BANK NEGARA MALAYSIA
CENTRAL BANK OF MALAYSIA

Stress Testing

Applicable to:
1. Licensed insurers
2. Licensed takaful operators
3. Licensed professional reinsurers
4. Licensed professional retakaful operators

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PART A OVERVIEW

1 Introduction

1.1 Stress testing is a risk management tool used for assessing the financial strength of a licensed person and the impact on the licensed person's solvency and profitability of a particular defined set of alternative assumptions with outcomes that are adverse but plausible.

1.2 The policy objective of this policy document is to provide standards and guidance for the insurance and takaful industry in conducting stress testing to support a licensed person's risk and capital management. Stress testing by licensed persons also forms part of the Bank's supervisory framework and monitoring of risks in the financial system.

1.3 This policy document sets out the following:
(a) key principles that licensed persons have to observe when conducting stress testing;
(b) requirements for conducting stress testing under both internally developed scenarios and scenarios specified by the Bank; and
(c) requirements for the governance and documentation of the stress testing programme.

2 Applicability

2.1 This policy document is applicable to licensed insurers, licensed takaful operators, licensed professional reinsurers and licensed professional retakaful operators.

3 Legal provisions

3.1 The requirements in this policy document are specified pursuant to-
(a) sections 47(1) and 143(2) of the Financial Services Act 2013 (FSA); and
(b) sections 57(1) and 155(2) of the Islamic Financial Services Act 2013 (IFSA).

3.2 The guidance in this policy document is issued pursuant to section 266 FSA and section 277 of the IFSA.

4 Effective date

4.1 This policy document comes into effect on 1 September 2016.

5 Interpretation

5.1 The terms and expressions used in this policy document shall have the same meanings assigned to them in the FSA and IFSA, as the case may be, unless otherwise defined in this policy document.

5.2 For the purpose of this policy document-

"**S**" denotes a standard, an obligation, a requirement, specification, direction, condition and any interpretative, supplemental and transitional provisions that must be complied with. Non-compliance may result in enforcement action;

"**G**" denotes guidance which may consist of statements or information intended to promote common understanding and advice or recommendations that are encouraged to be adopted;

"board" means the board of directors of a licensed person, or a committee of the board where the responsibilities of the board set out in this policy document have been delegated to such committee;

"internally developed scenarios" means a set of stress scenarios that are developed by a licensed person;

"licensed person" collectively refers to-
(a) a licensed insurer;
(b) a licensed takaful operator;
(c) a professional reinsurer; and
(d) a professional retakaful operator;
unless otherwise specified;

"specified scenarios" means a set of stress scenarios as the Bank may specify from time to time to be tested on a licensed person's capital adequacy and financial positions; and

"senior management" means the chief executive officer and senior officers of a licensed person.

6 Related legal instruments and policy documents

6.1 This policy document must be read together with other relevant legal instruments and policy documents that have been issued by the Bank, in particular-
(a) BNM/RH/GL/004-24 *Risk-Based Capital Framework for Insurers [Version 3.0]* issued on 20 June 2013;
(b) BNM/RH/GL/003-23 *Risk-Based Capital Framework for Takaful Operators* issued on 26 June 2013;
(c) BNM/RH/GL/003-29 *Guidelines on Internal Capital Adequacy Assessment Process (ICAAP) for Insurers* issued on 22 February 2012;
(d) BNM/RH/PD/033-2 *Internal Capital Adequacy Assessment Process for Takaful Operators* issued on 15 April 2016;
(e) BNM/RH/GL/013-5 *Risk Governance* issued on 1 March 2013; and
(f) BNM/RH/GL/003-17 *Financial Condition Report* issued on 30 December 2015.

7 Policy documents superseded

7.1 This policy document supersedes-

(a) BNM/RH/GL/003-23 *Guideline on Stress Testing for Insurers* issued on 11 December 2007; and

(b) BNM/RH/GL/004-16 *Guideline on Stress Testing for Takaful Operators* issued on 11 December 2007.

PART B CONDUCT OF STRESS TESTING

8 General requirements for conduct of stress testing

S 8.1 Stress testing shall form an integral part of the licensed person's internal capital management framework[1], risk management framework[2] and assessment of threats to its financial condition[3].

S 8.2 A licensed person is required to conduct stress testing based on its own internally developed scenarios for the following purposes:

(a) setting of an individual target capital level (ITCL) that is consistent with the overall risk tolerance and appetite set by the board, its own risk profile and risk management practices;

(b) assessment on its overall capital adequacy and evaluation on the appropriateness of its capital thresholds and corrective actions for maintaining adequate capital levels;

(c) assessment on threats to its financial condition and the impact of associated risk mitigation measures and management actions; and

(d) as an essential part in the development of its risk management framework and risk culture with results of stress testing to be integrated into its decision making.

S 8.3 In addition to conducting stress testing based on the licensed person's internally developed scenarios, the licensed person are required to conduct stress testing based on the Bank's specified scenarios in accordance with paragraphs 12.1 to 12.3 of this policy document.

Sensitivity testing and scenario testing

G 8.4 Stress testing is primarily used to determine the impact of risk factors or events on the financial condition of a licensed person.

G 8.5 The two general approaches to stress testing are sensitivity analysis and scenario analysis. Sensitivity analysis estimates the impact arising from assumed movements in a single risk factor or several closely related risk factors while scenario analysis contains simultaneous movements in a number of risk factors.

[1] BNM/RH/GL/003-29 "Guidelines on Internal Capital Adequacy Assessment Process (ICAAP) for Insurers" and BNM/RH/PD/033-2 "Internal Capital Adequacy Assessment Process for Takaful Operators" require the use of stress testing to determine a licensed person's individual target capital level (ITCL) and for the assessment of a sound capital management strategy.

[2] Paragraph 29 of policy document BNM/RH/GL 013-5 "Risk Governance" requires stress testing to be performed as part of a licensed person's risk management framework.

[3] Paragraph 12.1 of policy document BNM/RH/GL 003-17 "Financial Conditional Report" requires the appointed actuary to provide in the FCR, an opinion on the adequacy of the licensed person's capital position by conducting multi-period stress testing. .

Reverse stress testing

G 8.6 Stress testing can also be used to determine the scenarios which could give rise to a pre-defined adverse outcome, such as breaching a capital or earnings threshold, thereby allowing key vulnerabilities to be identified. This approach to stress testing is also referred to as reverse stress testing.

G 8.7 Reverse stress testing commences from a known adverse outcome and deduces the possible different forward looking scenarios that could lead to such an outcome for a licensed person. The focus of reverse stress testing is on the appropriateness of management actions rather than the assessment of financial adequacy. Therefore, reverse stress testing may be qualitative in nature although a sound understanding of associated risks and financial interactions are needed to assess the impact of appropriate management actions.

G 8.8 Reverse stress testing may supplement conventional quantitative models which are based on historical data and known experiences in the identification of "tail" risks and help uncover hidden vulnerabilities and interactions among risks relevant to a licensed person.

9 Key principles for conduct of stress testing

Rigorous and forward looking

S 9.1 A licensed person must conduct stress testing that is rigorous and forward looking.

S 9.2 A rigorous stress test is one which must identify a range of possible scenarios, the occurrence of which would have a material adverse impact on the licensed person's capital adequacy and financial positions.

S 9.3 A forward looking stress test must incorporate potential changes to the operating environment and the licensed person's risk profile, which are not necessarily covered by historical scenarios.

Comprehensive coverage and scope

S 9.4 A licensed person must ensure that the coverage and scope of its stress testing are sufficiently comprehensive to cover all risks that could have a material impact to its solvency and profitability as well as achievement of its business objectives.

S 9.5 To achieve comprehensive coverage, the licensed person must apply multiple approaches and a range of techniques in conducting stress testing, including quantitative and qualitative techniques to support and complement the use of models, where appropriate.

G 9.6 Stress testing approaches adopted by the licensed person may range from less complex sensitivity analyses based on changes in particular risk factors

to more complex scenario analyses that revalue portfolios taking into account interactions between risk factors which are conditional on the stress event.

S 9.7 The licensed person's assessment of material risks must include at least the following major risk categories:
(a) market risk;
(b) liquidity risk:
(c) credit risk;
(d) insurance risk;
(e) operational risk;
(f) financial group risk; and
(g) specifically for licensed takaful operators, shariah non-compliance risk and specific risks arising from takaful operational models.

G 9.8 Appendix 1 sets out guidance on the major risk categories and examples of the risk factors for each of the risk categories.

Risk concentrations and risk interactions

S 9.9 A licensed person must identify and appropriately reflect concentrations and interactions between risk factors within the stress scenarios.

G 9.10 Concentration risk is a risk of increased exposure to losses arising from undertaking risks that have common underlying risk drivers. Examples of concentration risk include loss from a single large event or a series of events, over-reliance on a small number of reinsurers or retakaful operators and large exposures to a small number of asset classes, instruments or counterparties.

S 9.11 A licensed person must assess the risk of concentrations and reflect them in stress testing by aggregating risks across various dimensions such as products, lines of business, counterparties, sectors and geographical areas.

G 9.12 Risk interactions arise from multiple direct interactions of risk factors within a scenario, increase in correlation between the risks under a stressed condition and second round effects which occur as consequences from the primary shocks. The overall impact of a stress scenario may exceed the initial impact from the primary shocks when taking into account risk interactions.

G 9.13 The assessment of impact arising from risk interactions may require an analysis of the correlation and multi-correlation between the risk factors within a stress scenario.

Risk mitigation measures

S 9.14 A licensed person must ensure that the impact of stress testing accurately reflects the effectiveness of its risk mitigation measures in a particular adverse scenario.

S 9.15 Where the risk mitigation measures applied by the licensed person are not expected to be as effective under the particular adverse scenario being

considered as compared to normal operating conditions, the impact of that scenario must be increased accordingly by the licensed person. For example, in a major catastrophe that results in the failure of a number of reinsurers, licensed insurers might not be able to obtain reinsurance recoveries and could be exposed to gross claim amounts.

G 9.16 Risk mitigation measures applied by the licensed person may include policies and procedures in place for avoidance, acceptance, control and transfer of risks.

Management actions

S 9.17 Where management actions are taken into account in response to stress scenarios, a licensed person must ensure that the management actions considered are objective and realistic.

G 9.18 Management actions are potential future actions that the licensed person would be reasonably expected to take in response to an adverse scenario for the purposes of restoring its financial position or adjusting its risk profile.

G 9.19 Examples of management actions include capital injection, provision of *qard*, changes in asset allocation, reduction in bonus rates for participating policies, retention of surplus in the insurance fund or Participants' Risk Fund, discontinuance of a product line, changes in product mix, increase in premium or contribution rates and revision of expense charges or *wakalah* fees.

S 9.20 For management actions to be objective and realistic, the following principles must be taken into consideration by the licensed person:

(a) the management actions and specific circumstances under which each of the management action would be taken must already be defined in policies approved by the relevant approving authorities of the licensed person;

(b) the licensed person has the required financial and operational resources to take the management actions;

(c) the management actions must be realistic in the context of the scenarios considered and have due regard to management actions actually taken in the past, including the impact of such actions; and

(d) the management actions must not be constrained by any legal, regulatory or market restrictions.

S 9.21 In quantifying the impact of management actions, the licensed person must take into consideration the following factors:

(a) the estimated time required for the management actions to take full effect;

(b) consistency and interactions with other assumptions and risk factors within the scenario;

(c) any second round effects resulting from the management actions, including reactions of policyholders or takaful participants; and

(d) costs associated with the management actions.

S 9.22 In scenarios where management actions are considered, the licensed person must also quantify the impact of the stress testing without the application of the management actions.

Data quality and availability

S 9.23 A licensed person must ensure that data used in any part of the stress testing programme is credible, accurate and complete.

G 9.24 The establishment of policies and procedures by the licensed person for ensuring the credibility, accuracy and completeness of data used in stress testing are important for the reliability and usefulness of the stress testing results in supporting the licensed person's risk and capital management objectives.

S 9.25 Where available data is not sufficiently credible, accurate or complete for the scope of the stress testing, the licensed person must make appropriate adjustments to the data or the models and assumptions to ensure that the reliability of the stress testing is maintained.

Modelling techniques

S 9.26 A licensed person must adopt modelling techniques that are appropriate to the nature, scale and complexity of its risk profile.

S 9.27 The types and complexity of the stress testing models adopted by the licensed person must be adequate to capture the risk characteristics of its business and fit for purpose.

G 9.28 The stress testing model may be deterministic, stochastic or a combination of both. The choice of model should reflect the complexity of the relationship between the risks and their impact to the licensed person’s financial condition.

G 9.29 A more complex model may be needed for dynamic scenarios that include feedback loops such as actions of management and policyholders or takaful participants.

S 9.30 A licensed person must support its use of models with robust processes for managing model risk to ensure that the model remains relevant and updated. This includes establishing access controls and limits, monitoring model performance, conducting regular reasonableness checks and making independent model validations.

G 9.31 Reasonableness checks referred to in paragraph 9.30 may include back testing of the models’ output or conducting sensitivity tests to assess the relativities of the models’ output under various scenarios.

S 9.32 Where external models or sub-models by a third-party are used for stress testing, the licensed person must be able to demonstrate a thorough

understanding of the external models adopted, which includes the following:

(a) how risk estimates used in the external models are derived and validated;

(b) methodological underpinnings and the basic construction of the external models, including an understanding of the models' capabilities, limitations and appropriateness of the use in developing the stress testing estimates; and

(c) rationale behind any adjustment made to the external models' input data sets as well as output.

S 9.33 The licensed person must incorporate adequate loadings and risk margins to allow for all sources of uncertainty that may have an impact on the variability of the stress testing results.

G 9.34 Examples of sources of uncertainty include the choice of models adopted, parameterisation of the models, data quality and stochastic error.

10 Projection of base scenario

S 10.1 A licensed person must project a base scenario of its capital adequacy and financial positions with a reference date and projection period that are appropriate for the purpose of its stress testing.

S 10.2 The licensed person must conduct the projection for each fund separately as established and maintained in accordance with section 81 of the FSA for licensed insurers (including professional reinsurers) and section 90 of the IFSA for licensed takaful operators (including professional retakaful operators).

S 10.3 The licensed person must develop the base scenario projection using a set of assumptions representing the best estimate of its future experience.

G 10.4 Best estimate assumptions for the base scenario should include consideration of future business volumes, claims experience, reserves requirements, expenses incurred and investments achieved over the projection period.

S 10.5 The licensed person must ensure that the best estimate assumptions reflect the realistic expectation of its future financial position and must be derived using current, credible and realistic information.

S 10.6 Information used by the licensed person in setting the best estimate assumptions must include its business plan over the projection period and consider external factors affecting the outlook of the business such as economic, political, demographic, social and regulatory changes.

S 10.7 A licensed person must also ensure that the assumptions made in the projections have due regard to its own historical experience. Where the credibility or relevance of the assumptions is affected by a lack of experience, data quality issues or a change in the underlying business, appropriate mitigating actions must be taken by the licensed person including data

adjustments and supplementing the choice of assumptions with appropriate expert judgement and benchmarks.

S 10.8 All underlying assumptions of the base scenario shall be internally consistent. For example, if the projection assumes significant growth in the licensed person's business, the associated costs necessary to achieve the projected level of growth, such as additional capital requirements, expansion of distribution channels and investment in systems must be accounted for.

Additional requirements for base scenario of multi-period stress testing

S 10.9 A licensed person must choose a projection period for multi-period stress testing which is sufficiently long to reflect the time period required to capture the full impact of a stress scenario.

G 10.10 Examples of stress scenarios in paragraph 10.9 are deterioration of mortality experience which may take at least two to three years for the trend to be recognised and a period of prolonged low interest rates where the impact on profitability of the business might emerge over or after a few years.

G 10.11 The projection period for life insurers and family takaful operators may typically lie between 5 and 6 years; while for general insurers and general takaful operators the projection period may typically be between 3 and 4 years.

11 Construction of internally developed scenarios

S 11.1 A licensed person must internally develop at least three stress scenarios with different types or combination of risk factors for purposes of carrying out the stress testing required under paragraph 8.2.

S 11.2 The licensed person must use stress scenarios that are adverse yet plausible such that their occurrence will have a significant negative impact on the licensed person's solvency and profitability.

S 11.3 The licensed person must define the level of severity of the stress scenarios using established risk measures and choose the magnitude of shocks that correspond to the defined level of severity. At a minimum, the level of severity must correspond to the licensed person's risk tolerance levels. As an example, a licensed person with a risk tolerance calibrated for 1-in-100 events over a one-year holding period must ensure that its stress scenarios are no less severe than a 1-in-100 event over a one-year holding period.

G 11.4 Where it is not possible to calibrate the magnitude of a shock to the defined severity level, the licensed person should use approximation methods that are adequately justified.

S 11.5 The licensed person must consider stress scenarios that have an instantaneous impact as well as stress scenarios that have a continuous effect throughout the period of projection.

G 11.6 Examples of stress scenarios referred to in paragraph 11.5 are as follows:

(a) scenarios with instantaneous impact may include sudden unexpected occurrences such as equity market crashes, short term interest rate and spread shocks, natural catastrophes, pandemics, business interruption and major fraud events; while

(b) scenarios with continuous impact may include a permanent change in mortality assumptions or claims experience, a prolonged depressed economic condition and a reputational risk event with a long term impact on the business.

S 11.7 Where the timing of events in a stress scenario has a significant impact on the outcome, the licensed person must choose the timing of shocks occurring during the projection period which result in the most adverse impact.

G 11.8 The licensed person may test the impact of a stress scenario at the end of each quarter during the projection period to assess when the stress scenario has the greatest impact to licensed person's capital adequacy ratio (CAR).

S 11.9 For a stress scenario involving multiple events or risk categories, the licensed person must ensure that the sequence and linkages between the events or risk categories are addressed in a realistic and logical manner in determining how the scenario unfolds.

S 11.10 The licensed person must also consider second round effects that may arise from the primary shocks of the stress scenarios due to dependencies on one or more risk factors. The risks arising from the second round effects could emerge concurrently with the primary shocks or at a later time.

G 11.11 Examples of possible second round effects of a given scenario include:

(a) credit ratings downgrade;
(b) liquidity constraints;
(c) fire sales of assets;
(d) weakened reputation;
(e) increased policyholder lapses and resultant adverse selection;
(f) reduced new business volume;
(g) reduced dividends;
(h) regulatory constraints,
(i) higher cost of capital, and
(j) for licensed takaful operators, insufficiency of Participants' Investment Fund (PIF) to support the Participants' Risk Fund (PRF) under a dripping model.

S 11.12 In developing the stress scenarios, the licensed person must consider internal and external experience, combined with an outlook on potential adverse events in the future. For events that are cyclical in nature, the licensed person must include in its assumptions margins for potential uncertainties in the assessment of the intensity and duration of the cycle.

S 11.13 The licensed person must also consider qualitative and quantitative input from all relevant sources by incorporating information from a wide range of

sources. This entails the licensed person having in place a robust process of eliciting and combining inputs from a range of sources including its various functions and business units, as well as internal and external databases.

Additional guidance on construction of internally developed scenarios for multi-period stress testing

S 11.14 The potential impact of second round effects becomes increasingly important with a longer projection time horizon. Hence, this must be considered carefully in order for a licensed person to fully understand the impact of a shock event over the entire projection period. For example, the second round effects arising from a shock event may include a change in the size and profitability of new business compared with a normal operating environment. In such cases, the base scenario assumptions on new business growth in periods subsequent to the primary shock event will need to be modified accordingly by the licensed person to ensure that the scenario remains appropriate and realistic.

G 11.15 In assessing the impact of management actions within a multi-period scenario, the management actions taken are triggered by the initial shock event based on the conditions prevailing at and information available up to each intermediate time period. Further effects arising from the actions should be reflected by the licensed person in a subsequent time period. This sequence of shocks-actions-effects should then be modelled recursively by the licensed person until the end of the projection period.

12 Conduct of stress testing for specified scenarios

G 12.1 With reference to paragraph 8.3, where a licensed person is required to conduct stress testing based on specified scenarios, the Bank may also specify:

(a) the frequency of the stress testing, including the frequency for any ad-hoc stress testing of the specified scenarios;
(b) the scope of the stress testing, whether applicable to all licensed persons or only a selected group of licensed persons;
(c) the reference date and the projection period of the stress testing;
(d) the methodology in conducting the stress testing;
(e) the detailed stress parameters for each of the specified scenarios and their application; and
(f) the form, manner and timeframe for submission of stress testing results to the Bank.

G 12.2 The specified scenarios will normally be specified by the Bank on an annual basis prior to the end of each calendar year. However, ad-hoc stress testing may also be required for specified scenarios from time to time as part of the Bank's monitoring of risks within the insurance and takaful sectors or across the financial system as a whole.

G 12.3 In general, a licensed person should not use the specified scenarios as internally developed scenarios for the purpose of stress testing conducted

under paragraph 8.2. This is because the specified scenarios are specified for the purposes of the Bank's macro-prudential surveillance activities and might not necessarily reflect the risk profile of licensed persons on an individual basis.

13 Analysis of stress testing results

S 13.1 Stress testing results provide a great deal of information about the risks that a licensed person is facing and the actions that it can take to mitigate those risks. A licensed person must therefore perform appropriate quantitative and qualitative analysis of its stress testing results in order to provide a meaningful understanding of its vulnerabilities and the causes of stress, and robustness of its stress testing approaches and methodologies.

S 13.2 The licensed person must provide analysis of the stress testing results. In the analysis, the licensed person must at the minimum, cover the following areas:

(a) identification of main vulnerable areas;

(b) explanation on key risk factors and drivers that are effecting the vulnerable areas;

(c) assessment of effectiveness and the costs of risk mitigation measures or proposed management actions; and

(d) comparison of actual experience with assumptions made under the projected base scenario from the previous stress testing exercise.

G 13.3 When assessing the effectiveness and the cost of risk mitigation measures or proposed management actions, the licensed person may consider conducting stress testing under multiple scenarios with different types and severities of risks, as well as multiple potential management actions for each scenario. This analysis may enable senior management and the board to decide on an optimal course of action and assist in formulating future risk management as well as business strategies.

G 13.4 The analysis of actual experience referred to in paragraph 13.2(d) may include explanation on any significant deviations from key assumptions made under the projected base scenario in the previous stress testing exercise.

S 13.5 Where the Bank, as part of its supervisory review processes, makes an assessment that a licensed person's conduct of stress testing does not meet the standards specified in this policy document, the licensed person shall make necessary improvements as the Bank may require, including re-running parts or all of the stress tests.

PART C GOVERNANCE AND DOCUMENTATION

14 Responsibilities of Board and Senior Management

S 14.1 The board of a licensed person must be ultimately responsible for the overall stress testing programme of the licensed person and must exercise effective oversight on all aspects of the stress testing programme. At a minimum, the board must be responsible for:

(a) approving policies and key components of the licensed person's stress testing;

(b) ensuring that the licensed person's stress testing approaches and modelling techniques are appropriate and commensurate with its risk profile;

(c) ensuring adequate governance and internal controls are in place with respect to the management of stress testing models;

(d) understanding the underlying assumptions, potential limitations and uncertainties relating to the output of the models and systems which could impair the accuracy of risk estimates and accurate interpretation of the results or outputs of the models;

(e) constructively challenge any management actions that are being considered to ensure that such actions proposed by senior management are objective and realistic;

(f) considering the implication of stress testing results on the licensed person's risk appetite and risk tolerance levels (including risks inherent in the takaful funds for takaful operators); capital and risk management policies; and strategic business decisions; and

(g) commissioning regular independent reviews to be conducted on models used for stress testing activities.

S 14.2 Senior management must be responsible for the effective implementation and management of the stress testing programme as approved by the board. The senior management must ensure that:

(a) the licensed person's conduct of stress testing is in accordance with the requirements set out in this policy document; and

(b) the licensed person's stress testing programme is consistent with its risk profile and supported by adequate risk management practices.

S 14.3 Senior management must ensure that the following are communicated in a clear, comprehensive and timely manner to the board to facilitate their duties as specified in paragraph 14.1:

(a) stress scenarios including detailed parameters used in their construction by the licensed person;

(b) results of the licensed person's stress testing and key areas of vulnerability;

(c) justification on management actions considered in the licensed person's stress testing; and

(d) comparison of emerging experience with scenarios used in previous stress tests by the licensed person and the impact of changes to scenarios.

15 Documentation

S 15.1 The licensed person must retain comprehensive, accurate and up to date documentation on all aspects of its stress testing programme. The licensed person may be required to submit such documentation to the Bank from time to time.

S 15.2 Areas to be documented by the licensed person must include, but are not limited to the following:

(a) policies and procedures of the stress testing programme;
(b) description of material risks;
(c) description of scenarios and reasons for the choices and bases for internally developed scenarios;
(d) detailed assumptions used in the base scenario projection and each of the internally developed scenarios;
(e) detailed stress testing approaches and modelling techniques including management of the models and limitations of model outputs;
(f) summary and analyses of results as specified in paragraph 13.2 including assessment of key vulnerabilities and changes in assumptions based on actual experience;
(g) detailed management actions considered including descriptions of situations that trigger the management actions and their rationale and results of the stress tests with and without the management actions;
(h) deliberation of the stress testing results by the board and senior management including issues raised and recommendations;
(i) constraints on the data and assumptions, and approximations or risk margins applied in addressing these constraints; and
(j) nature and extent of any reliance placed on external parties.

S 15.3 The licensed person shall document the results of its stress testing for each internally developed scenario at least to the level detailed in Appendix 2(A) for licensed insurers (including licensed professional reinsurers) and Appendix 2(B) for licensed takaful operators (including licensed professional retakaful operators)[4]. The results must include the impact of the stress scenarios to the following statements of the licensed person:

(a) Balance Sheet;
(b) Profit and Loss; and
(c) Capital Adequacy Ratio (CAR).

[4] The tables in Appendix 2(A) and Appendix 2(B) shall be extended to reflect the results of each of the period under a multi-period stress testing.

APPENDICES

APPENDIX 1 Guidance on Risk Categories and Risk Factors

Stress Testing for Market Risk

1. Market risk is the risk of financial losses as a result of the reduction in the market value of assets due to exposure to equity, interest rate, property, commodity and currency risks, as well as the risk of financial losses arising from non-parallel movement between the value of liabilities and the value of assets backing the liabilities due to movements in interest rate (interest rate mismatching risks).

2. The following are examples of risk factors that may be considered when developing scenarios involving market risk:
   (a) The extent of any mismatch of assets and liabilities, including reinvestment risk;
   (b) Widening of yield spread between non-sovereign and sovereign rates;
   (c) Exposure to movements in the equity market as a whole and to individual equity issuers;
   (d) Impact of foreign exchange movements on the value of assets and liabilities; and
   (e) Adverse non-linear effects on asset values due to usage of derivatives.

3. The following are examples of methods that may be considered in assessing the impact of market risk factors:
   (a) Parallel shifts in the yield curve and changes in the shape of the yield curve (e.g. steepening, flattening or inversions);
   (b) Widening of credit spreads based on ratings, sectors in which the issuer of the debt securities operates or tenure; and
   (c) Stress testing general equity risk based on historical events (e.g. Asian financial crisis) and specific equity risk using the beta of individual equities to the market index.

Stress Testing for Credit Risk

4. Credit risk is the risk of losses due to a counterparty's inability or unwillingness to fully meet its contractual financial obligations as they fall due. A licensed person is exposed to this risk from its financial transactions with counterparties such as debtors, borrowers, brokers, policyholders, reinsurers / retakaful operators and guarantors.

5. The following are examples of risk factors that may be considered when developing scenarios involving credit risk:
   (a) Deterioration in credit worthiness of reinsurers / retakaful operators, intermediaries and other counterparties;
   (b) Defaults or rating downgrades of bonds held by licensed persons;
   (c) Default by reinsurers / retakaful operators and debtors;
   (d) Deterioration in the extent and quality of collateral; and

(e) Greater losses from bad debts than anticipated.

6. The following are examples of methods that may be considered in assessing the impact of credit risk factors:
   (a) For rated private debt securities (PDS), apply published transition probabilities and losses given default statistics;
   (b) For unrated PDS, use a bottom-up approach such as assessing the impact of risk factors on individual obligor creditworthiness or a top-down approach such as ratings migration based on internal scoring systems; and
   (c) For receivables and recoveries, stress the flow rate between "ageing buckets".

Stress Testing for Insurance Risk

7. Insurance risk refers to the inherent uncertainties as to the occurrence, amount and timing of insurance or takaful liabilities and can be separated into the following:
   (a) product design, pricing and underwriting risk, which is the risk of costs and liabilities assumed in respect of a product line exceeding the expectation in pricing the product line; and
   (b) liability risk, which is the risk of under-estimation of liabilities and inadequate provisions to meet obligations to policyholders.

8. The following are examples of risk factors that may be considered when developing scenarios involving insurance risk:
   (a) increase in claims costs and benefit outgoes;
   (b) increase in expenses (including inflation);
   (c) variations in persistency and early terminations;
   (d) rapid increase or decline in the volume of new business;
   (e) changes in reinsurance premium rates, terms and conditions, and availability of cover;
   (f) increase in costs of options and guarantees;
   (g) catastrophe risks such as flood and pandemic; and
   (h) demographic risks such as adverse movements in mortality, morbidity and longevity.

9. The following are examples of methods that may be considered in assessing the impact of insurance risk factors:
   (a) additional number of deaths per 1000 lives to mortality rates across all ages;
   (b) additional number of claims reported per 1000 lives to rates across all ages for medical and health benefits;
   (c) estimation of Probable Maximum Losses (PMLs) for general fund exposures to a single catastrophic event with a 1-in-200 year return period;
   (d) applying a stressed claims inflation assumption to long-tail classes of general business; and

(e) applying a substantial increase in the number of policies surrendered under a mass lapse event.

10. Licensed takaful operators are also expected to cover scenarios specific to takaful and retakaful businesses. Examples of such scenarios include:
    (a) Deficits in Participants' Risk Fund (PRF) funds which require *qard* to be paid immediately from shareholders' fund;
    (b) Ability of the PRF to repay increasing amount of outstanding *qard*; and
    (c) Irrecoverability of *qard* due to longer than expected time period over which the *qard* shall be repaid.

Stress Testing for Liquidity Risk

11. Liquidity risk arises from a licensed person's inability to realise assets or otherwise obtain the necessary funds to meet its on-balance and off-balance sheet obligations as they fall due, without incurring unacceptable losses or costs.

12. The following are risk factors that may be considered when developing scenarios involving liquidity risk:
    (a) Mismatch between asset and liability cash flows resulting in realisation of assets during an inopportune time;
    (b) Market conditions that encourage the wide spread exercise of embedded options against the licensed person;
    (c) A significant and adverse change in the rate of surrenders due to a loss of confidence in the licensed person;
    (d) Lower than expected level of new business growth causing the licensed person to utilise assets to meet policy claims;
    (e) High new business growth resulting in net cash outflows due to high acquisition costs; and
    (f) Significantly large single claim or catastrophe.

Stress Testing for Operational Risk

13. Operational risk refers to the risk of loss resulting from inadequate or failed internal processes, people and systems; or from external events.

14. The following are risk factors that may be considered when developing scenarios for operational risk:
    (a) An error in key processes;
    (b) Increasing fraudulent activities;
    (c) The impact of a catastrophic event on the licensed person's day-to-day operations i.e. business continuity management (BCM);
    (d) Potential failure of back-up systems or failure in the efficiency and effectiveness of off-site back-up facilities during recovery period;
    (e) The reputational risks to which the licensed person may be exposed;
    (f) The impact of legal risks;
    (g) The failure of the compliance function in ensuring compliance with all applicable laws, rules and regulations;

(h) The failure of general personnel management controls or inadequate controls put in place;
(i) The marketing and distribution risks to which the licensed person may be exposed;
(j) The technological risks to which the licensed person may be exposed; and
(k) The possible impact of any outsourcing difficulties.

Stress Testing for Financial Group Risk

15. The membership of a licensed person in a group can be a potential source of strength to the licensed person, but it can also pose risks, particularly as a result of contagion.

16. The following risk factors, while not exhaustive, may be considered when developing scenarios for group risk:
    (a) The effect on the licensed person of a high degree of dependence on group resources to support the licensed person's operations; and
    (b) The effect on the licensed person of an impaired parent, subsidiary or affiliate within the group or downgrade in rating of the group.

Stress Testing for Shariah Non-Compliance (SNC) Risk

17. A licensed takaful operator could be adversely affected if any of its operations is not in compliance with Shariah, or against the advice of its Shariah Committee or the rulings of the Shariah Advisory Council of the Bank (SAC) and policy documents issued by the Bank on Shariah matters.

18. SNC could have financial and non-financial implications. Financial implications include fines imposed by regulatory authorities and loss of investment income while non-financial implications include legal risk and reputational risk.

19. The following risk factors, while not exhaustive, may be considered when developing scenarios for SNC risk:
    (a) Loss of income due to the holding of SNC assets which may be a result of improper market practices, system errors (e.g. systems not updated with the latest delisted SNC stocks) or purchases made by an external party;
    (b) Legal risk and reputational risk arising from operational activities that are not in line with SAC Shariah Resolutions; and
    (c) Loss of business due to reputational damage arising from occurrence of an unexpected SNC following from a Shariah Committee advice.

APPENDIX 2(A) Stress Testing Results Template for Insurers

Life Insurance Funds (Participating / Non-Participating / Investment-Linked)

Projection To:
Balance Sheet

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Assets					
A Cash and deposits					
B Investment Properties					
C Loans					
D Investments					
1 Debt instruments					
2 Equity instruments					
3 Others					
E Foreign Assets					
F Property, Plant and Equipment					
G Other Assets					
H Total Assets (A+B+C+D+E+F+G)					
Liabilities					
I Policyowner's Fund					
J Investment-Linked Fund					
K Other Liabilities					
L Amount due to Income Statement/Insurance Funds					
M Reserve for Insurance Fund					
N Provision for Tax on Unrealised Capital Gains					
O Total Liabilities (I+J+K+L+M+N)					

General Insurance Fund

Projection To:

Balance Sheet

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Assets					
A Cash and deposits					
B Investment Properties					
C Loans					
D Investments					
1 Debt instruments					
2 Equity instruments					
3 Others					
E Foreign Assets					
F Property, Plant and Equipment					
G Other Assets					
H Total Assets (A+B+C+D+E+F+G)					
Liabilities					
I Premium Liabilities					
J Claims Liabilities					
K Other Liabilities					
L Reserves for Insurance Fund					
M Total Liabilities (I+J+K+L)					

Shareholder's Working Fund

Projection To:
Balance Sheet

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Assets					
A Cash and deposits					
B Investment Properties					
C Loans					
D Investments					
1 Debt instruments					
2 Equity instruments					
3 Others					
E Foreign Assets					
F Property, Plant and Equipment					
G Other Assets					
H Total Assets (A+B+C+D+E+F+G)					
Liabilities					
I Policyowners' Fund EOY					
J Other Liabilities					
K Total Liabilities (I+J)					
Shareholder's Equity					
L Share Capital/Working Fund					
M Share Premium					
N Reserves					
O Retained profits/(loss)					
P Total Equity (L+M+N+O)					

Life Insurance Funds (Participating / Non-Participating / Investment-Linked)

Projection To:

Revenue Account

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Income					
A Net Premium / Net Creation of Units / Consideration for Annuities Granted					
B Net Investment Income					
C Net Unrealised Gain/Loss					
D Net Profit/Loss on Disposal					
E Net Writeback/(Impairment Loss)					
F Net Accretion/(Amortisation) on Securities					
G Other Income					
H Total Income (A+B+C+D+E+F+G)					
Outgo					
I Net Policy Benefits					
J Agency Remuneration					
K Management Expenses					
L Net Bad & Doubtful Debt / (Bad Debt Recovery)					
M Taxation					
N Other Outgo					
O Total Outgo (I+J+K+L+M+N)					
P Excess of Income over Outgo (H-O)					

Q Policyowners' Fund BOY					
R Policyowners' Fund EOY					

General Insurance Fund

Projection To:

Revenue Account

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Income					
A Gross Premium Income					
B Less: Reinsurance Ceded/retrocessions premiums					
C Net Premium Income (A-B)					
D Add/Less: Change in Premium Liabilities					
E Earned Premium Income (C-D)					
F Net Investment Income					
G Net Unrealised Gain/Loss					
H Net Profit/Loss on Disposal					
I Net Writeback/(Impairment Loss)					
J Net Accretion/(Amortisation) on Securities					
K Other Income					
L Total Income (E+F+G+H+I+J+K)					
Outgo					
M Net Claims Paid					
N Add/Less: Change in Claims Liabilities					
O Net Claims Incurred (M+N)					
P Net Commission Paid					
Q Management Expenses					
R Other Outgo					
S Total Outgo (O+P+Q+R)					
T Surplus/Deficit Arising (L-S)					

U Opening Reserves BOY					
V Closing Reserves EOY					

All Funds except Participating Fund / All Funds

Projection To:

Capital Adequacy Ratio (CAR)

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
A Tier-1 Capital B Tier-2 Capital C Less: Deductions					
D Total Capital Fund Available (TCA) (A+B+C)					
E Market Risk Capital Charges F Credit Risk Capital Charges G Operational Risk Capital Charges H Life Insurance Liabilities Capital Charges I General Insurance Liabilities Capital Charges J Surrender Value Capital Charges					
K Total Capital Required (TCR) [Max (E+F+G+H+I,J]					
L Capital Adequacy Ratio (CAR) % (D/K)					

APPENDIX 2(B) Stress Testing Results Template for Takaful Operators

Family Takaful Funds (Sub-Funds for Protection Fund and Annuity Fund)

Projection To:

Balance Sheet

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Assets					
A Cash and deposits					
B Investment Properties					
C Financing					
D Investments					
1. Debt instruments					
2. Equity instruments					
3. Others					
E Foreign Assets					
F Property, Plant and Equipment					
G Other Assets					
H Total Assets (A+B+C+D+E+F+G)					
Liabilities					
I Participants' fund					
J Investment-linked fund					
K Other Liabilities					
L Amount due to Income Statement/Takaful Funds					
M Provision for Tax on Unrealised Capital Gains					
N Revaluation Reserves for Takaful Funds					
O Total Liabilities (I+J+K+L+M+N)					

General Takaful Funds

Projection To:

Balance Sheet

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Assets					
A Cash and deposits					
B Investment Properties					
C Financing					
D Investments					
1. Debt instruments					
2. Equity instruments					
3. Others					
E Foreign Assets					
F Property, Plant and Equipment					
G Other Assets					
H Total Assets (A+B+C+D+E+F+G)					
Liabilities					
I Unearned Contribution Reserves					
J Surplus Attributable to Participants					
K Other Reserves					
L Other Liabilities					
M Amount due to Income Statement/Takaful Funds					
N Revaluation Reserves for Takaful Funds					
O Total Liabilities (I+J+K+L+M+N)					

Shareholder's Fund

Projection To:

Balance Sheet

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Assets					
A Cash and deposits					
B Investment Properties					
C Financing					
D Investments					
1. Debt instruments					
2. Equity instruments					
3. Others					
E Foreign Assets					
F Property, Plant and Equipment					
G Other Assets					
H Total Assets (A+B+C+D+E+F+G)					
Liabilities					
I Other Liabilities					
J Amount due to Income Statement/Takaful Funds					
K Total Liabilities (I+J)					
Shareholder's Equity					
L Share Capital					
M Share Premium					
N Reserves					
O Retained Profits/(Loss)					
P Total Equity (L+M+N+O)					

Family Takaful Funds (Ordinary Family/ Family/ Investment-Linked)

Projection To:

Revenue Account

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Income					
A Net Contribution Income					
B Net Investment Income					
C Net Unrealised Gain/Loss					
D Net Profit/Loss on Disposal					
E Net Writeback/(Impairment Loss)					
F Net Accretion/(Amortisation) on Securities					
G Other Income					
H Total Income (A+B+C+D+E+F+G)					
Outgo					
I Net Certificate Benefits					
J Wakalah Fees					
K Net Commission Paid					
L Management Expenses					
M Increase in Certificate Liabilities (R-Q)					
N Other Outgo					
O Total Outgo (I+J+K+L+M+N)					
P Excess of Income over Outgo (H-O)					
Q Takaful Fund and Reserves BOY					
R Takaful Fund and Reserves EOY					

General Takaful Fund

Projection To:

Revenue Account

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
Income					
A Gross Contribution Income					
B Less: Retakaful Ceded/retrocessions premiums					
C Net Contribution (A-B)					
D Add/Less: Change in Unearned Contribution Reserve					
E Earned Contribution (C-D)					
F Net Investment Income					
G Net Unrealised Gain/Loss					
H Net Profit/Loss on Disposal					
I Net Writeback/(Impairment Loss)					
J Net Accretion/(Amortisation) on Securities					
K Other Income					
L Add/Less: Change in Surplus Attributable to Participant and Other Reserves					
M Total Income (E+F+G+H+I+J+K+L)					
Outgo					
N Net Claims Paid					
O Add/Less: Change in Provision for Outstanding Claim					
P Net Claims Incurred (N +O)					
Q Wakalah Fee					
R Net Commission Paid					
S Management Expenses					
T Other Outgo					
U Surplus Paid and Payable to Participants					
V Total Outgo (P+Q+R+S+T+U)					
W Surplus/Deficit Arising (M-V)					
X Opening Reserves BOY					
Y Closing Reserves EOY					

All Funds (Family Takaful Funds, General Takaful Fund and Shareholder's Fund)

Projection To:

Capital Adequacy Ratio (CAR)

Item	Data as at Reference Date	Projections			
		Base Scenario	Scenario 1	Scenario 2	Scenario 3
A Tier-1 Capital					
B Tier-2 Capital					
C Less: Deductions					
D Capital Available (CA) (A+B-C)					
E Credit Risk Capital Charges					
F Market Risk Capital Charges					
G Takaful Liabilities Capital Charges					
H Operational Risk Capital Charges					
I Expense Risk Capital Charge					
J Total Risk Capital Charges					
K Surrender Value Capital Charges					
L Capital Required (CR) [max(J,K)]					

Total Capital Available (TCA)					
Total Capital Required (TCR)					
Capital Adequacy Ratio (CAR) %					