



Prudential Practice Guide

GPG 113 – General Insurance Internal Model-based Method for Determining Minimum Capital Requirement

March 2009

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About this guide

Prudential Standard GPS 113 Capital Adequacy: Internal Model-based Method (GPS 113) sets out APRA's requirements of general insurers and Level 2 insurance groups (insurers) in relation to the Internal Model-based Method (IMB Method).

Unless otherwise defined in this prudential practice guide, expressions in bold are as defined in *Prudential Standard GPS 001 Definitions* or GPS 113.

This prudential practice guide aims to assist general insurers applying for or considering applying for approval to use the IMB Method.

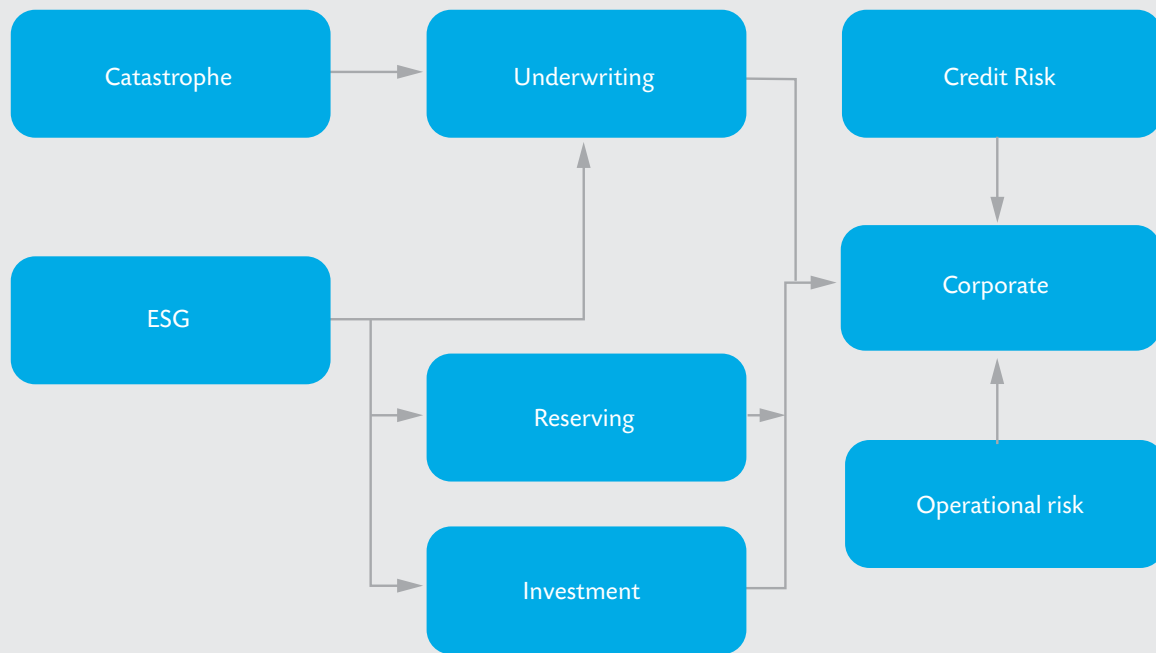
Background

1. The 2002 general insurance reforms introduced into the Insurance Act 1973 (the Act) provision for an insurer to use an approved internal model (the IMB Method) for determining its Minimum Capital Requirement (MCR). The underlying purpose of this provision is to have regulatory capital requirements better reflect the nature and extent of risks in the insurer's particular business structure and business mix.
2. To a large extent, APRA's approach to the development of the IMB Method for insurers follows the principles and concepts developed for authorised deposit-taking institutions (ADIs) under the Basel II framework. There are, however, differences of detail and emphasis because the nature and significance of the risks in the two industries are not the same.
6. For purposes of clarification, some terminology used in relation to ECM and DFA models is explained in this section. An insurer's ECM need not use an identical structure or terminology, although APRA expects that it should be possible to relate relevant parts of an insurer's model to the concepts in this section.
7. A typical DFA model includes the components depicted in Chart 1 (page 5).
8. Each insurer using an internal model will have developed an ECM that suits its own objectives, decision-making processes, risk appetite and business mix. There are no requirements imposed by GPS 113 on the structure, assumptions or operation of an insurer's ECM for its own risk and capital management purposes.
9. For regulatory purposes, however, some aspects of the ECM and the way in which the ECM is used must comply with certain requirements determined by APRA, in accordance with GPS 113, in order to produce the RCM. The RCM may differ from the insurer's ECM for internal purposes in respects such as:

Form and structure of internal model

3. In *Prudential Standard GPS 113 Capital Adequacy: Internal Model-based Method* (GPS 113), the model developed and used by an insurer for its own purposes is referred to as the insurer's Economic Capital Model (ECM). The particular implementation of the ECM used to determine the MCR is referred to as the Regulatory Capital Model (RCM).
4. There is no prescribed form or structure for the ECM. In this prudential practice guide (PPG), however, APRA makes the assumption that the ECM will take the form of a Dynamic Financial Analysis (DFA) model. This assumption is based on experience to date with industry participants.
5. If an insurer wishes to use an ECM (or part of its ECM) that takes a different form or structure, the insurer should discuss its approach with APRA at an early stage. APRA will apply the principles of GPS 113 in assessing such applications and will aim to achieve similar objectives to those outlined in this PPG.
- the time horizon of the projection;
- the risk or impairment measure used;
- allowance for planned profits;
- limited scope for management interventions in the RCM (whereas the ECM may allow for a wide range of management interventions, including capital raising);
- treatment of tax issues, asset concentration charges and the like;
- certain minimum parameter values or other conditions that APRA might specify for the RCM; and
- inclusion of the requirements in paragraph 30 of GPS 113.

Chart 1 Typical DFA Model Structure



Economic Scenario Generator (ESG) – a stochastic model of future economic conditions that produces scenarios for each simulation. These scenarios typically include future interest rates, equity returns, inflation rates, exchange rates and the like. The scenarios will feed into the underwriting, reserving, investment and corporate modules for each simulation.

Catastrophe module – produces simulated losses from catastrophe events.

Underwriting module – produces stochastic underwriting results for post-balance-date exposures in each business segment.

Reserving module – produces stochastic run-off results for pre-balance-date exposures in each business segment.

Investment module – produces simulated investment returns and values.

Credit risk module – produces stochastic results for credit losses on current and future reinsurance recoverables and other significant credit-exposed assets.

Operational risk module – a usually distinct module used to quantify operational risk.

Corporate module – combines the results of the other modules with items such as tax to give simulated outcomes for the total business. Some cross-segment reinsurance may also be covered in this module.

Pre-conditions for IMB Method approval

10. GPS 113 includes the following requirements (paragraphs 11 and 12):

APRA will not provide approval for use of the IMB Method unless an insurer has and maintains an advanced and stable approach to risk management, including operational risk management. APRA will make an assessment of the insurer's approach to risk management at the time of application under this Standard and on subsequent review of the RCM. This assessment will be based on information provided as part of the application under this Standard, as well as the information available through APRA's normal supervisory processes.

APRA will not provide approval for use of the IMB Method unless an insurer has and maintains a prudent approach to capital management. The insurer must have an internal measure of target capital that is higher than the MCR determined using the RCM. APRA will make an assessment of the adequacy of the insurer's approach to capital management, including target capital, at the time of application under this Standard and on subsequent review of the RCM. This assessment will be based on information provided as part of the application under this Standard as well as the information available through APRA's normal supervisory processes, including the insurer's business plan.

11. APRA will only approve use of the IMB Method for an insurer that already meets these requirements. An insurer considering seeking approval should make an initial approach to its APRA supervisor, at which time a discussion can be arranged to outline expectations. In considering whether the IMB Method is suitable for an insurer, APRA will have regard to the PAIRS¹ ratings for the insurer and the outcomes of recent supervisory visits.

12. While there is no particular benchmark for an acceptable internal capital target, since the circumstances of insurers vary widely, APRA expects to see the IMB Method used only by insurers that have a conservative approach to capital management. APRA does not regard the IMB Method as suitable for an insurer with limited financial resources and/or an aggressive approach to capital adequacy.
13. To assist it in assessing the readiness of an insurer to commence the approval process, APRA requires the insurer to make a self-assessment against the indicators set out in the Attachment to GPS 113. The self-assessment would generally comprise no more than 20 pages and be approved by senior management and the Board of the insurer.
14. APRA will consider an insurer's self-assessment without seeking evidence or verification (which will occur later in the application and assessment process). If the self-assessment reveals major deficiencies, APRA will advise the insurer of further progress that is needed before the insurer continues with the application seeking approval to use the IMB Method.
15. The self-assessment should be objective and realistic. If subsequent investigations reveal the self-assessment to be overly optimistic, APRA may regard this as evidence of failings in the overall risk management of the insurer; this is likely to make achieving internal model approval more difficult or may even preclude approval.

Criteria for IMB Method approval

16. Once the pre-conditions described above have been satisfied, there are three groups of criteria to be met in relation to the insurer's ECM in order to obtain APRA approval to use the IMB Method. These are set out in GPS 113 as follows:
 - model governance (paragraph 14);
 - model use (paragraph 15); and
 - model sufficiency (paragraphs 13 and 16 to 22).

¹ Probability and Impact Rating System (PAIRS) is APRA's internal risk assessment model.

17. The following sections of this PPG explain in more detail APRA's general approach to assessing each of these criteria. Governance and use of the model are important if APRA is to have confidence that the insurer has prepared the model in a proper manner and relies its results can be relied upon. Model sufficiency encompasses the model being technically appropriate, fit for purpose, and giving a reliable estimate of the capital required to meet the quantitative risk criterion in paragraph 13 of GPS 113.

Model governance

18. APRA will not give an insurer or insurance group approval to use the IMB Method unless it is satisfied with the governance arrangements for the ECM and RCM. The key requirements of the governance arrangements are set out in GPS 113 (paragraph 14). Further elaboration on APRA's general approach is set out in the following paragraphs.

Integration of the ECM with the Risk Management Framework

19. APRA would envisage integration of the ECM with the Risk Management Framework being evidenced by:
- (a) a network of linkages, in both directions, between the ECM and the Risk Management Framework;
 - (b) the role and use of the ECM being discussed in the Risk Management Strategy; and
 - (c) the Risk Management Framework having informed the design and structure of the ECM, including cross-referencing to ensure that the ECM captures all the material risks faced by the insurer.

Adequate resourcing, skills and objectivity of the team that is responsible for the development and review of the ECM

20. APRA will generally wish to assess whether the team:
- (a) is clearly identifiable and has sufficient resources for the work required (the team need not be full time but should have sufficient availability);
 - (b) has an adequate mix of technical and other skills for the work required;
 - (c) has sufficient independence from business operations responsible for accepting insurance risks to be able to take an objective view of risk factors and parameters; and
 - (d) has access to IT resources, including back-up and recovery, that are sufficient for the security and availability of the model.

Approval by the Board or relevant Board committee of the development and use of the ECM

21. APRA regards a level of Board involvement and a clear process of Board approval as important elements of the governance of the ECM; the Board is ultimately responsible for the capital adequacy of the insurer.

Adequate control processes for the development of the ECM, for calibrating and updating the model at least annually, for changing the model and for applying the RCM

22. APRA envisages that:
- (a) once the insurer has approval to use the IMB Method, the ECM will become a key element of the financial management of the insurer and require a standard of controls similar to other financial systems;
 - (b) controls will include those over sourcing of relevant data, correct transmission through the model process and validation of results; and
 - (c) there will be a transparent and verifiable process by which parameters for the model are derived, challenged and agreed.

Comprehensive documentation of the model (both the ECM and RCM)

23. Given the complexity of internal models, sound documentation is both a challenge and a necessity. APRA's expectation for documentation of the ECM relates mainly to those aspects which are relevant to the RCM. APRA's approach to assessing documentation includes the following principles:

- (a) documentation should be comprehensive and provide a level of detail sufficient to facilitate independent review and validation;
- (b) in order to mitigate and manage the risk of errors in the implementation of the model, there should be a document, separate from the computer code of the model, that sets out what the model is intended to do; and
- (c) documentation should include both non-technical and technical components, with adequate linkages.

Adequate linkages between the output of the ECM and the capital management of the insurer

24. To demonstrate adequate linkages between the output of the ECM and the capital management of the insurer, APRA envisages that there would be a pathway between the ECM and the capital management plan, by which the modelling has informed development of the plan and the updating of the plan is linked with updating of the ECM.

Regular reporting, to the relevant Board committees, Board and senior management, of results from the ECM and RCM and issues arising related to the ECM and RCM

25. Reporting to senior management and the Board is a necessary part of governance of the model. APRA envisages that:

- (a) the Board or Board committees and senior management review the ECM and RCM reports on a regular basis; and

- (b) relevant senior managers and directors would have a general understanding of the nature of the model, what it aims to do and what the results mean for the business. APRA does not expect these officers to have a detailed understanding of the technical aspects of the model.

Adequately documented independent review of the RCM (including those aspects of the ECM that are directly relevant to the RCM).

26. Given that the ECM forms an important part of the Risk Management Framework, APRA's expectations for independent review correspond to those described in *Prudential Standard GPS 220 Risk Management* (GPS 220) for risk management generally. The following points elaborate on APRA's expectations in relation to independent review in relation to an insurer's RCM:

- (a) independent review would generally be required when approval for the use of the IMB Method is sought (refer to Appendix 1);
- (b) APRA does not envisage an external audit review of the ECM or RCM (although the external auditor may be a suitable candidate to undertake the independent reviews required);
- (c) APRA envisages two types of review, which may be undertaken by different parties:
 - (i) governance, processes and controls – the kind of review that may be done by an operationally independent internal group (e.g. internal audit);
 - (ii) model sufficiency – a technical review that will require skills more likely to be available outside the organisation;
- (d) the governance, process and controls review is likely to be required annually (at least on a limited basis) with a more comprehensive review typically every three years;

- (e) the model sufficiency review may typically occur every three years, or earlier if there are substantial model revisions; and
- (f) the model sufficiency review should include examination of the appropriateness of key assumptions, at least on a sample basis, and comments on the overall results.
- (e) allocating capital to business units and measurement of business unit performance according to return on economic capital based on the ECM;
- (f) elements of incentive remuneration for senior management that relate to economic capital measures; and
- (g) use of risk-based capital to feed into pricing assumptions (target profit margins).

Model use

27. Paragraph 15 of GPS 113 states that:
- APRA will not provide approval for use of the IMB Method unless it is satisfied that the ECM plays an integral role in the insurer's management and decision-making processes, and that this use is embedded in the insurer's operations. APRA's consideration of model use will include, but will not be limited to, some of the indicators set out in the Attachment to this standard.**
28. There are two main reasons for APRA giving considerable weight to the use test:
- (a) it mitigates the risk that the insurer constructs or parameterises the model in a way that understates its true risk level; and
 - (b) it supports the underlying objective of encouraging insurers to manage their businesses better and be more risk-aware, thus reducing the probability of failure.
29. Typically, there would be several different uses of the model, over a period exceeding one year (perhaps three to five years or beyond), in order to satisfy the use test. The likely uses to be observed include:
- (a) assessing reinsurance strategy or alternative reinsurance programs;
 - (b) evaluating business plans and alternative acquisitions and divestiture initiatives on a risk-reward basis;
 - (c) developing the capital management strategy, in particular, consideration of economic capital and risk of impairment;
 - (d) assessing alternative investment strategies;
30. The fact that the ECM may have been amended or developed during the period prior to the application will not of itself prevent the insurer from satisfying the 'use test'. Models are typically being developed and improved over time and it will be common for the model submitted for approval to differ in a number of respects from that which has been used previously by the insurer. APRA will take account of factors such as the period of use, the context in which it has been used, the extent to which the model has been changed and the reasons for changes in assessing whether or not the 'use test' has been satisfied.
31. Given the range of issues feeding into management decisions and the inherent limitations of economic capital modelling, there may not be a direct link from the ECM results to the decision on a particular issue. In fact, it is unlikely that model outputs will directly drive decisions or other processes without some management overlay. Nevertheless, APRA would expect to see careful consideration of the risk issues in relevant business decisions, consistent with the Risk Management Framework and taking into account relevant ECM results as appropriate.
32. APRA envisages the ECM being developed and used in the head office of the insurer, under either the risk management or actuarial function. Evidence of the use of the model, however, should not be restricted to the head office and the Board. APRA would expect to see use of the ECM for business unit decisions, and for the accompanying risk-awareness to permeate to business unit level.

33. Information regarding use of the model will be provided by the insurer as part of the approval process (refer to Appendix 1). In evaluating this information, APRA will consider evidence including that gathered:
- (a) in interviews;
 - (b) in documents that were already in existence (e.g. management or Board papers) and were not prepared just for the IMB Method application; and
 - (c) by comparison with documentation and analysis already held by APRA.
34. APRA's consideration of the use test is an 'on balance' judgement, made having regard to the reasons described in paragraph 28.

Model sufficiency

35. GPS 113, in paragraphs 13 and 16 to 22, sets out the criteria that must be met in order for APRA to be satisfied that the model is 'sufficient' for purpose, i.e. that it gives a sufficiently reliable measure for use in determining the insurer's MCR. This section of the PPG elaborates on these requirements and gives guidance to insurers, including on how model sufficiency will be assessed.

The quantitative risk criterion

36. GPS 113 (paragraph 13) specifies the quantitative risk criterion for the MCR as the **'amount of capital sufficient for the insurer's probability of default to be 0.5 per cent or less'**. Further information on this criterion is available below.
37. A DFA model undertakes a stochastic projection of the future finances of the insurer. The projection commences from a date, referred to as the 'balance date', at which the details of the insurer's balance sheet are either already known when the model is run, or can be estimated with a reasonable degree of accuracy. These models use random number generation to create thousands of equally likely scenarios for the evolution of the insurer's finances in the years between the balance date and the extinction of all liabilities. The probability of default is the proportion of the scenarios in which the insurer is unable to meet its claim payments and other obligations as they fall due.
38. The model used for MCR determination (the RCM) should project insurance business written (new business and renewals) over one year from the balance date, with the insurer then being assumed to go into run-off. This is sometimes referred to in the industry as a 'run-off to extinction' approach, and is distinct from the 'balance sheet to balance sheet' approach. The difference between these two approaches is that the former allows for the full variation in experience that can occur during the run-off period, whereas the latter only allows for the variation in experience that is known or can be foreseen one year after the balance date.
39. Table 1 summarises the modelling period for the different risk categories as per paragraph 13 of GPS 113. Although the model should in essence be on a 'run-off to extinction' basis, the risks in the left-hand column of Table 1 are not modelled in this way for practical reasons.

Table 1: Modelling period for previous risk categories

Modelled for one-year projection period	Modelled to extinction of risk
Catastrophe risk	Underwriting risk
Operational risk	Reserving risk
	Market risk
	Credit risk

Risk categories

40. GPS 113, in paragraph 17, states that an insurer's ECM and RCM must adequately capture all the material risks of the insurer's portfolio and business, including the following risk categories:
- catastrophe risk;
 - underwriting risk;
 - reserving risk;
 - market risk;
 - credit risk; and
 - operational risk.
41. The first three of these categories are referred to generically as 'insurance risks' and are particular to the insurance business. The latter three categories are relevant to varying degrees in all prudentially regulated businesses and APRA aims to apply consistent approaches across industry sectors in respect of these risks.
42. Subsequent sections elaborate on the considerations for model sufficiency in respect of each risk type.

Integrated model

43. APRA will generally expect to see the ECM deal in an integrated manner with the first five risk categories in paragraph 40. A typical DFA model will undertake stochastic projections including all the relevant risk parameters and will allow for correlations between, and diversification arising from, the various risk factors.
44. Operational risk is generally regarded as more difficult to model in an appropriate manner. Both in Australia and internationally, there is lack of consensus about the nature and extent of dependencies with other risk types. For this reason, it is acceptable for the operational risk module to be either integrated with the other risk categories or a stand-alone model.

Insurance risks

45. This section gives guidance on the treatment of insurance risks – underwriting, catastrophe and reserving – in the ECM and APRA's approach to assessing model sufficiency in respect of these risks.

Accident year or underwriting year models

46. As with other aspects of financial management in insurance, either an 'accident year' or an 'underwriting year' approach may be taken.
47. An accident year approach considers the risk exposure in any given period as a 'cohort'. This risk exposure is often represented by the 'earned premium' in the period.
48. An underwriting year approach considers the policies written in a given period as a 'cohort'. The exposure for these policies covers the period from inception to expiry and thus normally runs over two years.
49. The accident year approach is more common in direct insurance and the underwriting year approach is more common in reinsurance, although both are used to varying extents in all types of insurance. The underwriting year approach is less well aligned to modelling of catastrophe claims, as major vendor catastrophe models naturally align with an accident year view.
50. This PPG generally assumes that the insurer's ECM will be developed on an accident year basis. This basis is not compulsory, however, and design of a model on an underwriting year basis will not be a barrier to approval. An insurer using an underwriting year model is advised to discuss this with APRA at an early stage, and will need to demonstrate that the outcomes are no less conservative than would be produced on an accident year basis.

Risk type categorisation

51. The precise delineation between catastrophe, underwriting and reserving risk is not critical, provided that it is understood by the insurer and by APRA and that the overall treatment of insurance risks is sufficient.

52. In most DFA models, the component for 'catastrophe risk' is used to model perils that can give rise to numerous claims across multiple classes of business and that typically are protected by catastrophe reinsurance. Generally this relates only to property classes, although the need for a cross-class model may arise in other types of insurance. APRA will need to understand the working definition of a 'catastrophe' in the model and how this scope fits with the modelling of attritional and large claims in each business segment. Generally this relates only to property classes, although the need for a cross-class model may arise in other types of insurance. APRA will need to understand the working definition of a 'catastrophe' in the model and how this scope fits with the modelling of attritional claims in each segment.
53. In an accident year model, the underwriting risk will generally be based on exposure in a period, often measured by a proxy such as earned premium. In this case, the first year of the projection will generally model underwriting risk based on the total of the unearned premium at the start of the period and the premium earned from business written in the projection period. The second year of the projection (or some other mechanism) will generally pick up the underwriting risk in respect of the business in force at the end of one year.
54. It might seem inconsistent to require modelling of catastrophe risk only for one year, but underwriting risk for the run-off after one year. This is a pragmatic approach adopted by APRA given the complexity of modelling catastrophes and catastrophe reinsurance for a run-off period. It is important that the modelling after one year adequately recognises the expected net cost of claims arising from catastrophes occurring in the second projection year as exposure runs down, including the cost of catastrophe reinsurance premiums, although this can be done in a simplified way.
55. In an accident year model, the reserving risk will generally be based on the outstanding claims liability as at the balance date (which includes any previous catastrophe events that have occurred).
56. Some risk factors will apply across more than one risk category. An important example of this is inflation, including price inflation, wage inflation and superimposed inflation. Inflation has a significant effect on underwriting risk and reserving risk, and will also affect catastrophe risk, although the latter effect may not be significant. APRA will look at the modelling of cross-risk-category factors as part of assessing the adequacy of all modules they affect.

Catastrophe risk

57. Management of catastrophe risk is a core business competency of most insurers, and is generally done in conjunction with a reinsurance broker and (directly or indirectly) one or more external catastrophe model vendors.
58. The major catastrophe models deal with natural hazards (cyclone, earthquake, etc) and cross several insurance product lines (commercial property, house, motor etc).
59. As an ideal, the catastrophe module of the ECM should cover all material perils (cyclone, earthquake, hail, windstorm, bushfire, storm surge, etc). It should also cover all locations covered by the ECM, i.e. catastrophes occurring in any part of the world where the insurer writes business and is exposed to catastrophe losses. APRA recognises that this ideal cannot be achieved at the present time.
60. Since each of the proprietary catastrophe models has its limitations and the exposure information of the insurer is usually imperfect, APRA will consider how the insurer's ECM makes allowance for perils that are not modelled, for demand surge in the cost of repair, for exposure information that is incomplete or of uncertain quality and for other known limitations.

61. The catastrophe modelling undertaken will usually generate both a 'loss exceedance curve' (a table showing the annual probability of a loss exceeding given amounts) and an 'event file' (frequencies and loss distributions for a large number of hypothetical individual events) for each major peril to feed into the DFA process. Event files contain more information and enable more sophisticated modelling of multiple events. APRA prefers insurers to use event files in their modelling because of their greater sophistication. Insurers that use loss exceedance curves should ensure that the approach taken is sufficiently robust and makes adequate allowance for the possibility of multiple catastrophes during the projection period and the risk of sideways as well as vertical exhaustion of reinsurance.
62. APRA will generally prefer the catastrophe modelling information submitted for assessment to be in the form of loss exceedance curves as, being summaries of the information in the event file, they are more concise and amenable to making comparisons between models. APRA will also examine the methodology for attributing costs to model segments, and the modelling of reinsurance impacts.
63. Catastrophe models are usually updated regularly, to incorporate advances in the scientific and engineering aspects of catastrophes, as well as the translation into financial losses. Insurers will be expected to keep catastrophe models linked to the ECM reasonably up to date.
64. APRA envisages that the insurer would also have considered the relevance of different types of accumulations other than natural hazards, e.g. terrorism risk, liability accumulations and pandemics. To the extent that these exposures are significant they should be allowed for in the ECM, whether in the catastrophe module or elsewhere.
65. In reviewing the catastrophe module of the ECM, APRA may wish to meet with the reinsurance broker (or other risk modelling adviser) as well as the insurer and will consider the governance and use test criteria as they apply to the catastrophe module of the ECM separately.

Underwriting risk

66. In addition to separate modelling of catastrophe losses (in order to capture cross-product impacts), it is common practice to separate the underwriting modelling between:
- (a) large claims, which are simulated individually in order to capture reinsurance impacts; and
 - (b) attritional claims, which are modelled as a single loss ratio or claims cost random variable for each business segment.
67. APRA's assessment of the adequacy of the underwriting modules of the ECM will include looking at the allowance for:
- (a) the number and size of large claims (including parameter risk for the number);
 - (b) the impact of reinsurance on large claims, including sideways exhaustion if relevant;
 - (c) the possibility of large claims exceeding the reinsurance limits, whether because of underwriting error or underestimation of the probable maximum loss (PML);
 - (d) variability in attritional losses, including economic and market conditions more extreme than experienced in recent years;
 - (e) the availability and cost of reinsurance renewals in future periods; and
 - (f) dependencies between business segments and accident periods.

Reserving risk

68. Modelling of reserving risk and uncertainty has received considerable attention in the actuarial community in recent years. It remains a difficult task, without consensus as to best practice.
69. In assessing the approach to modelling reserving risk, APRA will look at the way the ECM allows for:
 - (a) variability in run-off to extinction, not just over one year;
 - (b) extreme conditions not necessarily represented in available historic data;
 - (c) systemic influences that may impact on many portfolios and many accident years together; and
 - (d) for long-tail classes, possible periods of superimposed inflation that could last for several years and impact on many portfolios and most or all accident periods together.
70. As part of its reconciliation processes, the insurer would generally compare and reconcile the treatment of reserving risk in the ECM with the treatment of risk margins in the Insurance Liability Valuation Report. For regulatory purposes, the ECM is concerned mainly with more extreme events.
71. Depending on the structure of the ECM, changes in interest rates in future periods may be a source of variability for reserving (and underwriting) risk. Because the quantitative test is run-off to extinction, however, the final impact of interest rate changes will typically be mainly (or totally) reflected in market risk outcomes.

Unknown latent claims

72. In considering reserving and underwriting risk, APRA envisages that the insurer would give careful consideration to 'unknowns' such as the emergence of types of latent claim not represented in the historical claims experience and other emerging risks. For simplicity this issue is referred to as 'unknown latent claims'.

73. For at least workers compensation and public liability portfolios with long-term exposures, APRA would generally expect to see some allowance for unknown latent claims. Allowance may be implicit in the tail distributions chosen or may be explicit as an ECM component.

Run-off of claims to extinction

74. The purpose of the run-off to extinction basis is to capture the full extent of insurance risks, not to model precisely what the insurer would look like in run-off. APRA may accept a modelling approach that does not model insurance claims beyond some stage in the projection period, instead substituting in each simulation a reserve for any residual claims at that date. APRA will need to be satisfied that the risk of variation in claims beyond that time, arising out of premiums written up to one year after the balance date, is immaterial to the calculation of MCR.
75. APRA does not expect the RCM to include expenses incurred beyond one year after the balance date, other than expenses that are proportional to the size of the insurer's business as the exposure runs off, such as claims-handling expenses.

Market risk

76. The market risk module of the ECM will typically deal with the variability of returns on investments and the variability of interest rates, foreign exchange rates and economy-wide inflation (excluding 'super-imposed inflation' that would generally be dealt with as part of insurance risk) on both assets and liabilities. This component of risk is sometimes referred to as 'asset risk' or 'investment risk', but APRA uses the term 'market risk' for consistency with usage in other parts of the financial sector and because the risk relates to liabilities as well as assets.

77. As outlined in paragraph 7 and Chart 1, the stochastic engine for market risk is referred to as an Economic Scenario Generator (ESG). In some cases, the ESG will be a program that is distinct from the DFA model, provided by a different vendor and run prior to the DFA, with a file of economic scenarios produced by the ESG used as input to the DFA. In other cases, the ESG may be part of and integrated with the DFA model.
78. There are several commercial vendors of ESG models. An insurer may use one of these vendors or may develop its own ESG.
79. In considering the approach to modelling market risk, APRA will consider the way the ECM allows for:
 - (a) variability over the entire term of the run-off, not just over one year;
 - (b) extreme conditions and the possibility that dependencies between asset classes (as well as liabilities) may change in those conditions;
 - (c) dependency between market returns and other risks, such as credit default losses and claim levels;
 - (d) any additional risks introduced by active investment management; and
 - (e) credit risk on any assets for which credit risk is not handled in the credit risk module of the ECM.
80. Adverse economic scenarios will typically be reflected in both assets and liabilities.
81. APRA may accept a modelling approach that does not model market risk beyond some stage in the projection period (generally not earlier than one year after the balance date), thereby implying the asset portfolio is somehow 'de-risked' from that date onwards. Given that it is not possible to completely remove market risk from an asset portfolio backing a set of liabilities that is subject to both reserving and inflation risk, APRA will need to be satisfied that the insurer has articulated and understood the risk issues inherent in this approach.

Liquidity risk

82. Most general insurance businesses are naturally cash flow positive and, unless there are very substantial holdings of illiquid investments, it is unusual to have liquidity problems. There have, however, been examples where commitment of assets to support letters of credit (or other security) or ring-fencing of assets have resulted in lack of liquidity being the immediate trigger of an insolvency.
83. In the expectation that business arrangements that give rise to liquidity problems are likely to be rare, APRA does not expect every internal model to deal explicitly with liquidity as a risk factor. Instead, APRA envisages a careful analysis of the potential for liquidity issues as part of the Risk Management Framework and the design and documentation of the market risk module of the ECM. Only if particular issues are identified is it likely that liquidity risk will need to be incorporated specifically in the ECM.

Credit risk

84. The credit risk module of the ECM allows for all material losses that can arise from credit risk, other than those that are covered within the market risk module of the ECM.
85. The main sources of credit risk to a typical insurer are reinsurance receivables, premium debtors and items in the investment portfolio. Most items in the investment portfolio, such as corporate bonds, are able to have their credit risk fully covered within the market risk module of the ECM. However, some items, such as counterparty risk on derivatives, may need to be explicitly covered by the credit risk module of the ECM. If an insurer participates in credit derivatives, these may be covered either in the market risk or the credit risk module of the ECM, depending amongst other things on their purpose. There may also be non-tradeable assets and various related party exposures for which credit risk needs to be separately modelled.

86. For an asset that is marked-to-market, credit risk can be manifest not only as default but also as changes in the market value, because of changes in credit spreads or a change in the issuer's rating ('credit migration'). Generally, marked-to-market assets are within the investment portfolio and would have these aspects of their credit risk covered as part of market risk; hence it may not be necessary to include default or credit migration risk of marked-to-market assets in the credit risk module of the ECM.
87. APRA would broadly prefer to see all aspects of investments included in the market risk module of the ECM. However, this may not be practical due (for example) to limitations of the ESG, and the insurer needs to satisfy APRA that all possibilities are appropriately covered in its ECM.
88. In assessing the approach to modelling credit risk, APRA will consider the way in which the model allows for:
- (a) all assets or other relevant items (including 'off balance sheet' exposures such as guarantees) that are not covered by the market risk module of the ECM;
 - (b) treatment of residual credit risk on items in the investment portfolio for which only part of the credit risk is covered by the market risk module of the ECM (e.g. counterparty risk on derivatives and, in some instances, credit migration risk on corporate bonds);
 - (c) credit risk over the entire holding term of the exposed asset (not just one year);
 - (d) extreme credit risk events;
 - (e) application of credit risk to simulated future reinsurance receivables, not just those in place at the balance date;
 - (f) dependencies between defaults on different assets, especially between reinsurers;
 - (g) dependencies between reinsurer defaults and overall claims levels, especially catastrophes; and
 - (h) assessment of mark-to-market credit risk impacts, where appropriate.
89. Credit risk from premium debtors should not extend far beyond one year after the balance date, as premium ceases being written at that time. Provided the expected amount of premiums receivable one year after the balance date is not significant, the credit risk on that amount may be allowed for in a simplified manner.

Operational risk

90. The operational risk module of the ECM responds to the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This includes legal risk² but excludes strategic or reputational risk, as indicated in GPS 113 paragraph 17. The types of events APRA considers as operational risk can be understood by referring to Attachment E of *Prudential Standard APS 115 Capital Adequacy: Advanced Measurement Approaches to Operational Risk*.
91. APRA regards it as good practice for the operational risk module of the ECM to be integrated with the treatment of operational risks under the Risk Management Framework. APRA will wish to assess whether the insurer has captured all material sources of operational risk across the organisation. This will include reviewing the insurer's process of risk identification, linkages with the Risk Management Framework and consideration of potential gaps, overlaps and emerging risk issues.
92. Insurers using the IMB Method may measure an operational risk capital charge using a separate addition to the 'main' model. The confidence level required for the calculation of this charge is the same as that specified in paragraph 13 of GPS 113.

² Legal risk includes, but is not limited to, exposure to fines, penalties or punitive damages resulting from regulatory actions, as well as ordinary damages civil litigation, related legal costs and private settlements.

93. APRA expects that an insurer's operational risk capital would cover both expected and unexpected losses. Where these exposures are covered elsewhere in the ECM, the insurer will be expected to document its assessment of these overlaps as a basis for exclusion from the operational risk model.
94. **GPS 113 paragraph 21 states that the operational risk module of the ECM must consider all of the following four elements:**
- (a) **relevant internal event data (for which the insurer must maintain a suitably comprehensive operational risk event recording system;**
 - (b) **relevant external event data;**
 - (c) **scenario analysis; and**
 - (d) **the business environment and internal control systems.**
95. APRA envisages that an insurer will combine the four elements mentioned in paragraph 94 in a manner that most effectively enables the quantification of its operational risk profile. The extent to which each element is incorporated in the model will depend on the quantity and quality of the information and may change over time. A particular element may make no contribution to the model if the insurer's consideration concludes that such an outcome is appropriate.
96. APRA expects that the internal operational risk event recording system of an insurer includes:
- (a) a documented classification of the type of events covered by the system;
 - (b) information on the gross loss amounts (or potential losses in the case of 'near miss' incidents);
 - (c) the date(s) of the loss events; and
 - (d) information on any recoveries and descriptive information about the drivers or causes of the loss events.
- APRA expects this system to be subject to satisfactory review and control processes.
97. The insurer's threshold for collection of operational risk data is expected to take into account:
- (a) its approach to operational risk measurement for regulatory purposes;
 - (b) the use of operational risk data for risk management; and
 - (c) the administrative requirements placed on the business and the operational risk management function as a consequence of the data collection process.
98. Given the likely low volume and narrow range of historical events internal to the insurer, external data is expected to be utilised to the extent that the data sources are relevant and readily available. An insurer may wish to subscribe to one or more relevant operational risk data sources.
99. APRA envisages that scenario analysis is incorporated into the operational risk model to evaluate the exposure to high-severity loss events. The insurer is expected to develop a range of scenarios that draw upon the knowledge of experienced business managers and risk management experts to derive reasoned assessments of plausible severe losses. This is especially relevant for business activities or types of loss events where internal or external loss data do not provide a sufficiently robust estimate of the insurer's exposure to operational risk.
100. As stated in GPS 113, the operational risk module must consider the indicators of the insurer's operational risk profile (termed business environment and internal control factors), as well as other information related to the assessment of the insurer's internal control framework.

These indicators are intended to ensure that the operational risk model is forward-looking and aligned with the quality of the insurer's control and operating environments. Accordingly, these factors are expected to be responsive to changes in the insurer's operational risk profile and reflect potential sources of operational risk. Business environment and internal control factors need to recognise both improvements and deterioration in the insurer's operational risk profile. The operational risk model is expected to capture potential increases in risk due to greater complexity of activities or increased business volume as well as capturing changes in risk due to improvements in internal controls. Changes in the insurer's internal processes and risk management procedures are also expected to be similarly taken into account.

101. APRA envisages that the main source for structuring and parameterisation of the operational risk module of the ECM will be expert judgement, synthesising the four elements in paragraph 94. The use of expert judgement to establish the structure and parameters of the operational risk module of the ECM will need to be adequately documented in order to facilitate APRA's review.
102. To recognise insurance as an operational risk mitigant for calculating regulatory capital, an insurer needs to be able to demonstrate that the insurance will cover potential operational risk losses included in the operational risk measurement model in a manner equivalent to holding regulatory capital. The issues APRA will consider may be understood by referring to paragraphs 45 to 49 of Attachment B of *Prudential Standard APS 115 Capital Adequacy: Advanced Measurement Approaches to Operational Risk*.
103. APRA will wish to assess the insurer's treatment of 'boundary events'³ to see whether it is clear, consistent and well documented. At present, APRA does not prescribe the method for allocating boundary events between operational

risk and other risk classes, although it may do so in future. APRA would expect that the insurer would have a well-defined policy for the classification of boundary events, which would ideally be reflected both in the recording of operational risk events and the treatment of such events in the ECM. The more common boundary issues are likely to arise between operational risk and insurance risks (where an underlying operational cause leads to a loss that appears as part of the underwriting result). Other boundary issues may arise between operational risk and market risk (where an underlying operational cause leads to a loss on investments), and between operational risk and credit risk (where an underlying operational cause leads to a credit loss).

104. The governance of the operational risk module of the ECM will be assessed against the same requirements as outlined in paragraphs 18 to 26 of this GPG for the ECM as a whole.
105. Recognising that the measurement of operational risk is receiving a great deal of attention in many industries and jurisdictions, APRA anticipates that the approach adopted by insurers using the IMB Method will keep pace with developments in the insurance and other relevant industries.

Attribution principles

106. Since by its nature a DFA model combines all of the risk factors in a complex way, it is usually necessary to establish documented 'attribution principles' to determine how a total result is broken into component parts (both sources of risk and business segments). This would apply, for example, if an internal model were to be used by both a Level 1 insurer and Level 2 insurance group. It also applies within a model, when APRA will wish to see the 'contribution' to the MCR (the 99.5 per cent VAR) from each type of risk, each business segment etc.

³ Boundary events are events for which the boundary between operational risk and other risk types is grey and the event could be reasonably allocated to either risk type.

Reconciliation with business plans

107. In most circumstances, APRA would envisage the ECM being calibrated such that the mean value of the stochastic projections is equal to the business plan projection, both for profit and key financial items. A reconciliation with the business plan is part of the information required by APRA (Appendix 1).
108. To the extent that the insurer does not regard it as appropriate to calibrate the ECM to the business plan, APRA will wish to have the reasons explained and the financial differences quantified.

Allowance for planned profits

109. An implication of modelling the business over one year is that the ECM will take account of planned profits over the one-year projection period, except to the extent paragraph 108 applies. By way of comparison, there is no explicit allowance for planned profits in the Prescribed Method⁴ or in most VAR-based methods used in the banking and finance industries.
110. From a prudential perspective, APRA believes it would be inappropriate for the required capital to reduce solely on the expectation that business would be very profitable. APRA would generally expect to see the ECM calibrated to match the business plan, and regards this as the appropriate approach. For prudential purposes, however, APRA will expect to see a further assessment of the planned profit allowance based on a reasonably conservative assessment that reflects recent experience and market conditions. APRA will consider that assessment and, if it forms the view that the expected profit assumption in the projections from the model is not sufficiently conservative, the insurer may be requested to adopt a different expected profit assumption, or to make an adjustment to the capital requirement calculated by the model, as a documented part of the RCM.

⁴ The standardised framework detailed in GPS 110.

Stress testing

111. APRA envisages that the ECM will be subjected to a range of sensitivity and stress tests. The purpose is to identify the critical assumptions that have the most bearing on the calculated MCR and to test the robustness of the ECM in more extreme circumstances.
112. The choice of stresses is up to the insurer. A well thought out suite of stress tests, set within a robust reporting framework, will be viewed by APRA as an indicator of a serious and thorough approach to risk management.

Standard outputs

113. In order to assist APRA to evaluate the ECM and RCM, an insurer is requested to provide APRA with 'standard outputs' from various elements of its ECM and RCM. The specification of these standard outputs does not indicate that the ECM cannot be structured and implemented in any particular way.
114. If an insurer finds that its ECM cannot provide these standard outputs in a practical manner, it will need to discuss this with APRA at an early stage.
115. The standard outputs are set out in Appendix 2.

Consistency with Prescribed Method

116. There are several areas where APRA will require consistent treatment between the IMB Method and the Prescribed Method. These are specified in paragraph 29 of GPS 113:
 - (a) deductions from capital specified in *Prudential Standard GPS 111 Capital Adequacy: Level 2 Insurance Groups* (GPS111) (paragraphs 53 to 58) and *Prudential Standard GPS 112 Capital Adequacy: Measurement of Capital* (GPS 112) (paragraphs 25 to 30);

- (b) investment concentration charges and investment risk capital charges on reinsurance recoverables due from a non-APRA-authorized reinsurer specified in *Prudential Standard GPS 114 Capital Adequacy: Investment Risk Capital Charge* (GPS 114); and
- (c) the treatment of holdings in related companies representing retained profits that are equity accounted.

Deductions from capital base

117. The capital standards specify particular treatment of certain types of assets that are not regarded by APRA as of sufficient quality to count as capital for prudential purposes, even though they may be accurately recorded for accounting purposes. As a general principle, the same treatment will be used for the IMB Method as is required for the Prescribed Method.
118. The deductions from available capital are specified in paragraphs 25 to 30 of GPS 112. As stated in GPS 113, an insurer using the IMB Method must make the same deductions in measuring its capital base as for the Prescribed Method. GPS 113 indicates that the RCM may be adjusted, in a manner agreed with APRA, to remove any double-counting in the MCR that would otherwise occur as a consequence of these deductions.

Investment concentration charges

119. Investments subject to a 100 per cent capital charge in the Prescribed Method include (refer to GPS 114 Attachment A):
- (a) assets under a fixed or floating charge;
 - (b) loans to directors; and
 - (c) unsecured loans to employees in excess of \$1,000.

120. There are also investment concentration charges, which are specified in paragraphs 29 to 36 of GPS 114, and charges in respect of reinsurance recoverables from reinsurers that are not APRA-authorized, which are specified in paragraphs 5 to 7 of GPS 114 Attachment A.
121. An insurer using the IMB Method will need to ensure that assets referred to in the previous two paragraphs are treated in the same way as the Prescribed Method, generally by adding the relevant capital charge to the results from the ECM. GPS 113 indicates that the RCM may be adjusted, in a manner agreed with APRA, to remove any double-counting that would otherwise occur as a consequence of these capital charges.

Dividends and related companies

122. Under the Prescribed Method (refer to GPS 112 paragraph 16(a)), an insurer must deduct dividends expected to be paid from current year profits from its calculation of available capital. In using the IMB Method, an insurer will be expected to follow the same approach in determining the opening balance sheet. It is not necessary, however, to allow for the payment of dividends arising from projected profits after the balance date. This is one aspect in which the RCM may be expected to vary from the ECM used by the insurer for other purposes.
123. Under the Prescribed Method, any holdings in related companies representing retained profits that are equity accounted must be included in Upper Tier 2 capital, not in Tier 1 capital. The same treatment will need to be used by an insurer using the IMB Method.

Partial models

124. GPS 113 makes provision for partial models. An insurer may wish to apply to APRA for approval to use the IMB Method:

- (a) to calculate certain elements of its MCR; and/or
- (b) to calculate the MCR for some business segments;

while using the Prescribed Method for the remaining elements or segments.

125. APRA is unlikely to approve an ECM of the first type described above. The reasons are that the risk-based components of the Prescribed Method calculation are calibrated to an overall level of capital, not necessarily to the individual risks they attach to, and to avoid the risk of 'cherry picking' of the different elements of the model by an insurer.

126. On the other hand, APRA is comfortable with the use of an ECM that omits small or newly acquired business segments for a limited period. This type of partial model may be appropriate either at Level 1 (where some business segments may be omitted) or more likely at Level 2 (where some controlled entities may be omitted).

127. This type of partial model is referred to as a 'building block' approach, where the overall MCR is made up of the IMB Method for the majority of the insurer or group plus the Prescribed Method for controlled entities or the business segments yet to be included in the ECM. Where the building block approach is used, the IMB Method component of the MCR will not take account of any diversification benefits with the parts of business segments or controlled entities for which the MCR is calculated on the Prescribed Method.

128. General guidelines for the treatment of small business segments (or controlled entities) are:

- (a) for small business segments (less than five per cent of group insurance liabilities), the building block approach can apply indefinitely but subject to that business segments remaining below the five per cent threshold and not representing any significant risks that would make the Prescribed Method inappropriate;
- (b) the total of small business segments where this rule applies cannot be more than 20 per cent of group insurance liabilities; and
- (c) when a small business segment becomes more than five per cent of total group liabilities, a transition period (refer to the next paragraph) starts to apply from that time.

129. General guidelines for the treatment of newly acquired business segments (or controlled entities) are:

- (a) transition to the IMB Method for acquisition of Australian businesses would be no more than two years from acquisition; and
- (b) transition to the IMB Method for acquisition of foreign businesses would be no more than three years from acquisition.

130. The guidelines above are intended to give an indication of APRA's likely approach to partial models. Each case, however, will be considered on its merits and there is scope to agree a different approach depending on the circumstances.

Application and review process

131. The anticipated time required for the application and assessment process is likely to be between nine and 12 months, but may be much longer. To begin the process an insurer will typically make an approach to its APRA supervisor, following which APRA will establish a dialogue with the insurer. While the process may vary depending on the circumstances of the insurer, paragraphs 132 to 141 below outline what will normally be involved.
132. The insurer will need to make three separate submissions to APRA:
 - (a) self-assessment of readiness for the IMB Method (Attachment to GPS 113);
 - (b) preliminary application about eight to 10 weeks after the self-assessment; and
 - (c) final application after assessment and discussion of the preliminary application – likely to be at least six months after preliminary application.
133. Appendix 1 gives further detail on the information to be submitted with each part and the sign-offs required from the insurer.
134. APRA will undertake a preliminary analysis of the self-assessment and discuss it with the insurer. If there are significant deficiencies in the insurer's readiness, APRA may suspend the application process until those deficiencies are closed and the insurer makes a further self-assessment. This stage is intended to avoid wasting significant time and resources of both the insurer and APRA in situations where approval is unlikely.
135. The preliminary application is in three parts. Part A is the description of the RCM and its connection with the ECM. Part B is non-technical in nature and, *inter alia*, provides evidence relating to model governance and the use test. Part C provides in-depth technical material for all aspects of the internal model, and is used to assess model sufficiency.
136. APRA's review of the preliminary application will include both off-site and on-site reviews. Extensive dialogue between APRA and the insurer can be expected, along with requests for supplementary information.
137. APRA will provide a response to the preliminary application indicating any further work or information required to be undertaken prior to submission of the final application.
138. The insurer should then submit a final application on a timetable agreed with APRA. Depending on timing, the final application for approval may be based on the next annual cycle of the model after the preliminary application. APRA anticipates that the final application will be submitted after Board approval.
139. Assessment of the final application will be undertaken by APRA. This process may involve further on-site reviews and requests for information.
140. A formal response will be sent to the insurer. If the application is approved, the response will state the effective date of the approval and any conditions that apply.
141. Before approval of the final application APRA expects to have:
 - (a) reviewed and analysed the RCM against the corresponding Prescribed Method calculation at (a minimum of) two annual balance dates, including the movement between the two dates; and
 - (b) reviewed and analysed the insurer's quarterly (for Level 1) or six-monthly (for Level 2) update of the RCM for the interim reporting dates between at least the two annual balance dates referred to in (a).
142. This expectation implies either that the preliminary and final applications need to relate to consecutive annual balance dates, or that the application include comprehensive information at both the latest balance date and the one prior.

143. APRA will provide approval by modifying relevant requirements in *Prudential Standard GPS 110 Capital Adequacy* (GPS 110) or GPS 111 under subsection 32(3A) of the Act. Under subsection 32(3A) of the Act, the internal model must comply with criteria set out in GPS 113. Once a modification takes effect, APRA will notify the insurer concerned (subsection 32(3C) of the Act). APRA may vary or revoke a modification made under subsection 32(3A) of the Act. If APRA does so, it will also notify the insurer concerned (subsection 32(3CA) of the Act).

Nature of approval and use of internal model

What is being approved?

144. In accordance with GPS 113, APRA is approving an alternative method for determining an insurer's MCR, based on the insurer's RCM. This MCR will then be compared with available capital calculated in accordance with the capital standards, in a similar way to the Prescribed Method. APRA's approval for an insurer to use the IMB Method to determine its MCR will address all aspects of determining the MCR including the system, the surrounding controls, the parameters, the calculations and the way the calculations are used to produce the MCR.

145. As specified in paragraph 30 of GPS 113, **the RCM submitted to APRA for approval must include:**

- (a) **an adequate specification of the version and assumptions of the relevant ECM;**
- (b) **any particular parameters and other implementation rules applied in using the RCM to determine MCR;**
- (c) **any adjustments required to achieve consistency with the Prescribed Method as specified in paragraph 29;**
- (d) **the addition of Prescribed Method MCR calculations for any business segments or other elements of the MCR calculation not included in the ECM;**

- (e) **the procedure for determining the MCR based on the RCM at reporting dates other than the date as at which the annual calibration is undertaken;**
- (f) **the application of any minima or other conditions imposed by APRA; and**
- (g) **any other relevant matters that APRA may require.**

146. Once the modification under subsection 32(3A) comes into effect, the insurer can determine its MCR in accordance with the RCM at any time, subject to any conditions of approval, until a trigger for reviewing the approval is reached. These triggers will be specified in the approval and are likely to include:

- (a) material changes to the ECM or parameters that are relevant to the RCM;
- (b) material changes to the business of the insurer, e.g. acquisitions or disposals;
- (c) the elapse of time (up to three years);
- (d) changes requested by APRA following an annual model review (refer paragraphs 156 to 157); or
- (e) a request from APRA.

Minimum on IMB Method results

147. Paragraph 28 of GPS 113 states that APRA's approval **"may include requirements to be met on a continuing basis, including specifying that the MCR determined using the RCM will be subject to a minimum that is expressed as a percentage of the Prescribed Method calculation."**

148. Paragraph 28 goes on to say that for the first two years of the use of the IMB Method by an insurer, the MCR determined using the IMB method will be subject to a minimum of 90 per cent of the amount determined using the Prescribed Method. APRA has not yet formed a view on its requirements beyond this two-year period.

Timing of model calibration, update and running

149. APRA envisages that an insurer will undertake a significant annual exercise to calibrate the ECM coincident with (or shortly following) the annual business planning process. Most insurers complete their annual planning cycle and approve business plans before the end of a financial year. APRA envisages that the corresponding calibration of the ECM will be completed prior to submission of the annual returns to APRA and for the current ECM to be reflected in those returns.
150. Ideally, an insurer would complete its recalibration earlier, in time to incorporate the current ECM results in quarterly returns and annual financial statements (this would generally imply recalibration to be completed no later than one month after the end of the financial year). APRA recognises the complexity of the ECM, however, and considers accuracy to be more important than timeliness in this context.
151. APRA does not expect the ECM to be recalibrated and updated more than once per year, although it is open to the insurer to undertake more frequent updates if it chooses.
152. The RCM therefore needs to include an interim update procedure to enable the MCR to be determined at interim dates. APRA will consider any reasonable approach suggested by an insurer and does not require a high degree of sophistication unless warranted by the particular circumstances of the insurer. By way of example, APRA would generally consider acceptable an approach whereby the MCR based on the RCM at the most recent calibration was updated in proportion to changes in the Prescribed Method calculation from month to month. APRA envisages some professional oversight by finance or actuarial professionals to ensure that the update approach continues to be appropriate.

153. If a change to the ECM is required by the insurer between annual reviews (for example arising from one of the triggers in paragraph 146), the insurer should contact APRA as quickly as practical (and no later than 20 business days after the trigger event) to discuss the process for model changes and review by APRA. At the time of this approach, the insurer may suggest to APRA an interim approach to be applied until the changes are completed and reviewed. APRA may agree to an interim approach for a defined period or may require some other approach, possibly including reversion to the Prescribed Method.

Disclosure

154. Paragraph 36 of GPS 113 states that:
GPS 110 and GPS 111 require insurers to disclose certain information about regulatory capital. If an insurer uses the IMB method, the disclosure must include a statement to that effect, and the relevant MCR calculations using both the IMB Method and the Prescribed Method.
155. APRA envisages that an insurer will disclose for the year prior to the first use of the IMB Method (if approval has been given prior to its completion) the fact that approval for the use of the IMB Method has been sought and obtained. It is also envisaged that the insurer will disclose the results of the IMB Method and the Prescribed Method at that balance date even though the MCR will be determined at that time by use of the Prescribed Method.

Annual internal model report

156. **As part of maintaining IMB Method approval, an insurer is required to provide an annual 'internal model report', on the same timetable as the Insurance Liability Valuation Report (refer paragraph 34 of GPS 113).**

157. As guidance, it would generally be appropriate for the annual internal model report to cover:
- (a) recalibration of and changes to the internal model (ECM and RCM) at the latest annual update;
 - (b) analysis and reconciliation of changes in the MCR over the last year and on adoption of the new model;
 - (c) commentary on use of the ECM during the last year;
 - (d) documentation relating to model governance over the last year;
 - (e) results of any 'back testing' of the model undertaken;
 - (f) an analysis of the financial results for the last year relative to business plan and the ECM:
 - (i) where on the output distribution did the result lie, for key parameters?
 - (ii) what were the drivers of divergence from budget, relative to the risk factors incorporated in the internal model?
 - (iii) what lessons for the internal modelling were derived from the latest year's operations? and
 - (g) plans for further development of the model.

Fees

160. APRA is funded by an annual appropriation which is based on industry levies after the deduction of the Treasurer's determination for monies collected for ASIC and the ATO and it applies charges for certain functions, including applications for approval to use the IMB Method by general insurers. The application fee will be required when the draft application is lodged with APRA. The fee is not refundable unless a special circumstance applies. There will also be a smaller annual fee, the amount of which has not yet been determined. The application fee will be available on the APRA website under www.apra.gov.au/General/Levies.cfm.

Material changes and periodic reviews

158. APRA may undertake a comprehensive period review of the ECM and RCM on a periodic basis or when material changes occur.
159. The process and requirements will vary depending on the circumstances, although it can be expected that APRA will apply a subset of the requirements and procedures relevant to the initial application, as appropriate.

Appendix 1 – GI Internal Model-based Method (IMB Method) – Information Request for preliminary and final applications

The purpose of this document is to specify the information that a general insurer or Level 2 insurance group is required to submit to APRA as part of its preliminary and final application for approval to use the Internal Model-based Method (IMB Method) in accordance with *Prudential Standard GPS 113 Capital Adequacy: Internal Model-based Method (GPS 113)*.

Part A of the information requested is a description of the RCM and the ECM. This part also includes a comparison of the MCR calculations using both the Prescribed Method and the IMB method. Part B of the information requested is intended to be non-technical material relevant to a broad range of managers in your organisation which outlines general information regarding the ECM and related risk and capital management framework. Part C of the information requested is intended to provide in-depth technical material in relation to all relevant aspects of the ECM that would normally be prepared by your actuarial team.

APRA anticipates that the final application will be submitted after Board approval, and therefore requests that the preliminary application also be Board-endorsed. APRA anticipates that Board members should be in a position to express their approval of the content of Part B, and their familiarity with the process used to develop Part C.

The information required is as follows:

Preliminary application

1. Letter of application to use the IMB Method signed by the CEO with evidence of endorsement by the Board.
2. Part A (Description of the RCM)
3. Part B (General Information)
4. Part C (Technical Information)

Final application

1. Letter of application to use the IMB Method signed by the CEO, with evidence of concurrence of relevant senior management (including the Appointed Actuary or the Group Actuary) and approval by the Board.

2. Latest Risk Management Strategy updated with references to the use of the ECM and the RCM.
3. Part A (Description of the RCM)
4. Part B (General Information)
5. Part C (Technical Information)
6. Schedule comparing preliminary and final application contents (Parts B and C).

It is expected that much of the information in the final application will be same as the preliminary application, or very similar. In order to maintain a single source, relevant material from the preliminary application should be repeated provided it is still relevant. The application should be accompanied by a schedule (item 6 above) that identifies which documents are unchanged from the preliminary application, which are new, and which have had modifications along with a brief summary of the modifications. If convenient a 'marked up' format may be used to identify changes but this is not compulsory and will not suit all types of documents.

The application and accompanying information should be provided in both soft and hard copy formats. If you wish to submit information in a format different from the one suggested in the attachments or there is significant overlap in the information to be submitted for Parts B and C, please use your preferred format and provide a summary table indicating where each item is addressed.

Soft copies of documents should be provided using standard business software (e.g. Microsoft Word and/or Excel) and not proprietary software packages. It is suggested that a 'pdf' version be supplied to act as a single source of information along with, for the information that is relevant such as some Excel tables, the software files. In case a single document/spreadsheet needs to be submitted under several sections, the same filename should be used and the covering document should list all the instances of multiple use.

Please address all information/queries to your frontline supervisor in the first instance.

GI IMB Method – Information Required – Part A

– (Description of the RCM)

A1 Description of the RCM

- 1.1 Provide a complete description of the RCM which will be used to determine the Minimum Capital Requirement (MCR), covering the items specified in paragraph 30 of GPS 113.
- 1.2 Provide a comparison of MCR determined using the
 - (i) Prescribed Method and
 - (ii) Internal Model-based Methodfor at least one balance date in the preliminary application. If the insurer intends to submit the final application based on the same balance date as the preliminary application, then the comparison must be provided for at least two balance dates.

A2 Calibration and updating of the RCM & ECM

- 2.1 Provide details of interim updates of the RCM for the quarterly or six monthly reporting dates between the balance dates referred to in 1.2 above for calculating the MCR.
- 2.2 Describe the annual update procedure to calibrate the ECM which is likely to be coincident with the annual business planning process. In case the insurer does not expect the annual calibration of the ECM to be complete within a period of four months after the end of the financial year, describe the procedure for submitting the annual internal model report to APRA.

A3 RCM & ECM reconciliation

Provide a reconciliation between the RCM and the ECM.

GI IMB Method – Information Required – Part B (General)

B1 General information

- 1.1 The reasons for seeking approval for the Internal Model by the general insurer. What does the insurer aim to achieve if APRA were to grant this approval?
- 1.2 The contact people for information about the Internal Model and its application.
- 1.3 The members of the modelling team, their roles and relevant qualifications and experience.

B2 Legal and organisational structures

- 2.1 The legal entity or entities proposed to be covered by the Internal Model, and the specific entity(ies) for which the insurer seeks approval of the Internal Model for use in determining the regulatory capital requirements.
- 2.2 The organisational structure responsible for development, operation (including assumption setting), review, approval and interpretation of the Internal Model and how this relates to the business unit structure and legal entity structure.
- 2.3 The business unit(s) that the Internal Model covers, and how the scope and control of these business units fits into the legal entity structure.

B3 Risk management linkages

- 3.1 The relationship of the Internal Model to the Risk Management Framework. You may refer to documents already submitted to APRA, although if it is more convenient to include copies of documents such as the Risk Management Strategy, Risk Register etc in the application you may do so.

B4 Internal model governance

- 4.1 The most recent version of all relevant Internal Model Risk policies. These are the policy document or documents that set out principles and standards for the mitigation of Internal Model risk. The document(s) should describe the procedures that the institution requires to be followed for developing, maintaining and using the internal models.

Such policies would typically include requirements on topics such as:

- (a) identification of models;
 - (b) categorisation of models according to business criticality and complexity;
 - (c) roles and responsibilities of stakeholders, including ownership and sign-offs required;
 - (d) version control and security;
 - (e) model risk, including ensuring appropriate model structure and parameter estimation;
 - (f) IT risk including data security and business continuity issues;
 - (g) documentation;
 - (h) model review;
 - (i) training; and
 - (j) usage.
- 4.2 In relation to the Internal Model, the nature of reporting to, influence by, and acceptance by the business unit's management, financial management, executive management, the risk management function and the relevant Board(s) of Directors. Include a copy of relevant papers to Board(s), Board Committees and executive management. Papers provided should include all high importance papers, together with a sample of more routine and lesser importance papers.
 - 4.3 The nature of any external assistance used in development, operation and interpretation of the Internal Model.
 - 4.4 The quality control process for the development, operation and interpretation of the Internal Model, including the sign-offs required.
 - 4.5 The nature of any independent review (internal or external) of the development, operation and interpretation of the Internal Model. Include a copy of the scope of the review and relevant reports.

B5 Internal model usage

5.1 The uses to which the current Internal Model or its part(s) have been put in the last three years. Include a copy of relevant documents. Documents relating to use more than three years prior may be included at the applicants' discretion. It is important that a comprehensive description is provided of how use of the internal model is embedded in the Risk Management Framework of the insurer as well as its use as an input to the remuneration arrangements of senior staff.

- (c) a systems diagram showing the key systems involved in the Internal Model and data flows between them;
- (d) the key inputs and assumptions;
- (e) the outputs that are relevant;
- (f) what these outputs mean for the business; and
- (g) usage of the Internal Model.

B6 Capital management linkages

6.1 The relationship of the Internal Model to the Capital Management Framework. This should include, but not be limited to, information about:

- (a) the role, if any, that the Internal Model has in determining target capital of the entity(ies);
- (b) the relationship between target capital and the calculated MCR from the Internal Model; and
- (c) any triggers for capital management action that are determined in relation to either the capital requirements determined by the Internal Model, the entity(ies) target capital, or multiples thereof.

B7 High-level description

7.1 A high-level description of the Internal Model to provide an overview to a financially literate and insurance knowledgeable person without specialist statistical or actuarial skills. Include a copy of any documents used internally for this purpose. Information provided for this topic should include:

- (a) the nature and purpose of the Internal Model;
- (b) how the Internal Model works (in broad, high-level terms only);

GI IMB Method – Information Required – Part C (Technical)

The usual approach adopted by larger insurers in creating a comprehensive Internal Model of their business is a “Dynamic Financial Analysis” (DFA), which is a projection of the insurer’s financial results over a period of years, using Monte Carlo simulation to allow for the variability of key risk factors. A DFA is usually modular, with each risk dealt with by a separate module that generates, stochastically where appropriate, projected financial and other numeric values.

In order to avoid being too general, this request for information is drawn up in a form that parallels the structure of a typical DFA model by addressing the major risk types in separate sections. That should not be interpreted as a requirement that only DFA models are acceptable. An insurer that wishes to apply for accreditation for a differently-structured model should discuss this with APRA, in order that a request for information in a form appropriate to the proposed Internal Model structure may be agreed.

There are six main risk types envisaged in the request for information. The first three are specific to the insurance industry and may be referred to collectively as ‘Insurance Risk’, while the remaining three are common to all financial institutions:

1. Catastrophe risk
2. Underwriting risk
3. Reserving risk
4. Market risk
5. Credit risk
6. Operational risk

In describing the Internal Model, the following principles should be followed at each part of the modelling hierarchy:

- (a) the description should be sufficiently detailed to allow an experienced modeller to understand the design and specification of the Internal Model and to independently calculate sample results;
- (b) the description of Internal Model structure should be in mathematical terms, not excerpts of computer code, except where such code is easily self-explanatory and concise;

- (c) a detailed itemisation of all parameters to the Internal Model and their values should be provided;
- (d) the process used to choose an Internal Model structure and parameters, including any supporting analysis, should be described;
- (e) the program for ongoing review of assumptions, including frequency, parties involved, sign-off requirements should be described;
- (f) for the most significant stochastic variables, the extent to which the approach has considered and included the need for ‘fat tails’ should be described;
- (g) dependency structures modelled should be described, both between risk categories (e.g. between market and insurance risk) and between components within risk categories (e.g. between asset classes in market risk, between defaults of different counterparties in credit risk, or between claim costs in different lines of insurance business). Particular attention should be given to the treatment of tail dependencies – whether the model makes adequate allowance for things to go bad together.

Descriptions of the Internal Model according to these principles are required at the top level and for each of the six risk types. Section 1 of Part C covers principles of the Internal Model description. The issues identified under sections 2-7 below should be viewed as risk-specific issues that must be covered as part of, or in addition to, the description of that part of the Internal Model.

C1 Principles of internal model description

- 1.1 The insurer should submit a full description of the Internal Model, which incorporates details of:
 - (a) the structure (formulae, distributions, dependencies);
 - (b) parameters and numeric values (such as means or standard deviations);

- (c) data inputs (e.g. claims triangles, investment portfolio listings);
- (d) key outputs (for the purpose of determining the MCR, the relevant outputs are those that determine the capital estimate. However, details should also be supplied regarding outputs that are used for other purposes – this will provide evidence of other Internal Model usage as per section B5);
- (e) level of significance of the final variables included in the Internal Model; and
- (f) correlation matrix of modelled variables.
- (f) process for projecting balance sheet values and profit and loss entries for any accounting entries that are not specifically included in the modelling of the six main risk types (this may include such items as goodwill, fixed assets, amortisation, own capital instruments), and identifying any items (including capital instruments) that are omitted from the projection, with reasons;
- (g) how the proposed capital requirements are determined from the internal model; and
- (h) details of the modelling of dependencies between risk types.

C2 Top-level “corporate” module

2.1 Describe the top-level module, in which projected values from other modules and each risk type are brought together to generate projected corporate financial results. The other modules should be listed, but do not give detail on them in this section.

The Internal Model description for this module should include:

- (a) modelling of income tax obligations (other taxes, charges and levies, whether state or federal, may be dealt with at this level, or in one of the other modules, as appropriate);
- (b) modelling of capital management actions, including dividends, interest payments on capital instruments, and conversion of hybrid or contingent capital instruments;
- (c) modelling of investment portfolio turnover and rebalancing;
- (d) modelling of other management actions (e.g. changes to reinsurance in response to events);
- (e) modelling on any expenses not covered in other modules;

If any of these items are covered in modules other than the top-level module, they should be described in that section and cross-referenced here.

In some capital models, there will be no modelling of items (b) or (d). APRA has no view on whether or not these items should be included in the model, but any such items must be clearly explained.

C3 Insurance business segmentation

3.1 Explain how the insurance business has been segmented for modelling purposes. Give reasons for both the make up of each segment where it is not a single and clear business line and the level of detail at which the business is modelled. Explain the approach taken to choosing which segments are either not modelled, or which are not modelled in detail, and the approach taken for those segments.

Issues specific to the six main risk types are covered in the following sections 4-7.

C4 Insurance risk

The Internal Model description should cover the following risks within this risk area:

4.1 Catastrophe risk

This is the risk of claims arising from catastrophes occurring after the balance date.

- 4.1.1 List all catastrophe models that are external to the main model, providing details of the model vendors (where external), and the focus and coverage of the models. APRA is aware that, for many catastrophe models, full model specification is unavailable due to model vendors' wish to safeguard their intellectual property. In such cases, the applicant should provide full details of the nature of the data files provided by the catastrophe model, and how those files are used to simulate catastrophe claims within the model. Sufficient information regarding modelled distributions of losses from different types of catastrophes, and how these are distributed between business segments, should be provided to give a good idea of the impact each catastrophe risk source has on the model's results. The applicant should clearly indicate the extent to which any parameters or other inputs provided by it impact the values in the files provided by the catastrophe models to the capital model.
- 4.1.2 The model description should include the treatment of catastrophe reinsurance, an explanation of how the risk of multiple events is modelled, and the approach to, and costs of, reinstatement of reinsurance cover after a catastrophe. The treatment of catastrophe reinsurance should indicate any adjustments that are modelled to the catastrophe cover over the second year of the projection, as the exposure gradually declines through that year (premium writing having ceased at the end of the first year).

The applicant must give APRA the authority to communicate directly with the relevant external vendor(s), generally reinsurance brokers or catastrophe modelling companies, to obtain information about the catastrophe models and their implementation for the applicant.

4.2 Underwriting risk

This is the risk that future exposures will be loss making. It includes risk from unearned premiums.

- 4.2.1 The Internal Model description should include a description of the modelling of premiums, including any stochastic modelling of a 'premium cycle' if relevant, and the process for transforming written premiums into a pattern of paid and/or earned premiums.
- 4.2.2 If separate models are used for 'large' versus 'attritional' claims in some cases, the model description should cover both of these, making clear for which business segments this split is used and how the split is made (cut-off points, process for separating data and estimating parameters for truncated distributions, etc).
- 4.2.3 The description should include treatment of the non-catastrophe elements of the reinsurance programme (including any adjustments applied for the second year of exposure, as for catastrophe reinsurance), as well as commissions, expenses and any other underwriting items. The catastrophe and non-catastrophe elements of the reinsurance programme may be described in a single combined section if the applicant believes that will enable a more logical presentation.

4.3 Reserving risk

This is the risk that provisions for past exposures will be inadequate to meet the ultimate costs when the business is run off to extinction.

- 4.3.1 The internal model description should explain:
- (a) how run-off outcomes different from the held provisions are generated;

- (b) the way 'systemic' issues such as superimposed inflation and economic conditions are treated;
- (c) how premium-related and claim-handling expenses are modelled; and
- (d) how the reinsurance program and its impact is modelled.
- (f) whether the effects of active investment management, if present, are modelled and if so, how; and
- (g) whether liquidity risk is modelled and, if not, what measures are in place to ensure that the risk of liquidity problems causing losses or impeding the ability to operate is negligible. If liquidity risk is not modelled, describe how it has been captured by the ESG.

C5 Market risk

The part of the internal model used to generate market rate scenarios (investment asset returns, interest rates, inflation rates, foreign exchange rates and in some cases credit spread curves for standard rating bands) is referred to here as the Economic Scenario Generator (ESG).

- 5.1 Applicants should indicate whether their ESG is supplied by the same source (which may be in-house) as the main part of the Internal Model and, if not, provide information about the ESG supplier.
- 5.2 The ESG model should be fully described according to the principles outlined in C1 above. Particular items that should be covered in the applicant's description of Market Risk are:
 - (a) whether the model aims to reflect risk-neutral or "real-world" probabilities. If risk-neutral, explain how the generated rates are adjusted to create real world distributions of loss in the internal model;
 - (b) if the ESG generates more than one indicator of inflation per currency, please specify each indicator;
 - (c) whether the same sets of simulated foreign exchange rates are used for modelling both liabilities and assets;
 - (d) whether credit risk on investments such as corporate bonds is modelled as part of market risk;
 - (e) dependencies among the variables produced by the ESG;

C6 Credit risk

- 6.1 Applicants should indicate for which assets the credit risk is assessed by a specific credit risk part of the internal model, and for which assets it is included as part of market risk.

Credit risk of reinsurance claims (existing and potential future), premium debtors and derivative counterparties should be explicitly covered, but it is not essential to use the same methodology for each of these risks. Dependencies between defaults of reinsurers will be important.
- 6.2 For assets other than those whose credit risk is assessed as part of market risk, the internal model description should include:
 - (a) means of simulating default losses;
 - (b) description of whether, and if so how, the credit model addresses losses from causes other than default (e.g. credit rating migration or alteration in spreads); and
 - (c) identification of any assets, guarantees or other exposures for which credit risk is treated as immaterial, or otherwise not included in the calculation of capital requirements.
- 6.3 Applicants should specifically indicate whether they at any time have exposure to credit risk through credit derivatives and if so demonstrate how the risk of such activities is covered within the internal model.

C7 Operational risk

- 7.1 Provide a self assessment of the treatment of operational risk in the insurer's RMF. Describe how the operational risk module of the ECM is integrated with the treatment of operational risks under the RMF.
- 7.2 Link the operational risk module to the insurer's Risk Register, in order to explain the manner and extent to which each Risk Issue is captured in the ECM.
- 7.3 Document the coverage of operational event types, consistent with the event type categories in Attachment E of Prudential Standard APS 115 Capital Adequacy: Advanced Measurement Approaches to Operational Risk. Outline the coverage of both the expected (high frequency low impact) and unexpected (low frequency high impact) exposures. Where the risk exposures are already covered as other risk types in the ECM, document these overlaps as a basis for exclusion from the operational risk model.
- 7.4 Describe the use of the four data elements specified in GPS 113 paragraph 21. This should include:
 - (a) Documentation of the system used to record internal operational risk data. Describe the process for updating this system and the extent to which historical data in the system is regarded as reliable. Provide a copy of the current contents of this system.
 - (b) The use of external event data in considering operational risk. Specify any external data sources that the insurer subscribes to.
 - (c) The use of scenario analysis or expert judgment in determining the structure and parameters of the operational risk module, including the sources, elicitation process, challenge and validation processes, and results.
- (d) Consideration of business environment and internal control factors, including their links to the insurer's operational risk profile, and how they may be used to monitor changes in the level of operational risk within the organisation.
- (e) Justify the relative influence of each data element on the current capital estimate, and describe how the inclusion and weighting of each element in the model may change in the future.
- 7.5 In case insurance protection is considered as a mitigant against operational risk regulatory capital, the conditions and allowable degree of mitigation need to be agreed by APRA. Describe the risk mitigants intended to be used by the insurer with reference to the criteria outlined in GPG113 paragraph 101.
- 7.6 Detail any dependence assumptions used within the operational risk module, and between operational risk and the other risk types. Validate the dependence assumptions using appropriate quantitative and qualitative techniques, and assess the level of uncertainty surrounding the dependence assumptions.
- 7.7 Conduct an assessment of the model uncertainty in the operational risk module. This should include the following:
 - (a) Acknowledge all assumptions, choices and parameters, implicit or explicit in the operational risk model, and their limitations.
 - (b) This includes demonstrating that the insurer has considered a sufficiently comprehensive set of alternatives for each modelling choice, assumption and parameter. This may be supported by academic research and industry practice.
 - (c) Support the criteria used for selecting the most appropriate alternative for each modelling choice, assumption and parameter.

- (d) Identify, assess and document all residual model risks, as well as the corresponding sensitivity of the operational risk regulatory capital.
- (e) Indicate where conservatism has been applied to the model inputs, outputs and/or calculation, commensurate with the model risks and sensitivity outlined in 7.7(d).

C8 Dependencies

The nature of a DFA model is that risks are modelled simultaneously. The consequence of this is that risks are modelled as independent except where explicit dependency structures are established. Because of the danger to insurers from multiple risk types causing losses that lead to financial distress, APRA will be paying close attention to all implicit assumptions of independence that are embedded in the model. Applicants should show that they have considered all combinations of risk types and ensured that independence has been assumed (whether implicitly or explicitly) only where there is robust evidence to support that assumption. This covers dependencies:

- (a) within risks, such as between insurance classes or investment asset classes;
- (b) between different aspects of the same risk, such as between run-off performance and underwriting performance, or between large and attritional claims; and
- (c) between risks, such as between insurance and operational, or market and credit.

C9 Reconciliation to business plans

- 9.1 Detail the process by which the results of the Internal Model are reconciled to business plans, and what type of model result is reconciled (e.g. midpoints such as mean or median, or some other statistic);
- 9.2 Provide results of the reconciliation to business plan, including resolution of any anomalies, explanation of significant differences and evidence of sign-off at an appropriate level;

- 9.3 Detail process and results of any other reconciliations that are performed between internal model outputs and values from other sources. (e.g. reconciliation of model's 75th percentile claims outcomes to Liability Valuations).

C10 Internal model outputs

In assessing the suitability of the Internal Model, APRA will need to examine a variety of outputs from the Internal Model, in different levels of detail. It is likely that during the process APRA may request further outputs or different forms of presentation. Appendix 2 outlines a minimum set of standard outputs that will be required from all applicants.

C11 Business segment example

- 11.1 For one representative business segment, include more detailed documentation of the analysis used to derive assumptions, intermediate workings and internal model outputs to enable a detailed review.

C12 Validation and sensitivity testing

- 12.1 For internally sourced data, provide information on the reconciliation process used to ensure the accuracy of input data and its accurate transfer into the Internal Model.
- 12.2 Describe the testing performed to ensure that internal model outputs are reasonable, accurate, appropriate and comprehensive.
- 12.3 Provide a description of any Internal Model limitations or shortcomings identified during the validation process and the steps taken to address these.
- 12.4 Describe the process used to demonstrate the appropriateness of Internal Model structure and parameters e.g. sensitivity analysis.
- 12.5 List parameters or other inputs that, given a small move, may cause a significant change in the capital requirement. For each one, discuss the choice made in the light of this sensitivity.

- 12.6 List structural assumptions, such as choice of distributions or dependencies, for which the insurer is aware that making a different but still reasonable choice may cause a significant change in the capital requirement. For each one, discuss the choice made in the light of this sensitivity.
- 12.7 Provide details of any comparison models used to validate the code and mathematics of the Internal Model being accredited. Identify tolerance levels used in assessing accuracy of the internal model.
- 12.8 Document the mechanisms for reporting validation results to the appropriate levels of authority.

C13 Limitations, deficiencies and development plans

- 13.1 Describe the important limitations and deficiencies in the Internal Model and the capital modelling process. Explain the implications of these and any control systems that exist to deal with them.
- 13.2 If there are plans (even indicative) for development, please outline the content and status of these plans.

Appendix 2

Standard outputs

This Appendix describes the outputs from the RCM that should be included in Part C of an insurer's application for using the Internal Model-based Method (IMB Method) and also in the annual Internal Model Report. They are divided into the following groups:

1. Reporting MCR
2. Worst case simulations by risk and overall loss
3. Reporting by risk
4. Insurance risk reporting by segment
5. Market risk reporting

All outputs should be provided in spreadsheet form, to facilitate analysis.

Additional outputs may be required, as advised by APRA.

Group 1 – Percentiles of capital base deterioration

For each applicant (whether group or licensed entity), provide a table that shows the following percentiles of deterioration of capital base⁵: 99.9, 99.5, 99.0, 98.5, 98.0, 97.5, 95.0, 90.0. The calculation of these percentiles should be based on an assumed initial capital base equal to the Minimum Capital Requirement (MCR) arising from the RCM. Note that the 99.5th percentile would be expected to be approximately the same as the MCR.

Group 2 – Worst case simulations by risk and overall loss

Provide a table of the simulations generating the 1% largest deteriorations in capital base, showing for each included simulation the dollar contribution of each risk to the deterioration.

Describe the process for determining the contribution of each risk to the overall deterioration, i.e. which P&L items are included for each risk, and any adjustments made.

APRA's preference is for the modelling used to produce the simulations reported under this section to commence with capital base equal to the MCR, as in Group 1 above. However, alternatives providing an approximation to this may be used, provided they are explained.

APRA may request additional sets of simulations relating to worst cases for specific risks.

Standard Outputs for Distributions and Dependencies

For important outputs APRA will be seeking an understanding of the statistical distribution of those outputs, and dependencies between outputs.

Distributions

For distributions, measures of central tendency, dispersion and distribution shape are needed, with a particular focus on indicators of the fatness of tail of the distribution. With that in mind, APRA requests provision of a 'distribution table' for any output or other variable for which distribution information is requested.

This table comprises the following items:

mean, standard deviation, skewness coefficient;

percentiles 0.1%, 0.5%, 1%, 5%, 10%, 25%, 50%, 75%, 90%, 95%, 99%, 99.5%, 99.9%.

Additional information may be requested for any output for which more detailed distribution information than is provided by the above table is considered necessary.

Dependencies

APRA prefers to test dependencies between model outputs rather than input dependency assumptions, because of the complexity of interactions and the variety of modelling approaches.

Correlation coefficients are helpful overall indicators of broad dependency, but additional information is needed about the level of dependency in the tails of distributions.

⁵ Capital base as defined in GPS 112. Approximations or reasonable proxies for change in capital base may be used to simplify the calculations, provided they are clearly explained.

Dependency information should be provided for a number of lists ('vectors') of outputs for which dependencies (between items within a list) are of interest. An example vector might be the reserving profits for all reporting segments. For each vector, the minimum information required is a 'dependency table' consisting of three matrices, which will each be of order $n \times n$ for a vector of length n :

- correlation coefficients (specify whether linear or rank; either is acceptable)

- 10% tail dependency coefficients

- 1% tail dependency coefficients

Here, an $\alpha\%$ tail dependency coefficient for two outputs X and Y means:

$\Pr(Y > Y_\alpha \mid X > X_\alpha)$, where X_α and Y_α are the α -th percentiles of the marginal distribution of X .

Note that $\Pr(Y > Y_\alpha \mid X > X_\alpha)$ is the same as $\Pr(X > X_\alpha \mid Y > Y_\alpha)$, so the three matrices are all symmetric. Hence it is only necessary to provide the upper right or lower left triangle of each matrix.

The above is appropriate for outputs such as claims, for which upper tail values stress the insurer. For outputs for which lower tail values stress the insurer, such as investment returns or insurance results, the negative of the output should be used in the dependency table, in order to focus on stressed rather than unstressed tails of distributions.

The reporting guidelines below identify vectors for which dependency tables are requested. Dependency tables for additional vectors are likely to be requested by APRA, based on the nature of the applicant's model.

APRA acknowledges that significant processing is involved in populating the two tail-dependency tables, requiring a sort across all simulations for each element of each vector. In many cases strategies will need to be pursued to keep both the amount of processing and the volume of data submitted to APRA manageable. Those strategies are likely to be dependent on the nature of the insurer's model and hence will need to be discussed and agreed with APRA on a bilateral basis.

Processing for the correlation tables is more straightforward, but the tables may be large and unwieldy if the insurer uses a large number of reporting segments (see Group 4 below). Insurers with large numbers of business segments should devise, in consultation with APRA, a coarser, yet still informative, partition of their business for reporting purposes that will keep reporting files manageable.

Group 3 – Reporting by risk

For the six required risks identified in paragraph 17 of GPS 113⁶, and any other risks modelled, include:

- A distribution table for each risk's contribution to the insurer's modelled change in capital base⁷;

- A dependency table for the vector comprising these contributions; and

- A table showing the component of the calculated Minimum Capital Requirement (MCR) attributable to this risk, together with an explanation of the basis of attribution. Where the applicant is a group, this table would ideally show the split between components for each division, as well as for the group as a whole. A 'division' here means a large, identifiable component of the group. This table will be most useful if the split comprises no more than ten divisions.

Group 4 – Insurance risk reporting by segment

This part of the reporting is intended to provide information about the modelling of insurance risk at a level of granularity sufficiently fine to enable meaningful analysis of smaller, fairly homogeneous books of insurance business.

Reporting Segments

APRA envisages that the insurance elements of most models would be built up from a moderate to large number of business segments (20 to 100 or more), each of which has a separate underwriting module. These segments would typically be classes or groups of classes within major business units.

⁶ catastrophe risk, underwriting risk, reserving risk, market risk, credit risk and operational risk, subject to any amalgamation of these for reporting purposes that has been agreed with APRA.

⁷ or an approximation or proxy to/for that, as discussed in the section on Group 2 reporting.

The insurer may report to APRA in accordance with this section for all of the business segments, or it may choose to combine small business segments with each other or with larger, similar business segments. We refer to the sub-divisions of the business for which standard outputs are separately provided as 'reporting segments'.

The partition of the insurer's business into reporting segments may be the same as the partition into 'business segments' used for modelling (see GPS 113 paragraph 22, but need not be. An insurer with a large number of business segments may wish to group these into a coarser partition of reporting segments, in order to keep the processing required for reporting, and the size of the output files generated, at a manageable level.

APRA prefers there to be a reasonable alignment of the reporting segments with APRA classes for business in Australia, and by geographic region for international business. 'Reasonable alignment' does not imply a one-for-one match, but the insurer should provide a mapping of the reporting segments to APRA classes, together with assistance in understanding the comparability of overseas geographic reporting segments. Preferably the insurer should avoid combining classes that have different Prescribed Method insurance risk capital charges (as per GPS 115) into a single reporting segment, subject to materiality.

It will be helpful if an insurer can submit a map of the proposed partition of its business into reporting segments, with indicative earned premium and outstanding claim numbers for each segment, at an early stage. The sheet labelled "4. Rep Segments" in the attached reporting template could be used for this purpose. APRA will review the map prior to submission of the detailed information to reduce the risk of needing to do rework.

Underwriting and Reserving Risks

For underwriting and reserving risk, distribution tables should be provided for 'key indicators' of losses arising from those risks in each reporting segment and for the applicant (licensed insurer or group) as a whole. This section discusses what those key indicators should be. Each key indicator should be reported both as a dollar figure and as a ratio to some 'base for standardising'.

Where the base is itself stochastic (e.g. for underwriting risk where premium is modelled using a stochastic rating cycle and/or adjusted for stochastic inflation), the ratio part of the distribution tables should be for the ratio of the stochastic key indicator to the stochastic base, not the ratio of the stochastic key indicator to the expected value of the base. Where the base is known (e.g. for reserving risk if the base is the reserve at balance date), there is no difference between these two. In any case, the expected value of the base should also be reported for every reporting segment.

Dependency tables will also be required for the following vectors:

- Ratio of key indicator to base for underwriting risk, by reporting segment

- Ratio of key indicator to base for reserving risk, by reporting segment

Should underwriting be combined with catastrophe or separate?

While all models will give some separate consideration to catastrophe claims (across classes) the delineation between catastrophe and other underwriting is arbitrary, and for some purposes not very meaningful. Two main alternatives present themselves:

- Segment reporting for Underwriting Risk to combine attritional, large and catastrophe claims (catastrophe after attribution to reporting segments), with the consideration of the catastrophe modelling and underwriting volatility supplemented by study of inputs; or

- Segment reporting to be provided for Catastrophe Risk (in total and by reporting segment) and for other Underwriting (by segment).

APRA will probably accept either approach, provided the approach used is consistent with the underlying modelling structure.

For the sake of simplicity the remainder of this Appendix assumes the first option.

Underwriting risk

For underwriting risk, APRA's preferred key indicator is inflated undiscounted net claims, with net earned premium (written premium in an underwriting year model) used as a base for standardising. There are other possibilities for key indicator, including underwriting result (i.e. including expenses and commission), and use of discounted values. In an accident year model the claims included in this calculation should be those relating to the premium earned after the balance date in the projection, after running off the claims to ultimate. In an underwriting year model the included claims will be those arising from business written after the balance date in the projection.

Reserving risk

For reserving risk, APRA's preferred key indicator is the net profit (loss if negative) from the central estimate at balance date of outstanding claims, after run off to ultimate, measured on a net inflated undiscounted basis, with the net, inflated, undiscounted, central estimate reserve at balance date used as a base for standardising. Other possibilities for key indicator might be to include claims handling expenses, measure on a discounted basis, and include risk margin in the opening balance.

In an accident year model, the reserving risk will relate only to the outstanding claims at the balance date. In an underwriting year model, however, the reserving risk may relate to both the outstanding claims and the premium liabilities (unearned premium) at the balance date. If this is the case, care will be needed to clearly articulate the way in which the premium liabilities part is modelled, including the way catastrophe risk is treated.

Alternative definitions of key indicator

Different definitions of the key indicators and bases for standardising for underwriting and reserving risk may be used (as per the alternatives canvassed above, or other approaches agreed with APRA) provided that:

- the definition of each key indicator and base is clearly stated;
- the definition is consistent with the way the insurer manages its business; and

- the insurer uses the definition consistently across all parts of the model.

Group 5 – Market Risk Reporting

APRA's main assessment of the treatment of market risk is likely to be based on the input assumptions for the Economic Scenario Generator, rather than standard outputs from the overall RCM.

Distribution tables should be provided for the following key indicators for each currency in which the insurer has significant asset or liability exposures:

annualised cumulative equity return, cash return, bond return (for a bond portfolio that models the credit quality, diversification, duration and other key characteristics of the insurer's typical bond holdings), wage and price inflation and currency return (currency return is the percentage change in the AUD price of one unit of this currency) over the first 1, 3 and 5 years of the projection;

short rate, three year bond yield and 10-year bond yield (specifying in each case whether the modelled rate is government, swap/LIBOR or other) after 0, 1, 3 and 5 years;

Dependency tables should be provided for the following vectors:

equity return, cash return, bond return, wage and price inflation and currency return over the first year of the projection, for each currency in which the insurer has significant asset or liability exposures⁸;

annualised cumulative equity return, cash return, bond return, wage and price inflation and currency return over the first five years of the projection;

short rate, three year bond yield and 10-year bond yield (specifying in each case whether the modelled rate is government, swap/LIBOR or other) after one year;

short rate, three year bond yield and 10-year bond yield after three years.

⁸ For all these dependency tables, values from all currencies should be in the same table, not a separate table for each currency, thereby enabling observation of cross-currency dependencies.

The insurer's assets and liabilities in each currency at the balance date should also be reported, to enable an assessment of the relative importance of the different currencies' distributions, together with the effect of any hedge that increases or decreases the exposure to that currency.

Parts of the above outputs that are not used by the RCM may be omitted, provided an explanation of the omission is provided. For example:

If the model assumes that, at the commencement of run-off (one year after balance date), all shares and are sold and investments are restricted to bonds and cash, the parts of distribution tables and dependency tables relating to share returns over periods beyond one year may be omitted.

If the insurer has assets and liabilities in a foreign currency but no shares, the parts of distribution tables and dependency tables relating to share returns in that foreign currency may be omitted.

APRA may also request a spreadsheet with, say, 1,000 simulations from the ESG.

Credit and Operational Risk

No standard form of detailed reporting is prescribed for these risks, due to the wide variety of possible approaches to modelling. Insurers should consult with APRA to determine what reporting to provide.

Reporting template

A template for reporting in accordance with this appendix is available from APRA on request.



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