needed for a practical calculation. If the model specification does not take into account a matter, then the result is an implicit assumption about that matter, usually an assumption of zero probability or of zero rate. The actuary may compensate for an inappropriate implicit assumption regarding a matter that the model specification does not take into account by altering the explicit assumption regarding a matter that the model specification does take into account. For example, if the model specification takes account of investment return but does not take account of the risk of asset depreciation, the result, as just noted, is an implicit assumption of zero depreciation. To compensate, the actuary may assume a lower investment return rate.

.06.1 For stochastic models and models with interrelated model runs, such as sensitivity testing, the actuary would consider the interaction between risks.

Data assumptions

- .07 The available data may be not sufficient or not reliable. For example, files of pension plan members may lack the date of birth of the members' spouses. Based on sampling, or on comparison with comparable data, it may be appropriate to assume a relationship between spouse and member ages; for example, that a male spouse's date of birth is three years before the member's, and that a female spouse's date of birth is three years after the member's.

Other assumptions

- .08 The other assumptions are usually qualitative, dealing with the environment; for example, legislation, like the federal Income Tax Act, student education, the medical care system, government social security systems, and international treaties.
- .09 Those assumptions are needed to the extent that the model assumptions and, in some cases, the data assumptions depend upon them. Such assumptions are numerous and it is not practical to identify all of them.

Needed assumptions

- .10 Examples of matters about which assumptions may be needed are

Economic

discount rates to calculate present values,
investment return rates earned on the investment of positive cash flow or that affects the price at which assets are sold in order to meet negative cash flow,
investment return rates earned on assets that support liabilities,
risk of asset depreciation (C-1 risk),
risk of changes in the level or term structure of interest rates (C-3 risk),
rate of interest on member contributions to registered pension plans,
price and wage inflation rates,
compensation increases,
productivity rates,

number of hours worked by employees,
behaviour of indices to which benefits are linked,
rate of increase in maximum allowable pensions under a registered pension plan, and
trend rate (by type of benefit provided under the plan) – initial rate, ultimate rate and
the number of years and grading pattern to reach the ultimate rate,

Social

family composition,
marital status,
age difference between spouses, and
judicial decisions in litigation,

Decrement

termination of coverage voluntarily, or through job loss, death, disability, or failure to
maintain eligibility,

Benefit entitlement

rates of death, disability, sickness, accident, unemployment, medical treatment, and
early, normal, and deferred retirement,
election of options by members and policy owners, and
impact of benefit maxima,

Increment

rates of future new entrants,

Benefit continuance

death, disability recovery, marriage breakdown, remarriage, termination of economic
dependency, and re-employment rates,
post-retirement pension adjustments, and
maintenance expense for a disabled person,

Claims development

reporting patterns,
settlement patterns,
reopened claims,
initial claims cost by type of benefit and age, and

cost-sharing arrangements (such as share of cost borne by members in the form of premiums or contributions, coinsurance, deductibles, annual and lifetime maxima, etc.),

Expense

expenses of marketing, administration, claim adjustment, and investment management,

Taxation

tax rates,

definition of tax base, and

limitations on the funding of registered pension plans,

Other

government benefit plan provisions and their integration with private sector plans, and portion of claims costs paid under government programs.

1720 Selection of assumptions

- .01 The assumptions that the actuary selects or for which the actuary takes responsibility, other than alternative assumptions selected for the purpose of sensitivity testing, should be appropriate in the aggregate. These assumptions should also be independently reasonable unless the selection of assumptions that are not independently reasonable can be justified.
- .02 The actuary should select each needed assumption except for those, if any, which are prescribed, which are stipulated by law or which are stipulated by the terms of the engagement.
- .03 | If the actuary does not take responsibility for an assumption, ~~then~~ the actuary should so report. If the actuary considers it practical, useful and appropriate under the terms of the engagement to do so, the actuary should report the result of an alternative assumption. [Effective July 1, 2011]

- .03.1 The actuary would select independently reasonable assumptions. The following are examples.

For a typical defined benefit pension plan valuation, the actuary would adopt an explicit investment assumption, as well as an explicit expense assumption rather than using implicit assumptions incorporated within a net discount rate.

However, for a small defined benefit pension plan, the actuary may choose to use approximations for the investment expenses, in accordance with subsection 1510, and

For a typical non-participating life insurance portfolio where experience is not passed on to policy owners, all assumptions would be established independently. However, for a typical participating life insurance portfolio where experience is passed on to policyholders through changes to the dividend scale, a reasonable representation of reality would be to assume that the current dividend scale and current experience persist into the future, as long as any implicit offsets in assumptions simplify the valuation and do not materially affect the amount of the valuation.

- .03.2 The requirement for independently reasonable assumptions regarding contingent events would not require a test of reasonableness within an assumption. For example, a mortality assumption would need to be reasonable only as an independent assumption in total, even though there may be offsets between ages, sex and smoking status within the assumption.
- .03.3 The reasonableness of an assumption does not depend on the manner in which an assumption is expressed as long as the assumption would be a reasonable representation of reality over the entire period to which the assumption applies. For example, a life insurance administrative expense assumption would not be reasonable if it were expressed entirely as a proportion of premium, even though it may represent the current reality but would not represent reality if all policies were to become paid up and administrative expenses were to continue to be incurred.
- .03.4 A reasonable assumption would reflect current conditions as of the calculation date but would not necessarily have to reflect current conditions persisting into the future. For example, if current interest rates are extremely high or low in relation to past rates or future expectation, it would not be unreasonable to assume that interest rates change over time.
- .03.5 The actuary's use of independently reasonable assumptions may result in the assumptions not being reasonable in the aggregate. For example,
- if all assumptions are independently reasonable but biased in the same direction, the combined effect of all assumptions may produce an excessive overall provision, or
 - if all economic assumptions used in the valuation of a pension plan are independently reasonable but were developed based on different assumptions for price inflation, the assumptions may not be reasonable in the aggregate.

In such event, the requirement for assumptions to be appropriate in the aggregate would be more important than the requirement for independently reasonable assumptions. Certain assumptions may then be modified and may not be independently reasonable.

- .03.6 If an assumption is prescribed, is stipulated by law or regulation or is stipulated by the terms of the engagement, it would not be appropriate to compensate for this prescription or stipulation by modifying other assumptions. The remaining assumptions would be reasonable in the aggregate and to the extent possible be independently reasonable. Subsections 1310 and 1320 provide additional guidance for these situations.
- .04 If the use of assumptions that are not independently reasonable could be justified, inappropriateness in a particular assumption could be offset by the inappropriateness in another, for example if one is conservative and the other is not conservative, then they may be appropriate in the aggregate. For example, in a pension plan valuation, group annuity purchase costs may be calculated using mortality and interest rates that would be different from the rates used by an insurance company to price the annuity, but may still provide a reasonable cost for the annuity.
- .04.1 There would be justification for not using independently reasonable assumptions when the assumption
- is stipulated by law or regulation or is required by a court or by legal precedent, in which case the actuary would set assumptions as allowed by subsection 1310,
 - is in conflict with, or is impractical under, the terms of an appropriate engagement, in which case the actuary would set assumptions as allowed by subsection 1320,
 - is required in unusual or unforeseen situations, in which case the actuary would set assumptions as allowed by subsection 1330,
 - has no material impact on the results of the work, in which case the actuary would set assumptions as allowed by subsection 1340,
 - is an appropriate approximation, in which case the actuary would set assumptions as allowed by subsection 1510,
 - is a model assumption that reasonably represents reality, as described in subsection 1710, or
 - is consistent with accepted actuarial practice.
- .04.2 The use of independently reasonable assumptions implies that each assumption is explicitly defined. However, there would be no requirement to use explicit assumptions in the method for calculation model specification, as long as the result of using that method-model does not produce a material error. For example, for pension valuations, use of a discount rate net of expenses may produce a value very close to the value obtained by using explicit assumptions. In this case, the actuary would disclose both the gross investment rate assumption and the expense assumption.

- .05 Use of an assumption stipulated by the terms of the engagement is use of the work of another person.
- .06 If the stipulated assumption is appropriate but near the end of the accepted range, then it may be useful, if appropriate under the terms of the engagement, to report the result of an alternative assumption near the other end of the accepted range, especially in an external user report. The same is true for a stipulated assumption that, for example, the federal Income Tax Act continues as is when an amendment to it is virtually definitive.
- .07 In assessing the utility of reporting the result of an alternative to an assumption for which the actuary does not take responsibility, the actuary would consider the dependence of external users on his or her work. For example,
- utility in actuarial evidence work would be assessed in the context of the adversarial system in tort litigation, which expects each side to develop its own case without help from the other side, or to identify and expose any flaws in the other side's case; therefore, it is consistent with that system for the actuary engaged by one side not to report the result of an alternative assumption if the lawyer for the other side is able to compel the actuary (or engage his or her own actuary) to calculate the result of a desired alternative, and
- if members of a pension plan receive a copy of the actuary's report that uses an assumption for which the actuary did not take responsibility, and if the members are identified as users in the report, the reporting of the results of using an alternative assumption may be useful to those members.

1820 Reporting: external user report

- .01 In an external user report, the actuary should
- identify the client or employer,
 - describe the work, its purpose, and its users,
 - say whether or not the work is in accordance with accepted actuarial practice in Canada and, if not, disclose the deviation from that practice,
 - if useful, disclose any unusual application of accepted actuarial practice,
 - if the report is supported by the use of a model, disclose limitations in the model relevant to the intended purpose,
 - disclose any aspect of the work for which the actuary does not take responsibility,
 - describe each assumption used for the work, that is material to the results of the work, including the extent of any margin for adverse deviations included with respect to each such assumption,
 - provide the rationale for each such assumption that is material to the results of the work,
 - disclose any assumption that is different from assumption of continuance of the status quo and, if practical, useful and appropriate under the terms of the engagement, disclose the effect of alternative assumptions,
 - describe the methods used for the work,
 - in the case of a periodic report, disclose any inconsistency between the methods and assumptions of the current and prior reports and the rationale for such inconsistency,
 - describe any subsequent event that is not taken into account in the work,
 - disclose any reservation,
 - express an opinion on the methods and assumptions used for the work,
 - express an opinion on the results of the work,
 - identify himself or herself and sign the report, and
 - date the report. [Effective ~~March 31, 2015~~ Month XX, 201X]
- .02 Any description or disclosure may be in material referred to in the report and either accompany the report or plausibly be available to users.

- .03 Subsequently, the actuary should respond to a user's request for explanation except if that is contrary to the terms of the engagement.
- .04 Subsequently, the actuary should withdraw or amend the report if information comes to hand after the report date that invalidates the report.
- .05 A duty of confidentiality in an appropriate engagement supersedes any of the foregoing portions of this recommendation with which it conflicts, but does not supersede an actuary's obligations to the Canadian Institute of Actuaries, pursuant to the bylaws or the Rules of Professional Conduct. [Effective December 1, 2002]
- .05.1 Explanation of the limitations of a model and the implications of those limitations should include descriptions of:
- any relevant exclusions from the model;
- simplifying assumptions made; and
- the sensitivity of results to the key assumptions.
- .05.2 If the actuary uses a model developed by experts outside the domain of actuarial practice but is not able to verify the appropriateness of using such model, the actuary should so report. [Effective Month XX, 201X]

Description and disclosure in general

[the remainder of 1820 is unchanged]

In many subsections:

Show "model" as "model" except for subsections 4250 and 4340. Change spelling of "modeling" to "modelling" in paragraphs 2270.03 and 2330.32. These editorial changes may be deferred until there is a substantive change to the relevant section.