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Prudential Actuarial Community Comments on the Modeling ASOP 4th Exposure Draft

On behalf of the Prudential actuarial community

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Those primarily contributing to the comments in this document

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General comments

- **Outputs from upstream models.** It is important to make the point that model risk exists from using model outputs from one model in an inappropriate or incorrect way. Output from an upstream model, when used as input to a downstream model, should also be consistent with the intended purpose of the downstream model. For example, an upstream model that generates output using margins for adverse deviation in the assumptions is not appropriate for a downstream model that uses that as input to generate best estimate output. This is relevant in several sections of the document including 2.2, 2.10, and 2.12.
- **Segregation of duties.** One of the key tenets of model governance is segregation of duties. The phrase “The Actuary” appears many times throughout the document but it should be a separate person performing certain tasks. For example, it is critical to specify that model validation, as addressed in section 3.5.2, be performed by an independent person¹⁰. It is also important for model testing to be done by a separate person than the individual who developed the model. Consider adding a separate section to the ASOP which covers segregation of duties – including reference to the “three lines of defense” approach, which is covered in *Model Validation Principles Applied to Risk and Capital Models in the Insurance Industry*¹¹, the *Model Governance Practice Note, Some Considerations for Practicing Life Actuaries*, and other sources. Section 3.5.3 references review by another professional, but a good model governance program with clear roles and responsibilities – including segregation of duties – does not need to specify review by another professional because it is already included in the best practices administered by the company.
- **Use limitations.** It is an important tenet of model governance that model use limitations are clearly documented and communicated to model users. Examples are included in the *Model Governance Practice Note, Some Considerations for Practicing Life Actuaries* and the *Model Governance Checklist, Some Considerations for Practicing Life Actuaries*¹². This is relevant in section 3.1.3.b, 3.3.d, 4.1.b, and in the Appendix.
- **Actuarial model governance first principles and best practices.** It is best to specifically call out in an explicit section what the best practices and principles of actuarial model governance are. There is a long list of associated output from various actuarial organizations – including the Society of Actuaries, American Academy of Actuaries, International Actuarial Association, etc. – which address model governance. However, there is not one place where the best practices are summarized clearly and concisely.¹³ It seems that this Modeling ASOP exposure draft may be the best place to bring this together. The key principles of actuarial model governance are:

- **Sustainability.** There should be a formal policy to reduce ambiguity and inconsistency. This includes defining what a model is, keeping a model inventory¹⁴, and establishing clear segregation of duties, including independence in model validation.
- **Risk-smart.** It is important to consider materiality and risk. This lens should be applied to the testing and validation of model inputs, calculations, outputs, end-to-end process testing, and sensitivity testing.
- **Third-party principle.** A qualified individual should be able to understand what the model is doing and why. Documentation should cover intended purpose, inputs, calculations, outputs, use limitations, results of testing and validation, and ongoing performance monitoring processes.
- **Part of the culture.** A model governance life cycle encourages consistency. For efficiency, integrate model testing and documentation of changes in to the process.¹⁵
- **Accountability.** ASOPs place accountability on the actuary to ensure reasonable governance and controls to mitigate model risk.

Reasonable governance and controls. This concept is covered in section 3.5.4 and in the Appendix. However, what is presented in the Appendix has more to do with controls around the use of the model. The examples of model governance as given in the Appendix are also not consistent with those given in *ASOP 54, The Pricing of Life Insurance and Annuity Products*¹⁶, although one can argue that both the Modeling ASOP and ASOP 54 apply to models used to price Life Insurance and Annuity products. This is confusing to actuaries to see inconsistent definitions of the same phrase across ASOPs. That is why the idea of adding a section on model governance first principles and best practices – and potentially replacing the section on reasonable governance and controls, or leveraging the definition in ASOP 54, will give more clarity to the user.

Comments on specific sections

- **Section 1.1 Purpose:** Include mitigating model risk in the purpose of the ASOP. This is a key area of focus on the modeling process and there is an explicit section of the ASOP exposure draft dedicated to this practice. Same comment in section 1.2 on Scope, or change the wording to say, “This standard applies to actuaries in any practice area when performing actuarial services with respect to the purpose of this ASOP.” Also, explicitly mention testing as it is important to call out model testing independent from model development.
- **Section 1.2 Scope:** Consider stating that the actuary is “accountable” as opposed to “responsible” for model output. Accountability implies ownership – and the use of this term is more consistent with that used in the insurance industry to indicate appropriate ownership.¹
- **Section 2.12 Parameter:** To further distinguish parameter from data, it would be helpful to state, “Parameters often consist of product features that are used to configure a model for specific blocks of business. Unlike data, they typically remain constant from run to run, unless the model’s scope is expanded to include new products.”
- **Section 2.2 Data:** It will be helpful to provide examples of data which can be input to a model in the same way that examples of parameters are provided in that section. Data is often refreshed with each model run. In contrast, parameters and assumptions often remain unchanged from one run to the next. Examples of data that are typically refreshed include: then-current interest rates, option prices, and inventory of existing assets and/or liabilities. These types of data are often direct input

to a model and are neither parameters nor assumptions. This distinction is particularly relevant when considering whether margins should be applied to the data, or sensitivities should be run.

- **Section 2.4 Input:** The definition of input is very broad. It is important to distinguish between the different types of inputs. Clarify that input to a model can be in the form of 1) assumptions, 2) data, or 3) parameters. It is not clear enough that these are the three types of model input. Each term is defined separately later in the document, but the user must glean that they are not overlapping elements of input.
- **Section 2.5 Intended Purpose:** Clarify whether a model can have more than one intended purpose. It may be helpful to treat each intended purpose as a separate model, even where they have a common processing component. This approach will reinforce the need to assess the appropriateness of a combination of specific processing components, data, assumptions, parameters and output for each intended purpose. A modeling choice or assumption may be appropriate for one purpose but not for another. The definition of model run (section 2.9) and the discussion of range, consistency, appropriateness of assumptions and parameters in model runs (section 3.1.6.c-e) state that different model runs may use different assumptions and parameters, but all include the whole transformation process.
- **Section 2.6 Intended User:** Replace “actuarial finding” with “model output;” the term actuarial finding is not used anywhere else in the document, but “output” is used elsewhere in the document in similar context.
- **Section 2.8 Model Risk:** Consider adding the consequences of model risk. For example, Supervisory and Regulatory Letter SR 11-7² follows up the definition of model risk with a statement that “Model risk can lead to financial loss, poor business and strategic decision making, or damage to a bank's reputation.” As the definition of model risk given in the Modeling ASOP exposure draft tracks closely with that as presented in SR 11-7, consider referencing the consequences of model risk and changing “banking” to “insurance or other financial institution.”
- **Section 3.1.1 Designing, Developing, or Modifying the Model.** This section should speak directly to modeling choices. Where the design of a model includes significant modeling choices (e.g., simplifications, approximations), the actuary should understand the rationale and/or justification for the choices made. In some cases, developmental testing may be needed to understand the implications of alternative choices. Where an actuary is responsible for designing, developing, or modifying a model, the actuary should consider whether developmental testing is needed to assess the appropriateness of significant modeling choices. Evidence of any developmental testing should be included with model documentation. [Note: Need to clarify the difference between developmental testing and implementation testing. Add to Section 2 definitions].
- **Section 3.1.6.a Setting Assumptions and Parameters.** It should be a criterion that the actuary document assumptions appropriately or ensure that assumptions provided by others are documented as such. For best practices on what should be documented with the use of assumptions, see the Assumptions ASOP 3rd Exposure Draft.³
- **3.1.6.b Margins.** Make it clear that margins on assumptions or parameters should be clearly documented and discussed with the actuary who is the user and deemed appropriate for the intended purpose of the model. It is not appropriate to include margins on assumptions when the

model is used to generate best estimate output, so the user needs to be aware of any implication of doing so. As the same actuary often is not the one setting assumptions and running models, it is important to mention this.

- **3.1.6.f Reasonable Model in the Aggregate.** It would be helpful to provide an example of a situation where assumptions which are reasonable individually can produce output which is unreasonable in the aggregate; additionally, please include guidance around appropriate potential actions if the actuary determines this to be the case.
- **3.3 Reliance on Models Developed by Others.** To the extent the actuary relies on testing performed by others, the actuary should also make a reasonable attempt to understand testing that has been performed on the model, i.e., implementation testing as well as any developmental testing. This may include the high-level testing strategy that was followed, the time frame under which the model was last tested and any material findings that came about as part of testing. The current guidance related to an actuary's reliance on models built by others should be strengthened. We believe that an actuary who relies on a model built by a vendor or other developer is still responsible for ensuring the model is appropriate given its intended purpose. Results of any ongoing performance monitoring processes should be added to the list items to examine and understand.
- **3.5 Mitigation of Model Risk.** It should state that model materiality is an important consideration in actions the actuary should take to mitigate model risk. The more material the impacts of a model can have on the company financial statements, capital positions, or management action, the more actions the actuary should take to mitigate the model risk.
- **3.5.e Balance between the cost of mitigation efforts.** It should state that the actuary should use judgment when assessing mitigation efforts as compared to model risk, and that the level of model risk mitigation should be commensurate with the perceived or actual level of risk associated with the use of the model. For example, a highly complex model for a closed product with a small amount of earnings or reserve impact may warrant a lower level of review than a simplified model which can have a material effect on company financial or capital position.
- **3.5.1 Model Testing.** Should include reference to sensitivity testing. This is one of the key tenets of model governance best practices. This appears in multiple external sources⁴. Although this is covered in section 3.1.3 and 3.3, it should be clearer that this is an important part of model testing. This is also alluded to in section 3.5.2 but should be part of model testing, not just validation. This should also be addressed in section 3.1.6.c where it states that "The actuary may consider using a range of assumptions and parameters." In that consideration, the actuary should ensure that the output associated with using such a range is reasonable. Further, please include more explicit references to testing the full end-to-end process, e.g. updating required input data, performing model runs over a reasonable range of scenarios and sensitivities, and aggregating output. The actuary should use judgment when determining the appropriate level of process-focused testing based upon the materiality of the model, the complexity of the overall process, and the level of changes to the process. Testing which is focused solely on specific units of calculations and/or functionality and the financial impact of base model results can easily miss significant deficiencies in the model's end-to-end process and its ability to meet its intended purpose. Also, please clarify whether testing refers to implementation testing or developmental testing.

- **3.5.1.a Reconciling relevant input values.** An important tenet of model testing is to ensure the inputs are loaded in to the software correctly. For example, AAA Practice Note, *Model Governance Practice Note, Some Considerations for Practicing Life Actuaries*⁵ states that, “To assure that assumptions are accurately loaded to models, inspection, reasonableness checks, and peer review are validation procedures often employed.” It should be clearer that by “reconciling,” this means that the values are input correctly in to the model or modeling software, and not just that the input data *before* it is loaded in to the model reconciles to the source data. If someone reconciles that initial data before it is loaded in to a model reconciles with the admin system, but then loads it in to the model incorrectly, it is a source of model risk. It is also important to make sure that there is a way to ensure that inputs are loaded in to the model at each model use, not just the first time the model is set up. For example, the *IAA Note on the Use of Internal Models for Risk and Capital Management Purposes by Insurers*⁶ states that, “the builders of an internal model will, most likely, need to consider that the inputs, formulas and outputs of the model must be testable (auditable) on a regular basis.”
- **3.5.1.b Checking formulas, logic, and table references.** Deserves more attention as this is often the most time-consuming element of model testing. State that the actuary should consider what are the major modeling methodology choices and simplifications, as well as determine what is the best way to appropriately test formulas. This may include actions such as cell testing or attempting to replicate results outside the model within an established threshold, all the way to peer review, if the model is low-enough risk and materiality. The actuary should take the actions in reviewing formulas, logic, and table references which is commensurate with the level of risk that these elements have on the model output. The actuary can also review and rely on existing model testing where it exists, rather than re-create it, if the actuary takes reasonable steps to understand the existing model testing and the associated conclusions of the previous tester. In this case the actuary should ensure the model tester was a separate individual than the model developer. The actuary should also ensure that key modeling methodologies are implemented correctly and according to the specification of the user. The actuary should also consider testing formulas and logic under a reasonable range of scenarios and sensitivities if certain functionality only becomes relevant and material outside of a single baseline scenario.
- **3.5.2 Model Validation.** Should include and reference the concept of an “effective challenge”⁷. The concept of “independent challenge” is also covered in the *Model Governance Practice Note, Some Considerations for Practicing Life Actuaries*⁸. It should state that the intensity and effort of the challenge should be commensurate with the risk and materiality of the model.
- **3.5.6 Ongoing Performance Monitoring.** A model should include an appropriate ongoing performance monitoring process to provide reasonable assurance that the model continues to perform as intended. Ideally, the process should consist of a quantitative check that the model’s output satisfies a reasonability check. Where practical, it should be ongoing in nature, i.e., performed in conjunction with each model run. Examples include analysis of increase in reserves and run-to-run attribution analysis. Unexplained variances more than an appropriate tolerance threshold should be analyzed before model output is used. [Note: Ongoing performance monitoring process should be added to Section 2 definitions].
- **3.6 Documentation.** Should be more specific about what to document, like the testing section. Documentation best practices include documenting inputs, calculations – include key methodology

choices (including simplifications and approximations), outputs, intended purpose, use limitations, and ongoing performance monitoring processes. It is also important to document model testing (including any developmental testing) and validation. The *Model Governance Practice Note, Some Considerations for Practicing Life Actuaries* contains reference to best practices on model documentation.

- **4.1 Required Disclosures in an Actuarial Report.** It is confusing that this section is labelled “Required” disclosures but then goes on to say that the actuary “should disclose the following” which is not akin to “required.” Recommend changing the section name to “Disclosures in an Actuarial Report.” Any unreasonable, unexplained variances from recent ongoing performance monitoring processes (section 3.5.6) should be added to the list of items that should be disclosed.
- **Appendix.** It is a design flaw to indicate that the actuary should use reasonable governance and controls only if a model will be used repeatedly. Sometimes one-time uses of models may have a material impact on financial statements or management decisions, and so appropriate governance and controls is necessary in those circumstances. Further, one example given of governance and controls is to implement a model change management process. Please consider adding additional detail around what constitutes a model change management process directly in the ASOP or providing a reference to another document which expands upon this item.

<u>Source / Link</u>	<u>Footnote referenced</u>
Accountability vs Responsibility in Project Management	1
SR 11-7: Guidance on Model Risk Management	2, 7, 10, 14
Setting Assumptions Exposure Draft	3, 10
Actuarial Modeling Controls: A Survey of Actuarial Modeling Controls in the Context of a Model-Based Valuation Framework	4, 14, 15
ASOP 46, "Risk Evaluation in Enterprise Risk Management	4
Model Validation for Insurance Enterprise Risk and Capital Models	4, 10
Model Governance Checklist, Some Considerations for Practicing Life Actuaries	4, 11, 14, 15
Model Governance Practice Note, Some Considerations for Practicing Life Actuaries	4, 5, 8, 10, 14, 15
ASOP 52: Principle-Based Reserves for Life Products	4
ASOP 54: Pricing of Life Insurance and Annuity Products	4, 16
Note on the Use of Internal Models for Risk and Capital Management Purposes by Insurers	6, 7, 10, 15
Model Risk Management Guidance	7, 10, 14

Model Validation Principles Applied to Risk and Capital Models in the Insurance Industry	10, 11, 14, 15
Survey of Actuarial Model Governance and the Industry Evolution	10, 14, 15
Navigating Risk: The Past, Present, and Future of Actuarial Model Governance	13