Model Governance Checklist

Some Considerations for Practicing Life Actuaries

Principle-Based Reserves Checklist Subgroup
August 2016

Michael Failor, MAAA, ASA, *Chairperson*

Mary Bahna-Nolan, MAAA, FSA, CERA

Michael Boerner, MAAA, ASA

Brian Fomby, MAAA, FSA

Cande Olsen, MAAA, FSA

Peter Weber, MAAA, ASA

Ali Zaker-Shahrak, MAAA, FSA

AMERICAN ACADEMY *of* ACTUARIES

Objective. Independent. Effective.™

ACTUARY.ORG

The Principle-Based Reserves Checklist Subgroup of the Model Governance Work Group of the American Academy of Actuaries has developed a model governance checklist. This non-exhaustive checklist is offered as a resource for practicing life actuaries involved in actuarial model governance. Its development was prompted in response to the need for good model governance as addressed in PBR regulation; however, it will also be of value wherever actuarial modeling is performed. It should also be made clear that although this checklist represents model governance practices that many life actuaries and their companies would aspire to, they will not apply in every situation, as model governance is a complex and evolving process specific to a company's modeling environment.

A model is defined in the most recent exposure draft of the Modeling Actuarial Standard as "A representation of relationships among variables, entities, or events using statistical, financial, economic, mathematical, or scientific concepts and equations." It is likely that all the models that life actuaries work with will fall into these categories, but for the purposes of this checklist, there is no intention to exclude any model that life actuaries would work with.

While checklist items are presented in question format, they are only intended to foster awareness of the respective model governance concerns. These questions are not intended to be directed toward any specific individual, actuary, or group, but are offered solely as considerations for practicing life actuaries. Furthermore, the checklist is not intended as an instrument for rating or assessing an organization's level of governance; nor is it prescriptive in any way, and does not constitute a list of model governance requirements. There is no expectation that "yes" will always be the right answer to any of the questions posed. The answer will depend on many things, including the nature of the company, the model purpose, and the materiality of the model inputs and outputs. All questions are meant to be considerations and not a judgment that the actuary is doing a good or bad job. There may be a good reason for a "no" answer. For example, A6 asks, "Is there a training program in place to ensure users/modelers are adequately educated and capable of utilizing the modeling software?" The answer may be "no" for a small company that doesn't warrant a formal training program.

It should be further understood that many of the questions contained in this document are best comprehended by life actuaries who are involved in modeling and modeling systems management. Non-actuaries, and those lacking systems management expertise, may be ill-equipped to discern the proper context in which many of the questions apply. Consequently, any interpretation or implication derived from the application or extension of the questions contained in this list would necessitate an appropriate level of relevant experience, knowledge, and professional judgment. This would include an expectation of an understanding of terms that are commonly used in activities related to modeling. There are many terms used in this checklist that are not defined herein, because it is expected that life actuaries involved in modeling would be familiar with these terms.

The Model Governance practice note is an additional source of information for practicing life actuaries seeking to better understand models, model risks, model governance and related issues, as these actuaries implement PBR in their organizations.

Model Governance Checklist Categories

The checklist is divided into the following 10 categories:

A   Governance Standards
B   Modeling Process
C   Assumptions Setting
D   Input Data/Tables/Mapping
E   Access Controls
F   System/Model Changes
G   Model Selection/Versioning
H   Consolidation of Results
I   Reporting
J   Analysis/Validation

Note that "Governance Standards" and "Modeling Process" categories contain only those questions that are unique to these topics, and therefore do not appear under other categories. Questions touching on any of the remaining eight categories may be duplicated across those categories in which the question is associated.

Color Coding

The questions are further categorized with the following color codes:

█ Governance Policy/Process-Type Questions
█ Validation-Type Questions

The governance policy/process-type questions are high level, as they typically pertain to model governance policies, procedures, and modeling practices. In contrast, the validation-type questions may entail a more hands-on assessment.

General Guiding vs. Technical Focus Questions

Questions are further categorized under "General Guiding" vs. "Technical Focus." These two categories were difficult to assign, but this somewhat indeterminate classification is intended to aid in assessing the level of required technical knowledge associated with the respective model governance concern. With this in mind, the General Guiding questions may be more likely suited for those involved in model governance management, whereas the Technical Focus questions may be more fully comprehended by those directly involved in day-to-day modeling activities.

Reference Documents

The following documents served as primary sources in the creation of this checklist:

"A Survey of Actuarial Modeling Controls in the Context of a Model-Based Valuation Framework" Copyright © 2012 The Society of Actuaries, Schaumburg, Illinois.

"System Access and Change Controls" (The Modeling Platform) © Dec. 2015 The Society of Actuaries, Schaumburg, Illinois.

"Model Validation for Insurance Enterprise Risk and Capital Models" (© 2014 Casualty Actuarial Society, Canadian Institute of Actuaries, Society of Actuaries, All Rights Reserved).

"Report from the Actuarial Processes and Controls Best Practices Working Party" (Institute and Faculty of Actuaries, May 2009) — *This report was prepared by and/or on behalf of the IFoA. The IFoA does not accept any responsibility and/or liability whatsoever for the content or use of this document. © Institute and Faculty of Actuaries.*

A Governance Standards

Color Code: ⬜ Governance Policy/Process-Type Questions
🟨 Validation-Type Questions

General Guiding Questions

A1	Has a model governance framework been formally developed, documented, and adopted throughout the organization?
A2	Is senior management aware of and familiar with the governance policies?

A3	Is there a dedicated modeling "organizational structure" having clear and delineated responsibilities for development, maintenance, execution, and change management of actuarial systems and models? Such responsibilities include:
	    - Inventory of models subject to governance
	    - Creation, maintenance, and communication of all change requests
	    - Management of approval process
	    - Integration of changes
	    - Coordination of testing

A4	Have model documentation standards been established and adopted throughout the organization?
A5	Are modeling documentation standards periodically reviewed for adequacy and utility?
A6	Is there a training program in place to ensure users/modelers are adequately educated and capable of utilizing the modeling software?
A7	Is there a model/system governance committee?
A8	When discrepancies in the data, modeling, systems, or reporting are discovered, is there a process in place to document these issues and to mitigate them?
A9	Are discovered modeling or system errors documented and archived along with their effects? (Archived error/bug documentation is a valuable resource when conducting future reconciliations and testing.) Are processes in place to correct, prevent and/or mitigate such errors?
A10	Are the system and modeling peer reviewers experienced in the systems, models, products, and assets in which they review?
A11	Are there separate test and development environments?
A12	Are modeling procedures and protocols themselves archived when they are updated or modified?
A13	Are modeling/system "change request procedures" widely distributed and well understood throughout the organization?
A14	Is there a satisfactory level of buy-in among the affected departments regarding the modeling procedures and protocols?

Questions of a More Technical Focus

A15	Is versioning software in use for data, models, and systems?
A16	Has the modeling environment been consolidated away from silos and toward a more holistic environment comprised of fewer platforms and fewer redundant models? If not feasible, have additional controls been implemented to ensure model integrity across all modeling platforms?
A17	Are the impacts of coding modifications/enhancements/corrections captured and documented?
A18	Are model governance protocols strictly enforced during quarterly and annual reporting? (Bypassing protocols may indicate a lack of management buy-in, and/or the need to better address fast-track changes.)

B Modeling Process

Color Code: ▢ Governance Policy/Process-Type Questions
              ▢ Validation-Type Questions

General Guiding Questions

B1	Does the model inventory include a ranking of models according to significance, risk, financial impact, materiality, etc.? (Such ranking is often used to prioritize ongoing model review/validation.)
B2	Is there a process in place to determine which risks require modeling?
B3	Is there a process to determine which modeling applications are subject to model governance?
B4	Is there a process to assure proper documentation is created according to existing documentation requirements?
B5	Is there a formal model/code checkout system in place?
B6	Is there a formal model/system change request procedure?
B7	Are the intended users/audience of the model output well-defined?
B8	Is there a single source or repository that documents the data flow/system processing from end-to-end?

Questions of a More Technical Focus

B9	When vendor models are used, are the documented modeling/conceptual limitations vendor-supplied, or user-derived?
B10	Are model outputs reproducible? (i.e., have the inputs and model versions been archived, and has an operable version of the modeling software been retained?)
B11	Does documentation of applied modeling concepts make reference to external sources (either professional, academic, or regulatory sources)?
B12	Does documentation of applied modeling concepts describe how modeling components are connected, along with explanations of why they can be used together?
B13	Are the modeling concepts' limitations and inherent biases adequately emphasized in the documentation?

C Assumptions Setting

Color Code:
  ▇ Governance Policy/Process-Type Questions
  ▇ Validation-Type Questions

General Guiding Questions

C1	Are there regular external reviews of assumption setting methodologies?
C2	Are assumptions (including both deterministic and stochastic) given an independent review?
C3	When setting assumptions, is the "level of analysis" reviewed by a senior staff member to ensure such "level of analysis" is neither too broad nor too narrow for the assessment and intended application of the assumption? (same as **J6**)
C4	Has an assumption governance framework been formally developed, documented, and adopted throughout the organization? Does it include a centralized approach for common assumption setting and formal approval? Are differences in assumptions across modeling applications documented and approved?
C5	Is there a formal change management process in place for changing assumptions?
C6	Is there a formal process for updating assumptions that have routine calendar-based elements (e.g., economic scenarios, U.S. Treasury curves, etc.), where such assumptions are automatically updated and no judgement is required?
C7	Are assumptions archived and maintained in a known, centralized database/repository? Is write-access to this repository controlled/limited?
C8	Are experience studies performed on a regular schedule, and assumption updates performed at a consistent time each year?

C9	Are the components of an assumption defined and documented, including the raw experience data, margin, asset spreads, and projected changes to the margins (e.g., mortality improvement)?
C10	Does the assumption documentation address the independence of each assumption? If stochastic or deterministic modeling is being performed, does the documentation address the interaction of risks (e.g., interest rates and policyholder behavior)
C11	Is an automated process used to input or feed assumptions into the model(s)?
C12	Prior to implementing a change in an assumption, is an expectation formed and documented of the impact of the change? (Model results can then be compared to these expectations.)
C13	Has the organization adopted and documented a standard process or philosophy for isolating and evaluating the impact of each assumption change?
C14	Do those who are developing assumptions have the necessary skills and experience?
C15	Are all data sources well defined and documented?
C16	Have all input assumptions and parameters been peer reviewed?
C17	Have modeling assumptions for future investment, disinvestment, and management strategies received prior approval?
C18	Have expense assumptions received prior approval?

Questions of a More Technical Focus

C19	Are assumptions ranked or prioritized based on materiality/significance/impact/ frequency of change/etc.?
C20	Are the impacts of dynamic assumptions tested under different economic scenarios (e.g., dynamic lapse assumptions)? (same as **J24**)
C21	Is there a process in place to estimate the impacts of proposed assumptions? (same as **J29**)
C22	Are the experience studies credible? Has company experience been compared to industry studies? If company experience is not fully credible, what other sources were used?
C23	Has the experience study accounted for claims lag?
C24	Does assumption development follow regulations?
C25	Do assumptions reflect actual experience?
C26	Have experience study results been used for assumption setting?
C27	If improvements in experience are projected, is the basis for improvement justified and understood? (e.g., mortality improvement, expense improvements.)

C28	Do the assumptions input into the model match the source documents? (same as **D25**)
C29	Are policy and asset input parameters correct and up to date (e.g., policy expenses, crediting rates)?
C30	Are assumptions documented and approved (signed off) in accordance with a specified process?
C31	Do people signing off on assumptions understand the results?

D Input Data/Tables/Mapping

Color Code:
- Governance Policy/Process-Type Questions
- Validation-Type Questions

General Guiding Questions

D1	Are model input feeds obtained automatically from either a centralized data warehouse or another system?
D2	Has the organization automated and standardized a set of test analytics for validation of model input?
D3	Has there been a new policy administration system implementation (or a change to an existing system)? If so, has the seriatim output been tested?
D4	Has there been a new asset system implementation (or change to an existing system)? If so, has the output been tested?
D5	Are all data sources well defined and documented?

Questions of a More Technical Focus

D6	Are there checks in place to assure that policy data and inforce asset files were not unintentionally changed?
D7	Is model input data maintained and identifiable after model runs? Are there controls in place to ensure that input data cannot be modified prior to a model run in such a way that would bypass an audit trail?
D8	Are there controls in place to prevent other business units from changing data without proper documentation and communication?
D9	Are automated Extract Transform and Load (ETL) data processing steps tested when integrating data from source systems? (same as **J28**)

D10	Were the seriatim policy data correctly updated?
D11	Do the policy data and inforce asset files contain the correct fields and filters?
D12	Were the policy data and inforce data files selected for the right periods?
D13	Were economic scenario files updated for the current start date?
D14	Has policy or asset data been corrupted or partially loaded during the data extraction process?
D15	Have there been new policy data mappings?
D16	Does the underlying policy data contain material errors? If so, are subsequent adjustments to account for such errors properly documented?
D17	Have there been administrative changes that affect the processing of policy or asset data which could lead to incorrect results?
D18	Have the model point files and mappings been updated correctly?
D19	Do the model point files have correct file formats?
D20	Are policies grouped correctly for the modeling purpose? Similarly, are assets grouped correctly for the modeling purpose?
D21	Were policy data groupings executed without loss of data or data corruption? Similarly, were asset data groupings executed without loss of data or data corruption?
D22	Are grouping rules appropriate, reflecting changes in the underlying policy data? Similarly, are grouping rules appropriate, reflecting changes in the underlying asset data?
D23	Have existing assets been reconciled to investment reporting systems?
D24	Is the input data consistent with the data that was approved and signed off?
D25	Do the assumptions input into the model match the source documents? (same as **C28**)
D26	Are model input parameters correct and up to date (e.g., time horizon, valuation date)?
D27	Were the correct input tables picked up in the model?
D28	Have inputs to the results consolidation process been updated correctly?

E Access Controls

Color Code:
- ◼ Governance Policy/Process-Type Questions
- ◼ Validation-Type Questions

General Guiding Questions

E1	Are access controls in place for models and modeling systems?
E2	Is there a documented process for granting access to models, systems, assumptions, reports, etc.?
E3	If modeling assumptions, results, or other components are archived in a centralized database/repository, is write access to this repository controlled?
E4	Are access levels reviewed on a regular basis?

Questions of a More Technical Focus

E5	Is write access to model input databases controlled and limited?
E6	Is write access to model output databases controlled and limited?

F System / Model Changes

Color Code:
- ◼ Governance Policy/Process-Type Questions
- ◼ Validation-Type Questions

General Guiding Questions

F1	For homegrown or open-code modeling systems, are there system development and design standards in place for coding changes?
F2	Are coding changes peer reviewed?
F3	Is there a validation process in place to assure that the correct model and system versions have been released into production environments?
F4	Is there clear separation between development and production environments? Are appropriate development processes executed off-cycle (e.g., scheduling some of the work before the monthly/quarterly reporting cycle)?
F5	Are model and system changes achieved through a formal change management process?
F6	Is there a documented approval process in place for model and system changes?

F7	Are there documented coding/development guidelines in place for system changes?
F8	In the context of vendor software, system upgrades are separate from logic/calculation changes. Have protocols been established for system upgrades (including regression testing)?
F9	Has the organization implemented an automated attribution testing process to identify and quantify differences due to system, logic, or data updates? (This is especially important when using a common model of record.)
F10	Is there a controlled, documented process for "checking out" production models (e.g., for model development, sensitivity testing, new pricing, other analysis)?
F11	Is the organization managing to a calendar for internal model releases to ensure consistency of the model of record across the organization?
F12	Is there clear accountability for code changes, bug fixes, improvements, etc.?
F13	Are code comparison software tools in use?
F14	Are there dedicated model/system/data stewards?
F15	Are test beds (test packs) in use? (same as **J17**)
F16	Do new system or model changes that are placed in production have corresponding documentation describing the changes compared to the prior production version?
F17	Is there a published schedule of new and past system/model version releases?
F18	Are models and systems appropriately archived, along with associated inputs, to enable the regeneration of results?
F19	Is there a process to assure that protocols and procedures have been followed prior to promoting system and model changes?
F20	Do peer reviewers and testers report through a separate management reporting chain than the modelers making the model/system changes?
F21	Are modeling and system procedures reviewed on a regular basis?
F22	Are test bed results archived for new system/model releases?
F23	Is there a documented testing protocol for model and system changes?
F24	Are there automated regression tests to assure that model/system changes do not introduce unintended effects? (same as **J25**)
F25	Are all the modeling components versioned (i.e., the code, reports, test cases, etc.)?
F26	Is user acceptance testing (UAT) routinely performed and documented when there are modeling system changes?
F27	Are test packs (or test beds) kept up to date with new models, product features, and asset types? (same as **J22**)
F28	Are modeling systems well documented?

F29	Are system changes well documented?
F30	Are there helpful, descriptive comments in the code?
F31	Are test results for new system/model production versions well documented and accessible to modelers?
F32	Are internal stakeholders' (i.e., those within the organization who rely on the results either directly or indirectly) approvals obtained and documented prior to moving model/system changes into production?

Questions of a More Technical Focus

F33	Are requested functionality/feature modification requirements well documented, unambiguous, and correctly stated?
F34	Do proposed model designs correctly accommodate the requested change?
F35	Does the proposed system/model design adhere to development standards?
F36	Were the modeling system designs developed correctly?
F37	Was the model independently baseline tested?
F38	Were all product features and asset types modeled? Is the justification for those not modeled documented?
F39	Was model coverage under baseline testing adequate for the system modification?
F40	Are system/model errors adequately documented?
F41	Have system coding changes been adequately tested?
F42	Has a well-documented analysis of change process been consistently applied across each system/model change?
F43	Are exceptions to the system/modeling protocols well documented with respect to: • Reasons for the exception? • Associated testing and test results? • Exception approvals?
F44	When exceptions occur, are changes to the protocol being considered to reduce the need for future exceptions?

G Model Selection / Versioning

Color Code:
- Governance Policy/Process-Type Questions
- Validation-Type Questions

General Guiding Questions

G1	Is there a validation process in place to assure that the correct model and system versions have been released into production environments?
G2	Are reports automatically labeled to indicate data and version sources?
G3	Have experienced modeling experts been involved in algorithm selection and implementation of modeling concepts?
G4	Are all the modeling components versioned (i.e., the code, reports, test cases, etc.)?

Questions of a More Technical Focus

G5	Was the correct model and version used?
G6	Is the input data consistent with the data that was approved and signed off?
G7	Were the correct input tables picked up in the model?
G8	Has the correct results consolidation process version been used?
G9	Was the "purpose" of the model documented?

H Consolidation of Results

Color Code:
- ⬜ Governance Policy/Process-Type Questions
- 🟨 Validation-Type Questions

General Guiding Questions

H1	Is the reporting process documented? Is there specific documentation describing how reporting levels are mapped to one another? (same as **I1**)
H2	Is model output stored in a data warehouse that can be queried? This allows for additional analysis and evaluation of model results.
H3	Have all products been accounted for in consolidated results?
H4	Have consolidated results been adjusted to account for unmodeled business?

Questions of a More Technical Focus

H5	Is the results-consolidation process well designed?
H6	Has the organization standardized the model output that is used for reporting and analysis?
H7	Is write-access to model output databases controlled/limited?
H8	Do model outputs automatically contain documented references to the executed model input data and the model version used?
H9	Have the correct model results been retrieved?
H10	Are modeling results correctly interpreted within the consolidation process? (e.g., is it clear when reserves are net of reinsurance?) (similar to **I24** and **J35**)
H11	Has the correct results consolidation process version been used?
H12	Have inputs to results consolidation process been updated correctly?
H13	Are late adjustments to consolidated results implemented across all related fields? (e.g., when adjustments are made to account for unmodeled premiums, are they also made to account for the unmodeled reserves?) (same as **J36**)
H14	Are late adjustments consistently applied? (e.g., are adjustments in one reporting basis applied, as appropriate, to all other reporting bases?) (same as **J37**)
H15	Have summarized results been aggregated correctly from the lowest modeled level through each step up to the highest rollup consolidation?

I Reporting

Color Code: ▢ Governance Policy/Process-Type Questions
▢ Validation-Type Questions

General Guiding Questions

I1	Is the reporting process documented? Is there specific documentation describing how reporting levels are mapped to one another? (same as **H1**)
I2	Are staff trained on the reporting process, and is the reporting process reviewed on a regular basis by senior staff to ensure all significant items are considered?
I3	How is the analysis of results documented? Is commentary captured and preserved alongside the results, as evidence that key results are understood and explained?
I4	Are automated data feeds used to populate reports, as opposed to manual report preparation?
I5	Are reports automatically labeled to indicate data and version source?
I6	Are reports regularly reviewed by an experienced actuary or other subject matter expert?
I7	To ensure the structure/content are consistent with regulatory requirements, are reports periodically reviewed "independently"? (Potential independent reviewers could include: compliance, internal or external auditors, or consultants.)
I8	The larger the organization, the greater the risk. For large organizations, are the reviewers trained and educated well in advance of the model results/reporting review meeting? This ensures that reviewers have the required level of understanding to be able to perform a meaningful review.
I9	Are documented procedures in place for identifying and making adjustments to model output? For example, a financial projection may use approved budgets for expense assumptions while pricing might use a different basis or set of expenses.
I10	Are documented procedures in place to adjust model output for excluded products and/or assets? For example, are model results grossed up to reflect 100% of all inforce products?
I11	Is the report labeled to indicate the intended audience?
I12	Do reports include appropriate caveats to ensure they are not used for unintended purposes?
I13	Is model output stored in a data warehouse that can be queried? This allows for additional analysis and evaluation of model results.
I14	Do reports clearly state which model and data versions were used?
I15	Have all products been accounted for in consolidated results?
I16	Did the process owner and business owner sign off on the report?
I17	Are all the modeling components versioned (i.e., the code, reports, test cases, etc.)?
I18	Do the frequency and timing of reports align with the decisions which they support?

Questions of a More Technical Focus

I19	Has the organization standardized the model output that is used for reporting and analysis?
I20	Do model outputs automatically contain documented references to the executed model input data and the model version used?
I21	Are business users made aware of parameters that fall outside of agreed ranges or present other irregularities?
I22	Do the reports indicate how robust or sensitive key figures are, along with impacts due to estimation error of input parameters?
I23	Have the correct model results been retrieved?
I24	Are modeling results well understood within the reports? (e.g., is it clear when reserves are net of reinsurance?) (similar to **H10** and **J35**)
I25	Have summarized results been aggregated correctly from the lowest modeled level through each step up to the highest rollup consolidation?
I26	Are results communicated using institutionally accepted metrics that are commonly understood by the reporting audience?

J
Analysis / Validation

Color Code: ▢ Governance Policy/Process-Type Questions
▢ Validation-Type Questions

General Guiding Questions

J1	Is there a validation process in place to ensure that the correct model and system versions have been released into production environments?
J2	Is there a validation process in place to ensure the model is producing reasonable results?
J3	Is there a prescribed set of sensitivity tests performed for each modeling exercise? How are the sensitivity tests defined and approved?
J4	Is there a prescribed set of stress tests performed for each modeling exercise? How are the stress tests defined and approved?
J5	Are assumptions (including both deterministic and stochastic) given an independent review?
J6	When setting assumptions, is the "level of analysis" reviewed by a senior staff member to ensure such "level of analysis" is neither too broad nor too narrow for the assessment and intended application of the assumption? (same as **C3**)

J7	Are automated checks/reconciliations built into the analysis of results process?
J8	Has an appropriate amount of senior review time been built into the close schedule?
J9	Is there clear separation between development and production environments? Are appropriate development processes executed off-cycle (e.g., scheduling some of the work before the monthly/quarterly reporting cycle)?
J10	Has the organization planned and budgeted for the time and cost of analysis of results?
J11	Are staff trained on the reporting process, and is the reporting process reviewed on a regular basis by senior staff to ensure all significant items are considered?
J12	How is the analysis of results documented? Is commentary captured and preserved alongside the results, as evidence that key results are understood and explained?
J13	Has the organization implemented an automated attribution testing process to identify and quantify differences due to system, logic, or data updates? (This is especially important when using a common model of record.)
J14	Prior to changing an assumption, is an expectation formed and documented of the impact of the change? (Model results can then be compared to these expectations.)
J15	Has the organization automated and standardized a set of test analytics for validation of model input?
J16	Is model output stored in a data warehouse that can be queried? This allows for additional analysis and evaluation of model results.
J17	Are test beds (test packs) in use? (same as **F15**)
J18	Are test bed results archived for new system/model releases?
J19	Are all the modeling components versioned (i.e., the code, reports, test cases, etc.)?
J20	Are test coverage sample sets (or reports) available identifying the products, product features, and combinations that have been tested?
J21	Is user acceptance testing (UAT) routinely performed and documented when there are modeling system changes?
J22	Are test packs (or test beds) kept up to date with new models, product features, and asset types? (same as **F27**)
J23	Is there documented evidence of a formal change management process?

Questions of a More Technical Focus

J24	Are the impacts of dynamic assumptions tested under different economic scenarios (e.g., dynamic lapse assumptions)? (same as **C20**)
J25	Are there automated regression tests to assure that model/system changes do not introduce unintended effects? (same as **F24**)
J26	Are test cases independently specified by business domain experts?

J27	Are negative test cases performed using inadmissible parameters that should result in either aborted calculations or error indicators?
J28	Are automated Extract Transform and Load (ETL) data processing steps tested when integrating data from source systems?(same as **D9**)
J29	Is there a process in place to estimate the impacts of proposed assumptions? (same as **C21**)
J30	Were the modeling system designs developed correctly?
J31	Was the model independently baseline tested?
J32	Have system coding changes been adequately tested?
J33	Are the experience studies credible?
J34	Has care and consideration been adequately applied to ensure that modeling system capacities have not been exceeded, where overflow results may have been dropped?
J35	Are modeling results correctly interpreted within the consolidation and reporting processes? (e.g., is it clear when reserves are net of reinsurance?) (similar to **H10** and **I24**)
J36	Are late adjustments to consolidated results implemented across all related fields? (e.g., when adjustments are made to account for unmodeled premiums, are they also made to account for the unmodeled reserves?) (same as **H13**)
J37	Are late adjustments consistently applied? (e.g., are adjustments in one reporting basis applied, as appropriate, to all other reporting bases?) (same as **H14**)
J38	Have summarized results been aggregated correctly from the lowest modeled level through each step up to the highest rollup consolidation?
J39	Has a well-documented analysis of change process been consistently applied across each system / model change?
J40	Have appropriate methods been performed and documented in the validation of model fit (e.g., back-testing)?
J41	Has an analysis of change, from a validated model to a modified model, based on an automated attribution testing process been performed and documented?

AMERICAN ACADEMY *of* ACTUARIES

Objective. Independent. Effective.™

1850 M Street NW, Suite 300
Washington, D.C. 20036
202-223-8196

ACTUARY.ORG

The American Academy of Actuaries is an 18,500+ member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 50 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.