



BANK NEGARA MALAYSIA
CENTRAL BANK OF MALAYSIA

Stress Testing

Policy Document

Applicable to:

1. Licensed banks
2. Licensed investment banks
3. Licensed Islamic banks
4. Licensed international Islamic banks

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PART A OVERVIEW

1 Introduction

- 1.1 Stress testing is an essential risk management tool used to assess a banking institution's potential vulnerabilities to stressed business conditions. Effective stress testing enables a banking institution to quantify adverse unexpected outcomes related to a variety of risks and facilitate the decision to put in place risk mitigation plans to safeguard its safety and soundness. This includes providing sufficient amount of financial resources (including capital and liquidity) and implementing other risk mitigation strategies that are required to withstand losses arising from a particular stressed scenario.
- 1.2 This policy document sets out the following:
- (a) the Bank's supervisory expectations and requirements with regards to the governance, coverage of risks, design and implementation of banking institutions' stress testing programme;
 - (b) the corresponding basis for the Bank's supervisory assessment on the safety and soundness of banking institutions, monitoring of risks in the financial system and pre-emptive policy actions; and
 - (c) reporting requirements on stress testing results to the Bank.

2 Applicability

- 2.1 This policy document is applicable to all banking institutions as defined in paragraph 5.2 in accordance with the following:
- (a) on an entity level, referring to the global operations of the banking institution (i.e. including its overseas branch operations) on a stand-alone basis, and including its Labuan banking subsidiary; and
 - (b) on a consolidated level, which includes entities covered under the entity level requirement, and the consolidation of all financial and non-financial subsidiaries (except insurance/takaful subsidiaries)¹.

3 Legal provisions

- 3.1 This policy document is issued pursuant to–
- (a) sections 47, 48, 143 and 266 of the Financial Services Act 2013 (FSA); and
 - (b) sections 29, 57, 58, 155 and 277 of the Islamic Financial Services Act 2013 (IFSA).

¹ Insurance/takaful subsidiaries shall comply with the policy document on *Stress Testing* applicable to licensed insurers and takaful operators. The potential risks and losses on such entities arising from their own stressed scenarios shall be included in the banking institution's consolidated level assessment.

4 Effective date

- 4.1 This policy document comes into effect on 1 October 2017 except for paragraph 15 which comes into effect on 1 October 2018.

5 Interpretation

- 5.1 The terms and expressions used in this policy document shall have the same meanings assigned to them in the FSA or 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 actions;

“**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;

“**banking institution**” refers to—

- (a) a person licensed under the FSA to carry on banking business or investment banking business;
- (b) a person licensed under the IFSA to carry on Islamic banking business;
- (c) a licensed bank and licensed investment bank under the FSA and approved by the Bank under section 15 of the FSA to carry on Islamic banking business; and
- (d) any other person specified by the Bank;

“**baseline scenario**” means a scenario that reflects the banking institution’s business strategy, profitability targets as well as the expected macroeconomic and market conditions for a given time horizon;

“**board**” means the board of directors of a banking institution, including a committee of the board where the responsibilities of the board set out in the policy document have been delegated to such committee;

“**exceptional but plausible scenario**” means a scenario that has a significant negative impact on a banking institution, the occurrence of which is reasonably foreseeable and not too remote a possibility;

“**financial group**” refers to a banking institution and a group of related corporations primarily engaged in financial services or services which are in connection with or for the purposes of such financial services;

“**internally developed scenarios**” means a set of stressed scenarios that are developed by a banking institution;

“**reverse stress testing**” refers to the identification of stressed scenarios that could threaten the viability of a banking institution;

“**second-round effects**” refers to changes in the projected trajectory of key economic and financial variables which result in the amplification of risks and potential losses due to contagion effects and negative spill-overs from one sector of the economy to another as financial institutions, corporates and households respond to the effects of an initial stress scenario;

“**senior management**” refers to the chief executive officer and senior officers;

“**specified scenarios**” means a set of stressed scenarios as the Bank may specify from time to time to be tested on a banking institution’s capital adequacy, liquidity and financial positions;

“**stress testing programme**” refers to the origination, development, execution and application of a suitable range of stress tests;

“**worst-case scenario**” means a scenario where the magnitude of shocks used are greater than the conservative estimates over past business cycles and the “exceptional but plausible scenario”.

6 Related legal instruments and policy documents

- 6.1 This policy document shall be read together with the following policy documents:
- (a) *Capital Adequacy Framework (Basel II - Risk-Weighted Assets)*;
 - (b) *Capital Adequacy Framework for Islamic Banks (Risk-Weighted Assets)*;
 - (c) *Risk-Weighted Capital Adequacy Framework (Basel II) – Internal Capital Adequacy Assessment Process (Pillar 2)*;
 - (d) *Capital Adequacy Framework for Islamic Banks (CAFIB) – Internal Capital Adequacy Assessment Process (Pillar 2)*;
 - (e) *Risk Governance*;
 - (f) *Operational Risk*;
 - (g) *Best Practices for Credit Risk Management*; and
 - (h) *Investment Account*.

7 Policy documents superseded

- 7.1 This policy document supersedes the *Guideline on Stress Testing* issued on 19 March 2007.

PART B STRESS TESTING POLICY REQUIREMENTS

8 General requirements

- S** 8.1 A banking institution shall establish a rigorous and forward looking stress testing programme that is commensurate with the nature, size and complexity of its business operations and risk profile.
- S** 8.2 The coverage of the stress testing programme must be comprehensive and include on- and off-balance sheet exposures, commitments, guarantees and contingent liabilities.
- S** 8.3 Stress testing shall form an integral part of a banking institution's internal capital adequacy assessment² and risk management process. Evidence of this shall be demonstrated through the robustness of methodologies being used, the quality and comprehensiveness of data underpinning the stress tests, involvement of business lines, control and oversight functions in the design and implementation of the stress test programme, and the use of stress test results in informing business and risk strategies.
- G** 8.4 Specific uses of stress testing include:
- (a) providing a forward looking impact assessment of risk exposures under stressed conditions and enabling the development of appropriate management actions and contingency plans (including recovery and resolution arrangements) across a range of stressed scenarios or sensitivity analyses;
 - (b) as input in setting the banking institution's risk appetite and determining whether its risk exposures are within the stated risk appetite under stressed conditions;
 - (c) complementing risk assessments by capturing potential extreme losses (tail risk) beyond those calculated by risk measurement models that rely on historical data and assumptions, including the modelling of risks of new products where there is insufficient historical data³;
 - (d) assessing the appropriateness of the banking institution's capital management plans;
 - (e) identifying, measuring and controlling risk concentrations;
 - (f) strategic planning and forecasting⁴;
 - (g) active portfolio management;
 - (h) asset and liability management; and
 - (i) supporting internal and external communications regarding the banking institution's financial condition, particularly during periods of heightened market volatility and economic uncertainty.

² In line with the policy document on *Risk-Weighted Capital Adequacy Framework (Basel II) – Internal Capital Adequacy Assessment Process (Pillar 2)* and *Capital Adequacy Framework for Islamic Banks (CAFIB) – Internal Capital Adequacy Assessment Process (Pillar 2)*.

³ Including data during periods of stress.

⁴ For example, budgeting, forecasting dividend and stock repurchase policies, mergers and acquisitions.

- S** 8.5 A banking institution is required to conduct stress testing based on its own internally developed scenarios as specified in paragraph 14 and based on the Bank's specified scenarios in accordance with paragraph 20.

9 Responsibilities of the board and senior management

- G** 9.1 The board and senior management of a banking institution have an important role in ensuring a strong risk culture and governance that underpins the effective use of stress testing.
- S** 9.2 The board must exercise oversight on the development and implementation of the stress testing programme. Accordingly, the board must be responsible for:
- (a) approving the policies and procedures governing the stress testing programme, and ensuring sufficient resources and expertise to effectively implement the programme;
 - (b) ensuring that the design of the stress testing programme is consistent with the banking institution's risk appetite and is appropriate to the nature, scale, complexity of its risk taking activities and overall business strategy;
 - (c) ensuring that views and inputs from relevant functions and departments⁵ are considered in the stress testing programme;
 - (d) providing constructive challenge on the results of stress tests, scenarios, key assumptions and methodologies used in the stress tests;
 - (e) reviewing the appropriateness of management actions proposed by senior management to mitigate potential vulnerabilities, taking into consideration the factors set out in paragraphs 16.3 to 16.5;
 - (f) considering the implication of stress testing results on the banking institution's risk appetite, capital and liquidity planning, and strategic business decisions; and
 - (g) commissioning regular independent reviews on the stress testing programme in accordance with paragraph 17.
- S** 9.3 For an Islamic banking institution, the board shall ensure that the stress testing programme appropriately considers scenarios and key assumptions that are unique to Shariah contract and Shariah non-compliance (SNC). In doing this, the board may seek inputs from the Shariah Committee.
- S** 9.4 Notwithstanding paragraph 2.1(a), the Bank may, at its discretion, require a banking institution to conduct an additional stress testing on its Islamic window.
- S** 9.5 Senior management is accountable for the effective implementation and management of the stress testing programme as approved by the board. Senior management must:
- (a) develop stress testing policies and procedures in accordance with

⁵ This includes views and inputs from the banking institution's subsidiaries when conducting stress testing at the consolidated level.

- paragraph 10.1;
- (b) participate in the review and identification of appropriate stressed scenarios;
 - (c) ensure the banking institution conducts stress testing in accordance with the board-approved risk appetite and risk management policies;
 - (d) provide the board and where relevant, Shariah Committee⁶ with key information which have a bearing on stress testing exercise. This includes information on assumptions, extent of judgement used and limitations of the stress tests including the quantitative models used;
 - (e) communicate the stress test results in a clear, concise and comprehensive manner for the board to consider the impact on the banking institution's strategy, performance and financial condition;
 - (f) develop and recommend to the board appropriate management action plans to address potential vulnerabilities identified during the stress test exercise; and
 - (g) ensure timely and effective implementation of board-approved management action plans.

10 Policies, procedures and documentation

- S** 10.1 A banking institution shall establish comprehensive policies and procedures governing its stress testing programme which address the following:
- (a) types of stress testing and the principal objectives of each component of the stress test programme;
 - (b) oversight arrangements including the roles and responsibilities of the board, senior management, Shariah Committee, relevant business heads, risk management, treasury, compliance and internal audit;
 - (c) frequency of stress testing exercises corresponding to the types of stress testing and their purpose;
 - (d) methodologies used for stress testing of each risk category and development of relevant scenarios;
 - (e) a range of triggers and remedial management actions envisaged corresponding to the purpose, type and results of stress tests; and
 - (f) frequency of review and update of the stress testing programme to reflect changing market conditions.
- S** 10.2 A banking institution must retain comprehensive, accurate and up-to-date documentation on all aspects of its stress testing programme, including:
- (a) the description of hypothetical economic and financial conditions underlying each internally developed scenario, including the stress test parameters and variables used;
 - (b) key assumptions used for financial projections;
 - (c) the stress testing results according to the severity of the internally developed scenarios; and
 - (d) the board's and senior management's deliberations and decisions on the appropriate management actions to address the risks and

⁶ The requirement on Shariah Committee applies to risks unique to Shariah contracts and SNC risks.

vulnerabilities identified from the stress testing exercise.

- S** 10.3 Where a third-party model is used in stress testing, a banking institution must clearly document the following:
- (a) the methodology underpinning the model and its basic construction;
 - (b) how risk estimates are derived and validated;
 - (c) the rationale behind any adjustments made to the model's input data sets and output; and
 - (d) the model's capabilities and limitations.

11 Infrastructure and information system

- S** 11.1 A banking institution shall ensure that its risk management infrastructure and information systems are robust and capable of providing data of sufficient quality and granularity on a timely basis to support:
- (a) the conduct of ad-hoc stress tests (including the Bank's specified scenarios) at various levels (such as at the portfolio, business line, entity and consolidated levels) to assess specific risks;
 - (b) customisation of stress testing methodologies, scenarios or data sets; and
 - (c) aggregation of comparable risks and exposures (for example, to a given risk factor, product or counterparty).

12 Stress testing approaches

- S** 12.1 Consistent with a forward looking approach, a stress testing exercise conducted by a banking institution shall cover a broad range of scenarios capturing foreseeable changes in the banking institution's portfolio composition, new information, developments in operating conditions, and emerging risks which are not necessarily covered by historical events.
- S** 12.2 Stressed parameters used by a banking institution shall be conservative to avoid any underestimation of risk. For example, a banking institution's risk profile may change arising from venturing into new markets or higher risk segments. Macro-financial developments (for example, increasing level of household debt over time) may also significantly heighten the risk profile of a banking institution's retail portfolio going forward, which may not be sufficiently captured by its historical credit losses.
- S** 12.3 The scope of a stress test exercise must reflect the significant activities⁷ undertaken by a banking institution and consider all material risks⁸ affecting the banking institution.
- S** 12.4 The assessment of material risks must include the following major risk

⁷ Significant activities generally include products, lines of business, business units or processes that have a material impact on a banking institution's profitability or financial condition.

⁸ Material risks are risks that potentially have a significant adverse impact on any significant activity and overall financial condition of a banking institution.

categories or activities:

- (a) credit risk;
- (b) market risk;
- (c) interest rate/rate of return risk in the banking book;
- (d) liquidity risk;
- (e) risk arising from securitisation activities;
- (f) operational risk;
- (g) SNC risk; and
- (h) financial group risk.

- S** 12.5 Specific requirements on the stress testing of major risk categories are set out in **Part C**.
- S** 12.6 In relation to paragraphs 12.3 and 12.4, an Islamic banking institution must also take into consideration the specificities of Shariah contracts in the identification and assessment of material risks.
- S** 12.7 For an Islamic banking institution, the following specific risks arising from Shariah contracts and activities must be considered:
- (a) liquidity risk arising from providing support to unrestricted investment account holders during stressed conditions;
 - (b) investment risk under profit and loss sharing contracts (for example, *Mudarabah* and *Musharakah* contracts) or funds placed in an investment account offered by the Islamic banking institution;
 - (c) revaluation losses arising from investing in real estate, property development and any other types of physical assets;
 - (d) operational risk arising from failure to comply with Shariah rulings issued by its Shariah Committee and the Shariah Advisory Council of the Bank; and
 - (e) risk of non-completion of projects resulting in losses, such as in *Istisna* contracts.
- S** 12.8 A banking institution shall identify and appropriately reflect risk concentrations⁹ and consider the possible interactions between major risk categories in its stress testing programme.
- S** 12.9 A banking institution shall conduct ad-hoc and more frequent stress tests on specific risk areas in response to emerging risks and during periods of heightened market volatility and economic uncertainty.
- S** 12.10 A banking institution shall ensure that the stress test takes into account the potential spill-over effects and inter-dependencies among group entities (including cross border and overseas operations). This may arise from an

⁹ Risk concentration is measured by aggregating risk across various dimensions such as products, business lines, counterparties, depositors/funding providers, sectors, geographical areas and collateral. Risk concentration also arises due to heightened correlations or interdependencies within and across risk categories, including possible second-round effects under severe market shocks. The overall impact of an event may exceed the impact from the first round of shocks when taking into account risk interactions.

obligation or incentive to provide financial support (for example, capital or liquidity) to an affiliated entity in distress due to reputational concerns and to maintain market confidence in the banking group.

- S** 12.11 A banking institution shall determine an appropriate time horizon for its stress test, taking into account the risk profile and intended purpose of the stress test.
- G** 12.12 In determining the appropriate time horizon, a banking institution may consider the risk management horizon of the target portfolio, the liquidity horizon of the underlying exposures and the potential change in liquidity under stressed conditions.

Projections of income and expenses, balance sheet composition and risk weighted assets (RWA)

- S** 12.13 A banking institution shall clearly set out the assumptions underpinning the projection of its income and expenses, balance sheet composition and RWA in the baseline and stressed scenarios. Such projections must reasonably reflect the selected stressed scenarios and take into account the banking institution's practical ability to execute its business strategies under stressed conditions.
- G** 12.14 The following factors may be considered when projecting income and expenses, balance sheet composition and RWA under stressed scenarios:
- (a) reduction in interest/finance income and non-interest income due to subdued loans/financing growth and decline in capital market activities;
 - (b) higher costs of funding due to heightened competition for customer deposits/funding, tightening of funding liquidity and higher risk premium in the wholesale markets;
 - (c) ability to re-price interest/profit rates on loans/financing and prospects for recovery;
 - (d) increase in the cost of hedging;
 - (e) losses arising from fire sales or mark-to-market valuation changes in securities and derivatives positions;
 - (f) higher impairment losses for credit exposures;
 - (g) significant currency fluctuations resulting in translation losses or RWA increases; and
 - (h) changes in the composition of trading and banking book positions affecting RWA (for example, arising from asset sales or the expansion or contraction in loan/financing portfolio).

13 Stress testing methodologies

- S** 13.1 A banking institution shall adopt top-down or bottom-up approaches where appropriate in its stress testing programme depending on the purpose of the stress test.
- G** 13.2 A top-down approach to stress testing is a high-level assessment which

applies a defined set of macroeconomic scenarios and related stress factors to a group of exposures aggregated at the portfolio level¹⁰ to identify areas of vulnerabilities which can arise from changes in economic and financial conditions. In contrast, a bottom-up approach adopts a more granular assessment that is tailored to specific segments within a portfolio¹¹ or at an individual risk exposure level to provide a comprehensive assessment of risks. The use of both approaches allows a banking institution to validate the bank-wide view of risks affecting the banking institution.

- G** 13.3 In general, a quantitative measurement approach should provide the foundation of the stress testing framework. In measuring risks, a banking institution may establish quantitative approaches that appropriately reflect methodologies and standards that are well accepted in the industry. Quantification of risks and losses should be estimated based on credible data.
- S** 13.4 A banking institution must ensure that the data used for stress testing is representative of, and bears similar risk characteristics to, the specific products or risk profile of the banking institution. In cases where there is insufficient data or data limitations, proxy estimates can be used. However, the banking institution shall apply a margin of conservatism based on expert judgement to the proxy estimates.
- S** 13.5 A banking institution shall consider model limitations when modelling hypothetical and macro-economic scenarios. Periodic review and challenge of the model's assumptions and outputs must be conducted and informed by views of relevant subject matter experts such as risk managers, economists, business managers and dealers.
- G** 13.6 A banking institution may use expert judgement to supplement outputs from the quantitative models particularly where certain extreme events are difficult to model or well-established risk measurement techniques are absent (for example, for modelling operational risk or SNC risk).

Sensitivity and scenario analyses

- S** 13.7 A banking institution shall use a range of stress testing methodologies such as sensitivity and scenario analysis to ensure that its stress testing programme is comprehensive.
- G** 13.8 Sensitivity analysis estimates the impact on the value of a portfolio of exposures arising from assumed movements in a single risk factor or several closely related risk factors such as a parallel yield curve shift or an increase in the probability of default (PD) of borrowers. When performing sensitivity analysis, the identified risk factors are stressed using different degrees of severity. Scenario analysis contains simultaneous movement in a number of risk factors such as equity prices, interest rates, foreign exchange rates and macroeconomic variables. The stressed scenarios may be based on historical

¹⁰ For example, exposures that are grouped into corporate, equities and retail portfolios.

¹¹ For instance, corporate exposures are grouped into specific industry or economic sectors.

(a significant market event experienced in the past) or hypothetical events (plausible events that have yet to occur).

- G** 13.9 An adequate understanding of the risk characteristics of financial transactions is important to appropriately design sensitivity analysis. In particular, a banking institution should consider the limitations of sensitivity analysis in assessing the risks arising from transactions with non-linear features. For these transactions, the use of an appropriate methodology¹², hypothetical scenario analysis or expert judgement overlaid with a margin of conservatism should be applied to the stressed estimates to address these limitations.

14 Construction of internally developed scenarios

- S** 14.1 A banking institution shall develop exceptional but plausible, and worst-case scenarios to assess the impact of stress on its financial, capital and liquidity positions. This assessment must be made against a baseline scenario which reflects the banking institution's view of the normal or expected economic and market conditions.
- S** 14.2 The internally developed scenarios shall include economic recession scenarios, one of which must be a prolonged recession, to assess its ability to withstand and mitigate such scenarios.
- G** 14.3 For a stressed scenario involving multiple events or risk categories, a banking institution should ensure that the sequence and linkages between the events or risk categories are simulated in a realistic and logical manner. For example, market risk effects would typically materialise earlier whereas the impact of credit risk may only be observed over a longer time horizon.
- S** 14.4 A banking institution must consider second-round effects that may arise from the original shocks due to dependencies of one or more risk factors.
- G** 14.5 In capturing the second-round or spill-over effects, a banking institution should consider the lagged effects and potential amplification of losses that may occur due to reactions from market participants and the real economy, if the original shock is prolonged beyond one year.
- G** 14.6 For instance, the second-round effects from an increase in oil prices would result in lower household income, lower consumer demand for goods and services and ultimately lower corporate earnings. A hike in oil prices will raise the cost of production and in turn increase the price of goods and services. Higher prices lead to lower disposable household income, thus affecting retail consumers' debt servicing capability. Higher prices also lead to lower demand of goods and services which would affect companies' profitability. In a scenario of prolonged decline in oil price, deposit placements by oil-related corporates may be reduced and adversely affect the funding position of a banking institution.

¹² Refer to paragraph 22.3.

- S** 14.7 Stress tests shall also account for adverse interactions between credit, funding and securities market conditions in a stressed scenario. The following interactions must be duly considered by a banking institution:
- (a) credit deterioration of obligors leading to a reduction in cash inflows;
 - (b) price shocks for specific asset categories (for example, fire sales and significant mark-to-market losses) resulting in the drying up of liquidity for such assets;
 - (c) reduction of eligible high quality liquid assets (HQLA) due to issuer downgrades;
 - (d) increase in banking institution's liquidity needs as a consequence of higher drawdown of committed credit lines (for example, higher crystallisation of undrawn credit lines);
 - (e) additional posting of collateral due to a downgrade¹³ of the credit rating of the banking institution or adverse price movements;
 - (f) obligation to purchase securitised exposures, assets funded by unrestricted investment account (due to liquidity support arrangement and portfolio rebalancing strategies), assets of distressed off-balance sheet vehicles or conduits associated with a banking institution; and
 - (g) restricted access to secured or unsecured funding markets due to a deterioration in the banking institution's financial strength and credit rating.

15 Reverse stress testing requirement

- S** 15.1 A banking institution's stress testing programme shall include reverse stress tests, which identify a range of adverse scenarios which could threaten the viability of a banking institution (for example, the failure of its business model) and assess the likelihood that such events could materialise over a time horizon as determined by the banking institution.
- G** 15.2 Reverse stress testing commences from a known adverse outcome and deduces the possible different forward looking scenarios that could lead to such an outcome materialising for a banking institution.
- G** 15.3 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 banking institution. These insights should be used by the banking institution to inform and validate its risk mitigation or recovery plans under different scenarios. They also provide useful information to ensure that business decisions are aligned with the banking institution's capital and liquidity strategies.
- G** 15.4 The development of a reverse stress test is an iterative process which involves a combination of both qualitative and quantitative analyses. The scenarios should include both idiosyncratic and systemic events (such as the

¹³ Including downgrade of issuers of securities posted as collateral.

default of one or more major counterparties or a significant market disruption arising from a failure of a major market participant) and account for possible interactions between different risk categories and second-round effects under various stressed scenarios that could threaten the viability or solvency of a banking institution.

- S** 15.5 A banking institution must determine its point of non-viability as part of reverse stress testing which shall be higher than the minimum regulatory capital and liquidity ratios¹⁴ and establish triggers¹⁵ for management action before the viability or solvency of the banking institution is threatened.
- S** 15.6 The board must ensure that management actions corresponding to established triggers are pre-defined and regularly reviewed, taking into account considerations in paragraph 16.3 when certain triggers occur.

16 Use of stress testing results in formulating management actions

- S** 16.1 A banking institution shall evaluate the impact of stress tests against accounting profit and loss, regulatory capital and RWA, and liquidity and funding positions.
- G** 16.2 In addition to paragraph 16.1, a banking institution may also use other measures to gauge the impact of stress tests depending on the purpose of the stress test as well as the risks and portfolios being analysed including:
- (a) asset values;
 - (b) economic or risk-adjusted profit and loss; and
 - (c) economic capital requirements.
- S** 16.3 In response to the stress tests results, a banking institution shall formulate realistic management actions¹⁶, having regard to:
- (a) the type of actions and specific circumstances, including external conditions, under which the management actions are unlikely to be feasible. This includes a consideration of factors enumerated in **Appendix 1**;
 - (b) whether the actions would be consistent with the risk appetite or tolerance level set by the board;
 - (c) whether the banking institution has adequate financial resources and operational capabilities to undertake such management actions;
 - (d) constraints by supervisory or regulatory requirements, or market restrictions; and

¹⁴ This is to mitigate the potential for the loss of confidence by market participants before minimum regulatory thresholds are breached considering that additional time and resources are needed for any management actions and recovery plans to take effect.

¹⁵ Examples of triggers are sustained losses, ratings downgrade, widening of spreads, significant and sustained fall in share prices, substantial and continued withdrawal of deposits, request from counterparties for early redemption of liabilities, difficulty in obtaining funding or raising capital, deterioration in regulatory capital and/or liquidity ratios and negative press coverage.

¹⁶ Management actions refer to board-approved strategies undertaken by a banking institution to mitigate potential vulnerabilities during stressed conditions.

- (e) the possibility of other market participants adopting similar strategies which may reduce the effectiveness of the intended outcome.
- G** 16.4 Management actions should be based on careful analyses and deliberation by the board and senior management. The range of management actions may vary depending on the magnitude of impact and likelihood of stressed scenarios. Actions pursued should be proportionate to the severity of the impact of the stress tests and may include:
- (a) reviewing the risk appetite or limits and business strategies;
 - (b) restructuring, liquidating, unwinding or hedging exposures;
 - (c) seeking additional collateral, buying credit protection or reducing risk exposures to specific sectors, countries and regions;
 - (d) tightening underwriting standards;
 - (e) adjusting the asset and liability composition;
 - (f) building additional capital or liquidity buffers;
 - (g) implementing recovery or contingency plans; and
 - (h) recourse to central bank funding facilities.
- S** 16.5 Management actions must be approved by the board and senior management and clearly documented. Senior management must ensure effective monitoring mechanisms are in place to promptly activate management actions based on established triggers. Clear roles and responsibilities must be assigned to ensure prompt escalation to the board and senior management upon the occurrence of any trigger event. Reviews shall be periodically conducted to ensure that such management actions are executed in a timely and orderly manner.

17 Independent review

- S** 17.1 A banking institution shall undertake independent reviews to assess the effectiveness of the stress testing programme including the banking institution's observance of the requirements in this policy document. The review shall also assess the performance and appropriateness of use of third-party vendor's products, services and information, to the extent that they are employed for stress testing.
- S** 17.2 A banking institution shall ensure that independent reviews of stress testing programmes are performed by a qualified party within or external to the banking institution that is not directly involved in the development or oversight of the stress testing programme¹⁷.
- S** 17.3 A banking institution shall ensure that independent reviews are carried out in accordance with the frequency determined by the board, and the results are submitted to the board and senior management in a timely manner. The board and senior management shall ensure that any weaknesses highlighted arising from the review are promptly addressed.

¹⁷ For example, persons with relevant knowledge and expertise in the banking institution's risk function, internal audit, external consultants or external auditors.

18 Supervisory review and evaluation

- S** 18.1 As part of the Bank's *Risk-Based Supervisory Framework* and evaluation of ICAAP, a banking institution's stress testing programme will be reviewed and evaluated by the Bank against the expectations set out in this policy document. A banking institution will be required to take action to improve its capital or risk management processes if the Bank is not satisfied with the banking institution's stress testing programme.

19 Reporting of stress test and reverse stress test

- S** 19.1 A banking institution shall submit the stress test and reverse stress test results to the Financial Conglomerate Supervision Department or Banking Supervision Department. The submission shall include:
- (a) a description of the risks, exposures and entities covered;
 - (b) prevailing and projected macro-economic conditions as well as justifications for assumptions used;
 - (c) description of the methodologies used including justifications for any material changes to the previous methodologies adopted;
 - (d) the impact on the profitability, capital adequacy, liquidity as well as on all material risk indicators at each significant balance sheet date over the specified time horizon. Both absolute amounts and key financial ratios must be reported;
 - (e) a description of management actions that have been considered and an assessment of their reasonableness;
 - (f) where management actions have been considered, results of the stress test and reverse stress test shall be provided both with and without taking into account these actions;
 - (g) assessment on areas of vulnerability and the associated risk factors. The assessment must be at a sufficient level of granularity in order to provide a meaningful understanding of the vulnerable areas (for instance, business line, geographical sectors, economic sectors or sub-sectors, market segments, borrower groups) and the causes of stressed losses;
 - (h) extract of minutes of the board and Risk Management Committee meetings on the deliberation on the stress tests and reverse stress test results; and
 - (i) assessment and result of independent reviews, where such review has been conducted.
- S** 19.2 The reporting of stress test results by a banking institution must at minimum, cover a three-year horizon¹⁸ based on the following scenarios:
- (a) baseline scenario;
 - (b) exceptional but plausible scenario; and
 - (c) worst-case scenario.

¹⁸ This is to ensure that capital levels remain above the minimum regulatory capital requirements and are able to support its overall risk profile over a capital planning horizon of at least three years.

- S** 19.3 A banking institution shall submit the stress test and reverse stress test results based on the following timeline:
- (a) by 30 June and 31 December each year for stress test; and
 - (b) by 31 December of each year for reverse stress test.

The reference dates for the stress test and reverse stress test shall not be more than six months preceding the submission dates. Notwithstanding the above, the Bank may require a banking institution to submit the stress test and reverse stress test results at any other timeline or intervals as the Bank deems appropriate.

20 Stress tests based on Bank specified scenarios

- S** 20.1 A banking institution is also required to conduct additional stress tests¹⁹ based on specified scenarios to assess system-wide vulnerabilities as and when required by the Bank. The results of the stress test based on specified scenarios must be submitted within the specified timeline set by the Bank.
- G** 20.2 For conducting the stress testing of each specified scenario under paragraph 20.1, the Bank may specify among others, the following:
- (a) the scope and coverage of the stress test;
 - (b) the reference date and the projection period of the stress test;
 - (c) the methodology in conducting the stress test; and
 - (d) stressed parameters for each of the specified scenarios and their application.
- S** 20.3 The use of specified scenarios is mainly for the purpose of the Bank's macro-prudential surveillance activities. A banking institution shall not use the specified scenarios as a substitute for its internally developed scenarios.

¹⁹ Supervisory stress tests supplement the Bank's financial stability assessments and facilitate pre-emptive policy actions to address emerging risks well before conditions deteriorate into actual system-wide crisis. It also provides valuable information for deciding on the nature, timing and calibration of macroprudential policy responses.

PART C STRESS TESTING FOR MAJOR RISK CATEGORIES

21 Credit risk

- S** 21.1 A banking institution shall project the impact of an increase in expected credit losses²⁰ and in credit RWA due to the deterioration in the quality of credit exposures during stress. The coverage of credit stress testing shall include all on- and off-balance sheet²¹ credit exposures in both the trading and banking books.
- S** 21.2 A banking institution shall demonstrate how credit loss estimates would fluctuate with changes in the economic cycle arising from movements in macro-economic variables and interaction of risks²². As such, stress tests must adequately reflect the potential for a significant increase in credit risk arising from changes in economic conditions.
- G** 21.3 Where established internal rating systems are in place, a banking institution should ensure that the credit rating of obligors are downgraded by an appropriate number of notches, depending on the severity of the stressed scenario to reflect the higher PD of the obligor.
- G** 21.4 Where PDs for each segment or pool of credit exposures are assessed on a collective basis, a banking institution should ensure that the migration of exposures to a higher credit risk segment is commensurate with the severity of the stressed scenario used as more obligors are expected to defer or default on their payments.
- S** 21.5 A banking institution shall assess non-retail credit exposures individually for any increase in impairment provisions including arising from cross-default triggers. This assessment must be conducted for large credit exposures and credit exposures that exhibit or are likely to exhibit signs of credit deterioration which could cause significant losses during stressed conditions.
- G** 21.6 Large credit exposures may include the top twenty largest counterparties or group of connected counterparties or exposures above a banking institution's internal threshold for large credit exposures, whichever is more prudent. Credit exposures with signs of credit deterioration would include watch-list or special mention accounts.
- G** 21.7 For non-retail credit exposures which do not meet the definition of large credit

²⁰ Expected credit loss is the product of an obligor's PD, loss given default (LGD) and exposure at default (EAD).

²¹ Off-balance sheet credit exposures as defined in the *Capital Adequacy Framework (Basel II Risk-Weighted Assets)* and *Capital Adequacy Framework for Islamic Banks (Risk-Weighted Assets)*. This also includes credit risk arising from exposures of guarantors or protection sellers and counterparty credit risk arising from over-the-counter (OTC) derivative transactions.

²² For instance, depreciation in the local currency may affect the repayment capability of borrowers which are exposed to large foreign currency borrowings when their source of income is denominated in local currency.

exposures in paragraph 21.6, a banking institution may assess the potential for credit deterioration and defaults of such exposures within a particular industry or sector collectively based on common stressed factors.

- G** 21.8 For retail exposures²³, a banking institution may assess any credit deterioration collectively. In performing the assessment, the segmentation of retail exposures should be based on common risk drivers of a particular product type. This should enable a banking institution to project the potential impairment losses arising from shifts in key macro-economic variables during stress.
- S** 21.9 A banking institution shall assess the impact of a decline in the valuation and liquidity of collateral on LGD estimates during periods of stress. The assessment must also consider factors such as concentration of collateral, appropriateness of haircuts and the additional time and costs incurred for the disposal of collateral during stressed periods.
- S** 21.10 A banking institution shall project the impact of obligors utilising undrawn credit facilities and other commitments during periods of stress. A banking institution shall use appropriate modelling methodologies or credit conversion factors (CCF)²⁴ to reflect the higher probability of undrawn credit facilities and commitments being utilised under stressed conditions.
- S** 21.11 A banking institution must consider the potential increase in counterparty credit exposures²⁵ and expected losses during stress arising from the following risk factors:
- (a) break-down in bilateral netting and re-margining requirements for OTC derivatives and securities financing transactions including *tawarruq* transactions involving the buying and selling of commodities by an Islamic banking institution with a commodity broker; and
 - (b) wrong-way risk²⁶ where both exposure and the counterparty default probability increase at the same time.
- G** 21.12 A banking institution should estimate the impact of an increase in failed trades that occur during stress. For example, bilateral netting, re-margining and *tawarruq* transactions may fail where an exchange of principal is involved and the counterparty to a transaction defaults after the banking institution has delivered the principal amount of the transaction.

²³ Retail exposures refer to loan/financing facilities extended to individuals (for example, mortgage loan/financing, vehicle loan/financing, credit card loan/financing and personal loan/financing) and loans/financing extended to small businesses which are managed on a pooled basis.

²⁴ CCFs may be used when a banking institution is unable to model the utilisation of undrawn credit facilities and commitments. CCFs used shall correspond to the level of severity of a stressed scenario.

²⁵ Particularly leveraged counterparties such as hedge funds, financial guarantors, investment banks and derivative counterparties that may be exposed to specific asset types and susceptible to market movements.

²⁶ General wrong-way risk arises when the likelihood of default by counterparties is positively correlated with general market risk. Specific wrong-way risk arises when the future exposure to a specific counterparty is expected to be high due to the increase in the PD of the counterparty.

- S** 21.13 To ensure that wrong-way risk is addressed, a banking institution shall derecognise any net mark-to-market gains²⁷ (arising from potential increases in EAD) due to general or specific wrong-way risk in the stress testing results submitted to the Bank.
- S** 21.14 A banking institution shall ensure that any realised or unrealised losses due to the deterioration in the credit ratings of securities in the trading and banking book portfolios are adequately captured in the stress tests.

22 Market risk

- S** 22.1 A banking institution shall identify all significant market risk factors²⁸ for all material trading positions to be subjected to market risk stress testing.
- S** 22.2 In performing the top-down stress test, a banking institution shall determine appropriate shocks to be applied to the market risk factors consistent with the stressed scenarios used.
- S** 22.3 The stressed scenarios must enable a banking institution to identify potential vulnerabilities arising from both linear and non-linear²⁹ risk exposures. A banking institution shall adopt a full revaluation methodology for a trading portfolio with a non-linear profile to avoid underestimation of market risk during stressed conditions. A sensitivity-based valuation³⁰ methodology shall be used for linear portfolios.
- S** 22.4 A banking institution shall account for basis risk in the trading portfolio arising from a breakdown of correlation between market risk factors during stressed market conditions when the banking institution hedges its trading positions using different instruments. Where a banking institution adopts dynamic hedging strategies to manage its trading portfolio, it shall account for the potential risk that the portfolio could not be re-hedged effectively due to market illiquidity of the hedging instruments during stressed conditions.
- S** 22.5 A banking institution shall determine the magnitude of shocks for market risk factors taking into account any deterioration in the market liquidity of the trading positions or hedging instruments becoming ineffective during stressed periods. This could expose the banking institution's market risk for a longer period of time.

²⁷ Any mark-to-market gains arising from a stressed scenario may be determined on a portfolio level.

²⁸ For example, interest rates/profit rates, foreign exchange rates, equity prices and commodities prices.

²⁹ This refers to the profit and loss profile associated to exposures with optionality.

³⁰ This refers to the estimation of fair value of instruments based on risk sensitivities of the instrument.

- G** 22.6 Credit-related trading positions such as lowly rated corporate bonds and credit derivatives may become illiquid during stressed conditions. As such, a banking institution should use more conservative shocks to account for the higher market risk due to the potential inability to liquidate or hedge the trading positions on a timely basis.

23 Interest rate/rate of return risk in the banking book

- S** 23.1 A banking institution shall establish appropriate stressed scenarios to assess how interest rate/rate of return risk in the banking book will impact its earnings and capital positions under stressed conditions.
- S** 23.2 The assessment by a banking institution shall cover re-pricing risk, yield curve risk and basis risk, as well as the potential impact arising from option risk. This includes financial options and behavioural optionality embedded in risk exposures such as prepayment of loans/financing.
- S** 23.3 The stressed scenarios established by a banking institution shall cover parallel (i.e. upward and downward) and non-parallel movements (for example, steepening and flattening) in the interest/benchmark rates.
- S** 23.4 A banking institution shall ensure that the result of the multi-year top-down stress test accounts for changes in the projected level and direction of the benchmark rates. The result must also include expected changes in the profile of assets and liabilities.

24 Liquidity risk

- S** 24.1 A banking institution shall conduct stress testing on funding liquidity³¹ risk at the entity and consolidated levels to assess its capability to withstand liquidity shocks.
- S** 24.2 A banking institution must account for the potential impact of liquidity stress on the solvency position arising from higher cost of funding due to tightening of wholesale and deposit/funding markets and loss in value of marketable securities due to market illiquidity.
- S** 24.3 A banking institution must be able to identify and assess liquidity risk of significant business activities³² and concentration to a particular source of funding such as large depositors/funding providers, investment account holders, wholesale market funding or holdings of a particular asset class.
- S** 24.4 An Islamic banking institution must also consider the liquidity needs arising from honouring redemptions by investment account holders of unrestricted

³¹ Funding liquidity refers to the inability of a banking institution to meet its obligations when they fall due.

³² Significant business activities shall include lending/financing, trading and pipeline, and warehousing activities.

investment accounts at the level of individual funds.

- S** 24.5 For the purpose of paragraph 24.1, a banking institution must consider bank-specific and market-wide liquidity stressed scenarios separately and in combination. The banking institution shall also consider the system-wide interactions and feedback effects due to the high interconnectedness³³ of financial markets.
- G** 24.6 Bank-specific scenarios may include a rating downgrade, large deposit/funding withdrawals, investment account redemptions, non-rollover of deposits/investment account and/or reduced access to wholesale markets. Market-wide scenarios may include disruptions in wholesale funding (secured and unsecured) and foreign exchange swap markets as well as reduced liquidity in asset markets. The bank-specific or market-wide scenario enables a banking institution to assess its sensitivity of liquidity risk to the scenario individually. Where both bank-specific and market-wide risk factors are being stressed together, for example in the top-down stress testing exercise, the banking institution should use the scenario combining both the bank-specific and market-wide stressed scenarios.
- S** 24.7 A banking institution shall capture potential liquidity needs due to margin and collateral calls from counterparties for derivative transactions arising from a downgrade in the credit rating of the banking institution or issuers of securities posted as collateral, and volatile financial markets during stressed scenarios.
- S** 24.8 A banking institution shall assign prudent haircuts to the stock of liquid assets used for liquidity management in the stress test. The haircuts shall at least take into account the haircuts observed during previous stressed periods and potential developments³⁴ which could adversely impact the market value of the liquid assets. In addition, a banking institution shall consider the potential impact arising from the downgrading of liquid assets during stressed scenarios.
- S** 24.9 A banking institution shall conduct liquidity stress testing on material foreign currency portfolios by currency at entity and consolidated levels and consider potential restrictions on the movement of funds between entities and branches.
- S** 24.10 A banking institution which is an active market maker shall consider the potential liquidity needs arising from market-making activities in a stressed environment. Market-making activities could lead to additional exposures being taken on the balance sheet, putting further pressure on the banking institution's liquidity positions.
- S** 24.11 A banking institution shall take into account potential funding needs arising from spill-overs and interdependencies among group entities and off-balance

³³ Refer to paragraph 14.7.

³⁴ E.g. change in regulation or risk perception on a particular class of liquid assets which could lead to significant decline in the market value of the liquid assets.

sheet vehicles. The banking institution may not have any legal obligations to provide liquidity support but such support may be required to avoid contagion risks to the banking institution due to its association with such entities/vehicles.

- S** 24.12 A banking institution shall conduct stress testing on its ability to continuously meet the minimum regulatory requirements³⁵ during stressed period taking into account any unique characteristics of its assets (including HQLA) and funding liabilities profile. Consequently, the banking institution shall undertake appropriate management actions (such as maintaining a greater level of HQLA) to address any potential vulnerabilities that may result in non-compliance with the regulatory requirements.
- G** 24.13 In respect of paragraph 24.12, a banking institution's regulatory liquidity ratios could be adversely affected during stressed market conditions due to significant run-off of funding liabilities and/or decline in the market value of HQLA accentuated by the banking institution's weaknesses in the funding structure and risk profile of HQLA. As an example, a banking institution with significant concentration to a few large corporate depositors would experience significant decline in the LCR ratio in the event of large deposits withdrawal. In addition, the rise in market yields during stressed market conditions reduces the market value of rates sensitive HQLA further impacting the regulatory liquidity ratio.

25 Risk from securitisation activities

- S** 25.1 In carrying out stress tests for securitisation exposures, a banking institution shall consider all information related to the underlying asset pools, their dependence on market conditions, contractual arrangements and effects related to the subordination level of specific securitisation tranches.
- S** 25.2 A banking institution shall not assume that external credit ratings or historically observed credit spreads related to corporate bonds with the same external rating have similar risk characteristics to securitisation exposures. Such an approach would not be able to capture relevant risk characteristics of complex, structured products under stressed conditions. Therefore, the stressed yields and credit rating migrations must be referenced to structured credit securities with similar risk characteristics.
- S** 25.3 A banking institution shall ensure that underwriting commitments and warehousing of exposures which are to be securitised are included in the stress testing programme regardless of the probability of such exposures being securitised. This is to reflect the difficulty in accessing the securitisation market to off-load these exposures during stressed periods.
- S** 25.4 A banking institution shall assess the risks associated with commitments to off-balance sheet vehicles related to structured credit securities in the stress

³⁵ For example, Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).

testing programme. This assessment shall include the possibility of providing additional liquidity or taking on board certain securitisation exposures on the balance sheet due to reputational reasons.

26 Operational and Shariah non-compliance risks

- S** 26.1 A banking institution shall consider operational and SNC risk losses in the stress testing programme.
- S** 26.2 A banking institution must ensure that the scenario analysis³⁶ used for operational and SNC risks captures significant risks that could occur and translate such risks into loss estimates. This is regardless of whether such risks are directly linked to the stressed economic conditions.
- G** 26.3 Material risks identified through key operating indicators and metrics, including information on operational and SNC risk loss events and near misses may be considered in the scenario analysis. The use of expert judgement can be employed as extreme operational and SNC loss events may be difficult to model.
- G** 26.4 The following risk factors may be considered when developing scenarios for operational and SNC risks:
- (a) increased processing errors during market turmoil;
 - (b) increased fraud during an economic downturn;
 - (c) increased investor claims for compensation or litigation for mis-selling;
 - (d) documentation or processes not complying with Shariah rules and principles leading to non-recognition of income or higher provisions being set aside for SNC; and
 - (e) breach of terms or negligence in managing investment account holders' funds resulting in higher liquidity risk due to withdrawal of funds from the investment accounts.

27 Financial group risk

- G** 27.1 The affiliations of a banking institution as part of a financial group may pose risks, particularly as a result of contagion, excessive leverage³⁷, liquidity pressures and restrictions in the transferability of capital and liquidity.

³⁶ Scenario analysis is a systematic process in the creation of plausible operational risk events and is an essential element in operational risk management and measurement. It is a forward looking risk management tool that examines and explores emerging tail-end events, which are usually low frequency and have a high impact. A banking institution may take into consideration whether there are effective controls in place to mitigate or reduce operational risk losses in such scenarios. Through the use of such scenarios, a banking institution would be able to enhance its business continuity plans and incorporate potential operational risk losses in the stress testing programme.

³⁷ Excessive leverage occurs when a parent institution issues debt or other instruments which are not acceptable as regulatory capital and down-streams the proceeds to a dependent entity in the form of equity eligible for regulatory capital. Excessive leverage may undermine the financial strength of licensed institutions within the group.

- S** 27.2 When conducting stress testing, a financial group shall consider the interaction between different entities within the group as well as different risk types across sectors and across different jurisdictions where these entities operate.
- S** 27.3 For the purpose of paragraph 27.2, a financial group must also consider the aggregation of all material risks including off-balance sheet activities, special purpose entities and contingent liabilities.
- S** 27.4 Where stress tests are centrally managed and conducted at the group level, the banking institution shall use stressed scenarios that appropriately reflect the risk of any overseas operations of the group in the context of the relevant markets and jurisdictions of these operations.
- G** 27.5 The following risk factors, may be considered when developing stressed scenarios for financial group risk:
- (a) the effect on a banking institution arising from a downgrade in the rating or deterioration of financial condition of a parent, subsidiary or affiliate within the group; and
 - (b) provision of capital and liquidity support to entities within the group.

APPENDICES

APPENDIX 1 Factors to be considered in management actions

1. The following are examples of factors that may be considered in formulating the management actions during stressed conditions:
 - (a) the time required for full implementation, considering expected time for the management action to take effect such as improvement of asset quality due to tightening of underwriting standards;
 - (b) legal restrictions and impediments that may affect financial resources to be relied upon such as cross border transfers of capital to entities within the group;
 - (c) the elevated cost associated with additional borrowings and risk of undersubscription when issuing debt or raising capital;
 - (d) limited access to funding markets and reduced market liquidity for assets to be disposed as well as increased volatility which may further depress the price of these assets;
 - (e) loss of revenue and market share arising from any proposed reduction in lending activities; and
 - (f) reputational risk and potential negative market reaction caused by ceasing discretionary coupons or exercising convertibility provisions of capital instruments.