

Minimum requirements for stochastic simulation approach

According to rule 19(2), an applicable insurer must use a stochastic simulation approach in calculating the time value of options and guarantees under groups of contracts of insurance which include contractual options or financial guarantees.

The Economic Scenario Generator (“ESG”) adopted to produce the potential future scenarios should meet the minimum requirements of –

- a) having at least 1000 economic scenarios;
- b) having at least annual time steps. A more frequent time step should always be used if product features are sensitive to cash flow time step;
- c) considering all material financial risks;
- d) considering an interest rate model. Movement of at least short, medium and long tenors should be considered;
- e) considering a fixed income asset return model for the return and/or dividend income of fixed income assets, including sovereign bonds, corporate bonds and other similar assets. The model should be a function of at least level of interest rates and credit spreads, change in the level of interest rates and credit spreads, credit default and a random component;
- f) considering an inflation model where relevant and material;
- g) considering an equity asset return model;
- h) considering correlation between assets;
- i) performing martingale test and market consistency test;
- j) performing implied volatility tests to ensure that the implied volatilities of asset classes are consistent with market data;
- k) performing test on the correlation between asset types to ensure that the simulated correlations are reasonable compared with historical correlations;
- l) calibrated based on specified risk-free yield curves with matching adjustment (if applicable) determined in accordance with Schedule 4 and 5 of Cap. 41R under base and risk capital amount calculations; and
- m) being re-calibrated at least annually.

Simplified approaches for the calculation of matching adjustment (“MA”)

Pursuant to rule 24(6) of Cap. 41R, applicable insurers who have practical difficulty in performing full calculation of the matching adjustment may consider taking any or all of the simplified approaches allowed by the Authority –

- a) Proxy application ratio of 15% at the entity level
For insurers who opt for not to calculate portfolio-based application ratios due to practicality reasons, they are allowed to adopt a proxy application ratio of 15% on entity level for all MA portfolios and under all risk capital amount scenarios. For the avoidance of doubt, these insurers may choose to use the proxy application ratio of 15% for calculating the MA for some of their long term portfolios and adopt the specified risk-free yield curves as defined in Cap. 41R (i.e. without MA) for the remaining portfolios¹. For insurers who adopt the proxy application ratio on entity level, no additional constant prescribed spread would be considered.
- b) Additive proxy of 25% for an increase in accumulated cash flow shortfall percentage under lapse up and mass lapse scenarios for the predictability factor calculation
Under the simplified approach, the accumulated cash flow shortfall percentage is calculated based on an additive proxy of 25% to the accumulated cash flow shortfall percentage under the base scenario as:

$$\text{Accumulated cashflow shortfall \%} = \text{ACS\%}_{\text{base}} + 25\%$$

- c) Addition of prescribed haircuts to base $\frac{\text{Asset dollar duration}}{\text{Liability dollar duration}}$ for the calculation of stressed duration factors under prescribed capital amount calculations
Under the simplified approach, the stressed $\frac{\text{Asset dollar duration}}{\text{Liability dollar duration}}$ would be calculated as the base $\frac{\text{Asset dollar duration}}{\text{Liability dollar duration}}$ deducted by the prescribed haircuts set out below.

Prescribed haircuts (%)

Column 1	Column 2
Stress scenario	Haircut (%)
Credit spread risk	25
Interest rate up risk	0
Interest rate down risk	35
Equity risk	25

When using this simplified approach, insurers should apply all prescribed haircuts under all the risk capital amount calculations for credit spread risk, interest rate up risk,

¹ To avoid doubt, alternatively, they may also choose to use the specified risk-free yield curves for all their insurance liabilities.

interest rate down risk and equity risk, for all MA portfolios. If there is no equity investment in an MA portfolio, the prescribed haircut under equity risk is not applied.

- d) Use of policy data within one month before valuation date for the predictability factor calculation
Insurers will need to prove that there is no material difference in the liability cash flows valued using earlier data and data as at the valuation date. Insurers may expect to demonstrate there is no material difference when requested by the Authority.
- e) Use of data within one month before valuation date for the duration factor calculation
The simplification is allowed with evidence that the market condition at valuation date is close to the market scenario assumed in the calculation. Insurers will need to prove that there is no material difference in the liability cash flows valued using earlier data and data as at the valuation date. Insurers may expect to demonstrate there is no material difference when requested by the Authority.
- f) Interpolation of time value of options and guarantees during the calculation of duration factor
For those insurers who would like to interpolate the time value of options and guarantees during the calculation of duration factor, the reference points of interpolation should be within no more than 50 bps. Using a narrower range of reference points is allowed. The time value of options and guarantees should not be calculated using extrapolation approach. For the avoidance of doubt, if the time value of options and guarantees at the reference points are calculated using the stochastic simulation approach, the final time value of options and guarantees measured as part of long term insurance liability should also be calculated using the stochastic simulation approach, and not be calculated by interpolation or extrapolation of other time value of options and guarantees values.
- g) Calculation of current estimate under the base case and risk capital amount calculations, by using a final matching adjustment which is rounded down to the nearest 10bps.

When applying any of the simplification approaches (a) to (g), insurers are expected to demonstrate prudence over the default calculations based on own professional judgment, or to demonstrate there is no major impact to the solvency position. Insurers should be able to provide evidence when requested by the Authority.

Consistency is expected when insurers elect simplified approaches. In other words, the same simplification approach should be applied to all MA portfolios of the insurer, and the same simplification approach should be applied under the calculation of matching adjustment under base case and risk capital amount calculations for credit spread risk, interest rate up risk, interest rate down risk and equity risk.

Own Assessment of Risk Capital Amount for Natural Catastrophe Risk

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1. Introduction

1.1 Pursuant to rule 67 of the Insurance (Valuation and Capital) Rules (Cap. 41R) (“The Rules”), an applicable insurer must determine its risk capital amount for natural catastrophe risk using the factor-based approach in rule 68, unless it has obtained approval from the IA to use its Own Assessment (“OA”) to determine such risk capital amount. If an applicable insurer wishes to use its OA approach to determine its risk capital amount for natural catastrophe risk, then it must apply and obtain approval from the IA and, on an ongoing basis thereafter (during the period for which the approval remains in effect) submit information to the IA to enable the IA to monitor the continued effectiveness of the OA approach being used. This Appendix provides guidance on the application process for approval to use an OA approach and, if approval is given, the information, format and timing of submission of information relating to the approved OA approach for ongoing monitoring purposes.

1.2 In summary:

- (a) the IA will only approve an application by an applicable insurer to use an OA approach to determine its risk capital amount for natural catastrophe risk, if the insurer can demonstrate to the IA’s satisfaction that the proposed OA approach satisfies the principles in Section 2;
- (b) to make such application an applicable insurer should follow the procedure and complete and submit to the IA an OA Application Form together with the information and documents set out in Section 3 together with the prescribed fee as set out in the Insurance (Prescribed Fees) Regulation (Cap. 41B); and
- (c) once an applicable insurer is granted approval by the IA to use the OA approach, it is required to notify the IA of any proposed changes to its OA approach and to submit a Change Declaration Form (and other information) to the IA annually as set out in Section 4, together with the prescribed fee as set out in the Insurance (Prescribed Fees) Regulation (Cap. 41B) and the IA will take account of such information in considering whether it has any objection to the insurer continuing to use the OA approach to determine its risk capital amount for natural catastrophe risk.

1.3 Consistent with the determination of Prescribed Capital Amount as described under the Rules, the risk capital amount for natural catastrophe risk determined by an OA approach should represent a value at risk subject to a 99.5% confidence interval over a 1-year period, i.e. a 1 in 200 annual aggregate loss.

2. Requirements for Approval

2.1 This section sets out the principles which an applicable insurer’s OA approach must

meet in order for the IA to be satisfied that the OA approach can be used to determine the insurer's risk capital amount for natural catastrophe risk. The applicable insurer must be able to demonstrate this during the application process for approval to use its OA approach.

Scope Completeness

- 2.2 The risk management framework of an applicable insurer should cover all natural catastrophe risk to which the insurer is exposed. As such, an applicable insurer should provide complete representation of all such risk to the IA in the information submitted during the application process. The scope of the applicable insurer's OA should be described clearly and any natural catastrophe risk (perils, regions or specific exposures) that are not included in the modelling should also be identified and described.
- 2.3 An applicable insurer should monitor the changes in its risk exposures regularly and assess the impact of these changes on its OA results.
- 2.4 Any limitations due to time-lag in the risk exposure monitoring process should be understood and minimized by the applicable insurer. The insurer should also have a feedback process in place to assess the continued validity of the OA results for significant changes to risk exposures.

Own Assessment Process

- 2.5 An applicable insurer should have in place a clear and sound process for generating its OA results. Such process should be clearly documented, including but not limited to, identifying the persons involved in the OA and clearly defining their responsibilities (for example, operating, expert judgements, approving, peer review) and setting out the controls in place regarding subjective decisions and to minimize human error (which controls must be adequate).
- 2.6 An applicable insurer should regularly review the adequacy and effectiveness of the OA process and identify any weaknesses in the process so that such weaknesses can be managed or addressed through adjustments if required.

Governance and Usage

- 2.7 An applicable insurer should ensure that key decisions in relation to its OA such as model choice, data, model assumptions and the approval of OA results are subject to adequate governance processes. The materiality of the assumptions should influence the seniority of the persons/positions making such key decisions. Such governance processes and key decisions should be documented. Key decisions should be made and validated and results approved by persons or committees with appropriate knowledge, expertise and experience.

- 2.8 An applicable insurer should demonstrate that its OA for natural catastrophe risk is used by the insurer and forms part of its risk management and business decision-making.
- 2.9 Any limitations in the OA (such as limitations due to risks not covered, model limitation, uncertainty and sensitivity of assumptions, deficiency or lack of data) should be made known to and understood by users of the OA in the applicable insurer and its senior management. Such limitations and their implications on the uncertainty of the OA results should be addressed as part of the insurer's internal risk management.
- 2.10 If any part of the OA process is outsourced to a service provider, the applicable insurer should understand and manage the risks associated with such outsourcing and should comply with Guideline on Outsourcing ("GL14") issued by the IA. Any outsourcing does not alleviate the applicable insurer's responsibility to comply with the requirements of this Appendix.

Data Quality, Model Quality and Assumptions Quality

Data representativeness

- 2.11 Data used as part of an applicable insurer's OA should be sufficiently current and credible, accurate, complete, appropriate and representative of the exposure period being assessed. For example, exposure data should include an allowance for growth so that it is representative of the coming year. Exposure data should also be validated by assessing year-on-year changes. Data granularity approximations should also be well understood and their sensitivities tested. Any weaknesses in data should be addressed in accordance with paragraph 2.9 of this Appendix.
- 2.12 If any external data is used, there should be an assessment of the appropriateness of such data and adjustments should be made to allow for differences between characteristics of the insurer's exposures and the data source.

Assumptions

- 2.13 All assumptions within the modelling process should be identified, justified and documented. An applicable insurer should understand the sensitivities to these assumptions which should be reviewed regularly. There should be a feedback process from users of the results to those setting the underlying assumptions to help ensure the appropriateness of such assumptions.

Model Evaluation

- 2.14 Any models used are expected to be probabilistic event based, exposure, hazard and vulnerability models. There should be a model evaluation process for new or changed models, which should be performed in a timely manner and the findings from the evaluation should be documented. The complexity of the model evaluation should be commensurate with the materiality of the region/peril(s) for which the

model is used. A detailed model evaluation may include assessment of model appropriateness, scientific review of each component, sensitivity analysis on key assumptions, loss validation with experience and recommendations for adjustments where necessary.

Model validation with actual experience

- 2.16 There should be a feedback loop to assess the reasonableness of the applicable insurer's OA after the occurrence of a large event where the insurer is significantly impacted, with such assessment taking place in a timely manner.

Validation

- 2.17 An applicable insurer should have a validation process in place which covers all aspects of the OA. Validation should be performed by a person who is independent¹ from those who develop or operate the model. The scale of the independent review function² should be proportionate to the complexity of the modelling. IA may request that an external review by appropriate specialists be carried out where it deems necessary for the approval process.
- 2.18 An applicable insurer should also validate the year-on-year changes to the OA results to understand and be in a position to explain the drivers of any change in the results of the OA, and assess if any change is required to the OA process.

Documentation

- 2.19 Documentation of the OA should be up to date, detailed and complete enough for a knowledgeable person in the field to understand it.
- 2.20 An applicable insurer should be able to produce documentation to demonstrate that the principles in this Section 2 are satisfied.

3. Application Procedure

- 3.1 An applicable insurer seeking to apply for approval under section 67(4) of the Rules to use its OA to determine its risk capital amount for natural catastrophe risk, should make such application using an OA Application Form, together with any supporting evidence, information and documents required to demonstrate to the IA that the OA sufficiently meets the principles set out in Section 2. Prospective applicants should contact their respective case officers for the latest version of such form. The IA may also, during the application process, request further information concerning the OA application as it considers appropriate.

¹ Independent validation may be carried out by an internal or external body as long as the reviewer is independent, is not responsible for, and has not been actively involved in, the part of the OA that it validates.

² A full independent model and assumptions validation team may or may not be appropriate subject to the level of complexity of model, the extent of the customization of the model and whether it is a vendor or own model.

- 3.2 An applicable insurer considering to make an application is advised, as a first step in the process, to contact the IA for a preliminary meeting to discuss its proposed application before it submits its draft application to the IA. To facilitate the discussion, the applicable insurer should provide to the IA before the meeting, sufficient documentation and information to explain its proposed OA. The objective of the preliminary meeting is to enable IA to provide its initial feedback to the prospective applicant based on the information provided and provide the prospective applicant with an opportunity to discuss the overall OA process, the principles stated in Section 2, the application form requirements, and to ask any questions it may have.
- 3.3 Following the preliminary meeting, the IA may indicate to the prospective applicant to proceed with preparing a draft application with a date for such draft application to be submitted. The draft application should include supporting documentation to demonstrate compliance with the principles stated in Section 2. The purpose of submitting such draft application is to enable the IA to holistically assess the application and provide feedback on issues that need to be further addressed. There is no need to pay any prescribed fee on submission of a draft application. A prescribed fee is only payable (and must be paid) upon submission of the formal application. The prescribed fee in relation to an OA application under rule 67(2) of the Rules is set out in the Insurance (Prescribed Fees) Regulation (Cap. 41B).
- 3.4 As part of the application process, the IA may invite the applicant for an interview with a view to gaining a holistic view of the OA, particularly regarding the OA process and governance. Thus, the IA will take into account both the interview outcome as well as all the information submitted throughout the application process, in evaluating the application and in making a decision on whether or not to approve. The process for the IA to consider an application for the use of OA is illustrated in a flowchart in Section 5 of this Appendix.

4. Ongoing Requirements for approved Insurers

Ongoing Compliance

- 4.1 An applicable insurer that has received the IA's approval on its OA application is expected to adhere to all the principles set out in Section 2 in relation to the OA as approved at all times.
- 4.2 In addition, per rule 67(5) of the Rules, on an annual basis the applicable insurer is required to submit:
- (a) OA specific annual returns as listed in paragraph 4.3; and
 - (b) the change declaration templates (C.A.P.G.7F) (together with the prescribed fee) as well as any supplementary information as required by the IA, as set

out in (and in accordance with the time periods stated in) paragraphs 4.6 to 4.11.

- 4.3 For the purpose of paragraph 4.2(a), an applicable insurer should submit to the IA all the following forms regarding natural catastrophe risk, as part of the annual returns requirements under the Insurance (Submission of Statements, Reports and Information) Rules (Cap. 41S):
- CA.P.G.5_NatCat_OutwardRI
 - CA.P.G.6_NatCat_Exposure
 - CA.P.G.7A_NatCat_Own_Scope
 - CA.P.G.7B_NatCat_Own_WSEQ
 - CA.P.G.7C_NatCat_Own_Other
 - CA.P.G.7D_NatCat_Own_Details
 - CA.P.G.7E_NatCat_Own_YoYChange

Note that, as an exception to this, the applicable insurer does not need to submit the annual return CA.P.G.7E_NatCat_Own_YoYChange with respect to the valuation date for which the approved OA approach is used for the first year end to determine its risk capital amount for natural catastrophe risk.

- 4.4 The information to be submitted, for the purpose of paragraph 4.2(b), relates to the details of any OA related changes since the previous change declaration (or since initial application if it is the first renewal).
- 4.5 Based on the information submitted, the IA will consider whether or not, pursuant to rule 67(6) of the Rules, it needs to serve written notice on the applicable insurer, to object to the insurer continuing to adopt the risk capital amount for natural catastrophe risk based on the insurer's OA.

Change Declaration Process – applicable annually after the approval of OA

- 4.6 On an annual basis, an applicable insurer is required to declare to the IA any changes to the approved OA and whether or not such changes are material, by completing and submitting to the IA the OA Change Declaration template (C.A.P.G.7F) together with the prescribed fee regarding submission of information in relation to the use of the insurer's OA under rule 67(5)(b) of the Rules as set out in the Insurance (Prescribed Fees) Regulation (Cap. 41B). Note that, as an exception to this, an insurer does not need to submit the template after approval and prior to using the approved OA approach for the first time to determine its risk capital amount for natural catastrophe risk as at the next valuation date.
- 4.7 If the applicable insurer has material changes to its OA process for the purposes of its next valuation date, it must submit the OA Change Declaration template (C.A.P.G.7F) with the relevant parts completed and including the relevant documents stated therein (together with the prescribed fee), at least 5 months prior to the next valuation date (e.g. by 31 July for 31 December year-end). The applicable insurer will also be required to quantify the impact of the proposed changes using

the annual return template C.A.P.G.7E_NatCat_Own_YoYChange by comparing the previous year-end results with the estimated results at the coming year-end. For the avoidance of doubt, the same C.A.P.G.7E_NatCat_Own_YoYChange template is used for both purposes of the annual returns requirements and Change Declaration Process requirements. As such, the applicable insurer needs to submit the CA.P.G.7E_NatCat_Own_YoYChange template in accordance with both paragraphs 4.7 and 4.3.

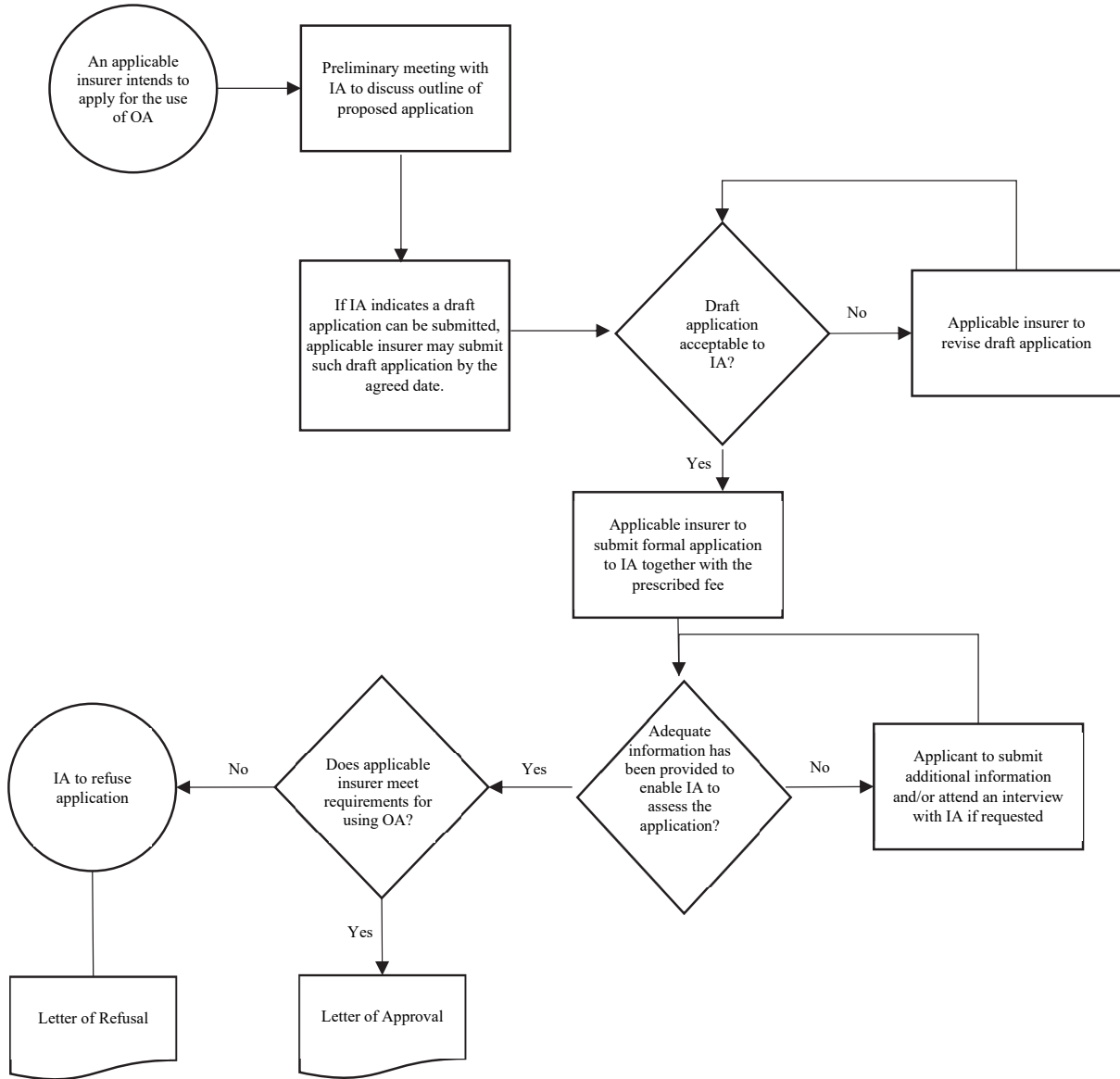
- 4.8 If the applicable insurer does not have any material changes to its OA process for the purposes of its next valuation, it should submit the OA Change Declaration template (C.A.P.G.7F) with the relevant parts completed, 3 months prior to the next valuation date (e.g. 30 September in the case of 31 December year-end).
- 4.9 Pursuant to rule 67(6) of the Rules, the IA may, by serving written notice on the applicable insurer, object to the insurer continuing to adopt the risk capital amount for natural catastrophe risk based on the insurer's OA. In order for the IA not to object (pursuant to rule 67(6) of the Rules) to the applicable insurer's continued use of the OA to determine its risk capital amount for natural catastrophe risk, the IA must be satisfied that the changes proposed to the insurer's OA (whether such proposed changes are material or not), do not jeopardize the OA's continued compliance with the principles set out in Section 2. In assessing such proposed changes, the IA may require the applicable insurer to submit any information in relation to such changes to the OA, as the IA deems necessary to demonstrate continued compliance with the principles as stated in Section 2. Representatives from the insurer may also be required to attend an interview with the IA. Once the IA is satisfied that the OA to be applied at the forthcoming valuation date continues to satisfy the principles in Section 2, it will notify the insurer that it has no objection to the insurer continuing to use the OA to determine its risk capital amount for natural catastrophe risk and the insurer may continue to use the OA for these purposes (such notice will signify that the IA will not be serving a notice under section 67(6) of the Rules, based on the information submitted).
- 4.10 The Change Declaration template (C.A.P.G.7F) and the Year-to-Year Change template (C.A.P.G.7E) categorize changes into the following drivers of change:
 - (a) Quantitative
 - (i) Scope
 - (ii) Exposure (e.g. increase/decrease in Sum insured/Limit, changes in top 5 peak regions/perils, etc.)
 - (iii) Model Change (e.g. model vendor/versions, model options, sub-perils, data granularity assumptions)
 - (iv) Parameters (e.g. adjustments for over/under estimation, loading for unmodelled exposure, etc.)
 - (v) Outward Reinsurance (deductible, limit, etc.)
 - (vi) Others

If an applicable insurer used any approximations to derive its breakdown into the above categories, it should provide the details of the approximation in the Year-to-Year Change template (C.A.P.G.7E) to the IA in accordance with paragraph 4.7.

- (b) Qualitative
 - (i) OA Process
 - (ii) Governance and Use
 - (iii) Data, Model and Assumptions Quality

4.11 For quantitative changes such as model change and adjustments, these would generally be considered material if they would have had an impact of greater than 10% (or lower threshold as determined by an applicable insurer) on the 1 in 200 total net annual aggregate loss, or on the 1 in 200 gross annual aggregate loss for any of the top 5 peak zones as reported in template CA.P.G.7D_NatCat_Own_Details. For changes to risk exposures, only significant changes such as a material new region/peril written or new region/perils in the top 5 peak zones would normally be considered as material. For outward reinsurance, a change would not be material if there is no implication to any subjective assumptions. For qualitative changes, the applicable insurer should use its discretion to determine whether the change is material (by way of example, changes such as significant structural or key personnel changes to OA process should be considered as material).

5. Flow-chart for Processing an Application for the use of OA



6. Flow-chart for the Change Declaration Process in OA

