Lloyd’s Capital Guidance

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Contents

1 List of abbreviations and acronyms

Acronym	Description
AoC	Analysis of Change
APS	Actuarial Professional Standards
ASR	Annual Solvency Return
BEL	Best Estimate Liabilities
CI	Confidence Interval
CIL	Coming Into Line
CPG	Capital and Planning Group
ECA	Economic Capital Assessment
ECU	Economic Capital Uplift
EIOPA	European Insurance and Occupational Pensions Authority
ENID	Event Not In Data
ESG	Economic Scenario Generator
EU	European Union
FAL	Funds At Lloyd's
FIS	Funds In Syndicate
FSR	Financial Strength Ratings
FX	Foreign Exchange
GBP	Great British Pound
ILW	Industry Loss Warranties
IT	Information Technology
JEP	Joint Exceedance Probability
LCM	Lloyd's Catastrophe Model
LCR	Lloyd's Capital Return
LIM	Lloyd's Internal Model
LGD	Loss Given Default
LOC	Letters of Credit
LOD	Losses Occurring During
M&UR	Membership and Underwriting Rules
MCT	Model Change Template
MDC	Market Data Collections
MMC	Major Model Change
MRC	Market Reserving and Capital
Nat Cat	Natural Catastrophe

Acronym	Description
NAV	Net Asset Value
OLW	Original Loss Warranties
ORSA	Own Risk and Solvency Assessment
QCT	Quarterly Corridor Test
QSR	Quarterly Solvency Return
PDF	Probability Distribution Forecast
PRA	Prudential Regulatory Authority
RAD	Risks Attaching During
RDS	Realistic Disaster Scenario
RI	Reinsurance
RICB	Reinsurance Contract Boundary
RIR	Reinsurance Recoverable
RITC	Reinsurance To Close
RST	Reverse Stress Testing
SAO	Statement of Actuarial Opinion
SBF	Syndicate Business Forecast
SBM	Syndicate Benchmark Model
SCR	Solvency Capital Requirement
SCR1	One-year Solvency Capital Requirement
SII	Solvency II
SST	Stress and Scenario Testing
SST	Sum of Squares Test
T0	Time Zero, the time of the opening balance sheet projection
T1	Time One, T0 plus one year
TP	Technical Provisions
TPD	Technical Provisions Data
ULR	Ultimate Loss Ratio
ULAE	Unallocated Loss Adjustment Expenses
ULR	Ultimate Loss Ratio
USD	United States Dollar
uSCR	Ultimate Solvency Capital Requirement
VaR	Value at Risk
XOL	Excess of Loss
YOA	Year of Account

2 Contact Details

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3 Purpose

This document provides guidance for Managing Agents on the calculation of the SCR, the submission of the LCR and any supporting documents required.

This guidance outlines Lloyd's requirements and considerations with respect to syndicate internal modelling. It is intended to assist managing agents in their model methodology, assumption setting and use. The guidance should be considered in conjunction with the new oversight framework, Lloyd's 'Principles for Doing Business', primarily Principle 7 which relates to capital setting.

This guidance consolidates previous versions into one document. Specific reference is made to any other relevant documentation. This guidance should be considered in conjunction with Lloyd's Validation and Model Change Guidance. We will publish additional guidance separately for new syndicates and those considering a RITC or other retrospective reinsurance arrangement.

This guidance is anticipated to remain in force with updates being highlighted to managing agents when amendments are published. A separate set of instructions regarding the LCR will be updated annually for the relevant deadlines, up-to-date review processes and any specific focus areas for Lloyd's in that year.

4 Introduction and Scope

4.1 Background

Each syndicate's internal model is required to comply with Solvency II tests and standards. Managing agents are also required to comply with Lloyd's 'Principles for Doing Business' Principle 7, with regards to capital setting.

Each syndicate is required to have sufficiently detailed documentation to describe compliance with regulatory requirements. This includes for example, the workings of the model, key assumptions, limitations, governance, changes made to the model, and validation of the model. Managing agents are required to ensure that all documentation, whether submitted to Lloyd's or not, meets all applicable regulatory requirements and professional standards. This includes but is not limited to, Technical Actuarial Standards issued by the FRC, and APS (for example APS X2).

Lloyd's routinely reviews syndicate submissions of internal model results, model changes and validation. We also carry out more detailed reviews during the year via deep dives, reviewing model methodology, parameterisation methodology and processes as well as other governance aspects within syndicates. The scope of the deep dive review is aligned to Lloyd's 'Principles for Doing Business'. Other model reviews may be performed to investigate issues of particular thematic or syndicate-specific interest.

In this guidance the words "must" or "required" mean a specific mandatory requirement. In contrast, the guidance uses "should" or "expected" to indicate that, while the presumption is that syndicates / managing agents comply with the provision in question, it is recognised that there will be some circumstances in which syndicates / managing agents are able to justify non-compliance.

4.2 Basis of Reporting

The required basis for the preparation of the SCRs is summarised as follows (with further information in the subsequent sections of this document):

- Lloyd's requires managing agents to calculate the one-year and ultimate SCR using a full internal model, taking into account all material quantifiable risks to which the syndicate is exposed to at the balance sheet date plus one future year of account. The SCR must cover at least insurance risk, market risk, credit risk and operational risk. 'Ultimate' is defined as the final realised position – not the most prudent time step path to ultimate.
- A partial internal model which uses one or more modules of the Solvency II standard formula is not permitted.
- Both the ultimate and one-year requirements must be fully analysed and validated by the managing agent.
- The SCRs must be prepared on a going concern basis.
- Methodology and assumptions used for completing returns to Lloyd's (in particular the LCR, SBF, LCM, the assets and liabilities on the Solvency II balance sheet, and the technical provisions (including the contract boundary)) need to be consistent. This does not mean they need to be the same but any appropriate difference must be clearly outlined and justified (e.g. loss ratio assumptions for the prospective year need not be the same in the LCR and the SBF). See section 4.10.6 for more details.
- The opening model balance sheet should be prepared on the basis of net nil basic own funds on a Solvency II basis. The LCR reports the projected net technical provisions at T0 and the model should assume that equivalent assets are held. Any FAL or FIS are not to be included in the SCR calculation.
- Syndicates are required to remain adequately capitalised on a continuous basis. Consequently, managing agents are responsible for monitoring their SCR and advising Lloyd's of material changes. Agents should also be responsible for advising Lloyd's where syndicate loss experience may reasonably be expected to have eroded member capital to the extent, they would be effectively trading materially closer to their regulatory capital requirement. See section 5.4 for further details.

4.3 Capital Setting

Lloyd's applies an economic uplift to the ultimate SCR to determine a level of member capital that supports the risk appetite of the Society including its target Financial Strength Ratings and to support its licence network.

The uplift is subject to annual review by Lloyd's board, taking into account current circumstances.

4.4 One-year SCR and Ultimate SCR

Lloyd's requires managing agents to calculate the one-year and ultimate SCR using a full internal model; taking into account all quantifiable risks to which the syndicate is exposed. Both SCRs must be fully analysed and validated by the managing agent. Member capital setting at Lloyd's is based on the ultimate SCR as this captures the risk in respect of the planned underwriting for the prospective year of account in full, i.e. covering ultimate adverse development and all exposures. Calculation of the one-year SCR is a regulatory requirement. Both SCRs are required in order to calibrate the Lloyd's internal model.

The one-year SCR corresponds to the value-at-risk of the own funds of a syndicate subject to a confidence level of 99.5% of balance sheet liabilities plus one year of new business over a one-year period. Where future management actions can be robustly supported these should also be included. The ultimate is the same measure with the risk measured to the ultimate run-off of the business. The ultimate SCR takes account of one year of new business in full attaching to the next underwriting year and the risks over the lifetime of the liabilities ("to ultimate"). 'Ultimate' is defined as the final realised position – not the most prudent time step path to ultimate. The requirements include risks for all business attaching to the next underwriting year (through Inception Date Accounting). So this covers existing business, as well as new business expected to be earned over the model time horizon. The critical difference between the one-year SCR and ultimate SCR is that the Solvency II regulatory one-year SCR captures the risk that emerges over the next 12 months and the ultimate measure captures the adverse development until all liabilities have been paid. The ultimate SCR considers all risks attaching to the proposed year of account and excludes exposures relating to underwriting years beyond the proposed year of account. This differs from the one-year SCR where un-incepted legal obligations on the T1 balance sheet will relate to underwriting years beyond the proposed year of account.

Consequently, the closing premium provision at t1 should be based on projected emerged experience. In the model at T1, managing agents will have two pieces of information to estimate the closing premium provision:

1. Their initial estimate of the closing provision based on the SBF assumptions; and
2. The performance of the business over the twelve months from t0 to t1.

The closing premium provision in the model should reflect this information and be estimated accordingly.

4.5 Model Scope

Managing agents are required to ensure that the scope of the model allows for the appropriate calculation of the regulatory and ultimate SCRs and allows sufficient risk coverage such that the requirements of the use test are met.

The scope of the internal model is significantly broader than the capital calculation kernel and it will not be sufficient to have a sophisticated capital model alone. To secure both initial internal model approval and continued compliance/approval, agents will need to demonstrate that the internal model plays a key part in the running of the business, that there are sufficient governance and standards around the model and that the risk management process is embedded within capital setting. Any component or process that can have a significant impact on the one-year and ultimate SCRs must satisfy Lloyd's 'Principles for Doing Business', irrespective of whether or not it has been defined as "within scope" of an internal model. Additionally, Lloyd's review of internal models will not be limited by the scope of the internal model but will cover all material risks and anything which is considered material to the review and decision-making process.

Agents must be able to define the scope of the internal model for each managed syndicate. Lloyd's does not mandate use of a specific scope for internal models as this must be relevant to the business and risk profile of each syndicate. Internal model scope does not need to be consistent across agents for the purposes of the LIM but agents will need to ensure that they satisfy both the SCR calibration requirements and model outputs required by the LIM.

There is a wide range of elements that could be defined as being within the scope of an internal model and the choice of whether or not to include these may impact how Lloyd's 'Principles for Doing Business' are met. Agents must understand the implications of including or excluding certain elements from the scope of an internal model and are required to be able to explain how the scope of the model was determined and why specific elements are included or excluded. In defining the scope of an internal model, an agent must consider a number of issues (for example, coverage of material risks, demonstrating the use test and validation). The wider the scope of the internal model, the easier it may be to demonstrate that the internal model is widely used within the risk management of the organisation. This is one of the potential drivers for the broadest scope of the internal model.

The scope of the validation will depend on the scope of the internal model itself, please see Validation Guidance for further details.

4.5.1 Model Structure/Granularity

The internal model must fit the business model in a sufficiently granular manner. As well as the requirement to differentiate between lines of business, risk categories and major business units, managing agents must consider the following:

- The uses of the internal model and whether these are strategic decisions or more detailed, day-to-day decisions.
- The managing agents' risk management framework and how granular this is.
- The granularity required for the decision-making process.
- The structure of decision-making bodies in the managing agent.
- The debate that is facilitated by the design of the output from the internal model.

Managing agents must be able to evidence that the model is fit for purpose in terms of these factors, and that the resulting feedback and debate results in improvement to the model.

4.6 Risk Coverage

Managing agents are required to ensure that all material, quantifiable risks are covered by the model and validated. The assessment of whether all such risks are covered is required to take into account an appropriate set of qualitative and quantitative indicators specified by the managing agent.

Lloyd's recommends that all risks included in the managing agent's risk register (or emerging from its risk assessment process) are listed and individually identified as being included within the internal model or not. If a risk is not covered by the internal model, then an explanation should be provided. This demonstration must be based on a combination of qualitative and quantitative 'risk indicators'.

The qualitative indicators must include at least the following:

- The identification in the own risk and solvency assessment of risks other than those that are covered by the internal model;
- The existence of a dedicated risk management process for risks other than those that are covered by the internal model; and
- The existence of dedicated risk mitigation techniques for risks other than those that are covered by the internal model.

The quantitative indicators must include at least the following:

- The capital allocation;
- The amount of profits and losses which cannot be explained by the risks covered by the internal model; and
- The results of stress testing and scenario analysis and any tool in the model validation process.

The SCR must cover at least insurance risk, market risk, credit risk and operational risk. For the calculation of the ultimate SCR models they are required to capture all risk types to ultimate with the exception of market risk, which may be modelled over a shorter time horizon (subject to a one year minimum). It is expected that addition of risk to a syndicate will result in addition of capital.

This means managing agents may model market risk over a one-year period for the calculation of the ultimate SCR. This involves consideration of the risk and return over one year on assets held. Managing agents may also consider a time horizon between one-year and ultimate, however, managing agents should note that the time horizon for modelled market risk and the credit for excess returns above the risk-free rate should be consistent.

The rationale for the chosen time horizon and assurance that ultimate risk is not understated by the inclusion of market risk on a one-year basis should be included in the methodology document.

For the one-year SCR, use of an ultimate time horizon is permissible for credit risk and operational risk.

4.7 Risk Ranking

As per section 8 below, managing agents are required under Solvency II to ensure that their internal model is capable of risk ranking all material risks covered by the internal model. Risk ranking can be defined as quantifying the materiality of sub-risks; it is the relative comparability between risks that is important, not the absolute amounts assigned to risks.

Ranking risk adequately is necessarily to support wide and important use of the internal model, to enable managing agents to identify the most material risks in the business and therefore ensure that their use of the model and risk management actions focus on the most important areas.

Lloyd's expects risk ranking to be performed at various levels, which may include:

- Major risk category (e.g. premium risk, reserve risk, market risk, credit risk etc);
- Business unit;
- Class of business or product (and possibly at a currency level); and
- Operational risk events.

One option is to start from the major risk category and consider the underlying core risk drivers. For example, for underwriting it should be possible to rank by class of business, for market risk rank by asset type, and credit risk rank by reinsurer or perhaps reinsurance programme.

A number of approaches could be employed to rank risk, and Lloyd's recommends that more than one method is applied. This could include:

- Capital allocation approach (a wide variety of methods can be applied);
- Rank according to standard deviation / variance; and
- Rank according to the stand-alone 99.5th percentile VaR, SpreadVaR or TVaR position (or other percentile).

Agents may find it helpful to consider risk in terms of quantum of total exposure, but also in terms of the risk per unit of exposure.

Where risk components are excluded from the model, managing agents must be able to demonstrate that this approach is appropriate. Usually, the reason will be materiality, in which case, agents must be able to show and subsequently monitor figures to support their views. Exclusion by reason of inability to quantify the risk, the other main exclusion criterion, requires careful analysis and justification, especially where the risk could be material.

For risk ranking to have real benefit and act as a model 'use', the results should be advised to management and be incorporated within the syndicate's wider risk assessment process. The results of risk ranking should be used to influence management decisions and/or generate discussions around the model output along with possible refinement to the model parameters. It is important that risks of a similar nature are ranked consistently throughout the syndicate and over time to enable appropriate decisions to be made. The overall risk ranking is reconciled with the capital allocation. Risk management action may be required where internal model outputs show that the quantifications or ranking of risk has changed, leading to a different understanding of the materiality of some risks. Actions could include increased validation or investigation of the reasons for change and may lead to model change.

4.8 Use Test

The internal model must be widely used in and play an important role in managing agents' systems of governance.

4.8.1 Scope of Model Use

Managing agents must be able to demonstrate that the internal model is widely used and plays an important role in the system of governance. The uses of an internal model are expected to vary according to the definition and scope of the model. Apart from the minimum uses (i.e. economic capital, capital allocation (at least at risk category level) and use in the ORSA), there is no checklist for uses of an internal model, so each agent must have its own list of uses which are both relevant and material to the business, which are tracked and documented. A policy or other board-approved document must be produced to demonstrate that model use is understood and properly managed by the board. Senior management and the board are required to use the model to make relevant business decisions (e.g. M&A) and this must be evidenced. Robust justification must be provided where use of the model is not considered to be appropriate and any model limitations in a use must be understood and clearly communicated. The model must be reviewed and the appropriateness of the model for the use in question considered and reported. New model uses must be linked to the development plan of the model. Adequate scope is also essential to allow a wide range of uses to contribute towards continuous improvement of the internal model.

Managing agents need to have a clear process for changing the internal model, as set out in Model Change Guidance and included within the model change policy.

4.8.2 Different Model Uses

Managing agents must assess each use according to the criteria of relevance and materiality, as a long list of trivial or irrelevant uses will not help towards satisfying the use test.

- Solvency capital and decision-making are mandatory uses, and Lloyd's requires that agents use their internal models for capital setting, including at a minimum, economic capital, capital allocation (at least at risk category level) and use in the ORSA.
- The internal model must also be used widely and regularly throughout the business, e.g. for assessing returns on capital, risk appetite, investment allocation, pricing and reinsurance purchasing decisions, as well as carrying out the profit and loss attribution (section 4.9.1) and performing the risk ranking exercise (section 4.7).
- Model uses must not be focused just on the regulatory capital impact level (i.e. the 99.5th percentile), but also other parts of the distribution (e.g. in the case of reinsurance purchasing).
- The model must be used when exploring potential new classes of business or closing existing classes of business.

4.8.3 Model Use in Decision-Making

The internal model must be used in managing agents' decision-making processes, specifically:

- To support the relevant decision-making processes, for example, reporting that is tailored to address the needs of different participants in the process;
- To assess the potential impact of material decisions; and
- Regular discussion and review by the board of the internal model and its results.

It is not expected that the outputs of the model will always be followed in terms of decisions made. However, it is expected that the outputs are an important consideration as part of those decisions and that this consideration is demonstrable. Managing agents must ensure that they take account of any known limitations of the internal model when they consider model outputs as part of the decision-making process. It is therefore important that model users are aware of the impact of any limitations for their specific area of use.

The internal model must give prospective support to decision-making and retrospective verification of decision-making. It must at a minimum be able to produce and measure the economic and regulatory capital and risk management impact of decisions for which the model is used.

4.8.4 Model Use Policy

Managing agents must ensure that they have documented their model uses in a model use policy or similar documentation, as this helps to ensure a common understanding amongst the board, senior management and model users of how it is intended that the internal model will be used within the organisation.

The information captured in a model use policy would typically include the following:

- A summary description of each use including:
    - brief details of how it will support business decision-making and
    - model outputs for the use;
- Key stakeholders, e.g. individuals, teams, committee(s), the board;
- Roles and responsibilities in relation to model use;
- Governance considerations – e.g. documentation and validation of model uses; and
- How feedback from model use will be captured and the link to model development and change.

There must be regular reporting on model use to the board which enables them to see whether the uses set out in the policy are fully in use and embedded. Typically, such a report would be produced on an annual or quarterly basis and must provide an overview in addition to the reporting that the board will see as a consequence of specific model uses.

Managing agents may wish to distinguish in their model use policies those uses that are seen as 'core' (i.e. regular and important uses of the model), as well as identifying the uses where further development is planned. Alternatively, this information could be included in a procedure document if not in the policy itself.

4.8.5 Evidencing Model Use

Meetings, internal review and discussion of model outputs are vital evidence of use. There must be clear evidence of the information presented to the meeting and minutes must be taken of the relevant committee or board meetings capturing the decision made as well as the key points of any discussion. If different options or approaches are discussed these must be clearly presented in papers circulated to those present at the meeting and/or clearly outlined in the minutes of the meeting. Documentation must always show the extent of use of and reliance on the output of the internal model.

Outputs from the internal model may be used more extensively than simply within committee or board meetings and form part of the information used on a day-to-day basis to manage the business. Such information may be produced for different functions within the business and may take many different forms. To evidence model use managing agents must be able to provide examples of such information derived from the internal model and identify where this is used to help with both governance and decision-making. It must be noted however that an error in the outputs of the internal model must be considered a material risk where it could influence the decision-making or the judgement of the users of the information, including the supervisory authorities.

A model use log can provide useful evidence of model uses, both for internal purposes and for external parties such as Lloyd's. The log must record where the model has been used for the uses set out in the model use policy and would typically include the following information:

- Date of use;
- Description of use e.g. capital assessment, assess impact of change in RI programme (with brief details of the change) etc;
- End user – i.e. individual/committee or board;
- Business decision outcome/summary – high level details;
- Record of decision e.g. Meeting minutes (date…), email etc;
- Model output used (e.g. reference to specific report);
- Note whether decision is consistent with internal model output; and
- Where decision is not consistent with internal model output, reasons why output rejected and/or model improvements/change required.

Internal model use is predicated on users having access to the information needed to understand and make effective use of the model. Managing agents must therefore ensure that such access is provided, using a mechanism such as tiering of documentation (see standard 6.3) into categories appropriate for different audiences. Appropriately categorised information will be good evidence when assessing the use test.

4.8.6 Consistency

Managing agents must be able to show how different uses are based on consistent model outputs. There must be robust, controlled and documented procedures for monitoring consistency. The internal model version used in decision-making must be consistent with the version used to calculate the latest approved SCR or where there is a model change in progress the version considered the best representation of the business.

The internal model must be fundamentally consistent with other tools used in the decision-making process, such as accounting, reserving and external models. Where there are divergences between the internal model and other tools used in decision-making, the managing agent must be able to explain the impact of and reason for these divergences.

4.9 Understanding the Internal Model

Managing agents should ensure that there is an adequate understanding of the internal model, both on an overall basis and in detail, within the managing agency.

In order to demonstrate compliance, the board and relevant senior management must have an overall understanding of the internal model. Senior management must have a sufficiently detailed understanding of the parts of the internal model used in the area for which they are responsible.

The board and senior management of the managing agent will be expected to know and discuss the principles of:

- The structure of the internal model, the way the model fits to the business and is integrated in the risk-management system;
- How the model is governed as well as the committee or forum charged with developing the model, overseeing the framework for designing the model and ensuring the effective operation of the model;
- Main uses of the model, and how it can inform certain decisions; examples of its use within the agent, including challenge provided to assumptions and outputs;
- The scope and purposes of the internal model and the risks covered/not covered by the internal model the general methodology applied in the internal model calculations;
- The process, in general terms, by which the model is validated;
- How the model is materially consistent with the business profile of each syndicate managed by the agent;
- The diversification effects in the internal model;
- Material limitations of the model; and
- That an error in the model is considered material if it will have influenced the decision made.

An essential part of the embedding process for managing agents is the demonstration that a process of education and communication has occurred, to ensure that all users have a sufficiently detailed understanding of the parts of the internal model relevant to the uses for which they are responsible. Examples of how this could be achieved may include:

- A training programme assigning categories to the board and senior management in accordance with the appropriate level of knowledge of the model that is required.
- Documenting elements of understanding that are appropriate for each grouping (e.g. by breaking down the 'internal model' into a number of areas and documenting the level of detailed knowledge required for each aspect).
- Evidence that training sessions and workshops were held, attendees present and the information presented. Agents should note that whilst receipt of training will help demonstrate understanding, it does not equate with "use": this can only be demonstrated through the utilisation of the model in material business decisions.

Appropriate methods should be in place to assess the effectiveness of training. This can include formal assessments, such as post training follow up reviews and consideration as part of the board effectiveness review, as well as more informal feedback and model user discussions. Whichever method is used, it is important to ensure that the purpose of the training is clear and that there is appropriate follow up to ensure that the training delivered has met its objectives and that any further training needs identified are addressed.

It is recognised that the level of knowledge expected from senior management and board members will vary according to their role. For example, the Chief Actuary would be expected to have greater technical knowledge of some parts of the model than, say, the non-executive chairman. The Finance Director may have greater understanding than the Business Development Director. However, where the model is used to inform certain decisions or as part of specific business processes, then the individuals involved in, and those who own those decisions or processes should have a detailed understanding of the model, its outputs and limitations. For example, the Reinsurance Manager and Active Underwriter should understand the reinsurance modelling process in some depth.

Senior management on the committee primarily charged with responsibility for the design, implementation and enhancement of the model will be expected to have more detailed knowledge of the model than those not on such a committee.

It is important to ensure that sufficient understanding of the internal model is maintained over time. Appropriate training is required to be provided for new directors and staff, where there is a change in responsibilities within the managing agent or where there is significant change to the internal model.

4.9.1 Profit and Loss Attribution

Managing agents must demonstrate an understanding of the causes and sources of profits and losses, show how they are explained by the categorisation of risk in the internal model and make appropriate use of the profit and loss attribution within the business – in particular apply the understanding of the key drivers of profit to business decisions made. Additionally, agents must evaluate and document their use of the P&L attribution, including understanding the reasons for deviations from the profit expectation, review it on a regular basis and ensure that feedback results in improvement both to the internal model and to the attribution itself.

Lloyd's does not intend to prescribe how managing agents must use the P&L attribution. The information provided by the attribution is a key element in an agent being able to demonstrate use of the model. P&L attribution sheds light on how the different elements of the economic balance sheet and the internal model interact, which is important in understanding the model. This information is potentially valuable in the validation process (see Validation Guidance), the system of governance, ORSA, decision support, risk management and other areas, so its use is an essential part of meeting the use test.

4.10 High Level Assumptions and Links to Other Areas

4.10.1 Prospective Loss Ratios

The principle underlying the business plan review is that loss ratio assumptions are "realistic and achievable". The principle underlying the expected loss ratio selection for capital setting is that of a best estimate (i.e. mean) outcome. Although these two concepts have similar goals, the Solvency II best estimate basis for the capital setting loss ratios should not incorporate improvements in performance, unless the measures taken have been shown to be effective (PRA's Supervisory Statement SS5/14). Lloyd's considers that only syndicates with a consistent track record of performing to plan can justify the use of SBF assumptions for capital setting purposes. Even with the occurrence of large isolated events (that are difficult to plan for), average performance should still be shown to be in line with plan over a series of years if the plan assumptions are proposed for use.

Consideration of these assumptions should be made at the level they are input into the model, for example it would not be adequate to demonstrate performance to plan in total by year if certain classes consistently do not perform to plan. Lloyd's would expect the managing agent to support the view taken by performing their own analysis showing the classes where they believe the SBF loss ratios to be too low given the track record and the increase required to achieve a best-estimate value.

The Actuarial Function opinion on underwriting policy is an analysis that should challenge these assumptions. Details on the tests that Lloyd's conducts for the prospective year loss ratios used as part of capital setting are outlined in the reserving tests of uncertainty instructions provided annually. This includes an expectation that the gross prospective loss ratio for capital setting should not be below the gross SBF loss ratio by class of business. Additionally, we highlight that systemic inability to execute planned loss ratio performance across recent underwriting years may lead to additional capital requirements beyond those implied by the reserving tests of uncertainty.

4.10.2 Opening Balance Sheet

The assets in the opening balance sheet in the model must be consistent with the projected balance sheet at the year end. The volatility in the modelling should allow for the uncertainty associated with the projection of this balance sheet. The opening model balance sheet projection (T0) should be prepared on the basis of net nil basic own funds on a Solvency II basis.

4.10.2.1 Funds at Lloyd's / Funds in Syndicates

The investment income arising on surplus assets at syndicate level and on capital, whether provided as FAL or FIS, is outside the scope of the syndicate-level SCR. Equally, the market risk associated with these assets is outside the scope and is considered within the central modelling of the Society capital requirement. The modelled asset mix should be a reasonable representation of the assets that are available to cover the opening technical provisions. It should not be assumed that these are the lowest risk assets unless this is supported by current asset-holdings and the syndicate's investment strategy. If there is an unusually risky mix of FAL/FIS assets Lloyd's may require additional capital to be provided to support this risk.

4.10.2.2 Technical Provisions

The opening balance sheet is required to be based on technical provisions projected to the model balance sheet date. Opening technical provisions are required to be set on a Solvency II basis and be subject to discounting at the risk-free rate. This must be prepared in line with the Solvency II guidelines for technical provisions (further information can be found at Lloyds.com).

The run-off of the technical provisions (excluding risk margin) within the T0 balance sheet is not expected to give rise to a profit or loss. In addition, there should be no concept of "reserve margins" as the Solvency II technical provisions are best estimate. Any reserve margins should be treated as a surplus asset and excluded from the calculation of the SCR.

Through the calculation of a best estimate premium provision, expected future profits on existing business will be recognised as part of the technical provision calculation.

Lloyd's expects that managing agents will have robust processes in place for performing the roll-forward of their latest audited technical provisions data when obtaining the T0 balance sheet. In particular, managing agents are expected to regularly refine

their roll-forward process to account for any historical inaccuracy of their T0 balance sheet. The volatility in the modelling should allow for the uncertainty associated with the projection of this balance sheet.

This is assessed as part of Lloyd's reserving tests of uncertainty tests, the instructions for which are provided to managing agents annually. As part of this process, managing agents are given the opportunity to justify what has driven any historical understatement of their T0 balance sheet. If adequate explanation cannot be provided; Lloyd's expects the managing agent to refine their process, and to perform back-testing to evidence that the new process is now appropriate. If this is not possible, a capital loading will be applied with the expectation that these process deficiencies will be addressed prior to the next roll-forward exercise being performed.

4.10.2.3 Risk-free Yield Curves

Managing agents should use consistent risk-free rates to discount their opening liabilities and project their asset returns in their capital model. This is not required to be the discount rate published by the PRA (or EIOPA). Post Brexit the PRA publishes risk-free rate term structures on a monthly basis which are required to be used for UK insurance firms to calculate the technical provisions required by Solvency II (see Technical information for Solvency II firms | Bank of England). Lloyd's requires the PRA risk free rates to be used (at an appropriate point in time) in the balance sheet for the QSR/ASR returns. Lloyd's understands that some managing agents may choose to use risk-free rates from alternative sources such as the ESG in the capital model. If this approach is being used, Lloyd's expects that agents will regularly assess the materiality of any inconsistency between the PRA rates and risk-free rates used in the capital model and make an adjustment to the SCR where this drives a material difference.

4.10.2.4 Reinsurance Contract Boundaries

Managing agents are required to ensure consistency in their treatment of contract boundaries when calculating the SCR and preparing their actual and projected T0 balance sheet and the T1 solvency balance sheets.

For existing or legally obliged reinsurance contracts any contractually obliged premium arising from current business should be included to the full extent that it is contractually obliged, with no inclusion of the *future* inwards business. For future reinsurance contracts (those not yet legally obliged) the expected proportion of the premium that applies to existing inwards contracts should be included; this proportion will need to be clearly justified.

As the authorisation of a binder does not lead to contractual arrangements with policyholders, the one-year SCRs capture solely the contracted underlying risks, not the ultimate premium under the binder. Managing agents should explain in their documentation, with suitable justification, any instances where they have taken any different approach.

Lloyd's guidance on technical provisions with regards to RI premiums is in line with Solvency II and states:

> *"Any future premiums payable on existing or legally obliged outwards reinsurance contracts (e.g. minimum and deposit premiums, and/or outwards reinsurance premiums owed in respect of the ceded business to date) should be included. These premium payments should be included at the level to which they are contractually obliged based on existing or legally obliged inwards cover, with no consideration to the future inwards business. This is irrespective of the accounting treatment adopted by the managing agent to allocate reinsurance costs equitably across years of account."*

The internal model opening balance sheet must allow for future premiums payable on existing or legally obliged reinsurance contracts in the technical provisions – and hence any assets in the model should also take these into account. Prior to this Solvency II rule, any legally obliged inwards or outwards RI premiums were considered as a future loss on the ultimate year basis and so included in the regulatory capital (ultimate SCR). These amounts are now to be treated as an upfront cost and so are moved from the regulatory capital to the technical provisions. Overall, the capital stack (technical provisions plus ultimate SCR) should remain unaffected by the adjustment. In other words, the increase in technical provisions has been offset by a decrease in capital of the same magnitude.

At Lloyd's however, the capital stack also includes the ECU. As the SCR decreases as a result of allocation of reinsurance premium to technical provisions, the ECU also decreases and thus the capital stack decreases. The SCR is adjusted to ensure the ECU is unaffected by the re-allocation of reinsurance premium. Details of the adjustment will be available on LCR Form 571. LCR Form 309 has a field to enter this adjustment for ultimate SCR and managing agents are required to complete this field.

Lloyd's adjusts the ultimate SCR to ensure the ECU is not understated as a result of this treatment of reinsurance premiums. The calculation for the adjustment is provided in LCR Form 571. The adjustment in LCR Form 309 is automatically populated from LCR Form 571. This amount should reconcile to figures in the Pillar III solvency reporting where relevant.

4.10.3 Market Risk Profit

In respect of investment return, the projection 'to ultimate' in the model may recognise income received in respect of retained profits. For the one-year SCR the model needs to release the profit as recognised annually – for the ultimate basis we require this no later than three years. This should avoid distortion in the results from inclusion of excess investment income up to the final claims payment date and it reflects the reality of full distribution of profits at Lloyd's.

Material profit from FX (i.e. over £1m) should not be included as an expected outcome of the modelling given this is not part of syndicate planned profit.

4.10.4 Ring-Fenced Funds

Lloyd's considers that overseas trust fund deposits do not fall within the definition of Ring-Fenced Funds and managing agents are not required to model these separately. The liquidity risk that arises from material overseas regulatory requirements (or any other source) should be included in the model within market risk.

4.10.5 Foreign Exchange

The LCR must be reported in converted sterling using the published prior 30 June rates for the September/October submissions or the 31 December rates for a mid-year Coming-into-Line submission. Mid-year FX adjustments are detailed in section 5.5.1.1. Please see section 5.5.1 for FX rates to be used for the QCT.

The managing agent may prepare its underlying model in any currency and present figures in the methodology document in US dollars where that is the dominant currency of exposure. All figures in the submission must be reported in converted sterling. The syndicate should make clear what currency and units are used in its reporting at any point.

Lloyd's expects models to allow for the risk of unfavourable currency fluctuations following a severe loss unless the syndicate can clearly demonstrate that the FAL strategy would deem this unnecessary. For example, if all catastrophic losses are expected in USD and the dedicated members supporting the syndicate have a defined strategy, with evidence and history, of holding USD FAL, then this risk can be assumed to be mitigated.

4.10.6 Consistency with Other Returns

The methodology and assumptions used for completing the LCR, SBF, LCM, the assets and liabilities on the Solvency II balance sheet and the technical provisions including the contract boundary definitions must be consistent. Any inconsistencies should be identified and justified with the potential impact understood.

The premium volume for the prospective year within the LCR submission should be consistent with the accompanying SBF. However, as outlined above, loss ratio assumptions for the prospective year need not be the same as those in the business plan, albeit the gross loss ratio assumptions should not be lower than those in the business plan. Additionally, consistency here means that syndicates should be able to articulate the differences between model and plan loss ratios clearly and bridge between the assumptions if there is a difference.

Any planned reinsurance arrangements should be consistent between SBF and LCR.

The assets in the opening balance sheet in the model should be consistent with the projected balance sheet as at the year-end. If agents expect to make changes to their investment profile, they should allow for this in projected balance sheet and therefore the opening balance sheet at t0 in the model as well.

Managing agents are required to reconcile the level of profit in the SBF and the LCR. Lloyd's expects this to be a bridging exercise considering any difference in assumptions (e.g. loss ratios) or accounting items and will query large amounts attributed to "other" differences.

Lloyd's will check for consistency between the LCR submission and several other returns. The validations that Lloyd's carries out will be outlined in the annual instructions.

If any of these validations fail or cannot be adequately explained, the syndicate will be asked to resubmit the affected return or an equivalent loading to capital will be applied to correct for any shortfall or operational risk implied by the inconsistency. Consideration of compliance with Solvency II requirements with respect to data and appropriateness of assumptions will also be considered.

Managing agents must have in place a process by which the consistency of data used, methodologies and assumptions can be verified. In particular, with respect to business plans and the technical provision calculation process, Lloyd's expects strong links between capital, reserving and pricing. The modelling approaches and assumptions used in pricing should be consistent

with the underwriting risk parameterisation and the assumptions used for setting reserves and determining volatility used by the reserving team should be aligned with the reserving risk parameterisation. The process verifying consistency must highlight the areas where there are inconsistencies and should ensure that these are justified, and their impact explained.

Lloyd's verifies that the profit in the unearned premium (as derived from the loss ratio on unearned premium) being claimed within the QSR / ASR submission is no greater than that calculated by the Signing Actuary as part of the SAO. Similarly, the earned margin being claimed in the QSR / ASR submission should be no greater than that calculated as part of the SAO. Where a loading is required within the QSR / ASR for the earned margin or unearned profit consideration of additional loadings in the SCR should be made, for example additional reserve risk on any earned margin loading. Lloyd's is aware that there are circumstances under which the earned margin / unearned profit in the QSR / ASR may be greater than that calculated as part of the SAO. These instances will need to be formally agreed by Lloyd's, as outlined as part of the review of those submissions.

4.10.7 Future Management Actions

Future management actions can be allowed for within the model where a managing agent would reasonably expect to carry this out in specific circumstances. Managing agents are required to document all future management actions which are modelled explicitly within a comprehensive future management actions plan.

Managing agents should not assume that future management actions would be taken that would be contrary to their obligations towards policy holders and beneficiaries, legal provisions applicable to the syndicate, and/or Lloyd's requirements. Future management actions should be consistent with any public statements that have been made.

Future management actions that could be modelled should reflect actions the managing agent will reasonably take, and the time necessary to action these. This might include:

- Withdrawal of cover or changes in policy conditions (e.g. for war business); and
- Future purchase of reinsurance.

The future purchase of reinsurance may include some uncertainty for managing agents who assume that reinsurance will be bought in line with the business plan. As detailed in Lloyd's 'Principles for Doing Business' Principle 3, the managing agent needs to evidence that the board is involved in the review and approval of the anticipated reinsurance programme for the next year. The anticipated reinsurance programme is likely to have inception dates at various times of the year (for example 1st of January, 1st of April) and there is the risk that in the event of a series of large or catastrophe losses the planned reinsurance programme may not be placed or placed at a higher cost. It is expected that syndicates can support the planned reinsurance purchases in context of their business and the commerciality of the reinsurance arrangements.

When assessing whether it is appropriate to model a future management action, the managing agent should consider the materiality of future management actions by calculating their impact on the SCR where practicable.

For any management actions that are assumed in the model, Solvency II requires that managing agents produce a future management actions plan that should be documented in line with Solvency II documentation standards. It is the responsibility of the board to approve the plan and ensure there is a process in place to maintain the action plan. These plans should include:

- Circumstances where the managing agent may not carry out the actions and how these are reflected in the model;
- The order that the future actions will be undertaken;
- Details of any ongoing work that needs to be completed before the future actions could be undertaken; and
- How the future actions are included in the PDF.

Assumptions for future management actions in the internal model should be objective, realistic and verifiable. The assumptions should take account of the time needed to implement the management actions and any expenses caused by them.

Future management actions which are allowed for in the model should be validated. Managing agents should compare assumed future management actions currently allowed for in the model with those modelled previously and those undertaken historically. Where these differ, Lloyd's would expect these to be documented and justified. The impact of any changes in the assumption on the value of the technical provisions should be considered.

Significant deviations from planned future management actions should be reported to Lloyd's, along with details of the reasons for the deviation and its consequences for the syndicate's SCR. Lloyd's would expect the model to be re-run in such circumstances, however if the model is not re-run, then capital add-ons may apply where additional risk is perceived.

Managing agents should note that such deviations may be deemed inconsistent with the Use Test. Previous deviations from planned management actions will be considered by Lloyd's in deciding whether to approve a new or changed set of future management actions.

5 Submission Requirements

5.1 Overview

This section outlines the requirements for capital submissions to Lloyd's, including any adjustments to be applied by Lloyd's. It provides a summary of the documentation requirements associated with submissions and how these interact with other returns.

Capital submissions to Lloyd's are required in September/October every year and resubmissions might be required following new business plans, March re-assessments and ongoing monitoring of capital. This section sets out the associated requirements.

5.2 Submission Requirements

The LCR captures quantitative information that, alongside the qualitative validation and documentation, allows managing agents to demonstrate that they have systems enabling them to identify, measure, manage and report risk and calculate SCRs.

The LCR provides two figures for the 99.5th percentile: The Solvency II statutory one-year balance sheet to balance sheet SCR and the Lloyd's risk to ultimate "SCR". The LCR provides data that forms a direct input into and is used to calibrate the LIM. The critical data points used are the mean and the 99.5th percentile. The other distribution points are required to validate the parameterisation / calibration produced for the LIM at syndicate level

A full submission is required in September/October (deadlines to be confirmed every year in the LCR instructions) for all syndicates with a business plan or any open year of account at the time of submission, including those in run-off or underwriting RITC business only. The exception are syndicates where capital is set by Lloyd's (see section 5.7). Syndicates planning to close all years of account at the balance sheet date and cease existence do not need to submit an LCR, as long as the receiving syndicate includes any ceded business in its LCR submission.

An LCR must also be submitted with a Major Model Change application (see Model Change Guidance for further details).

The table below provides the requirements for each element of capital reporting.

Item	Description
LCR	Quantitative capital return
Methodology document	Qualitative document supporting the LCR submission
Analysis of change	Document supporting the LCR submission
Focus Areas	Spreadsheet return
Model Change Template	Spreadsheet return
Validation	Documentation providing model validation
Validation signposting template	Spreadsheet return

A key focus for all submission items is how the capital reflects the up-to-date syndicate risk profile, with the expectation that capital responds in an intuitive way to the evolution of this. This should be clearly set out in the analysis of change.

The final SCR submitted to Lloyd's must be approved by the board or an appropriately authorised committee depending on the syndicate's governance arrangements, and in line with the Lloyd's 'Principles for Doing Business' Principles 7 and 10. Board members should ensure they are aware of all issues raised during the review process and recognise that following Lloyd's review of the SCR, loadings might be applied (see section 6).

The involvement of senior management and the board in deriving and challenging the capital assessment is part of the Solvency II Use Test. Consequently, Lloyd's requires managing agents to describe how they have engaged their senior management and the board in the process. In particular, evidence that they were able to provide informed challenge as part of the sign-off process. This is key particularly where an external model has been used or part of the SCR has been outsourced to external consultants. Lloyd's encourages managing agents to provide the board pack and board minutes with their LCR return in order to provide a clear summary of the submission and demonstrate engagement. Lloyd's expects board members to understand and be able to explain key areas of models for calculating capital requirements, e.g. primary strengths, key limitations, material expert judgements, major assumptions, or the reliability of the advice regarding the model that the board has relied upon. Lloyd's may request board minutes if a review is considering the execution of these requirements.

Information on model change is available in the Model Change Guidance. The Model Change Template must be submitted by all syndicates even if no major model change application is made.

The validation report is a key document for the board's sign-off of the capital requirements. Further information is available in the Validation Guidance. If there is a difference between the validated modelled outputs and the final submitted numbers (for example if there are late changes to model assumptions), then confirmation of the appropriateness of the validation in supporting the submission number should be provided. A full validation signposting template is required for new syndicates, otherwise, a reduced version of the validation signposting template is required from each syndicate to evidence compliance of the validation work with requirements.

An Analysis of Change document should be provided that provides commentary on the causes and impacts of the changes. The requirements for the documents are set out in more detail in section 5.9.2.

Lloyd's will publish an updated Focus Areas return every year in July. The purpose of this return is to collect information that is one of the following:

- Targeted at addressing any pre-existing concerns with syndicate modelling. This is intended to provide syndicates with additional time to consider and respond to areas of modelling that Lloyd's expects to raise as part of the review.
- One-off information that Lloyd's focuses on based on any current issues. Lloyd's will include detail on why this information is being collected.
- Information that is only been collected periodically and has hence not been incorporated into the LCR return.

5.3 SBF Resubmissions

If an SBF resubmission is required during the review process, the managing agent must assess the capital impact of this change. A resubmission of the LCR return may be required depending on the circumstances:

- Downwards capital movement:
    - Less than 10%: not required, the managing agent has the option to resubmit an LCR return. Lloyd's will not adjust capital downwards without a full resubmission.
    - Greater than 10%: Resubmission required.
- Upwards capital movement:
    - Less than 5%: No update required.
    - 5-10%: Managing agents can resubmit, or high-level adjustment can be applied by Lloyd's instead.
    - Greater than 10%: Resubmission required.

Generally, if an LCR resubmission is triggered by an SBF resubmission it is sufficient for agents to re-submit the LCR forms in MDC only without any additional accompanying documentation.

Any movement accepted without a full resubmission will still contribute to the 10% movement threshold for the ongoing monitoring of capital – i.e. if a 3% movement is accepted without resubmission then a further 7% movement in the same direction would require the managing agent to resubmit on an ad hoc basis.

5.4 Ongoing Monitoring of Capital

All managing agents are required to consider the impact of emerging information on the syndicate capital requirement and notify Lloyd's if this causes a capital movement of greater than 10% (measured before impact of risk margin, foreign exchange and Reinsurance Contract Boundary).

Managing agents are also responsible for advising Lloyd's where syndicate loss experience may reasonably be expected to have eroded member capital materially, for example, we would expect to be informed where syndicate loss experience is expected to exceed 15% of the capital associated with any year of account. There may be situations in which we would expect to know but with lower levels of impact. Please inform your syndicate capital point of contact.

Where syndicate membership changes year on year are relevant, the consideration of capital erosion through syndicate loss should look through to a year of account level to ensure that profits on one year do not offset losses on another.

In the event of significant insured or economic events close to or during a capital review period, it may be necessary for some syndicates to resubmit the LCR to reflect the impact of such events on their SCRs. Lloyd's will seek to adopt a pragmatic approach, but action and timetable will depend on the materiality and timing of any such event and the constitution of the syndicate's stamp. If required, instructions and revised timetable will be communicated at that time. Further details are available via the downloadable Market Turning Event guide on Lloyd's.com.

5.5 Quarterly Corridor Test (QCT)

All members are subject to Coming-into-Line annually in June, which is when members are required to ensure their capital meets the required level. Member level assets and liabilities are compared each quarter to their latest ECA requirement as part of the of the QCT. Where a member's assets, as defined in the Membership and Underwriting Rules (M&URs), is below the required level of 90% of ECA, further FAL will be required in adherence to the M&URs. Members will also be permitted to release surplus FAL above 110% of ECA.

Underwriting restrictions or other measures may be imposed to mitigate the risks until capital is lodged at Lloyd's.

The final agreed SCRs (per the latest CPG letter) will be adjusted for FX and balance sheet movements as detailed below for the quarterly corridor tests and mid-year CIL. CPG letters will not be published for the QCT process as the adjustments are at member level only to ensure consistency with solvency valuations. The notional adjusted syndicate ECA can be viewed in the Member Modeller and the member capital statements will include the QCT adjustments. CPG letters will be produced as previously to reflect the mid-year CIL adjustments. The introduction of the QCT process means that Lloyd's will in general consider changes in capital four times a year – and will not consider any other adhoc changes outside of this process unless in exceptional circumstances. This means syndicates can submit their LCR due to material movements (including any major model change applications if required) and/or can address loadings according to the following timetable. This includes large risk profile changes (e.g. due to new reinsurance arrangements or new SBFs). The timings are as follows:

- Penultimate Thursday in January for review ahead of the Q1 QCT;
- The March LCR resubmission date for review ahead of Mid-Yr CIL;
- The first Thursday in April for review ahead of the Q2 QCT; and
- The first Thursday in July for review ahead of the Q3 QCT (exceptional circumstances only).

Other changes to capital, which fall outside the definition of "material" as defined in the March re-assessment template (see below), will not be accepted or reviewed. Major model changes can be submitted to Lloyd's in line with the Model Change Guidance, but this will NOT lead to a change in the capital requirement in the QCT if the major model change does not result in a material change in uSCR.

Please note that from 2023 syndicates are expected to submit an LCR by the Q1 QCT deadline for greater than 10% movement in capital, which have occurred since the September/October submission and not wait until the March re-assessment. Changes include late re-submissions of SBFs, RITC and other retrospective reinsurance arrangements and cession changes for SPAs. In general, syndicates should prepare a LCR submission for material changes as soon as these are known.

Any LCR resubmission must be accompanied by validation that is proportionate to the nature and level of model change. It is expected that this will inform the board's decision to approve the SCR and submission to Lloyd's. In general, this means that a full validation report is not necessary for resubmission, however model changes should be validated, and tests rerun if the nature of the model change and/or risk profile changes requires this.

5.5.1 Lloyd's Adjustments for the QCT

As stated above Lloyd's centrally the agreed SCR capital requirements to ensure consistency with the solvency valuations – in particular using consistent exchange rates and adjusting the risk margin and RICB reported in the LCR to be consistent with the latest Solvency II balance sheet, i.e. the QSR and ASR submissions.

5.5.1.1 Foreign Exchange Movement

The SCR is adjusted for the movement to the latest quarter end USD exchange rate (31 December for the CIL process) from the rate used in the latest agreed LCR. This adjustment is applied to the percentage of USD losses present in the Lloyd's SBM for each syndicate (based on a combination of SBF for proposed and current years and QMA data for all prior years of account). This generates an approximate FX movement percentage, which is applied to the uSCR and one-year SCR.

5.5.1.2 Risk Margin Movement

The projected risk margin from the LCR, adjusted for the approximate FX movement percentage, is compared to the actual risk margin included in the Solvency II balance sheet (latest QSR submission for QCT and ASR for CIL). The difference is applied to the uSCR only. The risk margin movement is not assessed as part of the Q4 QCT process as the LCR is projected to year-end already.

5.5.1.3 Reinsurance Contract Boundary

The revised contract boundaries for outwards RICB, is shown as an adjustment to the uSCR only in the CPG letters. The adjustment is calculated as the difference of the modelled value (based on projected Q4 Technical Provisions) to the latest QSR, submission for QCT and ASR for CIL adjusted for the ECU.

5.5.1.4 Treatment of Loadings & Adjustments

Loadings are generally not updated for FX movements – unless the loadings relates to an adjustment of SCR (e.g. loading due to inconsistency between SBF and LCR, RITC capital adjustments etc) or the loadings are set as a percentage of SCR (e.g. new syndicate, controls and Solvency II loadings), as these will then be recalculated based on the updated SCR.

5.6 March Re-Assessment

Following year-end, all syndicates are required to re-assess their capital based on actual positions at year-end. Managing agents should update the model to include the actual technical provisions within the unaudited QSRs and make allowance for any changes in business plans, risk profile and rates of exchange. If ASRs are not available at the time of March re-assessment, managing agents should make reasonable efforts to use the latest view of technical provisions at the point of running the model. In a similar vein, managing agents should not use the latest approved SBF if there is a more recent version of the business plan that is being used internally at the syndicate. It is this more up-to-date version that should be used for the March re-assessment and, generally, for ongoing monitoring of capital. Lloyd's requires all syndicates to re-run their models to assess the movement and submit the movement in capital requirement in the March Re-assessment template which will be available on the website after the year-end exchange rates have been published.

The modelled impact of the RICB and risk margin are expected to be the same as reported in the Q4 QSR where a March re-submission is made. Lloyd's will centrally adjust these to match the audited ASRs when they are available as per the process outlined above.

If this return indicates a 10% (or greater) absolute movement in uSCR, prior to any adjustment for latest risk margin, foreign exchange and RICB movement, then a full capital submission is usually required in March. Lloyd's reserves the right to request a capital resubmission, for the mid-year Coming-into-Line exercise/Q2 QCT, where deemed appropriate even if the 10% threshold is not breached. Major model changes can be submitted to Lloyd's in line with the Model Change Guidance, but this will NOT lead to a change in the capital requirement in the QCT if the major model change does not result in a material change in uSCR.

As part of the March re-assessment process, any planned increase in LCM 5 catastrophe risk will be reviewed separately by Exposure Management to ensure adherence with market messaging in respect of the catastrophe risk appetite ratio. Therefore, while the change in catastrophe risk may not lead to a change in uSCR of more than 10% and hence a capital resubmission, Lloyd's may load capital to maintain the catastrophe risk appetite ratio.

If any changes to the SBF or LCR prospective loss ratios are made as part of the March re-assessment, this will trigger a review of any loss ratio loadings applied. The specifics of this test are outlined as part of the reserving tests of uncertainty instructions, which are provided annually.

Additionally to the re-submissions, Lloyd's will adjust syndicates SCRs centrally as outlined above. A capital letter detailing the capital adjustments processed by Lloyd's, as part of the mid-year CIL/Q2 QCT exercise, will be sent to all managing agents in early April. The FX item above does not apply to syndicates that resubmit their LCR in March, for these only risk margin and RICBs will be adjusted in line with the ASR data where necessary.

5.7 New Syndicates

Managing agents have time to develop their own internal model and apply for approval. This is required to be done within three years from the first SBF submission. However, in circumstances where the benchmark model is less appropriate for a syndicate's specific risk profile, Lloyd's may require the syndicate to develop an internal model sooner. During the period that a syndicate does not have an internal model, Lloyd's will set capital for the syndicate.

Further information about how capital is set for new syndicates and the process for obtaining approval for an internal model is set out in the specific guidance for new syndicates, which is available on Lloyds.com.

5.8 Retrospective Reinsurance (including RITCs)

For Retrospective Reinsurance (including RITCs), different procedures apply depending on the nature and timing of a transaction.

Syndicates will generally be required to provide a partial-LCR via MDC, splitting the capital impact of the business being ceded and that remaining in the ceding syndicate. The exact requirements of the ceding and receiving syndicate will depend on factors such as whether the receiving party is within Lloyd's and whether it is the final open year of account that is being closed.

Detailed guidance on the capital requirements for retrospective reinsurance deals will be published on Lloyds.com. This guidance will outline:

- The process that should be followed by ceding and receiving syndicates;
- Timing considerations and deadlines – in terms of both submitting the data requirements to Lloyd's, depositing capital for the receiving syndicate and getting capital returned to the ceding syndicate; and
- Guidance to syndicates in producing a partial-LCR.

It is important to note that the receiving syndicate should fund (via FAL) the additional capital requirement prescribed by Lloyd's, prior to signing the contract. The restrictions on Letters of Credit must also be considered in accordance with Market Bulletin Y5177.

5.9 Documents to be Submitted with the LCR Return

5.9.1 Methodology Document

Managing agents must prepare the methodology document in accordance with requirements under Article 125 of the EU Directive (2009/138/EC) to document the design and operational details of the internal model. The document must be prepared with the objective of demonstrating equivalent compliance with Articles 121 to 124 of the Directive and provide a detailed outline of the theory, assumptions, and mathematical and empirical bases underlying the internal model.

Managing agents should consider the principles of Article 243 of the Delegated Acts (2015/35) which requires that the document is *"…sufficient to ensure that any independent knowledgeable third party would be able to understand the design and operational details of the internal model and form a sound judgement as to its compliance with Article 101 and Articles 120 to 124 of [the] Directive"*. Managing agents should treat Lloyd's review team as the knowledgeable third party.

Accordingly, managing agents should include all information that they would reasonably believe would influence the judgement of a third party regarding the appropriateness of the methodology and the assumptions of the model. The methodology document should identify the key judgements, assumptions and sensitivities affecting the SCR and provide explanations of why the modelling approach is appropriate for quantifying these extreme outcomes.

Documentation on model appropriateness is required to be updated on at least an annual basis, as a minimum providing a confirmatory statement that previous documentation remains relevant.

Managing agents must provide the latest version of their methodology document on an annual basis, unless the document has not been updated due to there being no changes to the modelling assumptions. In this case a confirmation statement should be provided in the final document. Managing agents may submit two separate documents for modelling methodology and parameterisation. Managing agents must ensure that documentation satisfies the documentation requirements section below and Lloyd's 'Principles for Doing Business' Principle 7.

5.9.2 Analysis of Change

This section outlines the requirements expected for the documents accompanying the LCR submission.

In order for Lloyd's to ensure that the SCR is appropriate, it is important to understand any movements from one approved SCR to the next submission. Documentation must be provided in an analysis of change document that explains the movements in SCR from one submission to the next. Managing agents should explain the "WHAT" of the movement in key metrics and "WHY" these have occurred. This should align to a discussion of changes in the risk profile and how these have been reflected in the internal model.

The key metrics that Lloyd's investigates as part of the review are played back to syndicates in the analysis of change form (LCR Form 600), and includes any movement in:

- Ultimate and one-year SCR;
- Standalone risk types (Premium, Reserve, Insurance, Credit, Market, Operational);
- Diversification benefits within and between risk types including contribution to capital from different risk types; and
- Risk Margin.

Explanations of movements should explain and split out movements due to exposure/risk profile changes, parameterisation/volatility changes and methodology changes as far as possible. In general, movements in the SCRs as well as the risk categories should be explained in terms of the change categories detailed in the Model Change Guidance. In addition, changes detailed in the Analysis of Change document should link back to the changes submitted in the model change template. Furthermore, it should be highlighted if a change is carried out due to feedback from the regulator or validator.

Lloyd's expects a level of analysis that appropriately encompasses the syndicate's risk profile, including any changes to this. The detail needs to be sufficient for an independent knowledgeable individual to understand the changes made and should be proportional to the quantum and qualitative aspects of the changes, in line with the classification of the changes according to the syndicate's model change policy. A high-level summary designed for internal senior management will usually not provide sufficient detail. Comments on the main movements provided in LCR Form 600 are still required and are a useful high-level summary; but will not be at sufficient level of granularity to provide Lloyd's enough detail for review purposes.

Principles for the analysis of change are:

- Lloyd's expects managing agents to provide commentary on how the model represents the risk profile, with reference to recent experience and any emerging features of the risk profile. Movements will not be accepted by virtue of being the consequence of input updates and must be analysed in full to ensure they are clearly understood for both one-year and ultimate capital.
- The level of detail provided will depend on the materiality of the risk type to the SCR and the extent of the relative movement of the risk type.
- For the vast majority of syndicates this will mean that the detail for premium and reserve risk will include a description of changes to material classes of business.
- Within a risk type, Lloyd's requires explanations of changes, even if these are offsetting overall. For example, if premium risk is stable overall but there have been material changes to parameters and methodology which largely balance out, Lloyd's would still expect to see details of these.
- Explanations which cover both the one-year and ultimate SCR are acceptable, but where movements in these differ in proportion or are counter-intuitive (for example ultimate risk moving more than the one-year), this should be highlighted and explained.

Requirements:

- An AoC document in line with the guidance is required with each LCR submission, this includes Major Model Change submissions.
- The AoC document should be a single document detailing changes between the last approved capital figure or MMC (if submitted and approved) and the current submission.
    - If an MMC has been submitted and approved, since the last approved capital figure, the main focus of the AOC is on changes since the MMC, but the executive summary should include comments on changes since last approved capital as well. Multiple documents covering different time periods are not acceptable.
    - The only exception is in respect of minor changes made to the internal model just prior to submission where there has been insufficient time to update the main AoC document. In this case a document bridging between the version used in the AoC document and the submitted SCR would be acceptable.

- The AoC document can be an internal AoC not specifically prepared for Lloyd's if this details all changes between the last approved figure and the current submission and is in line with the other requirements set out in this section. The exposure measures used do not necessarily need to be the same ones used in LCR Form 600, but the definition of risk categories would need to be the same as set out in Lloyd's reporting (e.g. it would not be acceptable to include discounting within Premium Risk).
- The document can be in a currency other than GBP. If GBP is not used, it should be clear that the starting and end points of the one-year and ultimate SCR when converting to GBP are consistent with the relevant LCR returns.
- The magnitudes of changes reported in the AOC should match those reported in the MCT. A mapping may be useful in this case, if different granularity of changes are used in the different documents. If the magnitudes do not match, explanations must be provided as to the cause of the difference and this will be reviewed.
- Multiple syndicates can be covered by the same AoC document, however the principles outlined above apply for each syndicate. Explanations which cover multiple syndicates should identify the impact to each syndicate with justification of any differing impacts.
- There is no Lloyd's requirement for the document to be subject to prescribed governance. However, Lloyd's would expect the report to be produced in line with standards applied by the organisation on any other external report, including relevant professional standards.
- Model changes: where reference to model changes is made (major or otherwise), the specific relevant model change should be included. Lloyd's expects that the AoC documentation would refer to all model changes made in the relevant period and included in the Model Change Template and provide a summary of the impact of each individual change.

5.9.3 Model Validation

Managing agents are required to have a comprehensive validation process to demonstrate that an internal model is suitable for setting capital both for Lloyd's capital requirements and under Solvency II. Many validation processes are mandatory under Lloyd's Guidance and 'Principles for Doing Business', including stress and scenario testing, sensitivity testing, back testing and profit and loss attribution. The detailed requirements for model validation are set out in the Validation Guidance.

Lloyd's considers model validation an essential process for validating both the SCR and a managing agent's status against the Solvency II Tests and Standards. The report should validate and support the LCR submission made (both on a one-year and ultimate basis). Lloyd's expects the report to address any feedback provided by Lloyd's in previous reviews. The validation cycle each year must validate material risks and the SCR submission. A full validation programme may be extended over the three-year validation cycle.

Validation reports may be based on draft SCR numbers. Lloyd's encourages syndicates to treat model validation as a year-round process and not wait to undertake validation on only the final SCR to be submitted. Syndicates should therefore consider which areas of validation can be done on a draft version of the model and plan a timeline to enable continual validation. The syndicate should include a bridge between the draft validated and the final SCR submitted. Lloyd's expects the individual responsible for model validation to ensure the robustness of any findings or conclusions made on draft versions of the model. Validation of any material changes to the assumptions or outputs of the draft version should also be included in the validation report.

In addition to the validation report, managing agents must submit the validation sign-posting template. This template provides assurance that the validation report meets Lloyd's Validation Guidance.

Lloyd's continues to rely heavily on the validation report as part of the SCR review process and refers to the validation findings when gaining comfort with the level of SCR at an overall and risk type level. It is a matter for managing agent preference how reporting, such as analysis of change, is divided between modelling and validation functions. It is required that all output has been considered by the validation function.

6 Lloyd's Review Process

6.1 Review of the September/October LCR submissions

Lloyd's review of each syndicate SCR is designed to reach a conclusion on regulatory compliance and adequacy for capital setting to maintain policyholder protection and member equity. The review covers both one-year and ultimate capital.

Lloyd's has allocated responsibility for each risk category to the most relevant department to produce a multi-disciplinary team for each syndicate. The capital review will be led by the analyst within MRC.

The capital reviews are conducted in co-ordination with the business plan review. Accordingly, managing agents should expect to deal with a number of different staff members in a co-ordinated manner during the review periods with the main capital contact being the allocated MRC analyst.

Lloyd's is committed to ensuring transparency in its decision-making related to the approval of capital. This section outlines some of the considerations that will be made as part of capital reviews.

A capital review uses a number of high-level metrics/diagnostics supplemented by detailed investigation. The high-level metrics apply across risk types and generally consider the model output in the context of risk profile (especially emerging risk/experience) and movements from previous figures.

Test Area	Metrics considered	Questions asked
Overall	• Stress/Exposure • Contribution to capital • Movement from previous submission and identified drivers • Market decile and movement in this • Comparison to Central view • Sum of Squares test of Diversification	• Does the position match the risk profile – are the key risks driving capital? • Does the movement match the risk profile change? Has it been explained? • Is it consistent across risk types – e.g. premium risk down due to greater RI means greater RI credit risk? • How has experience been responded to? • What model developments have been made and why? • Are risks contributing more than under independence?
Reserve risk		
Premium risk		
Catastrophe risk		
Credit risk		
Market risk		
Diversification		
Operational risk		
One-Year		

Lloyd's expects syndicates to provide commentary on how the model represents the risk profile, with reference to recent experience and any emerging features of the risk profile. Movements will not be accepted by virtue of being the consequence of input updates and must be analysed in full to ensure they are clearly understood for both one-year and ultimate capital. Movements or results in the one-year values cannot be accepted as being a function of the ultimate without also being justified in risk profile terms.

Lloyd's considers and reviews the analysis and documentation provided by the managing agent in detail. In order to make the review more transparent, Lloyd's has shared a number of minimum tests with managing agents. Agents are required to run these and flag areas of concern. If any of the tests fail, the syndicate must provide robust justification to support the model output. The justification provided will be reviewed as part of the capital review and a loading may be applied if it is not deemed to be sufficient. Please note that the reverse does not hold, i.e. passing the minimum test does not necessarily mean that Lloyd's has no further questions on the minimum test areas, as these only constitute a baseline for our review. The tests are outlined in the LCR instructions and will be reviewed annually. Moreover, Lloyd's will also apply a number of tests on reserving uncertainty, e.g. the reserve roll-forward test and testing of prospective loss ratios. The details of these tests will also be outlined in the LCR instructions.

If Lloyd's review identifies a limitation in the modelling approach, analysis and/or documentation that introduces an uncertainty associated with the level of projected capital, Lloyd's will apply a loading to address this uncertainty until it can be fully resolved by the managing agent. Loadings will be applied in response to particular uncertainties, concerns around governance and processes (as a 'controls load') and/or in response to Solvency II compliance issues.

The LCR review process is risk-based and applies a more detailed level of review to syndicates considered to present a higher risk of capital understatement to the central fund. The review levels are determined according to a set of qualitative and

quantitative metrics which will be published in the LCR instructions. In general, the risk of capital understatement is influenced by:

- Materiality of the syndicate;
- Movement in SCR and the underlying risk types as well as stress to exposure measures;
- Model changes – major model change applications submitted with the LCR and any major model change applications reviewed during the year;
- Deep dives conducted in the year; and
- Known issues with the syndicate, e.g. those flagged for additional oversight through Lloyd's 'Principles for Doing Business', as well as prior loadings and model issues.

6.2 Other Reviews

To support the risk-based review process during September/October, reviews are also undertaken throughout the year. These reviews include major model change application reviews, investigations of syndicates with a large difference compared to the LIM's corresponding capital calculation, deep dives, thematic reviews and reviews of new syndicates coming off the benchmark model.

The regulatory capital requirement for the Society and Central Fund is calculated using the LIM. This model is parameterised independently of market models using market data (primarily TPD and SBF) and does not make a detailed allowance for all risk profile features specific to each syndicate. Lloyd's monitors the level of syndicate submitted SCR compared to the level in the LIM and will engage with individual syndicates to understand drivers of change and risk representation, where there is a material divergence in view.

For any review planned, Lloyd's will contact the syndicate to discuss the scope and associated timescales.

7 Internal Model Data

7.1 Data Governance

Managing agents are required to ensure there are appropriate data governance structures and procedures in place for the internal model. This includes both input data and output management information.

The data governance framework must capture the structures and procedures, including triggers for escalation, to support the quality of data used within the internal model and in the setting of insurance reserves. Managing agents are required to have a framework in place which shows clear oversight of the quality of data, responsibilities and accountabilities throughout the organisation, from the board down. A director(s) must be nominated with accountability for oversight of the governance framework for internal model data. Managing agents are also required to ensure that the necessary management information is produced to determine whether the syndicate is meeting strategic plans, syndicate business plans, budgets, forecasts and other model uses, such as operating within risk appetite (see section 4.8).

The data governance framework must set the tone and provide appropriate oversight of the implementation of the data policy with regards to data necessary for sound decision-making. In addition, it must ensure appropriate, accurate, complete and timely reporting to support required governance and management decision-making processes together with prompt detection of issues.

The data governance framework is part of the managing agent's general governance framework and must be included in the relevant policies and governance reviews. The written policies and procedures in place must allow for effective management, recording, production and reporting of internal model data; these must be reviewed and agreed by the board. Managing agents are required to consider data governance, controls and limitations within the internal model validation process.

Managing agents should able to demonstrate that the data policy has been approved by management and has received an appropriate degree of challenge and oversight prior to approval. Where there is inadequate oversight of the development and implementation of the data policy, there is an increased risk of poorly informed decision-making and non-compliance with the required quality and standards.

Lloyd's expects managing agents to ensure that written data policies, procedures and standards are kept under regular review, at least on an annual basis, and that the approval process is appropriately represented throughout a managing agent's governance structure. These documents must include the responsibilities and accountabilities of the various stakeholders across the managing agent and the quantity and quality of data metrics reported to management and the documents must be approved by the board.

7.2 Systems and Processes

Managing agents are required to ensure that they have systems, processes, modelling tools and analysis methodologies in place to meet the requirements of all aspects of the business. These must record internal model data in sufficient enough granularity and coverage to appropriately monitor performance against strategic plans, syndicate business plans, budgets and forecasts, as well as use the output for reporting to management and to Lloyd's. It is important that systems and processes relating to internal model data can produce timely and accurate returns to executive management, the board and ultimately to Lloyd's and external regulators in the required format.

Lloyd's expects relevant data from models and forecasts built to be in the data infrastructure for the production of internal model data returns to Lloyd's and for syndicates to give due consideration to IT systems with regard to data so that the quality and integrity of the data and its processing is not compromised, e.g. enabling syndicates to meet other appropriate external regulatory requirements and guidelines. Managing agents are required to document the use of IT systems within data management.

The resources involved in data management will need the relevant skills and experience to ensure there is familiarity with systems, processes and tools, recognition of market groups within the Lloyd's market and external service providers who could assist with data solutions and consideration of any tools and techniques suggested by Lloyd's.

7.3 Quality Control

Managing agents are required to have processes in place to review the systems and controls framework ensuring internal model data is accurate and complete.

Throughout the production process of data, from recording to reporting, there must be controls in place to ensure the accuracy, appropriateness and completeness of data, which can include, for example, data error reports, validation reports

and exception reports. Exception reports may contain unusually large data items, entries with unusual currencies for the syndicate or blank data fields where information would be expected to have been entered as well as many other types of exceptions identified by managing agents.

Syndicates are required to identify potential variances or control failures in recording and producing internal model data and ensure these are investigated and escalated as appropriate.

There must be a process of checking the quality of data on a timely, frequent and ongoing basis with due regard to the materiality and the potential risk associated with inaccuracies. Where data entry is outsourced, accountability and responsibility remain with the managing agent who must also have a process of quality checking.

Lloyd's expects agents to perform a risk and impact (sensitivity) assessment for each data set to identify:

- Whether the impact of poor quality data (individually or in aggregation) on the internal model is material;
- The points in the data flow from source to internal model where likelihood of data errors is the greatest, and therefore, what specific data quality controls are required; and
- Tolerance threshold beyond which a data error could become material (individually or in aggregation).

Managing agents are required to have an appropriate internal audit programme in place. Internal Audit are required to undertake regular reviews of the systems and controls for data used in the production of management information and returns to Lloyd's and other appropriate external regulatory and accounting returns. This programme must include:

- Data validation and consistency;
- Data completeness;
- Effectiveness of analysis procedures; and
- Process of converting data to Management Information.

Accuracy requires freedom from material error, consistency over time and timely and consistent recording.

Completeness requires sufficient granularity and adequate historical information to identify trends and assess data characteristics. Such data must be available for all key risk groups and all relevant data must be utilised.

Appropriateness requires consistency of the data with its uses, that there is sufficient data to exclude undue estimation error. Moreover, the data must not be able to falsify the assumptions made in the internal model or technical provisions calculations and must reflect appropriately the risks to which the syndicate is exposed. Data must be considered consistently with the model time horizon to which it will be applied with, for example, movements in single calendar periods being an insufficient reflection of ultimate volatility. Managing agents must be able to provide justification of the appropriateness of the data used to inform parameterisation.

7.4 Data Policy and Directory

Managing agents are required to establish, implement and maintain both a written data policy and a data directory for the data used in the internal model. This must include all items of data used in the internal model and calculation of the technical provisions and specify at a minimum the data source, characteristics and usage. It must also include explicit reference to other data frameworks, processes and procedures.

7.4.1 Data Policy

Managing agents must establish a data policy, setting out requirements on data quality and data updates. As with all other policies, this sits under each managing agent's documentation governance process and changes to this must be informed to Lloyd's based on each managing agent's model change policy. The data policy must cover the scope of the internal model and also the technical provisions, if they are not included within the scope of the internal model. It is the choice of the managing agent to define the internal model and the degree to which data standards are applied outside the internal model. Solvency II requirements imply that the data policy must be extended to cover the wider flow of data that feeds the internal model, including source systems and databases.

The data policy must include explicit reference to detailed frameworks, processes and procedures for the collection, processing and application of data. For example, a data policy could specify the requirements that data processes outside the internal model need to meet, in order to feed that data into the internal model. Where the internal model does not include the technical provisions, a separate document on the data policy for the technical provisions is required. Lloyds expects agents to

consider whether it may be appropriate to prepare a separate policy for different applications of the data or to create an overarching data policy.

The data policy is a key document and the guidance below provides further detail on the potential contents. This guidance is not intended to be prescriptive but instead provides an example of the potential content.

A data policy document must outline, at a high level, the overall intent of the data within the managing agent. The policy does not need to cover detailed processes provided that the processes which the agent has in place for checking and validating data quality are documented elsewhere in detail. It would, for example, be reasonable for a managing agent to have one data policy over a number of syndicates so long as the features and issues pertaining to that data were similar.

Example Data Policy

Proposed section header	Example fields
Title page	With managing agent/Syndicate name
Approval record and document history	Document owner, author, date and version number. Person(s) approving the Policy, date and version. Version history, changes made, date and author.
Table of contents	Summary of all headings and subheadings with applicable page number.
Purpose and scope of the Policy	Why the Policy is needed and its desired outcome? What is in scope of the data policy?
Executive summary	Background (explain the need for the Policy). Business objectives for the Policy. Policy ownership. Key stakeholders, signatories and period for Policy review. Communicating key uncertainty.
Terminology	Interpretation of the following terms to managing agent: Materiality; Consistency; Proportionality; and Accurate, complete, appropriate.
Ownership & controls	Data ownership. Data controls / checks.
Policy maintenance	Policy update process & frequency.
Expert judgement	Definition of expert judgement. Overall view on reliance on expert judgement. Details of who has authority to act in the capacity of an expert, and where the expert judgement can be applied. Details of independent review process.

Data quality and deficiency	Data quality management: • Data quality criteria to be applied (including accuracy, completeness and appropriateness); • Details of data limitations; • Data thresholds; • Roles and responsibilities; • Details of data audit processes; • Detailed processes for monitoring and validating data quality; • Data deficiency process; • Roles and responsibilities; and • Reference to other data frameworks, processes and procedures not covered here. Detailed process for application to external data.
Data update processes	Data update frequency standards: • For regular data updates; and • For unscheduled data updates. Details of process for recording and auditing data updates and adjustments.
Evidencing	Methodology for the validation of data. Guidance on appropriateness of validation test.

Managing agents are required to have processes in place ensure accuracy, completeness and appropriateness of the internal model data on a timely, frequent and ongoing basis.

The process specifications must include a precise description of the various methodologies in use, the determination of responsibilities and the frequency of application.

7.4.2 Data Owners

It is unlikely that managing agents will be able to achieve and sustain acceptable levels of data quality without formal accountability for data quality. Responsibility for the quality of specific data items and data sets must be assigned to specific "data owners". A data owner must be someone who understands the meaning and daily uses of the data, with sufficient authority to ensure adequate quality procedures and processes are implemented and followed.

7.4.3 Data Updates

Data updates must be related to the frequency of model use, but all data must be reviewed at least annually and updated when appropriate. Normally, more frequent updates will be required than once per year.

The data update process must be a well-defined and consistent process for refreshing or updating all data items in line with the data policy. The process must include appropriate change controls (automated or manual) which take into account any material impact (individually or in aggregation) on the internal model. MI must be produced to evidence the data update process.

The data policy must include details of the data update process, roles and responsibilities, triggers and any dependencies which may impact the update frequency.

7.4.4 Implementation of the Policy

Managing agents must also be able to evidence the practical implementation of the policy across the organisation and the governance around the policy. This must include the frequency of the review of the data policy, associated procedures and standards.

7.4.5 Data Directory

Managing agents must establish and maintain a data directory in order to meet Solvency II standards. It must cover all data used to operate, validate and develop their internal model, specifying source, characteristics and usage at a minimum.

The minimum requirement for the data directory is to cover the internal model related data, however so defined. It is the choice of the managing agent to define the internal model, and the degree to which data standards are applied outside the internal model. However, the data standards, including the data directory, must also apply to the data used in the calculation of the technical provisions. This guidance is not intended to be prescriptive but instead provides an example of the potential content.

The table below summarises the possible template column headings for a managing agent's Data Directory divided into the required elements:

Data directory field	Description
Source	Data Origin: Where the data originated from e.g. broker, assured. Data Storage: Where the data is stored e.g. data warehouse and if there are multiple copies. Data Owner: The Owner of the Data (this may change at varying stages of data use/transformation).
Characteristics	Granularity of the data e.g. line of business level, by year of account and currency. Data Type: What form the data is in e.g. frequency and severity. Currency of data: what currency to store data in, and relevant exchange rates to apply. Data Quality Standard. Data Quality Judgement / Comment: Commentary on quality of the data set i.e. completeness, accuracy and appropriateness. Materiality: A comment of how material is that data set in relation to the total model output e.g. significant driver of the SCR.
Usage	Risk Type: What risk type(s) the data is used to quantify / validate / develop e.g. Insurance Risk. Model Area: More granular use of data e.g. Gross Underwriting Losses. Data Usage: What the data is used for in relation to the internal model e.g. operate, validate or develop. Data transformation: aggregation, augmentation, enrichment and derivation processes.

In addition to the items above, there must be further documentation working through the detail of how data has been adjusted, parameters selected and methodologies chosen.

The directory must be used to help demonstrate other internal model requirements, including but not limited to:

- The consistency of data through clear definitions of data sets (no internal contradictions);
- Identifying data sets for focused demonstration of complete, accurate and appropriate data; and
- Data transparency.

It is important that there is a clearly defined link between the data directory and model changes to ensure the data directory remains consistent with model design and development.

Using and producing the data directory must help agents understand the uses and hence the materiality of each data item to the final modelling process and result. This must ensure that efforts in relation to data cleansing are focused on areas where the most material benefits can be gained. Such a directory must also help agents to understand where data is updated or adjusted using judgement.

The lineage of data is an important concept in demonstrating an understanding of data within the agency. Data directories may include details of this lineage to explain fully the journey that data goes through from the original data entry through to use in the internal model. Each managing agent will decide the most appropriate format for the data directory depending on its specific requirements. The following are all possibilities: relational database, flowcharts, spreadsheets, word-processed documents. Managing agents may or may not choose to include the former element in the data directory itself. Notwithstanding this, the data warehouse would still be subject to data requirements on documentation and it cannot be assumed that data within the data warehouse is exempt from data validation.

With regards to the data journey, it would be reasonable to draw a dividing line between data up to and including a data warehouse and data used after that point through to use in the internal model. The distinction between the two is that the former must be factual with little by way of judgement or interpretation. The latter is subject to the adjustments, as mentioned above. Major system / data flows from source databases into the internal model must be understood and documented as part of the overall internal model documentation.

7.4.6 Data Consistency

Managing agents must ensure the consistency of data assumptions used throughout the internal model, in the calculation of technical provisions and over time. Any inconsistencies must be documented and justified. Managing agents are required to ensure that:

- Assumptions made in collection, storage, processing and application of data must be consistent;
- Data is used consistently throughout the internal model and in the calculation of the technical provisions;
- They document where there are inconsistencies in the use of data and justify these; and
- Data is used consistently over time.

It is important that data required for different uses is consistent. For example, it is evident that capital requirements are impacted by the size of balance sheet items, and so claims reserves must be calculated consistently with capital, which includes a requirement for consistency of data used across the two areas. The assessment of data accuracy must include appropriate cross-checks and tests as to its consistency with other relevant data and with the same data at different points in time. The expectation is that the same data sets will be used for both the internal model and technical provision calculations.

Lloyd's carries out validation of data submissions received to check for the consistent use of data. Lloyd's will raise queries with agents where there are discrepancies and consider the impact of these on the agent's compliance with Solvency II requirements as well as whether remediation is needed.

7.4.7 Data Limitations and Adjustments

Managing agents are required to document appropriately any material limitations of the data used in the internal model and any resulting adjustments or approximations made via expert judgement. With regard to data used in the internal model, managing agents;

- May adjust the data to overcome weaknesses, in which case they must store the original data and document the nature of and reason for the adjustments; and
- Are required to ensure that limitations and any resulting adjustments or approximations are subject to appropriate governance oversight.

The data used in the internal model and technical provisions may present limitations and where material these limitations must be documented appropriately. The documentation of limitations must include:

- A description of the limitation, including information of materiality, duration and impact;
- How such limitations will be remedied where possible; and
- The functions within the governance system of the syndicate responsible for this process and data.

Managing agents are required to document all data limitations both in terms of weaknesses and absences of appropriate data. In order to achieve this, managing agents could consider the use of a Data Deficiencies Log or similar recording mechanism.

In considering the appropriate use of data, in particular where limitations or weaknesses are present, there may be instances where data needs to be adjusted or approximated via expert judgement. Where data is adjusted or approximated, this must be documented - this includes the reason for and the nature of these adjustments, as well as documenting and justifying the expert judgement employed. The managing agent must also ensure that adjustments/approximations are subject to appropriate governance oversight. In particular, data is likely to be adjusted as part of the internal modelling process by way of making historical data appropriate for use in forecasting future experience.

Some possible reasons for this are:

- Past or planned management action affecting the portfolio;
- Allowance for past and expected future trends;
- Changes in terms and conditions of the business written;
- Changes in the legal environment; and
- Changes in inuring reinsurances.

Where data is adjusted or approximated, or expert judgements are being used in model development, parameterisation or validation, the documentation must include the details of the adjustments made, the reasoning behind them and the appropriateness of the expert. For example:

- They data that has been included or excluded and why; and
- Adjustments made for trends, changes in line size etc, and the rationale for these.

Whilst managing agents are required to use a syndicate's own data to parameterise the model, sometimes this data does not have sufficient statistical credibility in terms of volume or history. Managing agents are required to carefully consider the extent to which they may be overstating the credibility of their own experience and a margin for the uncertainty may be required. Alternatively, the managing agent could include market data, adjusted to reflect syndicate-specific characteristics.

Please note that credibility does not only apply to history but also to the size of the dataset. In particular, in classes where the volumes are relatively small, a syndicate's own data must not be overly relied upon. When assessing volatilities (standard deviations) at a market level, adjustments must be made to reflect that the observed market volatility for a class of business, representing the pooled experience of many syndicates, will tend to be lower than the volatility of a standalone syndicate (as per the law of large numbers). This does not only affect the standard deviation, but also the estimate of the mean, which is more uncertain for small portfolios. The managing agent must document how this has been allowed for and must explain the relative reliance on the syndicate's own data, market data and judgement. Please note that Lloyd's might compare the volatility used in the capital model against the volatility shown in other returns that are submitted to Lloyd's (for example based on reserve movements in the TPD). Managing agents must be able to justify any difference between the volatility shown in other returns they submit to Lloyd's and the model, especially where model volatilities are lower than those implied by the data.

When trends start to emerge, managing agents are required to consider their impact on the results. It is not acceptable to wait until the effects of the trend are well understood before commenting on the possible implications. Managing agents should consider the validity of past data and assumptions within the model and ensure that these remain appropriate for calibration, particularly with regards to actual experience (e.g. rapidly changing exposures such as cyber or events such as the Californian wildfires). To stress, historical data must NOT be used blindly to parameterise the model – if recent experience suggests a difference to the previously assumed risk profile, Lloyd's expects model calibration to incorporate this view. Lloyd's will monitor the experience versus model outcomes, in particular through the collection of back-testing results, and will request further explanations of model appropriateness where particularly high return periods are being reported.

8 Approach and Methodology

8.1 Approach

All models are required to produce an output distribution which measures the change in own funds and assigns probabilities to changes from best estimate in profit and loss of the syndicate. It is recognised that there is a degree of uncertainty in establishing a 1:200 capital assessment. The methodology document should identify the key sensitivities affecting the SCR and provide explanations of why the modelling approach is appropriate for quantifying these extreme outcomes.

Lloyd's does not prescribe a method for the calculation of the output distribution by managing agents. In general we expect stochastic techniques to be used and where this is not the case (e.g. scenario-based approaches for operational risk) this requirement still needs to hold, that is a distribution is still required but it could be discrete distribution. The outputs of the internal model should reflect the risk profile of the syndicate and be capable of reflecting changes to the risk profile. The model output must be supported by the validation process. It must be possible to tailor it to the different levels of detail required for different stakeholders and explain it sufficiently for the understanding of the board. In order to ensure senior management awareness and understanding of the potential for uncertainty; there must be a formal process to provide an indication of the nature and extent of any material uncertainty inherent in the modelled results, which will tend to be presented as point estimates. The uncertainty inherent in point estimates could be indicated through the use of ranges, sensitivity analyses or other quantitative means.

Lloyd's understands that it may not be possible, or appropriate, to model all risks stochastically. A stress and scenario test approach can be applied for some risks, e.g. operational risk, but this is expected to be by exception and not the rule. In this case other Solvency II requirements may become significantly more difficult under an internal model that does not produce a full output distribution. For example the definition of the output distribution should enable the profit and loss attribution test requirements to be met. It is key that for all model output, drivers of outcomes and change are understood and documented.

Managing agents are required under Solvency II to ensure that their internal model is capable of risk ranking (see section 4.7) for all material risks covered by the internal model, i.e. quantify the materiality of any sub-risks in order to ensure relative comparability between risks.

Where adjustments to model output are made instead of using the output distribution generated directly by the calculation kernel to calculate the SCRs, approximations may be used in the estimations. Where approximations are made they must be clearly documented and justified. Justification should include reasons for and the impact of the approximation, the approximation should not introduce any material bias. One example of where such an approximation could be made is in the derivation of one-year risk from the ultimate view and agents must:

- Explain how risks correspond to 99.5% VaR over a one-year and ultimate time period, and show that this process does not introduce any material bias;
- Explain the reconciliation between the outputs of the calculation kernel and the amount of Own Funds, where the latter is not produced directly from the calculation kernel;
- Where a different time period than one year is used, justify the assumptions made in respect of dependencies between consecutive time periods; and
- Consider them as part of the internal model.

Where the distribution of Own Funds is not produced directly from the calculation kernel reconciliation will be required between the output distribution and the distribution of Own Funds. This demonstrates that there is a clear and transparent link between the calculation kernel and final SCR.

Managing agents should also be aware that the LIM is likely to require various points on the distribution. Where the internal model generates fewer data points than a full output distribution Lloyd's will require additional validation.

Managing agents are required to ensure that the methodology used to estimate the output distribution is based upon adequate, applicable and relevant actuarial and statistical techniques capturing the risk profile of the syndicate, which are up-to-date and generally accepted market practice. Lloyd's expects agents to provide detailed commentary on all areas including the following:

- Approach for modelling losses over a 12-month horizon in line with the calibration standards of Solvency II;
- Granularity of risk modelling;
- Insurance claims, including both premium and reserve risk;
- Treatment of exposure and business volumes;
- Rating variability;
- Treatment of reinsurance and associated credit risk;
- Correlation, diversification and dependency structures;
- Risk margin calculation;
- Currency risk; and
- Discounting.

The onus is on managing agents to demonstrate that the methods used are based upon current and credible information, and to this end regular methodological reviews are required. Managing agents should also demonstrate that they have a process for keeping abreast of progress in modelling techniques and approaches. This requirement could be captured by the validation exercise. Any issues arising from the validation process that cast doubt on the adequacy of the model methodology should lead to a specific action or further review.

The managing agent should demonstrate that they have a detailed understanding of the theory and assumptions underlying the methodology. Lloyd's expects managing agents to adequately document their understanding as this will help to ensure that the methodology used is transparent and should reveal the logical connection between inputs and outputs, i.e. not be a "black box".

Managing agents are required to ensure that the model is capable of producing results that are reasonable and respond appropriately to changes in the risk profile over time. The internal model should adequately reflect the risk profile of the syndicate. A managing agent should choose methods that are suitable to the modelling goals and accurately reflect the syndicate's risk profile. In addition to this, the regulator may require a managing agent to run their internal model on relevant benchmark portfolios and using assumptions based on external rather than internal data in order to verify the calibration of the internal model and to check that its specification is in line with generally accepted market practice.

The data available for the internal model may not permit use of some methods; it is therefore important that the methodology is adapted towards the available data. Any uncertainty associated with limitations to the data should be accounted for in the modelling. Any data which may affect the methodological basis of the model and information on model assumptions should be collected and considered in modelling or validation processes as appropriate.

Managing agents are expected to provide evidence to Lloyd's that the basis underlying the methodology of the internal model is credible, based on appropriate criteria, which may include:

- Consistency: there are no internal contradictions.
- Objectivity: a sufficiently large set of information sources is used, characterised by a high degree of independence from the syndicate. Exclusions are suitably justified.
- Reliability: the source and provider of the information are qualified, and its quality is verified.
- Transparency: the process of generating, processing and providing the information is well-documented, and any ambiguities in it are known.

In assessing the appropriateness of methodology, managing agents and Lloyd's should allow for the principle of proportionality. Note that this principle applies on a per model, not per managing agent, basis, and it is not acceptable for modelling to be directed by the largest syndicate in a managing agent if this doesn't allow reflection of risk profile characteristics of smaller syndicates.

The methodology document should identify the key sensitivities affecting the SCR and provide explanations of why the modelling approach is appropriate for quantifying these extreme outcomes. Model methodology must allow for Lloyd's 'Principles for Doing Business' Principles 7 and 10.

Where external models or data are used within internal models, managing agents must ensure that this is clearly identified, understood, and applied.

8.2 Risk Mitigation

Managing agents should take full account of the effects of risk mitigation techniques like reinsurance or hedging as long as they align with the managing agents risk management policies, i.e. risk mitigation views must be consistent. In particular, the risk mitigation techniques must deliver demonstrable transfer of economic risks, align with the agent's risk management policies and any associated secondary risks arising from the use of risk mitigation techniques as well as the interaction between them must be properly reflected in the internal model.

In more detail, a managing agent should take full account of the effects of risk mitigation techniques (e.g. reinsurance or hedging) if their inclusion in the internal model reflects the following criteria:

- Economic form over legal form, i.e. they deliver a demonstrable transfer of economic risk.
- They are legally effective and enforceable and are adequately documented.
- They are liquid and can be valued under both normal and stressed conditions. They meet documented liquidity requirements under both normal and stressed conditions. They are capable of liquidation (or retention) in the event of counterparty default. They are not double counted.
- Associated secondary risks (e.g. credit risk, concentration risk, basis risk, legal risk, operational risk), and the interactions between them, are identified, documented and included in the internal model.
- They provide a direct claim on the protection provider and the extent of cover is explicitly referenced to specific exposures or a pool of exposures. To the extent that the protection is not irrevocable or unconditional, this should be reflected in the model or, if not possible, the risk mitigation technique should be excluded from the model.
- Exposure is assessed at both the gross level and net of the effects of risk mitigation techniques.
- Where risk mitigation techniques are used to justify a reduction in the SCR, they should demonstrably reduce risk at 99.5% VaR over one year.
- Equivalent requirements apply whether or not the protection provider is independent from the syndicate or is part of the same group.

The risk mitigation techniques which satisfy the conditions above should align with the managing agent's risk management policies. Any deviations from the risk management policies should be documented and where appropriate the relevant policies should be updated to reflect the risk mitigation techniques included within the model.

8.3 Model Limitations

The agents documentation must consolidate any circumstances under which the internal model does not work effectively. When assessing and documenting circumstances under which the internal model does not work effectively, managing agents should take account of at least the following:

- The limitations of information technology used in the internal model; and
- The limitations of internal model governance.

In addition to the limitations for assumptions mentioned above, the documentation must consolidate any circumstances under which the internal model does not work effectively more widely.

When assessing and documenting circumstances under which the internal model does not work effectively, managing agents are required to take account of at least the following:

- The risks which are not covered by the internal model;
- The limitations in risk modelling used in the internal model;
- The nature, degree and sources of uncertainty connected with the results of the internal model including the sensitivity of the results for the key assumptions underlying the internal model;

- The deficiencies in data used in the internal model and the lack of data for the calculation of the internal model;
- The risks arising out of the use of external models and external data in the internal model;
- The limitations of information technology used in the internal model; and
- The limitations of internal model governance.

The documentation must include a summary of the limitations of the internal model, consolidated in a single document. This document should also include a summary of the work done to identify the shortcomings of the model and any plans for model improvements. Managing agents will then be able to use this as a way of demonstrating continuous model improvement as the issues are addressed.

It is likely that managing agents will maintain separate records of limitations for different elements of the model. Aggregation into a single document will assist managing agents, Lloyd's and external regulators in assessing the materiality of limitations, the appropriateness of the model and the effectiveness of plans to address the limitations.

Managing agents should document both quantitative and qualitative limitations, as far as possible. The documentation should include a description of the process used to identify and document limitations, including the sources of information such as the model validation and the validation report.

8.4 Modelling Assumptions

Managing agents should identify assumptions upon which the model is based in their methodology document and ensure that these are realistic and justifiable, to their board and to Lloyd's, by satisfying the following conditions:

- The managing agent has a suitable and justifiable explanation for the use of assumptions and that this is documented; and
- Understanding of when the assumption could be considered false.

Lloyd's requires all assumptions and expert judgements upon which the model is based to be explained and documented in detail and in a well-reasoned manner, including how expert judgement is challenged and reviewed/monitored against actual experience wherever possible. To ensure the assumptions remain appropriate, a process must exist for assessing the assumptions at regular intervals and updating the documentation where necessary. The extent to which judgement has been applied to assumptions should be clear along with the underlying rationale. The documentation should consider both the significance and uncertainty of the assumption.

The explanation of assumptions should cover the inputs on which the choice of assumptions is based, the objectives of the choice of assumptions and the criteria used for determining the appropriateness of the choice and any material limitations in the choice of assumptions made.

Managing agents must identify those model assumptions which are particularly material to the overall SCR figures or other key output such as risk ranking, and the associated documentation should be commensurate with the impact of the model parameter. The process of determining the materiality of assumptions should be evidenced. Lloyd's expects managing agents to perform sensitivity tests to assess the impact of changes to key assumptions, reporting the results. The sensitivity testing will also form part of the materiality assessment.

Model assumptions regarding diversification effects are regarded as key assumptions and are therefore subject to the requirements of material assumptions. Diversification effects are typically challenging to estimate and validate. The assumptions underlying the approach used for measuring diversification effects on an empirical basis are often based on expert judgement which will require further validation. Sensitivity analysis and stress testing should be performed as part of the validation process. The results of the validation exercise and any additional justification for the assumptions should be clearly documented and understood by those responsible.

8.5 Expert Judgement

Expert judgement relates to any decision that affects the selection of data, parameters or methodology within the internal model. That judgement may be exercised at numerous points in the journey from original data source to the final internal model input, but will nonetheless be considered within the remit of expert judgment.

Expert judgement should only be used where uncertainty exists. When expert judgement is used, if possible, it should be used with statistical techniques to minimise the risks highlighted below. In some cases, where credible statistical techniques cannot be used, expert judgement alone may drive decisions e.g. tail dependence assumption between two new lines of business. Where expert judgement alone has driven a material assumption, there will be a greater need to review and to validate the decision-making process.

Managing agents must document all instances in which data quality may be compromised as well as the implications. The agent must address the interrelationship between data and expert judgement and it may use expert judgment to complement or substitute the data. Such judgment must be reconciled with any relevant data.

Where expert judgment applied in respect of data deficiencies has a material impact, its use must be well founded and is admissible only if its derivation and usage follows a scientific method, as defined below:

- The expert judgment must be falsifiable, i.e. circumstances under which the expert judgment would be considered false can be clearly defined even though they may only be realised at a point in time far in the future.
- The expert judgment must be able to make transparent the uncertainty surrounding the judgment, e.g. by providing the context of the judgment, its scope, basis and limitations.
- Standards concerning the operation of the methodology used must exist and be maintained.
- The expert judgment must be documented. Documentation extends to:
    - why the expert is appropriately qualified to make the judgements;
    - the judgements made;
    - falsifiability of the judgements; and
    - the judgements are kept under regular review, in particular a track record of the expert judgments used must be available.
- The expert judgment must be validated - validation may include assessing the track record of expert judgments to assess reliability; challenging the expert judgment using scrutiny from other experts; comparing the expert judgment with existing and emerging data.

Managing agents will need to consider carefully the additional risks that arise when relying on expert judgement (e.g. conscious or subconscious biases in estimates). Care needs to be taken to minimise these risks when using expert judgement to calibrate or validate the internal model.

Expert judgement should be evidenced where it forms part of the internal model. The selection of the level and scope of documentation should consider proportionality and materiality. Examples of ways to document expert judgement could include:

- Name of expert;
- Date of opinion;
- What expert opinion is being used;
- Reason why expert judgement is required in this particular instance;
- Rationale for the opinion itself (e.g. the stress test backing a particular view of risk);
- Comment on any potential conflicts of interest that may arise from the use of this expert judgement;
- Review by an independent third party;
- Back-testing of the historic expert opinion in this class and from this particular expert; and
- Where expert opinion is contradicted by otherwise applied standard statistical techniques, the judgement should be documented further to explain the deviation.

This list is not intended to be prescriptive, it is intended to give examples of what might be appropriate.

8.6 Parameter Setting and Parameter Uncertainty

A statistical model, at best, is an approximate representation of the underlying reality. At worst, it is a biased and incorrect view of the risk. Invariably, there is insufficient data to be totally confident of the parameters or model,

and some degree of parameter and model error is unavoidable. Managing agents should therefore include some allowance for parameter uncertainty, where it is material to do so. For example, if a material parameter may lie within a range, managing agents should reflect the uncertainty in their choice of parameter value by selecting a value in the higher end of the range unless they have otherwise quantified and allowed for this uncertainty within the model.

The processes used to derive model parameters are part of the model methodology and are therefore required to have appropriate structure, documentation and validation. It is expected that methods include controls to avoid parameter instability (changes in parameters that are not linked to changes in risk profile).

Lloyd's considers that it is important for managing agents to recognise the issue and for the uncertainty to be adequately communicated to senior management. Parameters should be reviewed regularly to ensure their continued appropriateness. The frequency of review will depend on:

- Risk profile changes which might trigger parameter reviews; and
- The materiality of the parameter.

In line with the three-year validation cycle, which requires all areas of the model to be validated within three years, Lloyd's expects all parameters to be reviewed within a three-year cycle.

The LCR submission must contain information on how parameters have been chosen together with the logic of the model that brings the assumptions together. The choice of parameters should be carefully considered and well justified and documented. Managing agents are requested to highlight any changes to the syndicate's parameterisation in the documentation provided to Lloyd's. When setting parameters, managing agents should make allowance for uncertainty in their parameter choices due to the following:

- Credibility of the data used – margin for uncertainty on own data, size and other adjustments for market data
    - Where outliers are removed from data as part of setting parameters, this removes events from data. Managing agents should make a suitable allowance for this or demonstrate that it would not be possible for these (or similar) events to occur in the future.
- ENIDs
    - Managing agents should not assume that parameters can be estimated using only historical data, as this would not take into account all quantifiable risks, e.g. data sets covering recent years may not include sufficient examples of liability catastrophes and the resulting dependencies between policies, and hence overall volatility.
    - A simple percentage uplift to allow for ENIDs without justification is not a suitable approach. An implicit allowance is not acceptable on the basis that it cannot be validated.
- Adjusting data for correlated data points
    - Historical data will demonstrate correlations between various time periods, for example due to long-term industry effects, or one event impacting multiple years of account. Estimating parameters directly without adjustment will cause unwanted consequences, e.g. forward-looking volatility may be under-estimated.

It is expected that managing agents approximate aspects of parameter setting on grounds of materiality. Where this occurs, managing agents should quantify the materiality of approximations, both as a standalone approximation, and in aggregate across all approximations – it is not adequate to simply demonstrate that each approximation taken alone is immaterial. Regardless of the modelling approaches used, agents should be able to demonstrate that they have adequately accounted for the impact of parameter uncertainty on the SCR.

8.6.1 Volatility versus Dependency

Managing agents should take care not to conflate systemic driver effects and volatility. For example, effects like the uncertainty around inflation should ideally not be captured by uplifting the volatility parameters across all classes as volatility can diversify away and a systemic impact like that is more appropriately captured by a driver approach applied simultaneously across all classes. If systemic effects (e.g. inflation, mispricing or the uncertainty on premiums) are captured by an uplift in volatility, then managing agents should:

- Explicitly state the size of the uplift for this effect – it is NOT sufficient to include a generic uplift for all effects discussed in this section;
- Run a sensitivity test excluding the effect; and
- Validate the impact.

Systemic effects like the examples given apply both between classes and also between years of account. Hence, they need to be taken into account in the parameterisation of any dependency between years. If the data points used in the parameterisation of the standard deviation for a class are not independent (e.g. due to long-term driver effects), and a sample standard deviation is calculated from the data, then adjustments are required when estimating an appropriate forward-looking standard deviation for that class. For example, data might follow a distribution with a standard deviation of 20% and a mean of the best estimate mean claims. If data points are correlated by say 10% (e.g. due to claims inflation), then the mean will be overstated, and the standard deviation understated when estimated purely from that data. The mean might be discarded in the parameterization process (as the model assumes a mean equal to the best estimate reserves), and the standard deviation would be too low. As a rule of thumb, a 10% correlation in the observed data results in a 5% underestimate of the standard deviation. A 50% correlation in the data results in a 30% underestimate. Managing agents should evaluate carefully how the data should be adjusted for trends.

8.7 Offsetting and "prudent" Assumptions

The SCR is defined as the 1:200 value at risk. There is no requirement to build in implicit or explicit prudence within the modelling and managing agents should perform each part of their modelling at the required stress level. Where challenge during the reviews might highlight a weaker area, managing agents cannot point to an area of prudence to offset the weaker assumptions and credit will generally not be given for any offsetting margins as each component will be assessed for adequacy.

Lloyd's recognises that there is a place for uplifting assumptions and parameters, e.g. where model limitations exist, or a simplified approach has been taken. For these areas, the uplift would be considered an appropriate allowance for the level of uncertainty rather than an addition of prudence.

8.8 Simulation Error

Simulation error is common to all stochastic models. Lloyd's does not prescribe a minimum number of simulations to be run, or a specific way how managing agents should deal with simulation error. However, syndicates are required to ensure that the outputs of the internal model are stable in relation to input data that does not correspond to a relevant change in risk profile. This means that the SCR and also the contributions of risk types to the SCR must respond adequately to changes in risk profile – syndicates must ensure that neither the overall SCR nor the contributions of the risk types are inherently unstable. Syndicates may have to adjust their way of running their models to ensure this and demonstrate stability of their model results.

This can mean running a very large number of simulations and minimising simulation error. Syndicates can also run several seed runs and Lloyd's would expect managing agents to select from the "middle of the range" when compiling their SCRs. Lloyd's strongly recommends using a spread-VaR approach to calculate capital requirements and all other numbers in the LCR (see section 18), using the methodology document to outline the impact of selecting alternative runs / random seeds. Lloyd's would expect managing agents to select a mean or median SCR when finalising their figures.

When selecting the seed, syndicates should also take the contributions of the risk types to SCR into account as Lloyd's expects the contributions of the risk types to show stability and respond appropriately to risk profile changes. Contributions of risk types to SCR must be determined using a spread-VaR approach (see section 18) and movements should be intuitive – e.g. Lloyd's would expect the contribution of a risk type to increase if the standalone risk has increased. If this is not the case, Lloyd's expects the managing agent to provide an explanation and simulation error will generally not be acceptable as an explanation.

In practice syndicates could for example consider:

- Running a variety of seeds. Discarding the most extreme seeds. Of the middle seeds pick the one which exhibits most stability for the contributions of risk types.
- Running a variety of seeds. Combine the model output of all these seeds and calculate any model outputs from the combined model, effectively creating more simulations.

- Lloyd's currently sets a default confidence level of 95% when calculating the contributions by risk type. The calculation is set out in section 18. Syndicates can widen this range, however then they should provide justification why in their case the 95% confidence interval is not sufficient. Syndicates should input the simulation range used into LCR Form 540.

Syndicates should set out their approach in their documentation and show the results of various seed runs. They should explain how the seed was picked and demonstrate stability in SCR and risk type contributions.

8.9 Climate Change

Climate change poses a range of risks to syndicates and will continue to do so over the coming decades. Climate change has long term implications, but is also having an impact now.

Lloyd's considers there to be three types of climate risks for syndicates:

- Physical risks: these risks relate to specific weather events (e.g. floods, wildfires, hurricanes) and the longer-term impacts of climate change (e.g. on sea levels, increased average temperatures).
- Transition risks: these cover the impact to syndicates of the move towards a low-carbon economy, via changes to policy/regulation, changes to society, or emergence of new technologies and business models. For example:
    - As electric vehicles are further developed and desired, financial assets in the automotive sector may lose value.
    - As governments promote sustainable energy, fossil fuel extractors and associated power generators will suffer financially (if they fail to adapt).
- Liability risks: parties who have suffered loss or damage from physical or transition risk factors may seek to recover losses from those they hold responsible.

Although climate risks inherently feature wide-ranging impacts with uncertain time horizons, they are foreseeable, and the impact that they will have on syndicates depends on actions taken in the short term.

Lloyd's expects all syndicates' views of Catastrophe Risk (as represented within capital models) to be appropriate for the current climate, and to reflect changes in climate which have already occurred and may be influencing hazard now and over the timeframe covered by policies underwritten. However, Lloyd's does not expect syndicates to adjust their current view of risk (or level of capitalisation) to reflect future changes in climate.

Lloyd's expects syndicates, and their boards, to understand and monitor the financial risks from climate change that they are exposed to. Lloyd's expects all syndicates to be performing internal model stress-tests to ascertain the potential impact of climate change in the future, over short- and long-term horizons.

Lloyd's also expects all syndicates to be considering how their business model and/or portfolio management strategies may need to change in the future as a result of climate change.

In addition, syndicates should also make allowance for any transition and/or liability risks that are likely to manifest in the short term, by modelling and capitalising for this risk.

Further information can be found in the PRA's Supervisory Statement SS3/19.

8.10 External Model and Data

8.10.1 Identification of External Models and Data

Managing agents are required to be able to explain the role of external models and data in the internal model.

Agents are required to identify and understand the use and importance of external models and datasets used as part of their internal models. Agents are required to explain the role in the internal model of any external models and data used. This applies to external models and datasets within the scope of the internal model. Some examples of external models or external data sources that managing agents may wish to include in their internal models are:

- Models or data in relation to specialist areas of underwriting risk such as natural catastrophes;

- Industry loss, loss development, loss distribution or exposure databases, or models derived from such data, that can be used to validate, augment or substitute for the managing agent's own data or models;
- Models or data in relation to economic variables or economic scenarios, such as ESGs, yield curves, exchange rates, default rates; and
- Studies carried out by professional advisors that support parameterising the internal model, such as models used by brokers to model exposure and reinsurance.

All external models that are within scope of the internal model need to operate to the same set of requirements as the internal model itself. For external models this poses additional challenges because the managing agent does not always have direct access to or control of the model.

Agents are required to assess the materiality of the external models and data sources. Each year an identification and materiality assessment process are required to take place to ensure that all external sources in the internal model are captured, and managing agents' work is focused on external models that have a material impact on the outcome of the internal model. Views on materiality must be supported by sensitivity tests, where practicable.

8.10.2 Understanding External Models and Data

Managing agents are required to be able to explain the nature and reasons for use of external models and data.

Agents are required to explain why external models or datasets are used, to justify their specific choices and show that these are based on a sound understanding of the external models and datasets.

Managing agents must document a justification for their selection of material external models (and list alternatives considered), including reasons for choosing an external model over an internal one, and implement a regular review system to ensure such selections remain appropriate.

Managing agents can demonstrate their understanding of external models by addressing areas such as:

- Showing that the board and senior executives have a good basic understanding of the key assumptions, outputs and operation of the external models, and link them to relevant decisions.
- Showing that users understand the external models in detail and understand the nature and use of the key model components.
- Identification and documentation of model limitations and uncertainties, and communication of these to relevant stakeholders at all levels.
- Documentation of major changes to external model and adaptations for use within the agent's internal model.

A good understanding of an external model or dataset provides a sound basis for the application of expert judgement in determining the key areas for validation and the extent of validation required. This may be necessary where managing agents do not have full access to the underlying theory, structure and documentation of the external model.

8.10.3 Application of Internal Model Requirements to External models

Managing agents are required to ensure that use of external models or data within the internal model does not compromise the internal model meeting any of the relevant tests and requirements. Managing agents are required to explain how the internal model continues to meet the tests and requirements including use test, validation and documentation.

Lloyd's guidance and 'Principles for Doing Business' for internal models apply in full to external models and data sets, though managing agents are required to consider the principle of proportionality when assessing their approach. Where an external model has limitations, these must be monitored, and alternatives considered where these are material.

Managing agents should have their own view of risk which must be consistent across the subject matter expert teams (exposure management/investment teams) and capital. The managing agent should make (or consider) adjustments to external vendor models to reflect their own view of risk. External models should be adjusted where necessary for loss experience and emerging market issues.

Even if the external model is used as parameterised with no changes, the managing agent must validate and review the suitability of the models and monitor the limitations regularly, as well as consider alternative views and parameters.

The managing agent must ensure they are sufficiently resourced with the appropriate expertise to carry out the validation and governance required for adjusting external models to their own view of risk.

The utilisation of external models and data within the internal model must be monitored regularly, and models must be adapted in new areas for material exposures and (if appropriate) a number of different views should be considered (e.g. through blending or comparative approaches).

For each material external model the managing agent are required to additionally explain why the data used to populate the external model is appropriate, and whether it is internally sourced data or externally sourced data. For example, managing agent data or broker data can be used to populate external catastrophe models. Where external data is used to populate the external model, the managing agent needs to apply the same standards to this as they would to an internal model.

Following are examples of how the internal model requirements apply to external models.

Managing agents are required to be able to explain how they use the external model within the internal model. Where external vendor models have a material impact on the capital requirement, key limitations of the external vendor models are identified and communicated to the board and managing agents have to explain how the board and senior management obtained comfort over its limitations. Use of an external model falling within the scope of the internal model can itself contribute to the use of the internal model.

Obtaining the data sources used within external models is often not possible because they contain proprietary knowledge. Nevertheless, managing agents must be able to show that they understand the underlying data sources used in the external model (such as major attributes, limitations, characteristics of data used and approximations used for missing or unreliable data), and, at a high level, how the broad methodology works within the external model. Particularly important here is the ability to highlight the material assumptions within the external model and the level of sensitivity that the external model has to these assumptions in the context of the agent's internal model.

The external model itself does not need to be calibrated to a 99.5% probability over a twelve month time period because this requirement applies to the internal model calculation kernel directly. However, the contribution of the external model to this default probability within the internal model must be understood so that its materiality can be assessed.

This requirement does not apply directly to external models other than when considering the profit and loss attribution of the internal model; the external model must be able to give the required level of granularity of information to make this possible.

Validation is an important element in demonstrating an understanding of and identifying limitations and future improvements needed in the internal model. This applies to external models and data in just the same way as to the internal model. Managing agents' validation policies, processes and reports must cover external models and data to the same extent and standards as they do the rest of the internal model.

Documentation of external models is an important component of the documentation of the internal model, and agents should work with vendors to ensure there is sufficient material available to understand the methodology underlying the external model, its limitations and weaknesses (particularly circumstances where the internal model may become ineffective as a result of the external model), the key assumptions in the external model, and material areas of expert judgement that drive the external model results.

8.11 Documentation Requirements

This section outlines the documentation requirements for the internal model. The documentation in this section does not need to be submitted in full with every LCR submission, however it must be available on request and will generally be required for deep dive reviews and new model applications. Managing agents are required to document the design and operational details of the internal model, complying with the requirements outlined in this section.

The documentation of the internal model is required to be sufficient to ensure that any independent knowledgeable third party would be able to understand the design and operational details of the internal model;

and form a sound judgement as to its compliance with Article 101 & Articles 120-124 of the Delegated Acts (2015/35) relating to internal model design and operation, data, use and validation.

The documentation must include at least the following information:

- An inventory of all the documents which form part of the documentation;
- The policy for changing the internal model;
- Policies, controls and procedures for the management of the internal model, including responsibilities assigned to staff members of the managing agent;
- A description of the information technology used in the internal model, including any contingency plans relating to the information technology used;
- All material assumptions and their justification;
- The explanation of the methodology used to set assumptions;
- The directory of data used in the internal model;
- The data policy;
- The qualitative and quantitative indicators for the coverage of risks;
- A description of the risk-mitigation techniques that are taken into account in the internal model and an explanation of how the risks arising from the use of risk-mitigation techniques are reflected in the internal model;
- Documentation of the future management actions taken into account in the internal model;
- The specifications for the profit and loss attribution;
- The validation policy; and
- The role in the internal model of external models and external data and the reasons for their use.

Managing agents are required to consider whether further documents are needed in order to comply with the above requirements.

These are the principal documents explaining how the model is designed and operated so that a knowledgeable third party may understand the model. They form an integral part of the Lloyd's and regulatory review of the model.

Outputs of the internal model are required in principle to be reproducible using the internal model documentation and all of the inputs into the internal model. That is, together with the design and operational use documents, these documents must constitute a complete documentation of the internal model and in total, must provide an adequate description of the model to enable an equivalent model to be built, should the need arise.

Managing agents need to make this documentation available to users, presented appropriately to the differing audiences, as discussed below. Users may need training to ensure that they can access essential information adequately. As part of the structure of the documentation it is important to ensure that it is tiered to the audience for which it is intended for example:

Executive level - high level summary suitable for board members. This could include an outline of the model scope, uses of the model, the risk framework, model governance, and information systems.

Technical level - suitable for an independent knowledgeable third party to form a sound judgement as to the reliability of the model. This must include all the content at the executive level plus technical summaries and a description of the operation of the model.

Specialist level - suitable for individuals and teams involved in the detail of the model. The specialist level is best evidenced via appendices to the technical documentation and could include granular procedures, formulae, data, parameters, reasonableness checks and validation / sensitivity testing.

This will also help provide evidence that all levels of management understand the relevant aspects of the internal model. The level of understanding for different bodies and personnel would depend on their oversight responsibilities within the internal model.

The internal model documentation is required to be appropriately structured, detailed and complete and is required to be kept up-to-date.

The documentation must provide a detailed outline of the theory, assumptions, and mathematical and empirical bases underlying the internal model, as well as detailed internal model documentation including the information needed by technical specialists, such as the modelling team.

The documentation must include a user manual for the operation of the internal model, which would allow a knowledgeable third party to run the model, an important mitigant of key person risk. This essentially means a manual for the calculation kernel, though other elements of the internal model could be included if necessary. The manual must contain sufficient detail of the modelling platform and model design to allow a skilled user to run the model and produce results consistent with previous model output. A user manual does not need to be a single document; it can be a set of documents which can be easily accessed and are known in aggregation as the user manual.

The documentation of assumptions is an essential component of documenting the internal model and must demonstrate the appropriateness of assumptions in light of the syndicate risk profile (see sections 7.4 and 7.5).

8.11.1 Documentation Policy

To meet the SII level 2 requirements set out in Articles 120-125 managing agents need to do more than merely maintain a specific set of documents in line with the scope of the internal model, no matter how extensive the set is. Managing agents must have effective control procedures in place for model documentation, which must be brought together in a documentation policy document. The control procedures must be based on a precise, transparent document reference system; they must ensure that the documentation is kept up to date and regularly reviewed and provide an audit trail of the implementation of documentation changes.

Managing agents are required to maintain a board-approved policy for internal model documentation to ensure that all relevant requirements are met, covering at least the scope of the internal model.

The documentation is required to include at least an inventory of all the documents which form part of the documentation, the policy for changing the internal model and the data policy.

The policy must:

- Cover documentation of all risks within the scope of the internal model and explain how continuing coverage will be ensured;
- Demonstrate compliance with relevant requirements;
- Address maintenance of a documentation repository, including systems and controls for document ownership, review and update;
- Cover regular review of documentation, which must be at least annual; and
- Include a process for ad-hoc revision of documentation in response to feedback from application of the policy. Potential changes are required to be considered on the basis of materiality before deciding whether to make any ad-hoc revisions.

8.11.2 Documentation System

Managing agents must maintain an appropriate system for the storage of internal model documentation. Managing agents must ensure that the documentation system contains all internal model documentation and is capable of producing an index of the internal model documentation including mapping of the documents to the Solvency II requirements.

Solvency II requirements do not specify the use of document management systems however Lloyd's considers that managing agents could experience difficulties managing the volume of documentation required without a well-designed and controlled system.

An electronic storage system, whether wiki, portal or SharePoint style will allow the documentation to be managed in accordance with the documentation policy as detailed in section 8.11.1. The documents can be tagged with metadata e.g. owner, review date, tiering (see section 8.11 for more details) and mapping to Solvency II EIOPA requirements. Lloyd's would recommend that these are also mapped to the Lloyd's 'Principles for Doing Business'. This allows the agent to establish the full suite of documents that they may need to present

upon request to the supervisory regulator and/or Lloyd's. The metadata can be further used to instigate and monitor the annual review of documentation. Many agents have appointed a "librarian" who has responsibility to maintain the documentation management system.

9 Insurance Risk

9.1 Definition

Insurance risk is defined as the risk of loss arising from the inherent uncertainties about the occurrence, amount and timing of insurance liabilities and premiums.

9.2 Scope

Insurance risk includes the risk of loss arising from prospective underwriting and the development of prior years. It should also cover the risk associated with potential for increased operating expenses. Whilst there are numerous dependencies between these risks and other risk groups, such as credit risk and operational risk, the assessment of insurance risk can be considered under the headings of premium risk and reserve risk. Insurance risk should represent the diversified aggregate of premium and reserve risk. Managing agents should ensure that the 1:200 outcomes on premium and reserve risk should be consistent with the stress on an undiscounted basis.

These components are mutually dependent, and this must be recognised. More details on the delineation of credit risk and operational risk with insurance risk can be found in the credit and operational risk sections.

Managing agents must consider the risks associated with the use of, and potential reliance on, reinsurance linked with insurance risk. Reinsurance failure and dispute must be included within credit risk.

Insurance risk must be modelled on a one-year and an ultimate basis.

All insurance risk amounts (including, but not limited to, mean and 1:200 outcomes on premium and reserve risk) must be reported on an undiscounted basis. The exception is the total risk margin and allocated risk margin amounts to premium and reserve risk, which are reported on a discounted basis in all LCR forms. The risk of changes to the net value of assets and liabilities arising from changes in the risk-free rate must be included within market risk. Equally, excess returns over risk-free must not be included in insurance risk as they must be reported within market risk.

All anticipated future underwriting profits must be included within the assessment of premium risk on an undiscounted basis.

Lloyd's expects insurance risk to capture the impact of the market cycle on insurance business and as such claims inflation should also be included in insurance risk (see section 9.3.8).

9.3 Modelling Considerations

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

9.3.1 One-year and Ultimate Risk

Managing agents should not assume that insurance risk emerges simply according to a historical paid or incurred development pattern. Where managing agents use an emergence factor method (where one-year risk is assumed to be a proportion of ultimate risk), managing agents should not base the emergence factor purely on the incurred or paid pattern. Where historical paid or incurred patterns are used in the model, managing agents should not assume that these will be repeated in future, unless the managing agent has shown that this is a realistic assumption throughout the probability distribution forecast.

9.3.2 Class Granularity

Please note that in order to make a sound judgement on the appropriateness of the model, it is required that managing agents split data by class with meaningful class names and at sufficient granularity in returns to Lloyd's. It is not acceptable to call classes "Class 1, Class 2" etc, and it is also important that the level of granularity ensures that the class is homogenous enough in terms of risk profile that modelling as one class is warranted and that the outputs are consistent with the level at which assumptions are set.

9.3.3 Loss Modelling

Managing agents should consider the granularity of modelling losses. The level of granularity adopted should be appropriate to the characteristics of the underlying business. This should include consideration of territories, perils, currencies, and loss sizes and types. It is common for models to split loss modelling between attritional losses, large losses, and catastrophe claims, although this is not always necessary or appropriate.

Managing agents have a variety of options available to modelling losses. A common approach is to model attritional losses using an aggregate claims distribution, large losses using a frequency and severity approach, and catastrophe claims using a vendor model. The selected distributions using this approach should have a sufficiently heavy 'tail', reflecting the risk profile of the element being modelled. For example, when modelling large loss frequency, a Poisson distribution may not be sufficiently heavy-tailed for the modelled class and a Negative Binomial distribution may therefore be more appropriate. Lloyd's expects managing agents to include sufficient dependency between modelled elements of a class. For example, attritional loss distributions may be linked explicitly with large loss frequency using a correlation matrix.

Managing agents must justify the selected approach to modelling losses in their methodology documentation and ensure that the overall resulting volatility at both a class level and aggregate level reflects the risk profile of the syndicate. Alternate assumptions and/or distributions to assess whether the selected approach adequately captures downside risk reflective of the risk profile should be included in the validation.

9.3.4 Reinsurance

Syndicate SCRs must consider the risks associated with the use of, and potential reliance on, reinsurance in respect of both premium and reserve risk. This should cover the areas set out below, but the risk of failure of a reinsurance counterparty, as well as the dispute of recoveries should be covered in credit risk and more guidance is included in section 13. The LCR submission must contain details of the gross and net basis, with both gross and net extreme losses explicitly considered. The LCR submission should provide details of the variability of net losses taking the application of reinsurance programme into account. The risk of exhaustion (both vertical and sideways) must be allowed for within insurance risk, whilst the risk of failure and dispute must be allowed for within RI credit risk.

Details of material current and prospective reinsurance protecting the managing agent should be provided in the documentation in the LCR submission, or by cross-reference to the SBF. The documentation should also state assumptions with respect to cost and availability of reinsurance, and managing agents are requested to address the impact of any proposed material changes for the prospective year in the LCR submission. Please refer to section 4.10.7 for requirements on future management actions. Lloyd's expects commerciality to be a consideration in the assumptions on prospective reinsurance purchases. Outwards reinsurance purchases are expected to protect the volatility and capital requirements, but in general they cannot be expected to be profitable for the cedant. These considerations should be included in the documentation.

For further information on Reinsurance see Lloyd's 'Principles for Doing Business' Principle 3.

9.3.5 Expenses

Managing agents should consider the uncertainty and potential exposure to financial loss from higher than expected costs and expenses. These include operational expenses not directly related to claims as well as higher financial loss associated with increased loss adjustment expenses, particularly in a stressed scenario. Examples of this may be increased legal costs incurred with a higher frequency of large losses, or the need to hire additional claims handlers to deal with a high volume of claims following a major catastrophe (which may then be associated with demand surge arising from the same major catastrophe).

Managing agents might choose to model expenses using either deterministic or stochastic methods, or a combination of the two. Regardless of the approach taken, Lloyd's would expect that the approach is appropriately documented and justified; particularly addressing how their chosen modelling approach adequately allows for the potential for higher expenses arising in a stressed scenario as outlined above.

9.3.6 Risk Margin

The risk margin is designed to represent the cost of providing the required regulatory capital that would apply to another undertaking to take on the TPs. The balance sheet at Time 0 has a risk margin added to the TPs for this "cost of capital". For the one-year SCR, the risk margin in 12 months' time (T1) must be calculated, based on the

technical provisions in the (stressed at 99.5th percentile) balance sheet at that date, and the one-year SCR then includes the movement in the risk margin over one year. Justification for any simplification in modelling the risk margin in 12 months' time must be included in the documentation.

The ultimate SCR does, however, include a gain from the risk margin running off to zero. This is because at the ultimate time horizon, all claims have been paid, no technical provisions exist and so there is no associated cost of capital. This means that as the calculation of the SCR is the difference between ultimate 1:200 losses (no risk margin) and the Time 0 balance sheet (including risk margin), a credit is effectively produced. This credit must also be applied to the standalone component risks of the ultimate SCR and should be offset against insurance risk. Managing agents may consider it appropriate to allocate risk margin entirely to reserve risk, or to apply some of the credit to premium risk as well. Lloyd's requires managing agents to state in the supporting SCR methodology document which approach has been used and how much has been allocated to reserve and/or premium risk. This will allow Lloyd's to adjust appropriately when assessing the aggregation of premium and reserve risk. Lloyd's expects that the allocation should not result in either premium or reserve risk contributing a profit to the ultimate SCR.

Further information on Risk Margin can be found in Lloyd's guidance on Technical Provisions.

9.3.7 Lapse Risk

Lapse risk is the risk that contracts are cancelled or non-renewed. If material, lapse risk should be included within premium risk in respect of new business bound from 1 January of the prospective YOA and within reserve risk where it relates to incepted business. If the risk is not considered to be material this should be noted and justified within the documentation. This applies to both life and non-life business.

9.3.8 Consideration of Claims Inflation and Other Trends

Best estimate liabilities should include an allowance for future claims inflation. Inflation that is higher than the amount assumed in the best estimate will lead to an increase in ultimate settlement costs and this needs to be captured as part of insurance risk.

Claims inflation is the change in expected claims cost level of a like for like policy over time. This includes the cost for an individual claim (severity effects), but also changes in the likelihood of claiming (frequency effects). Claims inflation is the sum of pure inflation and excess inflation, where pure inflation is equivalent to economic inflation and excess inflation impacts claim costs over and above economic inflation. For example, excess inflation captures the impact on costs associated with emerging risks from new materials; medicines and technologies; changes in the legal environment; and social and political trends as well as demand surge following catastrophes.

Lloyd's expectation is that agents with material exposure to claims inflation risk ensure there is an appropriate allowance for this in the capital requirement, just like for any other material risk. The amount of effort put into inflation modelling and the level of sophistication should be guided by the principle of proportionality. Lloyd's expects detailed and explicit modelling approaches to be used by agents with material exposure to Casualty, Finpro and other long-tailed business.

Managing agents should be clear in their documentation how the uncertainty around pure inflation has been captured (e.g. by applying inflation indices from the ESG to insurance loss payments or otherwise), how excess inflation has been captured and how any other claim trends have been accounted for. This should have a particular focus on trends impacting liabilities that are not matched with assets, such as social inflation.

Inflation will be allowed for in volatility parameterisation to the extent that historic data includes the effect of the trend on claims costs. Agents should consider whether this is sufficient to allow for potential future trends as well as emerging trends. Lloyd's expects managing agents to consider the impact from inflation and other common trends on liabilities to occur across multiple classes and years of account simultaneously, particularly in stressed scenarios. These effects should be modelled explicitly and should create dependency between classes and years, ensuring the systemic nature of the effect is captured. If adjustments are made to volatility parameters to allow for this, they should ideally be made in a way that the effect can be isolated and tested, particularly if there is material exposure to long-tailed business. Uplifting volatility parameters has the drawback that the effect diversifies between classes of business, so uplifts should allow for this to ensure inflation risk contributes to capital as expected.

Inflation is also typically allowed for implicitly in the dependency framework. Similarly, explicit approaches are preferred so that the impact on capital can be tested and validated. Managing agents could use driver-based approaches to achieve this. Other methods, like scenario-based approaches, can be accepted if they provide enough dependency between classes and years and do not rely on using volatility as a proxy for these effects. Syndicates should show how their approach to capture dependency ensures there is enough tail dependency being achieved.

If there is a material exposure to inflation risk and reliance on implicit allowances in the model, this should be supported by detailed testing, validation and documentation covering the appropriateness of this approach. Agents should be able to identify all material sources of the risk and comment on why the chosen modelling approach is suitable in the context of the risk profile.

Even if the methodology and inflation framework is detailed and explicit allowances are being made, there should be sufficient testing to demonstrate that inflation risk is contributing to capital in a meaningful way, for example through sensitivity testing and scenario analyses tailored to focus on potential trends.

At a minimum the modelling approach for inflation risk should cater for:

- The systemic impact that inflation can have in stressed scenarios across multiple years of account and across all classes and related classes of business;
- Known and potential trends which could impact the number and size of claims differently;
- Emerging trends, such as social inflation; and
- The inflation assumptions used throughout the agency, for example by claims, underwriting, pricing and reserving teams.

Managing agents should be in clear in their documentation:

- How material inflation is to the risk profile and how this has been assessed;
- How the uncertainty around economic inflation and additional inflation has been captured, including all material implicit and explicit allowances and how these have been determined to be appropriate;
- The method(s) used to capture inflation risk dependency between years of account and between classes of business, with an emphasis on how dependency is generated in the tail of the capital distribution;
- The material expert judgments, assumptions and limitations;
- How inflation is used from the ESG, which includes what adjustments are made and what the mean reversion assumptions are;
- The impact of different sources of inflation on the capital requirement, where it can be quantified; and
- Validation that has been performed to test the appropriateness of the modelling approach and model outputs.

Capital modelling and validation teams should place a focus in the documentation on how well excess inflation trends in particular are captured in the model and validated.

9.3.8.1 Latent Claims

Latent claims are, by their nature, unexpected and therefore not necessarily reflected in actuarial projections but the internal model should reflect the risk that they will emerge. Managing agents should justify the considerations and modelling changes made to incorporate the potential for these claims in supporting documentation. The effects of latent claims on actuarial projections (i.e. mean reserves being impacted), as well as effects of latent claims on class volatilities and dependency between years and classes must be considered and validated. Lloyd's expects that managing agents, particularly those currently writing or having previously written casualty lines of business, will allow for latent claims within their internal model. If adverse historical syndicate-specific or market experience with respect to latent claims is considered to be excluded from current exposed business, it still should be used to inform the potential for new unanticipated and material sources of loss to emerge.

9.3.8.2 Regulatory, Legislative, Societal and Technological Changes

Managing agents should ensure that they consider within the SCR the risk of changes to regulation / legislation affecting their reserves, or the risk of sanctions preventing reinsurance recovery payments. In the UK, the changes in Ogden rates is an example of such a legislation change. Similarly, societal changes like trends in

behaviours and awareness resulting in more litigious societies or technological changes should also be considered. The approach may be similar to that of latent claims, and it is stressed that the impact on mean reserves, volatility and dependencies should be considered, not only the impact on one of these parts.

9.3.9 Dependencies Between Years and Classes

Dependency between premium risk and reserve risk is often a material component of a syndicate's internal model. Managing agents should review the dependency assumptions and modelling between premium and reserve risks at least annually.

Lloyd's requires that all classes are modelled such, that all pairs of classes (both within and across premium and reserve risk) are positively correlated with at least a minimum level of correlation, given common drivers, e.g. shared processes. As there are several methods of modelling dependencies between classes, Lloyd's will not prescribe the method by which managing agents should meet this expectation. More detail is given in section 15.4.1. Lloyd's will also not set a minimum correlation, but very low positive dependency will be subject to significant challenge.

Class dependencies should be internally consistent. For example, long-tailed class pairs will typically have higher correlations (particularly in the tail) than short-tailed class pairs, owing to the time it may take for problems to emerge on longer-tailed classes. Classes managed within a particular division may be correlated more strongly than class pairs across different divisions, owing to differences in underwriting practices, claims management, territorial exposure etc. Managing agents should ensure that class dependencies are sufficiently validated, including back-testing, sensitivity tests and stress and scenario tests, focussing on the material class pairs.

Managing agents can consider all years together or look at individual years separately, however they must be able to separate premium and reserve risk. In either case, the SCR should allow for dependencies between years and a total figure for all years is required. As for the class correlations, Lloyd's requires all years to be positively correlated with at least a minimum level of correlation, in particular for reserve risk (see section 11.3.5).

Lloyd's review will naturally involve scrutiny on the strength of tail dependency and Lloyd's expects managing agents to also ensure their review includes adequate focus on this, especially within insurance risk. Syndicates must consider how they can implement a dependency structure which on the one hand allows for an average correlation, i.e. a background correlation, whilst at the same time allowing adequately for tail events, for example for man-made catastrophes, systemic inflation or liability catastrophes.

Managing agents must ensure that the overall level of diversification between premium and reserve risk is appropriate and the correlation is not diluted. This can occur when classes and years are correlated at a very granular level. Managing agents need to ensure that they implement sufficient tail dependency or drivers into their models to counteract the dilution, if this occurs.

Lloyd's applies a minimum "sum of squares test" within premium and reserve risk, across premium and reserve risk and across risk categories. This test assesses that there is at least a minimal level of correlation being applied and is therefore passing is considered a minimum requirement rather than a test of appropriateness.

9.3.10 Contribution to Capital

Lloyd's will review the contributions to capital from risk types, but also contributions to insurance risk from individual classes to check the dependencies. Premium risk, as well as reserve risk as a whole, are required to contribute positively to capital, and individual classes within the risks are expected to contribute positively to insurance risk. This is due to the underlying principle that adding additional risk should not lead to a reduction in capital. In particular, when a new class is introduced, Lloyd's will not accept that the addition of a new class reduces capital given the uncertainty around a new class of business (see section 9.3.11). This means that classes should, at a minimum, contribute more than their mean result in all cases to premium and reserve risk- and ultimately also insurance risk.

Lloyd's will use the contributions by class in the review of dependencies, for example by checking that classes contribute at a sufficiently high percentile to premium and reserve risk. The contributions to premium and reserve risk by class should be calculated in the same way as the contributions by risk types (see section 18).

9.3.11 New Syndicates and/or New Classes

Where a syndicate is new or is planning to underwrite a new class of business, the additional risks associated with this should be considered. Lloyd's expects new classes of business to increase the overall capital requirement. Any resulting diversification credit from new classes of business should not override the additional capital for other associated risks.

The level of risk and the associated capital requirement will depend on the circumstances of the acquisition of this new business. In addition to the inherent risks of the business, the following situations may be considered to have relatively lower or higher risk compared to each other:

- Moving a portfolio from another part of the group to the syndicate (lower risk);
- Recruitment of complete underwriting team and book of business from another syndicate (medium risk);
- New syndicate set up through existing managing agent with effective risk management framework and controls in place (medium risk);
- Completely new to syndicate, underwriters, independent reviewers and senior management with disparate elements and a new book of business to be established (higher risk); or
- Entirely new setup / new managing agency with no existing framework and systems in place (very high risk).

Each of these will present different levels of challenge and therefore risk to the syndicate and the capital model should reflect this. In assessing the additional capital requirement, the parameters used should reflect the appropriate level of uncertainty and risk. Lloyd's would expect managing agents to allow specifically for the increased uncertainty in the best estimate loss ratio and consider the additional volatility in arriving at an estimate of a 1:200 confidence level. This may include:

- Additional volatility as compared to the existing classes;
- Increased uncertainty over the nature of the risks faced by the new book;
- Increased uncertainty about the business plan for the new book; and
- Where little or no historical data exists, managing agents should consider carefully the risk of mispricing and potential mismatching reinsurance.

In at least the first year of underwriting new business, managing agents should consider carefully what level of diversification benefit between classes of business within premium risk for such new business is appropriate given the uncertainties outlined above.

There is no requirement for new syndicates to include prior years of reserve risk in the first year (hypothecated reserves). As reserves start to build up for a new syndicate / a new class, the parameters used should reflect the appropriate level of uncertainty, as per premium risk. Lloyd's would expect managing agents to appropriately reflect additional volatility due to the small size of the portfolio/reserves. Additionally, Lloyd's expects an explicit margin due to the lack of information/data and experience of the class. This should be outlined explicitly in the documentation.

Detail on how capital is set for new syndicates is covered in section 5.7. There is an additional document specific to the requirements for new syndicates, available on Lloyds.com

9.3.12 Life Syndicates

Syndicates writing life insurance obligations should consider at a minimum the following risks (in addition to other areas described within this guidance, e.g. lapse risk). Documentation accompanying capital submissions must describe in detail the methodologies and assumptions considered for these areas:

- Mortality and longevity risk: Risk of loss, or of adverse change in the value of liabilities, resulting from changes in the level, trend, or volatility of mortality rates.
- Disability and morbidity risk: Risk of loss, or of adverse change in the value of liabilities, resulting from changes in the level, trend, or volatility of disability, sickness and morbidity rates (increase or decrease).

- Revision risk: Risk of loss, or of adverse change in the value of insurance liabilities, resulting from fluctuations in the level, trend, or volatility of the revision rates applied to annuities, due to changes in the legal environment or in the state of health of the person insured.
- Life catastrophe events: Risk of loss, or of adverse change in the value of insurance liabilities, resulting from the significant uncertainty of pricing and provisioning assumptions related to extreme or irregular events.

9.4 Example Stress Tests

The example stress and scenario tests below may be used when assessing insurance risk. This list is not exhaustive or prescriptive and is not a substitute for stress and scenario tests relevant to each individual business. Managing agents submit RDS tests to Lloyd's every year (further guidance can be found here).

Example stress and scenario tests are:

- Deterioration in rates vs plan: premium down in the range 5-10% with the same risk exposure;
- Significant (e.g. 25-50%) under-pricing in certain classes over a number of years, along with significant (e.g. 25-50%) growth in business in those classes;
- Claims inflation increases by 5-10% p.a. on all unpaid attritional claims;
- Main classes of business perform 50% worse than planned;
- Systemic poor risk selection over a number of years (for a variety of reasons);
- Combination of RDS scenarios;
- Ogden rate change;
- Systemic overstatement of rate change and/or understatement of inflation data over multiple years;
- Economic downturn and/or oil price drop;
- Claims accumulations which are not covered by the RDS, but may be relevant to the business, e.g. business interruption due to power failure, rogue professional causing several claims against a hospital/accountancy firm etc, impact of climate change on claims levels in various classes, the impact of a US/China trade war or scenarios concerning non-modelled catastrophe events;
- Significant reserve deterioration (e.g. 50%) in a significant class;
- Significant reserve deterioration (e.g. 10-20%) across a large number of classes (e.g. the whole casualty segment);
- Significant increase in inflation (e.g. 5-10%) across all classes, or in particular classes;
- Significant increase on medical and/or social inflation paired with increases in underlying inflation indices;
- Correction of systemic under-reserving;
- Emergence of a new risk, along with an associated change in the legal environment; and
- Largest two year-on-year reserve deteriorations in syndicate's history.

10 Premium Risk

10.1 Definition

Premium risk relates to losses arising from business earned from 1 January of the year of account for which the SCR is being prepared, for all prospective and prior years of account business.

10.2 Scope

Lloyd's appreciates that some models are prepared on an underwriting year basis, however, for consistency it is required that premium risk reflects all future underwriting risk (i.e. risk from business written from 1 January of the prospective YOA onwards) and risk on unearned reserves as at 1 January, and that reserve risk is the risk that best estimate reserves on earned business deteriorate. Premium risk must include catastrophe risk for all events occurring from 1 January of the prospective YOA, as well as all anticipated future underwriting profits

Premium risk must be modelled on a one-year and an ultimate basis.

10.3 Modelling Considerations

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

For each syndicate class of business, the LCR should contain an analysis of potential exposure to large individual and catastrophic event losses as well as the potential for adverse attritional loss experience. The analytical approach should be consistent for both existing and new syndicate classes of business, and the modelling methodologies applied should be clearly outlined.

Syndicate SCRs should address separately the risk of experiencing adverse loss ratios as a result of:

- Higher than expected claims frequency and/or severity;
- Under-pricing;
- A combination of the above; and
- Emergence of new types of claim.

10.3.1 One-year and Ultimate Risk

A view of premium risk must be provided on both a one-year and ultimate basis with the links and any differences between these clearly outlined in the documentation.

10.3.2 Consistency with SBF

An important contributing factor to the overall capital requirement is the assumed level of modelled profit that acts to reduce overall capital. A significant component of the modelled profit arises from new business in the prospective year of account, although there are other sources of profit and loss on a Solvency II basis that cause the mean ultimate SCR result to vary from the mean SBF result.

Managing agents are required to reconcile the level of profit in the SBF and the LCR. Lloyd's expects this to be a bridging exercise considering any difference in assumptions (e.g. loss ratios) or accounting items and will query large amounts attributed to "other" differences. These responses should be sufficiently detailed to allow a technically competent reviewer to form an opinion on their suitability. Managing agents should expect to address questions from Lloyd's where further detail is sought, particularly for figures that are not explained in enough detail. Poorly explained profit reconciliations may result in a capital loading for the unexplained element(s) of profit being claimed or the operational risk associated with a lack of scrutiny of model output. If the difference in profit is driven by action taken to address any deficiencies in historical plan versus actual loss ratios in response to the reserving test of uncertainty , then this should also be commented on.

10.3.3 Model Loss Ratios

As laid out in sections 4.10.1 and 4.10.6 assumptions used for the model should be on a Solvency II best estimate basis. Where the model loss ratios are not on the same basis as used to estimate the Solvency II

Technical Provisions, syndicates must provide a description of and rationale for the deviation. The basis of loss ratio assumptions for the LCR is required to be a best estimate, based on realistic and appropriate assumptions. As highlighted in the PRA's Supervisory Statement (SS5/14), this is not expected to incorporate improvements in performance unless the measures taken have been shown to be effective. Lloyd's considers that only syndicates with a consistent track record of performing to plan can justify the use of SBF assumptions for capital setting purposes. See sections 4.10.1 and 4.10.6 for details.

Individual syndicates are required to assess the appropriateness of the internal model assumptions, including the realism and appropriateness of prospective year loss ratios. Validation of these assumptions is also required. The Lloyd's Syndicate Reserving team conducts a test that compares planned and actual loss ratios over a range of historical years of account. Details of how this test operates are distributed to managing agents annually. Managing agents are given the opportunity to provide evidence to support any model loss ratio selections that would be deemed too low based on historical performance against plan. Lloyd's requires that managing agents will validate their loss ratio selections to evidence their realism and appropriateness, as would be the case for any other assumption used within the internal model. If insufficient justification is provided, the managing agent is expected to reflect any remaining deficiencies in their LCR submission (if possible), otherwise a capital loading will be applied by Lloyd's.

10.3.4 Class Level Volatility

Premium risk classes are expected to have modelled net loss ratios above 100% at the 99.5th percentile point of the net ultimate loss distribution. A class with a modelled loss ratio below 100% at this return period is assumed to almost never make a loss, which Lloyd's considers to be an unreasonable assumption. Lloyd's will apply a capital load at least equal to the difference in the net losses at the 99.5th point and 100% net ULR.

Managing agents should recognise the limitations in forecasting prospective underwriting from prior performance. Where historical performance has been poor, managing agents should not incorporate improvements in performance unless these measures have been shown to be effective. If any data is excluded from the parameterisation of the class volatility, then managing agents should demonstrate that these claims cannot occur in future. For example, if a line size is reduced for a class, then it is not appropriate to scale down all historical claims (unless the class writes proportional business), but the data should be capped at the new line size. Where historical performance has been good, allowance should be made for the fact that key factors may be liable to change, e.g. underwriting conditions, management. The relevance of superior performance to expected results is further limited when considering the extreme loss scenarios at the 1:200 confidence level and beyond.

For the prospective year, the relevant measure of volatility is from the expectation to the ultimate result, not the level of variability observed in the ultimate result over consecutive years. For example, a class of business that has an ultimate result of 110% five years in a row will have a low level of volatility measured on outcome but is likely to represent a consistent and material deviation from the opening assumptions.

10.3.5 Uncertainty of Premiums

Managing agents should consider the effect of the uncertainty regarding premiums, including the variability in premium volumes, premium rates, and contract terms and conditions, including whether changes may occur more severely than previously experienced. Managing agents should allow for premium volatility in their SCR as well as claims volatility. Please note that this does not mean that managing agents are required to model premiums or rate changes stochastically – however, it does mean that they should consider the impact of loss ratios being consistently underestimated across classes due to the uncertainty regarding premiums – which could create systemic dependency effects across classes that need to be taken into account, which could e.g. be modelled via an explicit driver and/or specific uplifts in the claims volatility.

With respect to applying expected loss ratios and 1:200 loss experience, Lloyd's would not normally expect material differences to apply over the life of the prospective YOA. Accordingly, managing agents may model the one-year and ultimate premium risk for the prospective YOA as a whole, with no requirement to apply judgement to model different outcomes dependent on the timing of individual risk attachments. Where managing agents consider that this is a material area of difference between assumptions for the one-year SCR compared to the ultimate SCR, they should include a commentary on its impact in the methodology document. This is a separate point to loss emergence recognition, which is expected to be a material driver of difference between the two modelled 1:200 outcomes. Please note that for outwards reinsurance, the timing of the attachment might matter,

as agents should consider the risk of cover being not available, or only being available at increased cost for cover attaching later on in the prospective year of account.

If the rating environment is expected to improve, managing agents should account for the volatility in the claims environment, as well as the market's ability to generate real improvements in pricing. See further comments on management actions relating to underwriting performance in section 4.10.7.

Where an SCR makes limited allowance for uncertainty of pricing assumptions on the basis that management will take appropriate actions to mitigate this risk, these future management actions must reflect actions the managing agent will reasonably take and the time necessary to action these, and these have to be documented within the future management action plan (see section 4.10.7), particularly where historical performance has indicated otherwise. The SCR is set at the 1:200 confidence level and at this extreme point of the range of outcomes, the SCR should carefully consider any level of credit that may be taken for management intervention, in view of survivor bias and the difficulty in assessing their own ability to respond at this level of severity.

Requirements on Pricing and Rate Monitoring can be found in Lloyd's 'Principles for Doing Business' Principle 1.

10.3.5.1 Additional Exposure or Risk Profile change

In addition to growth through new classes of business, managing agents should also consider growth via increased line size or additional policy count. Where a book of business has been written for some time on a particular scale, the experience may be unsuitable for setting parameters to measure the risk associated with the same book of business written on a larger scale. Managing agents should recognise the limitations that this places on use of historical performance data:

- Where the gross and net line size increases, volatility impacts should be considered;
- If different layers are written, this will affect risks and volatility assumptions;
- It may be difficult to obtain more business of the same quality ("niche" advantage lost);
- Different insureds may enter the portfolio;
- Control of the larger scale operation may not be possible (or not as good) using the same approach as was successful for a smaller book (e.g. underwriter may no longer be able to consider all risks individually); and
- Managing agents should also consider if growth occurs in a softening or hardening market.

The operational risks associated with growth should be captured in operational risk, however the risks above should be reflected in the mean loss ratio and volatility assumptions of the growing classes.

10.3.5.2 Uncertainty Due to Policy Features

In recent years, Lloyd's has identified a number of areas where policy terms and conditions are widening. Managing agents are expected to allow for uncertainty in areas where terms and conditions are widening and provide explanation of the parameterisation process in the methodology document submitted with the LCR. Explanations on how gaps and differences in terms and conditions between the inwards business and the outwards reinsurance protecting it should be included. Any adjustment of historical experience based on the introduction of exclusions is expected to be robustly demonstrated and governed, notwithstanding this the potential for unforeseen events that by their nature have not been subject to exclusions should be considered.

In addition to uncertainty arising due to changes in terms and conditions, managing agents should also consider any trends in line size (maximum and average) as part of the evolution of their risk profile.

10.3.5.3 Modelling of Multi-year Policies

Multi-year contracts should be modelled until run-off for the estimation of the ultimate SCR. This applies specifically to policies that cannot be cancelled by an insurer. In addition, a syndicate's internal model should estimate lapse risk for policies where the insured party reserves the right to cancel before run-off. See section 4.10.7 for information about future management actions.

Modelling of exposure should be clearly explained for policies where the exposure increases with every passing year. The impact of the exposure assessment on the catastrophe losses should be included in the methodology document. The earning pattern for the portfolio should be consistent with the duration of the multi-year contracts.

Managing agents should also consider the effects of multi-year deals on delegated underwriting authorities.

10.3.6 Loss Modelling

Managing agents are required to break their mean losses down into attritional, large and catastrophe losses, and a gross and net of reinsurance basis for the SBF. For the model, the level of granularity adopted should be appropriate to the characteristics of the underlying business. The allowance for ENIDs should be considered across all claim types.

The thresholds between attritional and large claims can vary by class and should be determined by managing agents. In general, attritional claims are modelled in aggregate and large claims as individual claims. Hence the threshold should be chosen in a way to provide:

- A sufficient number of large claims to allow setting parameters; and
- A relatively homogenous set of attritional claims with a relatively smooth distribution of claim sizes.

Please note that it is expected that the claims should be classified as either attritional or large from the ground up (i.e. large claims should NOT have an attritional and a large element).

10.3.6.1 Attritional Loss Modelling:

When projecting attritional claims, managing agents should consider the extent to which inflation, rate changes, definition of large claims and other external factors can impact the historical development data. Where an SCR has implicitly assumed that the volatility of future inflation will be in line with that in the historical data, this should be supported by clear examples on how appropriate this assumption is.

10.3.6.2 Large Individual Risk Losses

Managing agents should ensure that, when assessing large claims, the parameters used are sufficiently severe and reflect both their own experience and benchmark data. Historical experience can be used where relevant, with allowance for terms and conditions as well as inflation.

10.3.6.3 Catastrophe Loss Modelling

Catastrophe losses submitted in the LCR forms should be consistent with those submitted in the LCM, hence catastrophe losses should refer to natural catastrophes only. Managing agents should be clear about how man-made catastrophe events have been taken into account and where they are allocated.

Please note that managing agents should take care if they have a “re-balancing” feature for loss ratios in their model, i.e. where loss ratios are calibrated to the SBF or an uplifted SBF number, as this can cause counter-intuitive movements in capital. Catastrophe loss ratios should be consistent with those submitted in the LCM forms, and managing agents should not assume that the attritional loss ratios change automatically when those catastrophe losses change – the attritional and large components should be assessed separately and should reconcile to actuarial loss ratio analysis (as explained in section 10.3.3).

10.3.7 Natural Catastrophe Risk

Syndicate SCRs should reflect the loss potential from all-natural catastrophe exposure within the syndicate’s portfolios. Use of vendor catastrophe models, incorporating stochastic event catalogues is good practice.

Lloyd’s recognises that different catastrophe models are in use across the market and managing agents should include, within their submission, details of the model used as well as how this has been adapted to suit their particular exposures. Details should include at least the following:

- Modelling software used and version number;
- Which perils have been modelled, and relevant geographies (e.g. US windstorm, Japanese earthquake);
- Any alterations made to standard model assumptions and settings; and
- Details of data used in the model and any alterations made for planned prospective year underwriting.

Managing agents must ensure that internal models appropriately represent all material accumulations of underwriting exposures and loss potential, in line with Lloyd’s ‘Principles for Doing Business’ Principle 2.

Where external models or data are used within internal models, managing agents must ensure that this is clearly identified, understood, and applied, in line with Lloyd's 'Principles for Doing Business' Principle 7. When justifying the assumptions underlying an external model, it is not sufficient to justify the assumptions on the grounds that they are selected by default. Managing agents should justify all assumptions on the basis of their own specific risk profile.

Lloyd's will also look for an analysis of the output of the model against actual loss experience and the use of models by managing agents in their business.

When using a scenario-based approach, managing agents are reminded to consider the potential for multiple events in a given year. The catastrophe scenarios should represent sufficiently extreme events, or combinations of events to be relevant to requirements at the 99.5% percentile (which may be beyond the level of some of the existing RDSs). Managing agents using a scenario-based approach should explain the rationale for the selection of the scenarios used.

External catastrophe models tend to focus on natural catastrophes, and only for a limited set of classes of business and territories. Syndicate SCRs should not understate the potential exposure from other natural catastrophe events, liability or man-made catastrophes, nor should they understate the potential contribution to catastrophe losses from unmodelled classes of business.

10.3.8 Model Completeness

Use of external catastrophe models incorporating stochastic event catalogues is good practice. However, the SCR should allow for the possibility of model error and for events not included within the catastrophe model catalogues. Actual loss experience in recent years highlights that catastrophe models alone and unadjusted may not always be sufficient.

Consideration should be given to classes, coverages and secondary perils that may not be included in all catastrophe models as standard. Furthermore, region-perils not covered by vendor catastrophe models should be appropriately parameterised and included in SCR calculations.

The model documentation must include information on the level of non-externally modelled catastrophe risk included in the model and clear justification for this. Managing agents should have a robust process in place to identify, assess, and monitor the completeness of their natural catastrophe risk profile. This should include, stress testing, reverse stress testing and back testing against historical events.

10.3.9 Cyber Risk

Details of the cyber risk parameterisation process should be included in the methodology document submitted with the LCR. Managing agents are not required to model cyber lines of business separately. Depending on the nature of business mix, an aggregate class structure may be used in the internal model. However, managing agents should aim to model it separately where possible, and details of the parameterisation of cyber and the rationale behind the selected class structure should be provided in the methodology document.

Managing agents are required to provide an indication of cyber exposures (direct and incidental) at class level in the LCR.

10.3.10 Liability Catastrophes

Managing agents should consider the potential for events to occur that would result in significant losses for liability/long-tailed classes of business. These might lead to significant accumulations of loss in one particular class of business, or across multiple classes of business, usually from a combination of increased frequency of losses, both large and attritional. There may also be a knock-on effect on claims inflation arising as a result of the increased claim frequency that managing agents should consider.

Managing agents should also consider the potential for these events to simultaneously lead to latent claims that affect earned business.

10.3.11 Reinsurance

With relation to premium risk, reinsurance is in general modelled explicitly on the generated gross claims. Managing agents should document any simplifications to the reinsurance programs applied and ensure that the level of recoveries is appropriate, in particular for relatively complicated reinsurance programs.

With regard to reinsurance, managing agents are required to demonstrate that the reinsurance contracts fully provide the protection that the internal model assumes. Areas to consider should include:

- Reinsurance dispute and default;
- Policy deductibles and excess points;
- Reinsurance coverage (e.g. exclusions and geographical coverage);
- Willingness to pay;
- Loose policy wording;
- Basis risk (e.g. for ILWs);
- Matching of coverage (e.g. risks attaching versus losses occurring terms);
- Currency mismatch between reinsurance terms and the underlying risk; and
- Horizontal and vertical exhaustion; reinstatement provisions.

Agents should consider modifying their internal models to reflect potential short comings of reinsurance protection and/or including an allowance within their operational risk assessment. See below for further details on some of the above.

10.3.11.1 Non-matching Reinsurance

Managing agents should consider the risks arising as a result of:

- Multi-year, long term, non-cancellable inwards policies written by the syndicate where there is a material reliance on reinsurance of shorter duration, and where there is no certainty over renewal coverage or pricing of such reinsurance (particularly in a post loss scenario), or where known renewal terms and conditions would impose an additional cost and/or reductions in available coverage.
- For multiple year reinsurance covers with an aggregate limit for the contract period that is less than the sum of the annual limits, the calculation of the credit for the multi-year reinsurance should reflect the aggregate limit available.
- Reinsurance covering LOD, rather than RAD, the period of cover and where there is no certainty over renewal coverage or pricing of such reinsurance (particularly in a post loss scenario), or where known renewal terms and conditions would impose an additional cost and/or reduction in available coverage.
- Gaps and differences in coverage between the inwards policies and the reinsurance coverage in relation to contract conditions, exclusions or sub limits including loss event definitions, and/or as a result of a change in the basis of the reinsurance coverage, e.g. moving from LOD to RAD cover, increased retentions, reductions in reinsurance limit.
- The use of reinsurance where the limits are in a currency that differs to that of the inwards policies, and/or fixed currency rates of exchange for programme deductibles/limits.
- Reduced or non-recovery due to the erosion or exhaustion of reinsurance protection that is shared with other Lloyd's syndicates or parties external to Lloyd's.
- Reduced or non-recovery caused by negative basis risk arising from indexed, parametric reinsurance or other similar reinsurance products where recoveries are not triggered by the syndicate's own losses (see Basis Risk guidance notes below).
- Failure to complete the placement of reinsurance prior to the occurrence of a material loss.
- Reduced or non-recovery caused by breach of reinsurance terms and conditions associated with the syndicate's underwriter, exposure or claims management and controls.
- The operation of reinsurance exclusions, or differences in interpretation of coverage due to unclear reinsurance contract wordings, whereby the syndicate would retain an unexpectedly larger proportion of a significant loss.
- Potential for different legal jurisdiction to apply on inwards business compared to outwards reinsurance, and/or political / regulatory sanctions that prevent payment of reinsurance recoveries.

Syndicates are expected to assess the points above and make an allowance in the model where considered material. In line with section 4.10.7, the model must allow for the placement of future reinsurance at different terms or even unavailability of reinsurance if material. So, if e.g. a significant proportion of outwards reinsurance

is placed at 1/6 instead of 1/1, then the risk of a catastrophe happening before that is higher, hence leading to different pricing. The model could then not include the future management action (i.e. exclude this cover) at one extreme, model higher prices or reduced availability from a certain trigger point or model an artificial reinstatement premium.

The considerations above apply to a variety of risk types – some of the risks should be captured in dispute risk or operational risk as outlined in the respective sections.

As detailed in Lloyd's 'Principles for Doing Business' Principle 3, any non-standard reinsurance or alternative risk transfer arrangements that fall within the Lloyd's definition must not be treated as reinsurance within the SCR unless (i) the managing agent can effectively demonstrate that the recovery under the contract is based on the principle of indemnity and (ii) is able to provide confirmation that the managing agent's auditors have confirmed and signed-off that the reinsurance contract conforms to applicable accounting and regulatory requirements, and (iii) has had Lloyd's prior approval.

Further details on reinsurance risks can be found in Lloyd's 'Principles for Doing Business' Principle 3 Managing agents should also consider the effects of reinsurance matching on delegated underwriting authorities.

10.3.11.2 Exhaustion

Syndicate SCRs should consider exhaustion of reinsurance cover and risks arising as a result of:

- The occurrence of multiple losses at a level that exceeds the maximum available aggregate and/or reinstatement limits requiring material reinsurance support, i.e. the purchase of insufficient sideways coverage;
- The occurrence of an unexpected large event that may exhaust vertical cover;
- The erosion of cover as a result of losses from other classes where reinsurance protects more than one class of business, and/or more than one loss period, and/or more than one reinsured syndicate or non-Lloyd's entity; and
- The risk associated with projecting the appropriate amount of reinsurance cover to purchase, e.g. natural catastrophe reinsurance limit purchased based on loss estimates derived an inadequate natural catastrophe model.

10.3.11.3 Post Loss Impact on Cost

Syndicate SCRs should consider the post loss impact on reinsurance costs arising as a result of:

- The effect of contractual conditions, e.g. reinstatement premiums, loss adjustment additional premiums;
- Increased minimum reinsurance premiums; and
- Potential unavailability or uneconomic pricing of reinsurance.

10.3.11.4 Material Reinsurance Covers

Where the SCR takes credit for material reinsurance arrangements, for example a whole account stop loss or quota share treaty, Lloyd's requires that the accompanying SCR documentation clearly sets out the SCR pre- and post- the reinsurance. This should show the premium and anticipated recoveries at the premium (or reserve) risk level, diversified insurance risk, the incremental reinsurance credit risk and at aggregate level after all diversification between risk categories. The SCR should naturally account for the reinsurance premium in 100% of simulations and the diversified appropriate recovery (net of any premium adjustment) at the stress point after including all modelled losses that fall outside the cover.

This will provide insight into the reliance being placed on the cover. Furthermore, the managing agent should also confirm at what percentile the reinsurance limit under the contract is exhausted. It can then be ensured that, after the economic uplift is applied, the credit against member capital is, in aggregate, no greater than the maximum recovery.

A separate LCR should be submitted, excluding the material reinsurance, to show the impact on capital of the material reinsurance. Material reinsurance is defined as a single contract that impacts uSCR by more than 10%.

10.3.11.5 Basis Risk with Regards to Reinsurance relying on Market Triggers

The SCR should specifically address any material basis risk, for example in respect of ILWs / OLWs, forms of cover in which a recovery is triggered in the event of a specified amount of industry loss. This may expose the syndicate to material losses if the trigger mechanism for the contract is not exceeded despite a significant industry loss. Full details of the methodology used to calculate or mitigate the basis risk should be provided in the LCR submission.

11 Reserve Risk

11.1 Definition

Reserve risk is the risk that claims reserves set as at balance sheet date for business earned up to that date prove to be inadequate. Allocated loss expenses should be included within the claims reserves.

11.2 Scope

The forecast claims technical provisions as at the balance sheet date should be based on the latest set of best estimate reserves, which have been subject to auditor's review. Assumptions made for the run-off of the business over the period between the latest set of reserves and the valuation date (including assumptions regarding business expected to be earned by the valuation date as well as that already earned) should be clearly stated and justified. Managing agents should also ensure that they incorporate the latest claim information available to the syndicate prior to submission. For example, if (large) losses are known to have occurred that have not already been allowed for within the audited technical provisions, then these should be included when forecasting the T0 balance sheet used for the LCR submission and specifically commented on.

Reserve risk must be modelled on a one-year and an ultimate basis.

For further information on Reserving, see Lloyd's 'Principles for Doing Business' Principle 6.

11.3 Modelling Considerations

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

11.3.1 One-year and Ultimate Risk

A view of reserve risk must be provided on both a one-year and ultimate basis with the links and any differences between these clearly outlined in the documentation.

11.3.2 Modelling Techniques

Lloyd's does not prescribe the method in which stochastic reserve distributions are derived. Market practice varies from using actuarial analyses such as bootstrapping, to individual claims modelling, to modelling reserve risk distribution by class or by year and class.

Whatever the approach taken, stress tests on reserves should be performed to validate the deterioration of reserves in the tail. Lloyd's would like to further emphasise the need for caution when using any stochastic reserving technique, and to stress that managing agents must treat the output of such stochastic methods as only one part of the overall assessment of reserve risk. Managing agents should not depend on stochastic reserving without further adjustment or consideration, as they may break down in extreme percentiles. Managing agents should ensure that they include sufficient justification for the level of reserve risk within their SCR and provide detail of any adjustments made. Managing agents should be able to qualitatively explain why the reserve distributions they are fitting are appropriate, particularly in light of the potential shortcomings of the stochastic methods referred to above. The following should be considered and adjusted for if necessary:

- Data for any continuing business will contain "survivor bias";
- Additional shock losses might have to be added;
- Benchmark data might have to be adjusted, allowing for size and age of the portfolio; and
- Gross and net volatility needs to be considered.

In particular, no method must ever be applied as a black box, but the volatility implied as a whole and for each year of account must be justified and validated.

When setting parameters from data, managing agents should make allowance for uncertainty in their parameter choices due to the following (as per section 8.6):

- Credibility of the data used – margin for uncertainty on own data, size and other adjustments for market data;

- ENIDs; and
- Adjusting data for correlated data points.

Where data is adjusted to remove anomalies or ceased classes, the resulting “smoothed” dataset may understate the level of volatility and hence understate capital. Lloyd’s is unlikely to accept “smoothed” datasets unless substantial evidence can be provided that these types of exposures are no longer present within the book. Furthermore, as syndicates’ own data is unlikely to contain examples of 1:200 reserve deterioration, smoothing would generally not be expected, and managing agents should be looking to consider other sources to supplement their own data (for example, by including “as if” losses or uplifting model output). Regardless of the approach used, the resulting reserve distributions must be accompanied by appropriate justification and validation.

The modelling of the volatility of reserves should make an allowance for the age and the size of reserves. Managing agents need to explain how they have adjusted reserving data for differences in size and age in comparison to the current reserves. This is particularly important when market data is used in the parameterisation.

11.3.3 Loss Modelling

The SCR should include adequate reserve risk arising from catastrophes that have already occurred. Unpaid catastrophe losses will need to be considered carefully, in particular with respect to their gross and net position. The SCR should also take account of the reserve risk arising from large losses. This should include historical large losses, which may deteriorate suddenly as disputes are started or resolved. This uncertainty at a gross level might be amplified for the net position. Moreover, late advices should be considered, i.e. claims which are notified late or where the size of the claim only becomes suddenly and belatedly apparent. Managing agents should take care when assuming that claims are “reserved at limits”, as theoretical cover may still exist for the underlying policies which should be accounted for within the SCR calculation. Managing agents should also consider that claims expenses might have to be paid on top of the cover amount for some policies.

As well as considering the impact of large and catastrophe losses on reserves, managing agents should also consider the impact of attritional losses and general reserve deterioration. The SCR should allow for unexpected adverse movements including new trends or the continuation of existing adverse trends. If the number of claims turns out to be higher than expected, the SCR should allow for any consequences such as sideways reinsurance exhaustion or lack of claims staff / external advisors (e.g. demand surge following the 2005 US hurricanes). These allowances need to be embedded in processes: for example, a high-level adjustment to reduce a volatility parameter of a class due to it containing more “event loss reserves” is unlikely to be accepted if the process by which this is derived and would therefore “run off” is not clear.

11.3.4 Reinsurance

Reserves may materially benefit from previously placed reinsurance. Managing agents should justify the approach taken to modelling reinsurance on earned business. In general, the approach that managing agents take for reserve risk is not as granular as for premium risk: reserve risk is not necessarily modelled on an individual claim basis. One approach to modelling reinsurance on earned business is the use of net-to-gross ratios. Managing agents should consider whether the modelling of reinsurance for reserve risk with such simplifications is appropriate, in particular if the managing agent relies heavily on reinsurance. Managing agents should consider the following in addition to the applicable points listed in section 9.3.4:

- Whether changing reinsurance structures across different years of account have been modelled appropriately.
- The most appropriate allocation of reinsurance recoveries from contracts that protect both the Reserve Risk and Premium Risk.
- Whether reinsurance exhaustion is appropriately allowed for in the reserve risk distribution, reflecting both non-proportional and proportional protections with inner per risk / per event / aggregate period limits.
- How a net-to-gross approach accounts for the balance between large claims reaching an XOL attachment and smaller claims across the distribution. For example, for a class with relatively high attaching reinsurance in the distribution’s tail might be driven by a relatively large number of claims below the attachment, resulting in a higher net to gross ratio than at other points of the distribution.

Managing agents should ensure that the benefit of reinsurance on reserves is not overstated. Individual claims or event modelling (in particular for catastrophes or other events with specific reinsurance programmes in place, as well as material aggregate covers) might be more appropriate in some cases and managing agents must regularly monitor the appropriateness of their methodology.

11.3.5 Dependencies within Reserve Risk

As mentioned in section 9.3.9, managing agents should ensure that their models include sufficient dependency both between reserving classes, and across prior years within classes. Lloyd's requires that similar to the considerations for setting dependencies between pairs of classes, dependencies modelled across years are internally consistent and positive; with stronger dependencies modelled for years that are more exposed to factors that would cause reserve movements in the same direction (particularly reserve strengthening). Lloyd's will not set a minimum correlation, but the level should adequately reflect shared systems and processes across years, common trends across years and other effects. Low positive dependency will be subject to significant challenge.

Reserve risk parameters are often measured using actuarial analyses such as bootstrapping, although it is not essential to take this approach. When performing such analyses (and in general), managing agents should consider the inherent dependency assumptions across years being incorporated into the parameters and ensure that an appropriate dependency (in particular in the tail of the modelled distribution) is captured in the final modelled volatility. In particular, bootstrapping assumes independence between years, which does not meet the requirement of a positive correlation being applied. Lloyd's expects that managing agents will take this into account in their modelling and explain the approach taken in their methodology documentation.

Managing agents should explicitly state where they are allowing for certain trends in their dependencies, and to what extent. For example, if an allowance is made via an uplift in dependencies for claims inflation, regulatory changes, and latent claims, then the amount of uplift for each of these factors should be specified.

12 Market Risk

12.1 Definition

Market risk is the risk arising from the level or volatility of economic variables which have an impact upon the value of the assets and liabilities of the syndicate. Market risk must represent the net 1:200 deterioration from the opening balance sheet at T0. It must include the risk to the value of the assets and liabilities arising from volatility in the following:

- Interest rate risk (includes the unwind of the discount rate);
- Credit risk (including spread risk, default risk and concentration risk);
- Equity risk (including other risks and property risk);
- Currency risk; and
- Liquidity risk.

The following provides additional details on each of the above risk categories within market risk.

12.2 Scope

The expected return in market risk is the total expected returns from the syndicate's assets, allowing for net nil balance sheet at T0 plus the new premium income, reduced by the total risk-free discounting already allowed for in the projected insurance liabilities. The discounting credit at T0 is expected to unwind to ultimate but any associated loss due to unwinding will not be included in insurance risk. Market risk should also include the risk that there are changes to the risk-free rate in the valuation of T1 technical provisions in the one-year SCR. If not modelling on both a one-year and ultimate basis, agents should state clearly the time horizon adopted for market risk when assessing the ultimate SCR and ensure this is consistently applied for expected returns and associated asset risk. Both expected returns and asset risk should exclude capital and surplus syndicate assets

Market risk includes exposures arising from variations in exchange rates, interest rates and investment returns. Market risks tend to be interdependent, such that movements in one variable are likely to have implications for other variables and/or asset classes. For example, fluctuations in interest rates will usually have an impact on equities, bonds and exchange rates.

Market risk should be considered in conjunction with insurance risk, credit risk and operational risk, and the correlations recognised.

The sensitivity of capital to changes in the underlying asset mix should be considered. This should include not only the current asset mix, but also deviations from the asset mix as the assets evolve (as far as possible) within the syndicate's investment policy. Moreover, the asset mix should be based on the planned asset mix for the next year, which might differ from the current mix if there are plans to change the investment strategy. Managing agents must explicitly state any actions considered to be future management actions and ensure they adhere to Lloyd's 'Principles for Doing Business' Principle 7 and the above section 4.10.7.

Managing agents are required to "demonstrate that their internal model is consistent with their investment governance, risk management and decision-making processes", in line with Lloyd's 'Principles for Doing Business' Principle 8.

The balance sheet projection for T0 must be prepared on the basis of net nil basic own funds on a Solvency II basis. The LCR reports the projected net technical provisions at T0 and the model must assume that equivalent assets are held. The investment income arising on surplus assets at syndicate level and on capital, whether provided as FAL or FIS, must not be included in the calculation of the syndicate level SCR. Equally, the market risk associated with these assets is also not included and is considered within the central assets required to meet the Society capital requirement.

In respect of investment return, the projection 'to ultimate' in the model may recognise income received in respect of retained profits. For the one-year SCR the model must release the profit as recognised annually – for the ultimate basis Lloyd's requires this no later than three years. This should avoid distortion in the results from inclusion of excess investment income up to the final claims payment date and it reflects the reality of full distribution of profits at Lloyd's.

Lloyd's considers that assets cannot be held on a basis perfectly matched to the underlying liabilities of a syndicate in both term and currency since the timing and extent of liabilities are uncertain. In particular, under extreme conditions, claims inflation is likely to exceed income from investments.

The risk-free discounting credit in the SCR should reflect the fact that existing assets may be depleted more quickly in a 1:200 scenario and consequently the risk-free return will reduce compared to best estimate projections.

The ESG is an external model and all external models within the scope of the internal model must operate to the same set of standards of the internal model itself, as per Lloyd's 'Principles for Doing Business' Principle 7. Further details are provided in the section 12.3.2. External models can focus on certain types or elements of market risk only. Where managing agents use external models, they must take particular care to demonstrate that their resulting model covers all material risks in their risk profile. For example, if a managing agent uses an ESG for government bond valuation, they should ensure that their internal model covers related risks such as liability discounting due to risk-free rates. Movements in market risk must be articulated in terms of movements in underlying risk profile caused by economic variables, rather than referred to as movements in the ESG. See section 8.10.

12.3 Modelling Considerations

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

12.3.1 One-Year and Ultimate Risk

Lloyd's accepts market risk on a one-year balance sheet to balance sheet basis as a proxy for the ultimate risk. The approach taken, with rationale, must be included in the SCR methodology document. This involves consideration of the risk and return on assets held over one year. Managing agents may also consider a time horizon between one-year and ultimate; however, managing agents should note that the time horizon for modelled market risk and the credit for excess returns above the risk-free rate should be consistent.

If not modelling on both a one-year and ultimate basis, managing agents must state clearly the time horizon adopted for market risk when assessing the ultimate SCR and ensure this is consistently applied for expected returns and associated asset risk. If modelling on an ultimate basis, managing agents should provide evidence that the time horizon is consistent with the length of the claims payment pattern. Both expected returns and asset risk must exclude capital and surplus syndicate assets. In any case, as stated in section 4.2, Lloyd's expects market risk to ultimate to be adequately captured in syndicates' capital models, and thus justification is required to support the chosen time horizon.

Historical volatility should be considered when making assumptions about future volatility, and therefore the riskiness of a syndicate's investment portfolio. In addition, forward-looking considerations should consider whether the current market position is expected to persist over the period the assumptions will be used.

Market risk should be valued for each of the underlying assets of collective investment vehicles and other investments packaged as funds (i.e. a look-through approach). Evidence of the result of this look-through approach should be included in managing agents' reports, including how the underlying assets have been categorised between the asset categories as defined above. Additionally, for illiquid investments (such as, but not limited to private equity, private debt, and infrastructure), managing agents should clearly state the modelling approach, and care should be taken to ensure that the illiquid features of these assets are captured within the assumptions stated.

It will generally be expected that any increase in expected return is accompanied by an increase in risk.

12.3.2 Economic Scenario Generator

Managing agents must demonstrate that they adhere to Lloyd's 'Principles for Doing Business', in particular, that the role of the ESG is explained and its materiality on capital assessed annually, for example with regards to parametrisation assumptions or as a result of ESG version updates.

Managing agents should explain why the selected ESG has been chosen instead of other versions which have been listed and considered. This explanation must assess how adequately the selected ESG reflects the syndicate's risk profile with respect to the current asset portfolio. Any limitations or uncertainties with respect to

the chosen ESG should be understood, and the materiality should be assessed and documented. Any expert judgements should be included within the expert judgement log and be validated appropriately. This assessment should be sign-posted within Validation Reports submitted to Lloyd's.

When justifying the assumptions underlying an external model, it is not sufficient to justify the assumptions on the grounds that they are selected by default. Managing agents must justify all assumptions on the basis of their own specific risk profile.

As part of the validation process, it is expected that managing agents validate the forward-looking appropriateness of the ESG and provide expert judgment logs where any adjustments to ESG assumptions have been made.

It may not be possible to know exactly what assets are invested for funds or other pooled investments. For such investments within the asset portfolio, Lloyd's expects managing agents to assess the riskiness and adequacy of associated ESG assumptions using a look-through approach and make appropriate allowance for any uncertainty in the allocation.

12.3.3 Interest Rate Risk

Interest rate movements will directly impact the value and expected return on fixed interest securities and cash and may impact other asset classes. In general, interest rate increases will reduce the value of held securities and increase the return on reinvestment (and vice versa).

The expected return in market risk is the total expected return from the syndicate's assets, allowing for a net nil balance sheet at T0 plus the new premium income, reduced by the total risk-free discounting already allowed for in the booked insurance liabilities. Modelled liabilities should be discounted by the risk-free rate, in line with SII guidance. This discount credit at T0 is expected to unwind to ultimate and any associated loss due to unwinding is to be included in market risk (in the sub-risk interest rate risk on liabilities below). Interest rate risk should also include the risk that there are changes to the risk-free rate in the valuation of T1 technical provisions in the one-year SCR. This is relevant for one-year market risk, and also if ultimate market risk is modelled on a one-year basis.

As the assets eligible for discounting represent solely the existing assets at T0 plus future premiums and exclude cash injections to meet capital shortfalls, managing agents should make sure the unwind of the discount benefit is not overstated, i.e. that no credit is taken for investment income on FAL (see section 12.3.3.3).

The unwind of the discount is reported as part of interest rate risk in the LCR forms.

12.3.3.1 Interest Rate Risk on Assets

Booked Solvency II Technical Provisions at Time 0 are discounted at the risk-free rate of return by currency. Most syndicates will expect to receive a return in excess of risk-free on the assets backing the booked liabilities; this will occur through a combination of an active investment strategy and investing in higher risk/return assets. In both cases, this exposes the syndicate to market risk and the degree of market risk increases with the level of expected return in excess of risk-free. The degree of market risk is further influenced by the level of mismatch between assets and liabilities: this will include currency and duration mismatches.

Interest rate risk on assets should include the impact of changes in the level and volatility of risk-free rates. If the ultimate time horizon is modelled as one year, or more than one year but fewer years than the ultimate time horizon, then this will be non-zero. Interest rate movements will directly impact the modelled revaluation of assets in 12 months' time, and this should be recorded in the interest rate risk on assets. The expected risk-free rate will also be directly linked to interest rates and hence the revaluation of the liabilities in 12 months will be impacted by movements in interest rates.

Managing agents should consider the position on the yield curve, as well as the impact of both upwards and downwards movements in interest rates. The impacts of these should be reported in interest rate risk.

12.3.3.2 Interest Rate Risk on Technical Provisions

The interest rate risk on technical provisions is the unwind of the discount credit. The unwind of discount credit on liabilities is equal to the discount credit on closing liabilities minus the discount credit on opening liabilities. This then means that on an ultimate year basis, all liabilities have run off at time ultimate, so the discounted closing

liabilities are zero, which leaves a negative amount equal to the discounted opening labilities as the unwind of the discount. This amount is known at time 0 and so is deterministic.

In summary, the interest rate risk on technical provisions on an ultimate basis is simply the deterministic amount of the discount credit on opening liabilities. If a proxy ultimate balance sheet is used to model capital/market risk, this property should still hold true.

On a one-year basis, the interest rate risk on technical provisions is more complicated, as there are liabilities at time 1 which need to be simulated and discounted. The discount rate at time 1 is unknown at time 0 (as is the magnitude of the time 1 liabilities at time 0). This usually means that the discounted credit on closing liabilities might be greater than the discounted credit on opening liabilities (in downside insurance scenarios where technical provisions at time 1 have grown), and therefore, the unwind of the discount credit would be positive, i.e. a profit. This profit therefore acts to reduce one-year interest rate risk, and so reduce one-year market risk and can therefore cause a negative contribution to post-diversified capital from market risk on a one-year basis.

With regards to the risk margin, the discounted risk margin is accounted for in insurance risk and the unwind of the discount should not be reported in market risk.

Interest rate risk on technical provisions should only include the impact of the unwind of the discount rate. Any changes as a result in the change in the risk-free rate is considered as interest rate risk volatility and should be included in interest rate risk on assets.

12.3.3.3 No Credit for Investment Income on FAL

As stated above, the LCR reports the projected net technical provisions at T0 and the model must assume that equivalent assets are held. The investment income arising on surplus assets at syndicate level and on capital, whether provided as FAL or FIS, is not included in the calculation of the syndicate level SCR.

One-year Basis

Lloyd's assumes the one-year risk horizon to be based on the presumption that technical provisions will be transferred to a buyer at the end of year 1 (T1), as per this numerical example. Lloyd's adopts the Solvency II principles for one-year SCR, such that technical provisions at T0 and T1 balance sheet dates are to be fully discounted at the risk-free rate. The assumption that NAV is 0 at T0 aims to ensure that no FAL assets are included in the calculation of the SCR and hence, to obey the rule that no credit is taken for investment income on FAL. The investment income between T0 and T1 should only be from the opening non-FAL assets and income earned from premium cashflows less outgoings.

In a stressed scenario, there may be larger than expected losses between T0 and T1 and this would act to deplete the level of opening assets as they are used to pay claims. This would be expected to reduce the level of investment income, as a result of the reduced level of assets to invest and therefore, Lloyd's expects syndicate models to adjust down the investment income in this scenario. Syndicates must not assume that a cash call can be made in a stressed scenario, as this inherently implies that FAL assets are utilised. In this stressed scenario, the technical provisions can still be fully discounted at the risk-free rate, as the Lloyd's one-year SCR adhere to the Solvency II principles. Therefore, the stressed scenario can give rise to a larger than expected unwind of discount benefit on the one-year basis, which results in a profit that is allocated to market risk. The technical provisions on the T1 balance sheet should reflect the increase in risk margin due to stressed conditions, which may be fully discounted to T1, but the one-year SCR should not include additional discounting from T0 to T1 as explained above.

Therefore, whilst Lloyd's acknowledges that the unwind of the discount rate can give rise to a market risk profit on the one-year basis, managing agents should ensure that the benefit is not overstated, i.e. that no credit is taken for investment income on FAL. This can be achieved by making sure NAV at T0 is 0 and by depleting assets when necessary, meaning that there is no implicit cash call in stressed scenarios.

Ultimate Basis

Previous guidance has referred to "capping" the unwind of the discount benefit on an ultimate year basis. This arose because in the case where the ultimate basis is modelled by a proxy ultimate time horizon, the assumption that NAV = 0 at T0 is not enough to ensure that no credit is taken for investment income on FAL. That is, where a smaller number of years has been modelled than the actual time taken for liabilities to fully run off. Using this proxy ultimate basis, the closing balance sheet will not have technical provisions equal to zero, and therefore is

different to the true ultimate basis. The technical provisions on the closing proxy balance sheet are often discounted. The discount credit was thought to be a fair approximation to the investment return, which was not included after the closing proxy balance sheet date. However, in the stressed scenario, this approximation does not hold. This is because technical provisions are likely to be larger than expected and so give rise to a larger than expected discount credit; however, assets should have been depleted to pay for the additional claims. Therefore, future investment income will be lower and the discount credit higher than expected. Taking full credit from discounting the technical provisions the closing proxy balance sheet, therefore, implicitly takes some credit for investment income on FAL assets. Assets are allowed to increase in line with investment returns and premium income and should be depleted as necessary (as on the one-year basis).

Lloyd's expects managing agents to ensure that the principles of an ultimate year basis are applied to a proxy ultimate year basis. That is that no credit is taken for investment income on FAL and that the unwind of the discount benefit is a deterministic loss equal to the opening discount benefit (which is allocated to market risk). The former can be achieved in different ways: for example, by not discounting the closing proxy balance sheet technical provisions, or by scaling down the discount credit (i.e. "capping"), which could be in proportion to the level of assets compared to technical provisions. Lloyd's will not prescribe the method which managing agents should use; but will expect managing agents to demonstrate that the above features hold, i.e. that the overall principle that no credit for investment income should be taken on FAL holds.

Interest rate risk on technical provisions should only include the impact of the unwind of the discount rate. Any changes resulting from the change in the risk-free rate is considered as interest rate risk volatility and should be included in interest rate risk on assets.

12.3.3.4 Consistency of Discount Rates and Interest Rates

As per section 4.10.2.3, managing agents are required to use consistent risk-free rates to discount their opening liabilities and project their asset returns in their modelling. This is not required to be the discount rate published by the PRA. The PRA publishes risk-free rate term structures on a monthly basis and these rates (at an appropriate point in time) must be used as discount rates in the T0 balance sheet for the QSR/ASR returns.

However, Lloyd's understands that some managing agents may choose to use risk-free rates from alternative sources such as the ESG in the capital model. If this approach is being used, Lloyd's expects that managing agents will regularly assess the materiality of any inconsistency between the PRA rates and risk-free rates used in the capital model and make an adjustment to the SCR where these drive material differences. If the impact is immaterial, and the assets and liabilities within the internal model use consistent risk-free rates, the inconsistency is acceptable. Immateriality is to be determined by the managing agent and explained (with justification) to Lloyd's. Immateriality should be justified throughout the probability distribution forecast – not only at the mean.

12.3.4 Credit Risk

Spread risk, default risk (on assets as opposed to reinsurance counterparties) and concentration risk are expected to be modelled separately within capital models but reported as part of credit risk within market risk.

12.3.4.1 Spread Risk

Spread risk is the risk of a change in the credit spread on a corporate bond, which in turn may impact the returns and reinvestment return. Migration risk is the risk that a bond's rating migrates to a different (lower) rating, resulting in a higher credit spread and reduction in value.

There is generally no direct impact on liabilities from spread risk. Spread risk should be reported as part of (market) credit risk in the LCR.

12.3.4.2 Default (Credit) Risk

Default risk is the risk of non-performance / default of a held security. It will relate to all asset classes not considered risk-free and does include cash or cash equivalents – including e.g. bank balances held as collateral.

Default risk may be correlated to general economic conditions which in turn are linked to other risk categories such as inflation (on both assets and liabilities) or interest rates.

12.3.4.3 Concentration Risk

Concentration risk arises from a lack of diversification in an asset portfolio or large exposure to default by a single issuer of securities.

This is strongly linked to default risk and will normally be assessed concurrently. Managing agents should be clear on how they have assessed any additional risk if the portfolio is exposed to a single issuer (or group or related parties). The correlation of the various investment types within the portfolio should be assessed in order to reflect realistic conditions. The standard formula includes a methodology for assessing concentration risk.

12.3.5 Equity Risk (Including Property Risk and Other Risks)

Equity risk relates to the level or volatilities in equity prices. Where pooled investments cannot be reasonably segregated into underlying asset classes, they should be treated as equities or the highest risk class considered in the model.

Property risk relates to the level or volatilities in real estate prices. This does not include mortgage-backed securities which should be included in both spread and credit risk.

There is generally no direct impact on liabilities from property risk, although there could potentially be a link between property risk and property losses.

Lloyd's is not expecting "other" market risks, but some unique features of a syndicate's portfolio could give rise to an additional risk.

Other high risk, variable-reward investments (such as hedge funds) should be included as Equity risk.

12.3.6 Currency Risk

FX risk relates to exchange rate fluctuations that impact the value of the liabilities differently to the assets. The assets may then be worth less than the liabilities in converted sterling. Currency risk is principally derived from currency mismatch between assets and liabilities.

Lloyd's expects models to allow for the risk of unfavourable currency fluctuations following a severe loss unless the managing agent can demonstrate that the FAL strategy would deem this unnecessary. For example, if all catastrophic losses are expected in USD and the dedicated members supporting the syndicate have a defined strategy, with history, of holding USD FAL, then this risk can be assumed to be mitigated. Otherwise, this situation should be included in the models.

Lloyd's will not allow a profit at the mean of currency risk (greater than £1m), given the uncertainty of exchange rates.

12.3.7 Liquidity Risk

Liquidity risk relates to projected cashflows where assets backing a set of liabilities are not available at the time that liability payments are due. This can occur through circumstances such as holding illiquid assets or the timings of funds becoming available (for example, having to pay gross claims before reinsurance recoveries are received, or overseas trust fund arrangements).

The liquidity risk is valued as the associated cost of borrowing required to cover the liquidity strain.

Lloyd's requires that syndicates have a clear liquidity risk appetite (owned by the board) and a liquidity risk management strategy (with appropriately documented policies and processes consistent with that policy) that is consistent with that risk appetite. Lloyd's requires that a syndicate's liquidity risk management strategy will identify all material sources of liquidity risk to which the syndicate is exposed (in accordance with Lloyd's 'Principles for Doing Business' Principle 7 and the PRA's Supervisory Statement SS5/19), so that the syndicate adheres to the liquidity risk appetite and liquidity risk limits. Sources of liquidity risk may include (but are not restricted to):

- Asset-side risk: whether assets can be monetised (in normal and stressed conditions), the time taken to monetise, and the potential for a significant reduction in asset value.
- Concentration risk: including counterparties, instrument types, geographical regions, and economic sectors – concentration risk may occur relative to the syndicate's own portfolio, or to the total amount of an asset in the market.

- Off-balance sheet risk: any off-balance sheet activity may affect a syndicate's cash flow, e.g. derivative positions.
- Cross-currency risk.
- Intra-day risk, including requirements for collateral.

Managing agents should consider the ability to manage unplanned changes in both funding sources and market conditions as well as a syndicate's access to other sources of funding and any regulatory capital tied up.

When assessing liquidity risk, managing agents should take account of the minimum level of free funds (i.e. funds not tied up in overseas regulatory deposits) required, taking account of the time horizon used.

Managing agents must conduct liquidity stress and scenario tests to identify sources of liquidity strain. Managing agents must use quantitative metrics and tools for measuring liquidity risk drivers (and to serve as early warning indicators).

Liquidity risk should also be considered in conjunction with insurance risk (both gross and net of reinsurance), credit risk, and market risk, particularly in relation to the impact that various stress and scenario tests may have on a syndicate's cash position and its ability to pay claims.

Managing agents must consider and address, as a minimum, each of the areas listed below:

- Planning and cashflow;
- The impact of distribution of profits;
- Unexpected events;
- Illiquid capital markets; and
- Post-loss environment.

If a managing agent makes no allowance for liquidity risk within a syndicate's internal model, it must state clearly the reasons for arriving at this conclusion within the LCR submission and demonstrate a clear understanding of the timing of key cashflows under stress. Stress and scenario testing conducted must support the conclusion of not modelling it.

Planning and Cashflow

Managing agents should consider liquidity risk arising from failures to forecast cashflow requirements accurately. Process weaknesses may also impact on cashflow, for example poor credit control and management of disputes, both from inwards policies and from outwards reinsurance, could cause liquidity strains.

The Impact of Distribution of Profits

As required, the internal model must be prepared on the basis that all profits have been distributed. Where a managing agent considers that this poses a liquidity strain, this should be allowed for within liquidity risk.

Illiquid Capital Markets

Managing agents should consider the additional risk arising from potential financial turmoil which could lead to extreme illiquidity in capital markets. The internal model should consider the risk of being unable to obtain fair value or even sell financial investments when required.

Unexpected Events

Liquidity strains resulting from unexpected events such as changes in overseas regulatory funding requirements should also be considered, including reductions in the benefit that can be taken for outwards reinsurance arrangements. Managing agents should also consider their ability to manage unplanned changes in funding sources as well as changes in market conditions that may affect their ability to liquidate assets promptly with minimal loss.

Post Loss Environment

Managing agents should consider how the impact of a loss may affect liquidity. For example, following an extreme loss, there may be delays in collecting reinsurance recoveries or increased trust fund requirements. The risk of delayed payments from counterparties should be included within liquidity risk, not credit risk.

Access to money markets and other sources of funding (such as lines of credit), the associated costs, and how these may be affected by adverse underwriting conditions, should also be considered.

12.3.8 Mean Reversion

Many managing agents use vendor supplied ESGs to generate economic series for their internal models. These ESGs may include assumptions regarding the long-term mean reversion of certain economic series, such as interest rates or foreign exchange rates. The assumption of mean reversion can significantly impact the level of market risk. However, Lloyd's is aware that alterations to this assumption might impair the internal consistency of the ESG.

Given the above, Lloyd's expects managing agents to undertake the following with regards to mean reversion:

- Clearly state within the SCR methodology document for which economic series mean reversion has been assumed;
- Provide a justification in the SCR methodology document of why the assumption is appropriate for the given series and in the current economic environment;
- Sensitivity test of the impact of mean reversion assumptions, where the ESG provides the facility to do so; and
- If modelling on both a one-year and ultimate basis, provide a justification of the difference between the one-year and ultimate risk, taking into account the duration of the portfolio and differences in assumptions over an ultimate vs. one-year horizon.

12.3.9 Inflation Risk

Inflation risk relates to the risk of inflation being different to anticipated and accounted for when setting the balance sheet at time 0.

If any inflation risk is modelled on assets (e.g. on bond payments, as these are usually based on fixed interest rates and an increase in inflation diminishes their purchasing power), then this should be included within the interest rate risk on assets.

Inflation risk on liabilities is considered as part of insurance risk.

12.3.10 Asset Liability Mismatch

It is expected that syndicates assess the impact of accelerated liability payments on the rate of depletion of assets following shocks / adverse event: for example, a reduced pool of assets and hence, reduced investment income.

12.3.11 Dependencies with Other Risk Categories

Managing agents should assess the impact that a particular insurance disaster will have. Managing agents should firstly consider the direct impact and models should contain a link between insurance payments and the amount of investable assets. If greater than expected losses are experienced and paid, this will deplete assets more quickly than expected and so:

- Liabilities will not be able to be discounted by as much (due to reduced asset volume and reduced risk-free return compared to best estimate projections);
- Investment income will be lower than expected;
- There will be increased liquidity risk; and
- There will be increased reinsurer delays in payment and credit risk, as they too will be potentially exposed to negative impacts on their investment portfolios.

Moreover, above the depletion of existing assets, there could also be a wider impact on investment portfolio returns if the disaster has a detrimental effect on the financial markets. Therefore, the correlations between market risk, insurance risk, and credit risk should be considered in the internal model as the cause of an extreme insurance loss is likely to have some impact on asset values and vice versa – i.e. turmoil in the financial markets can lead to certain insurance claims. The correlation between asset risk and liquidity risk should also be considered, particularly where assets may be realised at unusually high costs or where the timing is such that unusually low valuations are realised.

Furthermore, economic variables (such as inflation) should be used consistently in the market risk and insurance risk calculations, introducing a certain level of dependency between market and insurance risk. However, such links (by themselves) shouldn't be assumed to produce a sufficient dependency between market and insurance risk.

12.4 Negative Contribution to SCR by Market Risk

In general, additional risk should add additional capital to the SCR. However, in the case of market risk, the contribution to capital might be negative (i.e. market risk reduces capital) under some circumstances, if investment returns outweigh the risk from liquidity, FX and credit risk. Lloyd's does not expect a negative contribution from market risk on an ultimate basis. On a one-year basis, the impact of the unwind of discount credit is accepted as part of the reason for a negative contribution from one-year market risk.

If a syndicate has a negative contribution from market risk to the SCR on an ultimate basis, or on a one-year basis where the contribution is larger (on an absolute basis) than the benefit from discounting, Lloyd's will ask for an additional Negative Market Risk Template (available on Lloyds.com) to be filled in, in order to ensure that the syndicate is modelling market risk appropriately. If this template is not filled in, or is not answered satisfactorily, then a loading at least equal to the negative contribution of market risk for ultimate SCR will be applied. For the one-year SCR, market risk will be loaded as a minimum to level of the negative contribution from all but interest rate risk on liabilities (if this data is provided by the syndicate, if the table is filled in as expected, and if the minimum requirements are met), as the benefit from discounting is allowable on the one-year SCR.

If the minimum requirements are met (see 'LCR 2021 YOA Instructions'), then the loading will be adjusted to reflect the acceptable items, or no loading will be applied. This includes the requirement for the internal model to include an inflation risk driver to capture the relationship between insurance risk and market risk for financial classes in particular. If insurance losses are linked to the simulated inflation series from an ESG, then an inflation risk driver is considered to be modelled. In this case, the managing agent should assess whether the strength of this relationship sufficiently captures the actual strength of relationship especially in the tail and if not, consider including an additional inflation risk driver. If no inflation risk driver is currently modelled, then the managing agent should assess the materiality of this relationship and either implement an inflation risk driver in the internal model; or submit sufficient justification and evidence to Lloyd's to explain why an inflation risk driver has not been modelled.

12.5 Example Stress Test

The example stress and scenario tests below may be used when assessing market risk. This list is not exhaustive or prescriptive and is not a substitute for stress and scenario tests relevant to each individual business.

Scenario tests may be based on one of more of the following events – considering their impact on a variety of asset types and economic inputs to the model:

- 2008 financial crisis;
- Global trade war;
- Hard Brexit;
- Disintegration of EU;
- Severe inflation;
- Mass corporate failures & ensuing defaults; and
- Default of largest 5 investments.

13 Credit Risk

13.1 Definition

Credit risk refers to the risk of loss if another party fails to perform its obligations or fails to perform them in a timely fashion. For syndicates, key counterparties include reinsurers (including group reinsurances), brokers, insureds, reinsureds and coverholders. Credit Risk in respect of investment counterparties must be included within Market Risk.

13.2 Scope

Any financial transaction with a counterparty may expose a syndicate to credit risk. Managing agents must take into consideration all potential areas of credit risk, including but not limited to reinsurers, brokers and coverholders. When considering reinsurance credit risk, managing agents must not include exhaustion; this must fall into insurance risk. The aggregate credit risk should represent the diversified aggregate of reinsurance credit risk and other credit risk (but not on financial assets).

Reinsurance dispute risk must be allowed for and must be included within Reinsurance Credit Risk.

Managing agents should consider the dependency between dispute risk and credit risk. When assessing the appropriate level of capital for credit risk, managing agents should exclude credit risk in respect of central assets, as these are covered in the overall Lloyd's SCR.

13.3 One-year Versus Ultimate

Credit risk must be modelled on a one-year and an ultimate basis, however, it is permissible to use ultimate credit risk for the one-year view of risk if the additional complexity of one-year modelling is not proportionate One-year credit risk is a model area that is particularly prone to instability given the binary nature of this risk. As for all risk types, managing agents are required to ensure that modelling is appropriately stable: simulation error is not usually acceptable as an explanation for movements.

13.4 Modelling Considerations

Reinsurance credit risk is likely to be the largest component of Credit Risk and deals with the potential bad debt on reinsurance assets.

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

Lloyd's expects managing agents to consider the following in the modelling of reinsurance credit risk:

- Link increased probability of reinsurance failure to stressed scenarios;
- Concentration risk;
- Reinsurance failure rates should allow for the risk of downgrade;
- Duration of recoveries;
- Treatment of reinsurance placed with other Lloyd's syndicates;
- Treatment of any intra-group reinsurance;
- Dispute risk; and
- Allowance for collateral in stressed scenarios – dispute risk and impairment.

It is a requirement that reinsurance credit risk is captured to ultimate for the ultimate SCR. If the modelling for the one-year SCR only allows for reinsurance credit risk on a 12-month basis, allowance must be made for ratings transitions over the period.

When considering credit risk, managing agents should differentiate between premium and reserve risk elements. Reserve credit risk is in respect of earned exposure but subject to volatility due to reserve deteriorations. Premium credit risk is on unearned exposure with uncertain losses on an uncertain asset with variable counterparty security. Managing agents should consider the dependency between gross losses and credit risk for

premium and reserve risk; and should consider extreme gross losses / extreme reserve deteriorations and their link to reinsurance credit risk.

The stress level of credit risk should take account of the amount already being held in the technical provisions at best estimate and should, therefore, be the excess deviation from currently held provisions to the 1:200 confidence level. Projected mean modelled losses should assume that this provision runs out at no profit or loss, as under Solvency II this is the underlying pure best estimate.

RI Credit Risk must be on an undiscounted basis, with no allowance for investment income.

The modelling of RI credit risk must be consistent with the credit taken for reinsurance recoveries in the SCR, and this should be in line with guidance given on the modelling of reinsurance given in section 9.3.4 of this document. In addition, the modelling of reinsurance recoveries should be at a sufficient level of granularity to ensure that the allowance for RI credit risk is appropriate. For example, it may be necessary to split out RI contracts into different layers if the reinsurance security on individual layers varies.

Although managing agents should use their own data in parameterising RI Credit risk (for both probability of default and loss given default), it is unlikely that this will be sufficient. Therefore, managing agents should use (where available) FSRs, non-payment impairment / default studies, and credit ratings reports, as well as their own view of a reinsurer's financial strength, where appropriate. Solvency II requirements require consideration to be made relating to the appropriateness of financial strength ratings. It is not sufficient for the level of default to be based on historical frequency of this: there must also be an assessment of forward-looking credit quality.

Different non-payment probability studies will have their strengths and weaknesses, e.g. inclusion of only (re)insurance sector companies, timeframe of data used, age of the study and appropriateness when it comes to countries. Managing agents will therefore need to select the study or studies which they believe provides the most appropriate match to their own individual circumstances, balancing the different limitations and benefits of the different studies in the decision-making process.

A key consideration is the trigger event, so it is appropriate to consider those studies which are based on the earliest trigger of potential reduced payment or non-payment, which is commonly the point of financial or operational impairment rather than full default.

When using FSRs and credit ratings reports as a basis for parameterising RI Credit risk default parameters, managing agents should take into account that these studies generally do not include dispute risk.

Managing agents should also test data against their own worst experience and scenario tests. Managing agents should stipulate the basis of the default rates used (i.e. specific term) and the degree of stress applied to these rating factors to reflect the current economic environment. For example in an economic downturn it might not be appropriate to base the default probabilities on studies covering a period of economic growth. Default probabilities might have to be adjusted to reflect realistic levels of risk in the economic environment present.

Lloyd's expects managing agents to apply a loss given default probability of at least 50%. This is in line with the standard formula. However, when assigning the loss given default ratios, Lloyd's expects syndicates to also consider:

- Positive and negative risk features of the syndicate's reinsurers (e.g. financial strength rating, current aged debts or regulatory action);
- Positive and negative risk features of the syndicate's reinsurance contracts (e.g. contract clarity, current disagreements or disputes); and
- The probability that loss given default ratios would increase under stressed scenarios, including with the scale of the unpaid recovery.

It should be noted that the loss given default probability should be applied to the unpaid recovery at the point of default. Collateral can be taken into account, but only if the collateral has not already been used as a positive risk offset when considering default/impairment probabilities. Syndicates must be able to justify the assumptions in this area, in particular when the 50% loss given default probability is lowered for some simulations, noting the lack of data in this area.

13.4.1 One-Year and Ultimate Risk

Credit risk must be modelled on an ultimate basis. It is permissible to use this basis for the one-year view of risk if the additional complexity of one-year modelling is not proportionate. One-year credit risk is a model area that is

particularly prone to instability given the binary nature of this risk. As for all risk types, managing agents are required to ensure that modelling is appropriately stable: simulation error is not usually acceptable as an explanation for movements.

13.4.2 Link Increased Probability of Reinsurance Failure to Stressed Conditions

The SCR should also take into consideration the increased risk of reinsurance failure in extreme loss scenarios. Lloyd's view is that correlations increase in many of the extreme loss scenarios. In modelling terms, this might involve correlating reinsurance failure rates with adverse loss scenarios – from catastrophes, single large losses or reserve deteriorations. Managing agents should also consider the potential effect of multiple reinsurer failures in their modelling assumptions, especially in extreme scenarios.

Lloyd's considers that even for syndicates which are primarily exposed to liability business, there is a potential dependency between default probability and extreme insurance losses, especially if reinsurers have any liability risk concentration. In these cases, it may be more appropriate to link increased default probabilities with adverse reserve risk outcomes rather than with (or in addition to) premium risk driven scenarios.

13.4.3 Concentration Risk

In determining the capital requirement for reinsurance credit, the SCR should reflect individual contract and aggregate contract concentration risk as well as the financial strength (including any collateralisation) for each individual reinsurance counterparty. When assessing concentration risk, managing agents should also consider the extent to which reinsurance recoveries with separate legal entities that are part of the same corporate group should be aggregated.

Where a syndicate has a significant concentration to individual reinsurers and/or a corporate group of reinsurers (including intra-group related party and intra-Lloyd's arrangements), managing agents should provide an assessment of the impact of the reinsurance counterparty/group failing.

Lloyd's expects that at least the following should be considered significant concentrations:

- In excess of 50% of the expected reinsurance recoveries at the mean are from the concentrated reinsurer, or
- In excess of 50% of the expected reinsurance recoveries at the 99.5th are from the concentrated reinsurer, or
- In excess of 50% of the expected reinsurance recoveries under stressed / tail scenarios are from the concentrated reinsurer, or
- The reinsurance recoveries from the concentrated reinsurer are expected to exceed 20% of the syndicate's total balance sheet assets.

At these levels Lloyd's expects the managing agent to be considering deterministic reinsurance concentration risk thresholds alongside modelled results and applying additional risk provisions to capital where these concentration risk thresholds are not met by the modelled outcome alone. This is because probabilistic modelling alone can understate the level of risk. Lloyd's expects this to be calculated on the difference between the SCR values with and without the benefit of the reinsurance with the concentrated reinsurer that presents the concentration risk. The scale of the provision should also reflect any positive and negative risk features including the financial strength of the reinsurer, scale and nature of any supporting collateral, the value of any funds withheld that is available to offset actual or potential recoveries, the volume of reinsurance contracts involved and existing volume and value of aged debts and/or contractual disputes

Accordingly, Lloyd's expects the capital charge to increase in line with the materiality of these features and be significantly higher than perhaps the standalone Financial Strength Rating, albeit appropriately stressed, would indicate. If Lloyd's considers the syndicate's total uSCR Reinsurance Credit Risk provision values to be insufficient to cater for the risk from the concentrated reinsurer and all other reinsurers then an additional load may be required to be added to the SCR as outlined below.

When high levels of concentrated counterparty exposures and reinsurance are present, Lloyd's also expects credit risk to contribute more materially to capital, so any material levels of diversification would need to be substantiated by the managing agent. Further detail is outlined below.

Lloyd's outwards reinsurance team can provide more guidance on this on a case by case basis.

13.4.3.1 Reinsurer Concentration Risk Provision – Risk Matrix Guide

Managing agent's SCR pre-diversified Reinsurance Credit Risk values (pre-diversification) should be benchmarked against the following guide and if they are materially lower then should be uplifted by model adjustment within Credit Risk or by an overall SCR management adjustment by the managing agent or by the application of a load by Lloyd's to the syndicate's SCR.

It is important to note that the total SCR Reinsurance Credit Risk values should cater for the exposure to both (i) the concentrated reinsurer and (ii) all other reinsurers, so the managing agent will need to be able to provide an apportionment / breakdown of the total SCR Reinsurance Credit Risk value by (i) and (ii).

The ratios detailed below should be applied to the estimated RI benefit within the SCR calculated on the difference between the syndicate's SCR values with and without the benefit of the reinsurance with the reinsurer / reinsurer group.

For example:

If the SCR with the RI benefit is 150 and 200 without, then the concentrated reinsurer benefit is 50. If the guide indicates a ratio of 10% then the minimum Reinsurer Concentration Risk Provision would be 5. If the managing agents Reinsurance Credit Risk modelled result value or deterministic provision for the Concentrated Reinsurer (entity / group) is 3, then an additional provision of 2 should either be applied by the managing agent or Lloyd's. It is important to note that the additional provision should only be for the Concentrated Reinsurer shortfall against benchmark amount that is not already catered for in the syndicate SCR Reinsurance Credit Risk otherwise, i.e. an additional 2 not an additional 5.

Financial Strength of reinsurer	**Known reinsurer arbitration, mediation or dispute**	**Without additional collateral**	**With additional* collateral up to the 1:200 RIR risk that does not have market risk**	**With additional** collateral up to the 1:200 RIR risk that does have market risk**
AAA or equivalent	N	5.0%	2.5%	3.7%
AA equivalent	N	7.5%	3.7%	5.0%
A or equivalent	N	10.0%	5.0%	7.5%
BBB or equivalent	N	20.0%	10.0%	15.0%
<BBB or lower or equivalent	N	50.0%	25.0%	30.0%
Any rating	Y**	50.0% of impacted RIR	50.0% of impacted RIR	50.0% of impacted RIR

***** This needs to be truly additional and not:

a. Being used as the only asset that the reinsured has access to, i.e. instead of access to the reinsurers balance sheet assets
b. Already being used by the syndicate to reclassify a <A rated reinsurer to a >A rated reinsurer

** These should be cross referred to any Bad Debt provisions that syndicates are holding on their current balance sheet and should be consistent. They can be increased or decreased if the managing agent can evidence that not all the RI recovery is associated with the contract(s) that are subject to arbitration, mediation or dispute, subject of course to the ratios in the previous rating bands.

It is acknowledged that unlike other forms of collateral, funds withheld by a reinsured syndicate which are owed to the reinsurer in question, can commonly be used to offset actual or potential reinsurance recoveries (but only where a legal write to offset without challenge or permission of the reinsurer contractually exists). As a result, reinsurance recoveries up to the actual value of the funds held may be considered as presenting **no** RI Credit Risk, and in such instances the recoveries excess of the funds withheld values would only need to be considered for a concentration risk provision.

13.4.3.2 Reinsurer Concentration Risk Diversification Cap within overall Credit Risk

Lloyd's would not expect the Reinsurer Concentration Risk Provision to be heavily diversified away when considered against the syndicate's other reinsurers and Other Credit Risk. Lloyd's expects the level of diversification within Reinsurance Credit Risk and overall Credit Risk to be capped by the percentage the Concentrated Reinsurer represents of the RI recoverable at the 99.5th percentile.

Examples:

1. If the Concentrated Reinsurer (entity / group) is the only reinsurer being modelled for RI Credit Risk, i.e. 100% of the modelled 1:200 RIR then **no** diversification can be applied to Credit Risk.
2. If the Concentrated Reinsurer (entity / group) represents 80% of the modelled RI recoverable then a maximum diversification benefit of 20% can be applied to Credit Risk.

The post-diversified value should cater for any pre-diversified provision / load, in an ideal world the managing agent should be asked to re-run the LCR with the pre-diversified provision / load applied. If this is not possible then the pre-diversified provision / load should simply be added to the reported post-diversified credit risk value without the benefit any diversification benefit.

As a starting point Lloyd's assumes that all reinsurer entities within the same corporate group are 100% correlated strategically and financially and therefore should not in themselves benefit from any diversification. If managing agents wish inter-group diversification to be taken into account, they would need to evidence that the financial stability of the reinsurer entities are not materially correlated, e.g. do not form part of the reinsurer groups consolidated financial statements.

13.4.3.3 Reinsurer Concentration Risk Diversification within Overall SCR

It is acknowledged that within the overall SCR, Reinsurance Credit Risk will both correlate and diversify against other risk categories to varying degrees, but we would not expect high levels of SCR diversification to be applied to Reinsurance Credit Risk where the syndicate's reliance on outwards reinsurance for Insurance risk is material as the Reinsurance Risk of reduced recovery will be heavily correlated with the scale of reinsurance recoveries. As such managing agents should provide explanations when high levels of diversification have been applied to Credit Risk, especially if greater than 80%.

13.4.4 Reinsurance Failure vs. Downgrade

Managing agents should allow for downgrading of reinsurers when assessing credit risk and not refer only to standard default rates or current ratings. A weakness in using standard default rates is that a market average rate is not always applicable to an individual syndicate's reinsurers or to the scenarios for which reinsurance is being relied upon. Reinsurance assets are very likely to be much larger in the stress scenario than in non-stress conditions.

In addition, if factors are derived from historical corporate bond default rates, which do not have any direct relationship to future reinsurer default rates, then these studies should be used as a benchmark only. As stated above, managing agents should stipulate the basis of the default rates used and the degree of stress applied to these rating factors.

13.4.5 Duration of Recoveries

Managing agents should explicitly consider the duration of liabilities when considering reinsurance credit risk as there is a higher probability of default on a more distant recovery. Within this, managing agents will need to take into account how the duration of liabilities may change in a stressed reinsurance scenario.

The above may be carried out through the use of a full reinsurance cashflow model and reinsurance default and transition ratings, or it may be carried out by considering the mean duration of reinsurance cash flows.

13.4.6 Treatment of Reinsurance Placed with Other Lloyd's Syndicates

Lloyd's does not wish to indirectly influence the placement of reinsurance as a result of the SCR process. Therefore, managing agents should treat policies placed at Lloyd's on a similar basis to another reinsurer with a comparable financial strength.

Based on the same principle, credit risk on recoveries owing from a special purpose syndicate should also be accounted for in the SCR.

13.4.7 Treatment of Intra-Group Reinsurance

Managing agents that belong to wider insurance groups should not treat reinsurance placed with the parent group more favourably than reinsurance placed with an unrelated insurer with similar financial strength.

In addition, managing agents should also consider whether the use of intra-group reinsurance introduces additional dependencies between stressed scenarios and reinsurer default, for example if the intra-group counterparty writes similar risks (or even lines on the same risk) to the syndicate. This will be more significant the higher the overlap between the business written by the syndicate and the intra-group counterparty, and the higher the materiality of the intra-group reinsurance to the counterparty is.

13.4.8 Collateral and Bad Debt Provisions

It is acceptable within the modelling to make allowance for collateral held against reinsurance contracts, in order to reduce RI credit risk. Managing agents should however take into account the nature of the collateral arrangement (e.g. funds withheld) and the form the collateral is held in (e.g. bank balances). Lloyd's view of the risks arising from collateral arrangements are detailed in Lloyd's 'Principles for Doing Business' Principle 3 and include but are not limited to:

- Dispute risk in accessing the funds, depending on the nature of the arrangement; and
- Impairment of collateral, depending on the form in which it is held.

Lloyd's does not consider it to be acceptable to assign a zero-reinsurance credit risk to collateral arrangements. The only exception to this is where funds are withheld by the syndicate; however, these funds would attract Market Risk.

Managing agents should also consider to what extent collateral arrangements would be impacted in stressed scenarios.

Managing agents can (where collateral is not the only asset supporting the reinsurance obligations) either use collateral to improve their opinion of the financial strength rating of the reinsurer for impairment / default probabilities or to improve the LGD ratio applied, but **not** both.

Managing agents will also be expected to explicitly capture the risk that the collateral held covers a lower proportion of the relevant RI recoveries in scenarios where RI recoveries increase. This includes instances where there are terms in the reinsurance contract that would require the reinsurer(s) to provide additional collateral in specific circumstances, as it should not be assumed that these will be honoured in stressed scenarios.

Reinsurance bad debt provisions within technical provisions at T0 are set out on LCR Form 312. Projected mean modelled insurance losses should assume this provision runs out at no profit or loss, as under Solvency II this is the underlying pure best estimate. Where additional mean provisions are modelled to emerge on new business, this should be included within reinsurance credit risk. The stress level of credit risk should take account of the amount already being held at best estimate and should, therefore, be the excess deviation from currently held provisions to the 1:200 confidence level. Where material bad debt provisions at time T0 have been reported, Lloyd's would accept modest negative risk values for RI Credit Risk at lower percentiles, but not at higher percentiles.

13.4.9 RI Dispute Risk

Allowance for reinsurance dispute risk must be included in the modelling. This must be included within RI credit risk.

The managing agent should consider the nature of its reinsurance program, both prospective and historical, in determining an appropriate allowance for dispute risk. Lloyd's expects managing agents to be able form an internal risk opinion classification on their reinsurance contract wordings, e.g. Low / Medium / High / Significant.

Whether a contract is low, medium or high would depend on a number of factors. For example, the greater the volume of the following, the greater the contract risk:

- Basis risk on the trigger;
- High levels of conditional information provision, special acceptance and/or notification requirements;
- Unusual and uncommon clauses that have no or limited legal precedent of interpretation; and
- Existence of critical warranties that would void the contract.

It is unlikely that sufficient internal data is available to determine an appropriate allowance for dispute risk and a stress and a scenario approach, either to test the allowance included in the SCR or to directly model dispute risk, may be appropriate.

Whatever approach is taken, the managing agent should ensure that there is sufficient dependency between dispute risk and insurance risk.

Implicit allowance for RI dispute risk is not acceptable, i.e. the model should be capable of running a scenario where dispute risk has been excluded and there should be a measurable impact on a risk category.

For example, where allowance has been made within reinsurance credit risk through uplifted default probabilities, then it should be clear in the parameterisation process or elsewhere what uplift has been applied for RI dispute risk. The RI credit risk model will therefore be capable of being run with dispute risk being excluded.

13.5 Specific Modelling Considerations on Other Credit Risk

As outlined in Article 105 of the EU Directive (2009/138/EC), the risk of default should cover all risk-mitigating contracts, receivables from intermediaries, and other credit exposures not covered by spread risk. The risk of default should reflect the risk associated with the counterparty irrespective of the legal form of the contractual obligations with the syndicate. Issues to be considered when assessing non-reinsurance credit risk areas are covered below. Please note that ratings for the parties below are often not available. In order to assign a rating and hence a default rate in the model, the managing agent should formally assess the creditworthiness of the counterparty or model them as "unrated".

13.5.1 Brokers

Managing agents should consider the failure of their largest brokers - this may be considered remote, but the SCR must be assessed in the context of a 1:200 confidence level. Additional areas to be considered under brokers include premiums receivable from brokers, claims paid to brokers but not yet to the insured, commissions not recovered when policies are cancelled, and premiums returned or never received.

13.5.2 Coverholders

Managing agents should consider the following issues:

- Where premiums are not received but policies are bound;
- Where claims are paid but not passed on; and
- Where commission is paid but policies are cancelled and premiums returnable.

13.5.3 Third Party Claims Administrators

Managing agents should consider the risk of claims paid to a third-party administrator but not passed on to policyholders. Where third party claims administrators hold claims floats, managing agents should consider the possible effects of misappropriation of funds or failure of the third-party administrator.

13.6 Example Stress Tests

The example stress and scenario tests below may be used when assessing credit risk. This list is not exhaustive or prescriptive and is not a substitute for stress and scenario tests relevant to each individual business.

Example stress and scenario tests are:

- Failure of the syndicate's largest broker;
- Failure of the syndicate's largest reinsurer;
- Downgrade of all reinsurers by one notch;
- Dispute on largest RI contract in a stressed scenario; and
- Significant reduction in collateral held due to dispute/impairment of assets.

14 Operational Risk

14.1 Definition

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

14.2 Scope

Operational risk must be covered in the SCR. Since the SCR must cover all material risk to which the managing agent is exposed, operational risk must be clearly delineated from other risk categories and must capture the material risk not covered by other risks. The documentation must make clear which risks are included in operational risk and should show that there is no duplication or omission. Group risk should be included within operational risk (this does not include credit risk from group reinsurance covers).

Operational risk should exclude risks arising from strategic decisions, as well as reputation risks.

Operational risk must be modelled on a one-year and an ultimate basis, however, it is permissible to use the ultimate basis for the one-year view of risk if the additional complexity of one-year modelling is not proportionate.

14.2.1 One-Year and Ultimate Risk

Operational risk must be modelled on an ultimate basis. It is permissible to use this basis for the one-year view of risk if the additional complexity of one-year modelling is not proportionate.

14.3 Modelling Considerations

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

14.3.1 Operational Risk Modelling

The quantification of operational risk can be challenging, especially due to the lack of historical data. However, syndicates are required to quantify operational risks - an arbitrary loading will not be considered an appropriate methodology when calculating operational risk, no matter how “prudent” the level of capital allocated.

Modelling approaches to operational risk vary across syndicates from scenario-based approaches to full Monte-Carlo simulation approaches stochastically modelling the risks in the risk register and the controls associated with them. Operational risk modelling must be linked to the risk register and the wider risk management framework. The risks in the risk register should be split into risks that are used to assist management in the day-to-day running of the business and those risks which, when extreme event scenarios are applied to them, result in a capital requirement. The lack of data should be supported by a detailed stress and scenario testing approach in order to ensure a robust approach to operational risk modelling.

Another consideration in the modelling of operational risk is the categorisation. Operational risk can be split between “standalone” risks (e.g. business interruption through loss of the building or technology), and risks associated more closely with other risk categories (e.g. misreporting of case reserves or a rogue underwriter). The delineation must be guided by the principle that risks which apply to a multitude of losses across classes and years should be modelled in other risk categories as to not underestimate the effect. For example, the risk of systemic under-pricing (i.e. the risk that the mean loss ratio for a multitude of classes is understated at the same time) must be included in premium risk as explained in section 10.3.5. However, mispricing of contracts due to operational factors (e.g. a wrong pricing model or a rogue underwriter) is related to human error and should therefore be allocated to operational risk. Similarly, catastrophe vendor models capture the variability of the damage factor for catastrophes; however, the risk that the exposure to a catastrophe loss is higher than expected due to the failure of exposure management controls should be included within operational risk. In order to ensure no duplication or omission, methodology documents must clearly state the delineation between operational risk and the inclusion of capital impacts in other risk categories. In particular, managing agents should be explicit in the allowances made in assessing operational risk for historical data considered to capture implicitly such risks (e.g. binding authorities exceeding limits or contracting business outside its terms of reference).

Managing agents will rely on systems and controls in place in their assessment of operational risk and they should consider the failure of controls, e.g. by considering operational risk “gross” and “net” of controls in place. The managing agent should assess any potential change to the syndicate’s business and operational controls following an extreme event, for example taking into account the fact that controls may not operate as intended in a stressed scenario. A capital allocation in respect of a failure of controls under a stressed scenario does not necessarily indicate a poor control environment; rather this is merely appreciating the magnitude of the extreme scenario.

However, managing agents should consider whether capital is needed in respect of current known weaknesses in controls, for example where identified by internal / external audit, Lloyd’s governance reviews, or any other internal or external concerns.

Managing agents should consider specific features of their business (e.g. delegated underwriting and the added operational risks due to data quality issues, the impact of controls, additional due diligence processes and selection criteria).

Moreover, managing agents must consider the impact of any recent risk profile changes on operational capabilities and hence operational risk. In particular:

- New classes of business, e.g. through mergers and acquisitions or taking on underwriting teams. This includes the impact of the cultural implications on the organisation as well as revised processes and controls that need to be incorporated into existing processes, integration and staff implications.
- Closure of books / going into run-off, including the implications for remaining people/processes and systems, as well as the risk of heightened control failure.
- Growth of business or plans for future growth, e.g. less formal control frameworks, adequacy of existing systems, procedure and infrastructure for increased volumes and the available expertise.

In addition, recent experience should also be taken into account. For example, if a syndicate has just had a year of poor experience, then it should be considered that certain controls are more likely to fail: poor experience might lead to more pressure on underwriter performance, which might lead to it being more likely to write risks outside limits or other restrictions, but there might also be more pressure on the reserving team and senior management attention might be on remediation with a higher likelihood of other areas being neglected.

When assessing operational risk, managing agents should ensure that all potential sources of operational risk are considered. The table below has been designed to assist managing agents to identify operational risks in their business by providing a (non-exhaustive) breakdown of potential causes and data sources for each of the four types of operational risk, i.e.:

- People;
- Processes;
- Systems; and
- External events.

Area of Risk	Potential Cause
People	• Temporary/permanent loss of key personnel / inability to hire • Malicious/accidental errors made by people (use of model, not following processes, unauthorised activity) • Internal theft or fraud including bribery and corruption • Inadequate training • Slow response to emerging business risks • Poor communications in particular lack of escalation • Lack of supervision / management attention / management stretch • Data protection breach / loss of data • Change in cultural behaviours
Processes	• Failure in corporate governance • Inadequate segregation of duties • Poor information flow through the business • Inadequate/ inappropriate policies • Inaccurate/incomplete data • Process control failures • Poorly documented/communicated processes
Systems	• Hardware / software / network failure • Inadequate virus protection / system security • Insufficient processing capacity • Insufficient / untested business continuity processes • Inadequate change / release management • Inadequate and ineffective business continuity and disaster recovery plans
Laws/Regulation	• Litigation issues • Legislative/regulatory changes and poor implementation/adherence • Poor compliance with regulatory requirements[1]
External Events	• Natural/man-made disaster • Third party provider failure • External theft or fraud • External breach of system security (e.g. cyber-attack) • Power outage

Irrespective of the approach managing agents choose to quantify Operational Risk, they should bear in mind that past experience is not always an accurate indicator of future losses. Therefore, management may wish to consider a number of data sources and scenario analysis in order to take into account the full spectrum of loss potential.

External Loss Databases:

- External loss data like e.g. ORIC can provide an indication of the size, frequency and sources of losses experienced by others and is therefore a useful reference when assessing potential risk exposures. The principal value of such data would be to prompt discussion of the most extreme potential future scenarios that historical data may be unable to show. From a day-to-day management perspective, these scenarios may not be relevant, however when considering extreme events these may warrant inclusion.

[1] Please note that that some types of regulatory fines might be covered by managing agents and not syndicates and therefore, might not have to be included in syndicate models. Please see market bulletin is Y5341.

- Loss databases can also provide additional data which may assist with the modelling of operational risk capital requirements. However, careful judgement is needed on the relevance of such data, in view of different industry or industrial sector data sources, differences in operational scale, control systems, cultures and the likely completeness of the data.

Internal Loss Databases:

- This involves systematic tracking of actual, potential and “near miss” operational risk losses.
- Losses could arise as a result of a new risk giving rise to a loss, or due to the failure or lack of a control in relation to a previously identified risk.

Lloyd’s would encourage managing agents to track their internal loss data in order that management is able to measure risk exposure more accurately, identify trends and lessons to be learned over time, and therefore use this loss data as an input for capital calculation.

14.3.2 Operational Risks Associated with Insurance Risk

The delineation must be guided by the principle that risks which apply to a multitude of losses across classes and years should be modelled in other risk categories as to not underestimate the effect. However, limited incidences related to human error or system failure should be included in operational risk.

14.3.2.1 Risk of Mispricing/Under-reserving/Miscoding

Managing agents should consider the risk of mispricing and miscoding and its consequences elsewhere before it is identified, for example:

- Inadequate reserves are generated from incorrect pricing;
- Losses emerge with a large amount of business exposed - the syndicate may already have incurred reinsurance costs and therefore business continues to be written at a price which is too low and without adequate reserves; and
- Overstatement of reinsurance recoveries.

14.3.2.2 Timeliness of Management Information and Operation of Binders / Delegated Underwriting Authorities

Managing agents should consider the reporting and procedures in place for monitoring loss development, binder income etc., and any potential time delays in being aware of significant risks or developments arising.

Where part of a syndicate’s book of business is underwritten through binders or other types of delegated underwriting authorities, managing agents should explicitly address the risks associated with this in the internal model, e.g.

- Data quality issues, e.g. the managing agent may not be aware of poor experience and binder continues (e.g. renews at 1 January and new policies enter until 31 December). This leads to syndicate exposure continuing until 31 December of the following year and the possibility that the binder continues to deteriorate;
- Cessation of a poorly performing binder can exacerbate the situation and may pose a “moral hazard” where risks continue to be written in the knowledge that the binder will not be renewed; and
- Reporting and procedures in place for monitoring loss development, binder income etc., and any potential time delays in being aware of significant risks arising later than expected.

14.3.2.3 Controls Around Underwriting/Reserving

Managing agents should address the operational controls around underwriting and reserving. In particular, inadequate price or exposure monitoring can lead to the syndicate writing too much inadequately priced business and/or overwriting pre-agreed limits. This, in turn, can lead to inadequate pricing and/or insufficient reinsurance cover being purchased. Inadequate reserving and claims processes as well as data deficiencies can lead to systematic understatement of reserves and increase the risk potential and materiality for reinsurance disputes.

14.3.3 Group Risk

This section sets out the areas which should be considered by managing agents who are part of a group when assessing their group risk capital requirement. Where applicable, managing agents should consider the risks associated with managing multiple syndicates, as well as those arising from being part of a wider group with a common parent company.

When assessing potential group risk, managing agents should consider the risks that may arise as a result of their own particular group structure. To aid Lloyd's review, managing agents are required to include in the LCR submission the current group structure chart, with details of both ownership and control.

Managing agents should consider events occurring elsewhere within the group that may have an impact on the capital requirement including:

- A change in group strategy;
- Parent company exerting undue influence on the strategy of the syndicate;
- Allocation of group resources elsewhere;
- Regulatory action against another group member;
- Financial pressure upon syndicate / managing agent from elsewhere in the group, which adversely impacts the syndicate;
- The likelihood and financial consequences of both insolvency and credit downgrading of the parent company;
- The effect of a downgrade on the business plan (loss volumes and increased marketing costs) and on profit margins; and
- Losses in another group entity, followed by a downgrade of that company's security rating to a level below secure by the major rating agencies.

Group reinsurance arrangements should be considered like any other arrangement and the credit risk arising from this arrangement should be included within reinsurance credit risk. If a syndicate assumes that an LOD reinsurance structure will be renewed in future years, they should consider the risk that group reinsurance arrangements may not be available and may need to be replaced, possibly with cover on less favourable terms.

Where a managing agent shares services with other group entities, they should consider the risks associated with these arrangements including:

- The availability of support services provided by the group company (e.g. Investment management, IT, actuarial); and
- Shared management structures/staffing with resources being diverted away from the syndicate in a 1:200 level scenario.

Where a managing agent shares management resources with other group entities, the potential "stretch" of these resources should be considered. In particular, managing agents should consider the increased impact of extreme loss events on shared management resources. Similarly, if actuarial work is undertaken by a group/shared function, there should be additional controls in place to ensure that obligations of a Lloyd's management agents can be met.

14.3.4 Dependencies with Other Risk Categories

The dependency between operational risk and other risk categories will vary for the underlying risks. As discussed above, some risks are explicitly associated with insurance risk (e.g. the failure of certain operational controls leading to unexpected claims), and similarly the failure of investment controls or credit rating controls could lead to unexpected losses for market or credit risk.

For other risks there might not be a direct association, but nevertheless a causal link. For example, a cyber-attack or an external event might lead to business interruption, which could lead to lower exposure due to a slow-down in underwriting. On the other hand, in times of heightened insurance claims, operational control failures are more likely due to management attention being diverted and strain on the organisation, leading to a heightened risk of human errors.

Managing agents should consider how they can most appropriately link operational risks to other risk types. If the operational risks are linked at a total level (for example to insurance risk), then Lloyd's would expect the parameterisation of the dependency to be appropriate for the risks most associated with insurance risk – not the average, as this can lead to an understatement of the contribution of operational risk.

14.4 Example Stress Tests

The example stress and scenario tests below may be used when assessing operational risk. This list is not exhaustive or prescriptive and is not a substitute for stress and scenario tests relevant to each individual business.

Example stress and scenario tests are:

- Bomb/power outage in the City of London;
- Loss of underwriting team;
- Underwriting controls failure;
- Cyber risk via a virus / data breach; and
- Loss of license in a significant market.

15 Diversification

15.1 Definition

Diversification reduces risk, since the capital required for two or more risks combined is generally less than the sum of the capital requirements of the individual risks. This applies at many levels to differing degrees – between policies in a class, between different types of classes, across time, between risk types, and so on. It is a fundamental principle of insurance. Lloyd's applies a principle as part of capital reviews that additional risk should be additive to capital. The key consequence of this is that it should not be possible to add new risk into the model and have the impact completely diversify away.

The more related the risks, the lower the reduction in capital from diversification. Dependency can be due to a number of factors, including event occurrence and environmental factors.

There are a number of mathematical measures of the level of dependency between variables. Many such measures do not capture the level of "tail dependency". Tail dependency refers to the fact that the dependency between two variables can increase in more adverse scenarios. In a model without explicit tail dependency, correlations should be set using appropriate judgement to reflect the level of dependency expected in the tail. Independently of how this is accounted for in the model, Lloyd's expects that tail dependency between classes and risk types has a material impact on capital.

15.2 Scope

Managing agents must allow appropriately for diversification effects within the internal model. All allowances for diversification are in scope and Lloyd's will review the allowances for all levels of diversification. The LCR forms contain results at certain specified levels of aggregation to allow Lloyd's to see the effect of diversification between these levels.

Managing agents must include the methodology used to allow for diversification effects within their documentation. The approach used for measuring diversification effects within and across risk categories should take into account:

- Any material dependence and any material tail correlations under extreme scenarios;
- The underlying key variables driving these dependencies and how they should be modelled; and
- Post-diversified outputs from the model need to be reasonable when allowing for these dependencies.

The appropriateness of the diversification credit should be demonstrated by justification of:

- The risk distributions used;
- The dependencies between them; and
- Validation testing of the credit.

Managing agents should be prepared to provide detailed and explicit information on the impact of diversification within the model.

A process to identify, quantify and review the dependencies within their business and those assumed within their internal model should be evidenced. This may take the form of periodic calculations of dependencies seen in historical data, assessment of possible dependencies by experts with relevant experience, and use of market data or expert judgement.

At each of the key aggregation steps in the model (e.g. between the main types of risks, and between classes of business), managing agents should consider whether tail correlations are present and should be allowed for within the model. Lloyd's expects that tail dependency between classes and risk types has a material impact on capital.

Managing agents should use a dependency structure which is appropriate for estimating the capital based on a 99.5% VaR measure. They should also ensure it is appropriate at other percentiles of the balance sheet distribution, which may be more relevant to other considerations such as reinsurance purchase.

The key variables driving dependencies and syndicates' exposure to them should be identifiable. Depending on the chosen aggregation method, different variables come into consideration, e.g. risk factors, risk drivers for market, credit or insurance risk, economic indicators or overall profits and losses.

15.3 One-year versus Ultimate

Managing agents should be prepared to provide detailed and explicit information on the impact of diversification within the model on both an ultimate and one-year basis. Managing agents should ensure that they justify why the dependency structure is appropriate on an ultimate and one-year basis.

15.4 Modelling Considerations

This section includes a number of areas that should be explicitly included in the model documentation. This list is by no means exhaustive.

The level of dependencies included in syndicates' internal models is a material driver of capital, both on an ultimate and one-year basis.

15.4.1 Different Approaches to Implementing Dependencies

There are many methods of introducing dependencies between classes of business and risk categories, e.g. copulae, common drivers, tail drivers. Lloyd's does not prescribe a particular structure and considers the individual dependency structure used in an internal model in its SCR review. However, managing agents should keep in mind that the overruling principle when assessing a dependency structure will be that additional risk adds capital. The unique and complex nature of many dependency structures means that it is often difficult to consistently assess from a bottom-up analysis whether any particular approach is appropriate. As a result, Lloyd's also examines the output of internal models to ensure that sufficient dependency has been introduced. If output levels of diversification are not acceptable, this cannot be justified based on granular methodology details.

The main approaches that managing agents take are:

- Application of explicit correlation/copula assumptions, e.g. between classes and/or between risk types;
- Dependency driver approach; or
- A combination of the above.

Most managing agents apply a combination of the two, with a wide variety of permutations of where drivers and explicit correlations are applied, and where correlations might be overlaid by additional drivers. For certain risks, managing agents also use trigger approaches, where there is a step change in the level of risk triggered by events in other risks (e.g. higher default probabilities triggered by catastrophe events).

Managing agents model a varying degree of dependency drivers, for example:

- Catastrophe models, e.g. applying the same catastrophe events across a number of classes. Traditionally, the main models here have been external natural catastrophe vendor models but managing agents might also use man-made catastrophe models like models for cyber risk or other liability catastrophes.
- Inflation drivers, e.g. applying inflation from an economic scenario generator across classes and also consistently between market and insurance risk.
- Other loss trends, e.g. latent claims / regulatory change.

A pure driver approach may tend to understate correlation as there will be a high level of diversification between the impact of drivers unless these are also linked. Managing agents should examine the output of such models carefully with regard to the implied correlation. Models which apply correlation to the body of distribution (e.g. by applying Gaussian copulae) should ensure that tail dependency is adequately captured. For insurance risk, it should be taken into account that factors such as:

- Under-pricing (leading to lines of business with unrelated claims nevertheless being dependent);
- Inflation;
- Trends over time (e.g. legislative and societal changes);
- Whether the class is long-tailed or short-tailed;
- Shared processes such as reserving processes, parameterisation processes etc.; and
- Whether the classes are managed within the same business division.

lead to a certain level of dependency between any classes of business and between premium and reserve risk. Hence Lloyd's does not consider it appropriate for any classes or years of account to be fully independent; instead a minimum level of positive dependency must be applied. Lloyd's will not set a minimum correlation, but the level should adequately reflect shared systems and processes, common trends and other effects across years and classes. Low positive dependency will be subject to significant challenge.

Stochastic models might restrict the number of explicit assumptions with regards to dependency. Where there is no explicit assumption, managing agents should satisfy themselves that the model is sufficiently realistic. At the same time, models should be capable of being understood by non-specialists. It may be sufficient for managing agents to model dependency in a relatively straightforward manner and to test the results using stress tests of combinations of the variables in question.

If managing agents use a copula without tail dependency, then it will be necessary to add drivers for tail dependency or increase correlations to allow for the impact of this effect at the capital setting point.

15.4.2 Parameterisation of Dependencies

Model assumptions regarding diversification effects are regarded as key assumptions and are therefore subject to the requirements of material assumptions. Diversification effects are typically very hard to estimate and validate. The assumptions underlying the approach used for measuring diversification effects on an empirical basis are often based on expert judgement which will require further validation. Sensitivity analysis and stress testing should be performed as part of the validation process. The results of the validation exercise, and any additional justification for the assumptions, should be clearly documented and readily understood by those responsible.

A dependency table such as a correlation matrix can contain a large number of assumptions, some of which may be implicit. A syndicate's own data is unlikely to suffice for full calibration and managing agents should additionally consider external data (adjusted) and sources of expert judgement.

Benchmark correlations and dependency may be obtained from market level data, though allowance needs to be made for both the greater pooling seen in larger portfolios and any structural model differences.

When using correlation data, managing agents should consider carefully any implied negative correlations occurring naturally within the data and whether these are appropriate at the 1:200 level. Where managing agents use judgement in selecting correlations, Lloyd's will not expect managing agents to use negative correlations and requires the correlations chosen to be sufficiently extreme at the 1:200 level.

Even when data is available, stress and scenario testing is required to substantiate the expert judgements.

15.4.3 Aggregation of Risk Types

The overall SCR is the capital required for the aggregate of all the risk types. Because of diversification, this may be less than the total of the separate calculations. As stated above, Lloyd's does not prescribe any method on how to aggregate risk types to the total SCR. Managing agents are required to ensure that the post-diversification number is reasonable and that the contributions of the risk types to the overall SCR are reflective of the risk profile of the syndicate. Dependency assumptions must be stated explicitly and be clearly justified, in particular in terms of risk profile. The key dependencies that Lloyd's expects to see are those between premium and reserve risk and between operational risk and insurance risk. A direct link between reinsurance credit risk and the modelled reinsurance recoveries is also expected, as well as a consideration of the development of reinsurer defaults in extreme insurance loss scenarios. Further, Lloyd's would expect to see a link between insurance and market risk, where either economic conditions might drive losses in both risk types, or a third factor impacts both insurance losses and market risk.

The complexity of the dependency structure should be proportional to the syndicate's risk profile. For example, many syndicates implement a dependency between catastrophe losses and reinsurer defaults, but this might be immaterial for a syndicate with low catastrophe risk. For a syndicate driven by reserve risk, a dependency between reserve deteriorations and reinsurer defaults should be considered; however, this might be immaterial for a syndicate with large cat exposures. The managing agent should consider which dependencies are key for the syndicate's risk profile and this should be monitored over time in order to ensure that it remains appropriate.

15.4.4 Measures of Dependency

A variety of measures can be used in order to assess dependencies, e.g. output correlations (as collected in PRA internal model output returns), JEPs (as collected in LCR Form 520), and other metrics. Lloyd's assesses a variety of metrics, but the overruling principle is that the dependencies should ensure that additional risk adds capital, and syndicates should keep that in mind when assessing their dependencies. For example, joint exceedance probabilities focussed on the 99.5th percentile of individual risk type distributions are unlikely to reflect the relative contributions at the 99.5th of the combined distribution. In order to ensure a minimum level of acceptable dependency for within insurance risk and between risk types, Lloyd's assesses the dependency using the SST (Appendix D) and JEPs (Appendix E). A variety of other metrics will be considered if required. The minimum tests applied in conjunction with any additional information that Lloyd's might require from managing agents to assess their dependency structures are published in the instructions for the LCR submission on an annual basis.

15.5 Example Stress Tests

The example stress and scenario tests below may be used when assessing risk that affects a number of risk areas. This list is not exhaustive or prescriptive and is not a substitute for stress and scenario tests relevant to each individual business.

Example stress and scenario tests are:

- Global pandemic affecting insurance losses and financial markets;
- Insurance losses combined with adverse FX movements;
- Climate change affecting natural catastrophe losses, regulatory change and asset value corrections; and
- Any combination of SSTs affecting risk areas outlined in previous chapters.

16 Appendix A: Analysis of Change

This appendix elaborates the requirements for an Analysis of Change document which needs to be submitted with the LCR, as set out in section 5.9.2. The appendix also includes good practice examples in respect of all risk types and comments on the examples. Please note:

- The following are examples of Lloyd's view of good practice in respect of AoC reports
- The examples are, by necessity, simplified. They are used to illustrate the:
    - Types of information required to be provided
    - Level of granularity and detail required
    - Form of presentation of results that Lloyd's has found useful
- The exact nature of each managing agent's AoC report will vary according to business structure, risk profile and changes to the SCR. More detail will be expected for risk categories which contribute significantly to the SCR, and to more significant changes at individual risk level.
- The different examples are not consistent between each other, and there may be inconsistencies within examples. Figures presented within the tables should not be assumed as being acceptable to Lloyd's.
- There is no requirement for managing agents to adapt the examples given in this appendix. However, managing agents should consider that if the analysis of change is aligned with Lloyd's expectations and review metrics (e.g. by giving explanations of movements in terms of the measures contained within LCR Form 600), Lloyd's is likely to have fewer questions during the LCR review.

16.1 Example AoC Structure

1. Introduction and scope
    a. Purpose of the AoC Document
2. Summary figures
    a. Context - main Risk profile/exposure and business changes (in relation to change in SCR)
    b. Model Changes – including reference to any submitted MMC
    c. Change to ultimate SCR – key drivers (what and why)
    d. Change to one-year SCR – key drivers (what and why)
3. Premium Risk
    a. Discussion of Risk Profile/Exposure Changes impacting the business
    b. Model Changes - including Data, Risk Profile, Methodology, Parameters
    c. Change to ultimate SCR
    d. Change to one-year SCR
4. Reserve Risk
    a. Discussion of Risk Profile/Exposure Changes impacting the business
    b. Model Changes - including Data, Risk Profile, Methodology, Parameters
    c. Change to ultimate SCR
    d. Change to one-year SCR
5. Dependencies between classes (if not covered above)
6. Credit Risk (RI credit risk and other credit risk)
    a. Discussion of Risk Profile/Exposure Changes impacting the business
    b. Model Changes - including Data, Risk Profile, Methodology, Parameters
    c. Change to ultimate SCR
    d. Change to one-year SCR

7. Market Risk (including liquidity risk)
    a. Discussion of Risk Profile/Exposure Changes impacting the business
    b. Model Changes - including Data, Risk Profile, Methodology, Parameters
    c. Change to ultimate SCR
    d. Change to one-year SCR
8. Operational Risk
    a. Discussion of Risk Profile/Exposure Changes impacting the business
    b. Model Changes - including Data, Risk Profile, Methodology, Parameters
    c. Change to ultimate SCR
    d. Change to one-year SCR
9. Dependencies between risk types
10. Changes to post-diversified amounts by each risk type.
11. Impact of simulation error (if material and not covered above)
12. Appendices – including documents providing further information where appropriate

Comments

1. All risk categories are covered for the one-year SCR and the ultimate SCR
2. Changes to diversification effects have been explained.
3. The structure is consistent between risk categories where relevant, leading to faster and more efficient review.
4. Changes in standalone amounts by risk type reported in the AOC must match those recorded in the MCT. Any deviations should be explained and justified.

16.2 Summary

Lloyd's expectations

- The summary should enable Lloyd's to confirm that the SCRs being bridged between represent the last approved capital figure and the current submission.
- The summary should show both the one-year and ultimate SCRs split by standalone risk category and diversification benefits between them.
- Analysis should focus on SCR movement but include commentary on movement in other points in the distribution where this supports the reasoning provided, particularly the mean as these figures are also submitted to Lloyd's.
- The summary should include reference to changes in the risk profile.
- Any changes that are not linked to risk profile should have clear articulation of the drivers for making the change and any prioritisation of changes within the development plan
- The significant movements in the SCR should be explained at a high level in terms of the segmentation outlined (e.g. split by changes in data, business plan/risk profile, parameterisation and model methodology changes).
- Lloyd's has found the use of waterfall charts to be a useful way of summarising changes
- Clear signposting to the areas in the document where further details are provided should be provided
- Major Model Changes (and Minor changes where appropriate) should be discussed and linked to the discussion of significant movements
- Key validation findings which have led to the changes, or additional validation as a result of the changes, should be highlighted and signposting to the relevant validation documentation should be provided

Example - SCR summary table and commentary

	Final Old SCR Ultimate (£m)				Final New SCR Ultimate (£m)			
	Pre-diversified	%	Post - diversified	%	Pre-diversified	%	Post-diversified	%
Insurance Risk	341	52%	293	75%	344	**1**	302	76%
Underwriting risk	*259*		*209*		*253*		*204*	
Reserving risk	*207*		*110*		*220*		*132*	
Credit risk	107	16%	33	8%	107	17%	41	10%
RI credit risk	*106*		*33*		*107*		*41*	
Other credit risk	*4*		*1*		*4*		*1*	
Market risk	155	24%	44	11%	138	22%	33	8%
Operational risk	50	8%	19	5%	50	8%	19	5%
Undiversified total	**652**				**638**			
Diversification benefit	- 262	-40%			- 243	-38%		
Diversified Total			**390**				**395**	

The overall ultimate SCR has increased by 1% from £390m to £395m: increases in the contribution from insurance risk and Credit Risk have been partially offset by a reduction in Market Risk.

Insurance risk is relatively stable on a pre- and post-diversified basis - there has been some increase in planned written premiums, in line with the growth strategy into Marine lines, offset by slightly better rates, with reserving risk up slightly as a result of growth in reserves. Catastrophe risk on a gross and net basis is unchanged.

There have been minor changes to both premium and reserving risk parameters (Model Changes #A and #B), which are largely offsetting, and these are covered in more detail in sections U and V.

Reserving risk post diversified has increased slightly more than the pre-diversified figure due to the growth in reserves being concentrated in longer tail lines which generally have more dependency with premium risk.

Credit risk - is stable on a pre-diversified basis with only small changes to net recoveries, the O/W RI programme and Reinsurance Panel. However, the post-diversified contribution has increased as a result of the dependency between Credit Risk and Natural Catastrophes having been strengthened following feedback from Lloyd's - previously following a large market loss a single downgrade to RI ratings was applied, this has been changed to a double downgrade following a review of recent studies produced by rating agencies. This is outlined in more detail in section W and is covered by Model Change #C.

Market Risk pre- and post-diversification has reduced, following a change in planned asset allocation, with increased allocation to cash and short-dated government bonds, which has also resulted in less dependency with insurance risk – the ESG models movements in short term interest rates having a dependency with inflation, which to an extent mitigates inflation risk within the liabilities . The update to the ESG has had only a minor impact. More details are included in Section X.

Operational Risk - Following a review by the Risk Team, there has been a change in the scenarios constituting Operational Risk. The dependency between insurance and operational risk has been reviewed in light of the new scenario set. These changes are covered in more detail in Section Y. Despite these changes, Operational Risk remains stable on both a pre- and post-diversified basis. This is consistent with the overall conclusion of the risk team review that while scenario updates are required there is no material change to the overall level of operational risk.

	Final Old SCR 12 month (£m)				Final New SCR 12 month(£m)			
	Pre-diversified	%	Post - diversified	%	Pre-diversified	%	Post-diversified	%
Insurance Risk	290	52%	249	75%	301	**1**	272	77%
Underwriting risk	*233*		*188*		*240*		*193*	
Reserving risk	*155*		*83*		*165*		*99*	
Credit risk	91	16%	28	8%	91	16%	35	10%
RI credit risk	*85*		*28*		*85*		*35*	
Other credit risk	*4*		*1*		*4*		*1*	
Market risk	132	24%	37	11%	117	21%	28	8%
Operational risk	42	8%	16	5%	46	8%	18	5%
Undiversified total	**554**				**555**			
Diversification benefit	- 223	-40%			- 202	-36%		
Diversified Total			**331**				**353**	

The one-year SCR has increased by 6% from £331m to £353m. This is somewhat higher than the 1% increase in the ultimate SCR.

The factors outlined above resulting in movements in the ultimate SCR have generally caused similar movements to the one-year SCR. The exceptions to this relate to premium risk and Operational Risk

Premium Risk

-The growth in Marine lines noted above, which have a higher one-year emergence factor than average

-A revision of loss emergence factors for casualty lines as a result of a timetabled review of these and following on from a previous validation finding, resulting in small increases for a number of classes.

More details of the above are given in Section Y on the one-year SCR and the change in loss emergence factors is included within MC #E.

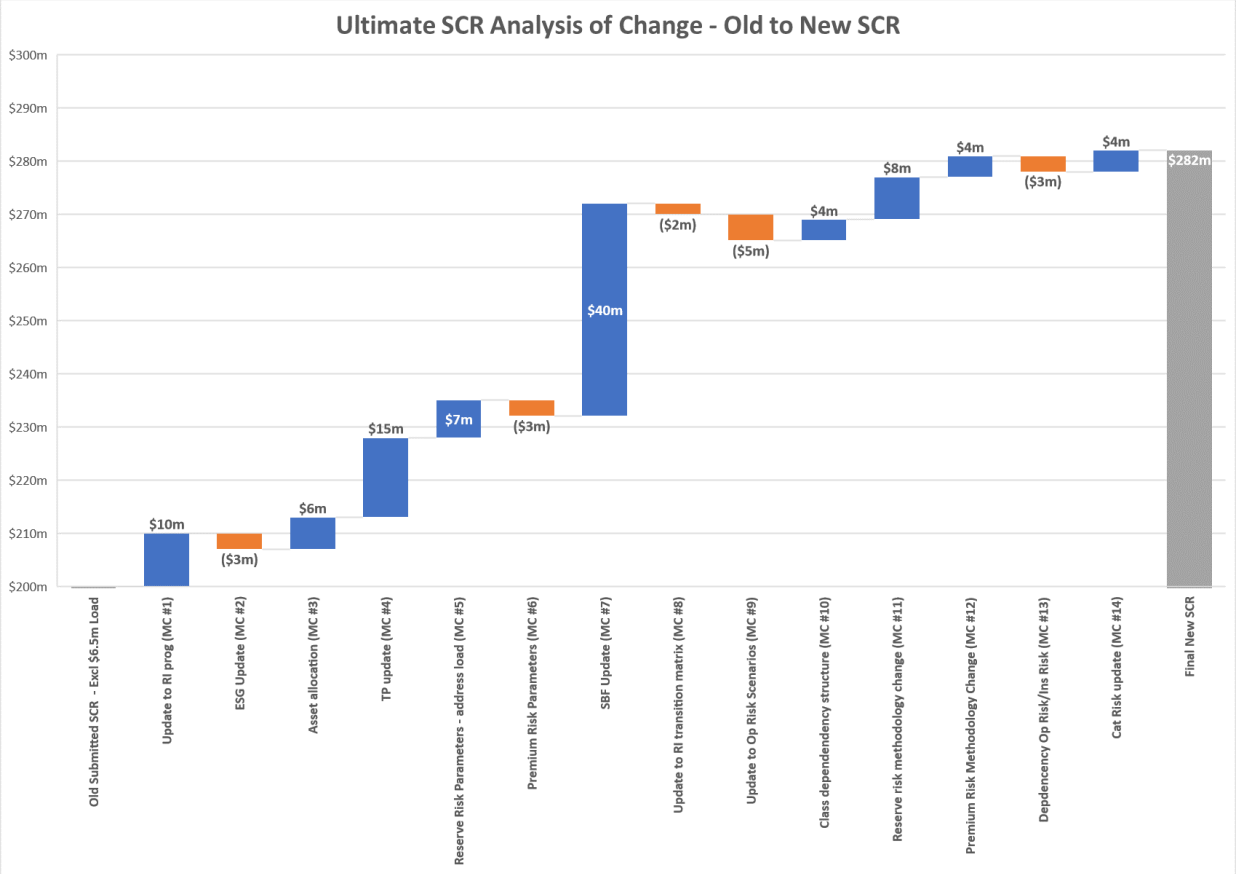
Operational Risk

The change in the Operational Risk scenarios noted in the commentary for the ultimate SCR resulted in scenarios which generally had losses which have a faster emergence than those previously used. More details on this is included in Section Y on Operational Risk.

Comments on example

- The table provides a high-level explanation on key movements in the SCR by risk category. It shows both pre- and post-diversified figures and explains the reasons for the movements. There is clear linkage to Model Changes and changes to risk profile and signposting to areas of the report where further information can be found.
- The commentary highlights changes which (although offsetting) are material at a more granular level (i.e. changes to reserve risk and premium risk parameterisation).
- The commentary includes movements in the one-year SCR and highlights areas where there are differences to the ultimate SCR movement
- The commentary links to the business when describing the drivers for movements.

Example - Waterfall chart



The above waterfall chart shows the movement between the Old submitted SCR of $200m (£152m) and the New submitted SCR of $282m (£214m). It excludes the load applied by MRC for low reserve risk volatility parameters of $6.5m (£5m). This loading is addressed in MC #5.

Comments on example

- The waterfall links the movements in the ultimate SCR to Model changes as submitted in the MCT. Although the table is given in $m, the commentary gives the £m figure to enable reconciliation to the LCR.
- It is clear on what basis the AoC has been prepared on, in respect of excluding loadings.
- There is a link to all model changes submitted in the MCT.
- A similar waterfall for movements in the one-year should be included.

Example - Model Changes

					Change from Approved			*Change from Approved*		*Further Information*	
Change	Model Change	Major/Minor Change/ Data	Lloyd's Reporting Date	One-Year SCR (£m)	£m	%	Ultimate SCR (£m)	£m	%	AoC Report	Additional papers
Approved Old SCR	**v1.00**			**200**			**180**				
Reserving Risk volatility paramter change	1	Minor	01-Mar	210	10.0	5.0%	189	9.0	5.0%	Section 3.3 - Reserving Risk	Reserving Risk Parameter Update Report
U/W risk attritional & large parameter change	2	Minor	01-Mar	220	10.0	5.0%	198	9.0	5.0%	Section 2.6 - U/W Risk	Premium Risk Parameter Update Report
Loss Recognition Parameter change	3	Minor	01-Mar	230	0.0	5.0%	207	9.0	5.0%	AoC Ref	Ref to other material supplied
Update to Y/E TP's	4	Data	01-Mar	220	(10.0)	-5.0%	198	(9.0)	-5.0%	AoC Ref	Ref to other material supplied
Update to SBF	5	Data	12-Jul	240	20.0	10.0%	216	18.0	10.0%	AoC Ref	Ref to other material supplied
Change to RI Credit Risk Methodology	6	Minor	12-Jul	230	(10.0)	-5.0%	207	(9.0)	-5.0%	AoC Ref	Ref to other material supplied
Submitted New SCR	**v1.06**			**230**	**30**	**15.0%**	**207**	**27**	**15.0%**		

The above table bridges between the Approved Old SCR and Submitted New SCR. The changes above are consistent with the MCTs submitted since last approval.

Comments on example

- This table shows clearly movements to both the one-year and ultimate SCR and links to Model Changes.
- There is signposting to where in the AoC report and other material supplied that additional information can be found.

16.3 Insurance Risk

Lloyd's expectations

Specific issues which may need identifying in respect of insurance risk (premium and reserve risk) are:

- Impact of changes to dependency between premium and reserve risk

Example

	Old Ult SCR	New Ult SCR
Modelled SCR figures (£m)		
Prem Risk Stress	100	90
Reserve Risk Stess	100	100
Modelled Ins Risk Stress	145	140
Dependency Metrics (Stress £m)		
Independence - Scrambled Sims	135.0	125
Independence - SST	141.4	134.5
Complete Dependence	200.0	190
Modelled stress as % Metrics		
Independence - Scrambled Sims	107%	116%
No diversification	103%	108%
Complete Dependence	73%	76%
Diversification benefit (stress basis)		
Diversification benefit	28%	26%

Diversification benefit between premium and reserve risk has reduced on several metrics, as shown above. The overall diversification benefit has reduced from 28% to 26% and the modelled stress as a % of scrambled sims has increased from 107% to 116%.

The dependency structure and parameters have not been changed and the reduction in diversification benefit is as a result in a change in the level of exposure by class only. A lower cat risk level has resulted in more of the tail of the premium risk distribution being driven by liability lines which have higher dependencies between years of account.

More details can be found in Sections X on Natural Catastrophe exposure and Section Y on Premium Risk

Comments on example

- The table shows dependency metrics between premium and reserve risk on several basis, with comparison to scrambled sims, the SST and complete dependence
- There is an explanation of reasons why dependency has changed - in this case, a change in the risk profile and signposting to other areas of the document. A similar table for diversification benefit for one-year insurance risk would also be required, highlighting differences between movements in the diversification benefit for the ultimate insurance risk.

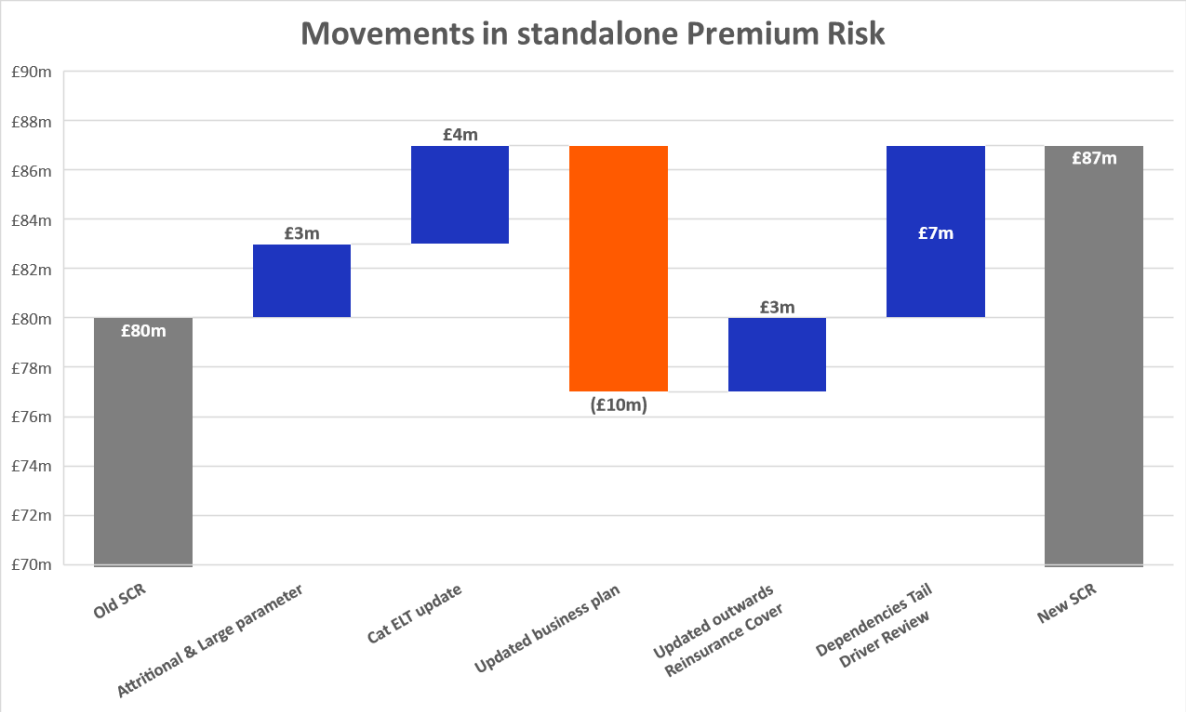
16.3.1 Premium Risk

Lloyd's Expectations

Specific issues which may need identifying in respect of premium risk include:

- How movement in Nat Cat and man-made cat exposure has impacted the SCR – identifying movement at the overall level and by peril (e.g. US Windstorm), gross vs net exposure changes and the classes of business impacted.
- Changes to the outwards reinsurance program – if this has caused a material change at either the mean or SCR, then a summary of changes to the prior and current modelled program as well as the impact on RI recoveries will need to be given. This should explain any change in the context of the performance of the contract for both the cedant and the reinsurer.
- Major changes to risk profile through, for example, changing mix of classes written, or substantially increasing exposure in a specific industry/region
- Impact of changes to parameterisation – Lloyd's would expect a discussion in respect of the following
    - Main classes impacted
    - Reasons for the change – data, risk profile, methodology, expert judgement
    - Changes to attritional, large loss frequency and large loss severity
- Changes to granularity of classes modelled or reported and their impact on the SCR
- Changes to diversification between classes and their causes, e.g. methodology (change to dependency structure for instance with reason for the change) or risk profile.

Example – Summary



The above waterfall shows the main drivers of the increase in premium risk from £80m to £88m.

Attritional & Large parameters
These were updated as part of the annual parameter review (MC #B). Although the impact was small overall, for certain classes of business (Med Mal and Property Binders), they were more significant. Further details are given in Section X below.

Cat ELT update
As part of the move to v17 of RMS these were updated (MC #C). Further details are given in the Cat Risk section, section Y.

Updated business plan
This comprises of a reduction of 5% in plan NWP together with an improved loss ratio of 3% following rate increases. (MC #D)

The main contributors to these were:

Marine: NWP +10%, Loss Ratio -5%

Aviation: NWP + 15%, Loss Ratio -6%

The above is aligned with the strategy of prioritising these classes due to the management view of their favourable risk/return trade-off.

Outwards RI Cover
There are various changes in the planned RI cover compared to the Old SCR. The most significant is the reduction in the MAT XoL cover from 90% placed to 80% placed. (MC #E). More details are included below.

Dependencies Tail Driver Review
Feedback from Lloyd's and a validation finding from last year was that tail dependencies between classes were potentially understated. As a result of this, a "deep dive" into the dependency structure was performed. This concluded that dependencies between casualty

classes should be increased materially and has led to a minor Model Change (MC #D). More details are included in Section Z below.

Comments on example

- The table and commentary set out the main drivers to changes in Premium Risk and links these to validation findings, changes in the risk profile (business plan), parameter change and changes to the outwards RI
- The commentary signposts other areas of the document where more detail can be found, as this would not be sufficiently detailed in itself. For example, changes to volatility at class of business level would also need to be included.
- A similar table for movements in one-year premium risk could be provided highlighting differences in movements compared to the ultimate

Example - Analysis by class of business

Premium Risk (Ultimate) (inc-cat)															
	New SCR					Old SCR					Movement		New SCR	Old SCR	
Class Name (in order of size by net premium)	Net Premium	Mean Net Claims	99.5th claims	99.5th Claims / Mean	Contribution / Mean	Net Premium	Mean Net Claims	99.5th claims	99.5th Claims / Mean	Contribution / Mean	Mean Net Claims (%)	99.5th: mean ratio (%)	Contribution %ile to Premium Risk	Contribution %ile to Premium Risk	Change in Contribution %ile
1. Property Treaty	200.0	160.0	381.5	238%	120%	200.0	160.0	408.0	255%	140%	0%	-6%	74%	79%	-5%
2. Casualty Treaty	100.0	90.0	336.7	374%	154%	110.0	88.0	336.2	382%	152%	2%	-2%	83%	82%	1%
3. Marine - Cargo	90.0	72.0	314.0	436%	218%	90.0	72.0	244.8	340%	180%	0%	28%	95%	95%	0%
4. Casualty - US	80.0	64.0	168.8	264%	123%	80.0	64.0	192.0	300%	145%	0%	-12%	74%	74%	0%
5. Casualty non-US	70.0	56.0	132.9	237%	119%	70.0	56.0	137.2	245%	119%	0%	-3%	73%	73%	0%
6. D&O	70.0	56.0	298.1	532%	183%	70.0	56.0	308.0	550%	183%	0%	-3%	92%	92%	0%
7. Property Binders	60.0	48.0	198.1	413%	282%	60.0	48.0	198.1	413%	350%	0%	0%	89%	97%	-8%
8. Marine Hull	20.0	16.0	161.8	1011%	645%	50.0	40.0	404.5	1011%	645%	-60%	0%	98%	98%	0%
9. Aviation	10.0	8.0	32.6	408%	199%	10.0	8.0	33.6	420%	199%	0%	-3%	91%	91%	0%
10. Med Mal	5.0	4.0	7.6	191%	116%	5.0	4.0	8.0	200%	116%	0%	-5%	75%	75%	0%
Total	**705**	**574**	**947**	**165%**		**745**	**596**	**1,063**	**178%**		**-4%**	**-8%**			

Premium risk volatility has decreased faster than exposure, with the 1 in 200 claims to net premium ratio reducing from 178% to 165%. This has been driven by reduction in the volatility from the largest class, Property Treaty, as well as some smaller classes. This has been partially offset by an increase in volatility for the Marine Cargo class. These changes are primarily driven by changes to Premium Risk parameterisation and dependencies between classes (Model Change #4 and Model Change #9) respectively.

Property Treaty.

The reduction in the standalone 1 in 200 is a result of reduced Cat Risk particularly in respect of US WS. The 1 in 200 Net Loss for this has fallen from £200m to £160m, mainly as a result of increased RI protection. Furthermore, with this class now being driven by Japanese EQ, which diversifies significantly with other classes (which do not have significant exposure to this peril), the contribution (as measured by the contribution percentile) has also fallen. Further details of this change are included in Section A on Natural Peril Catastrophe Exposure and Section B covering the main changes to the RI program.

Casualty Treaty

This account has been subject to adverse experience compared to plan in recent years, as shown in the back testing in Section Y of the validation report. As this was consistent over recent years, this has triggered a parameter review. The conclusion of this was that the adverse experience was based on mispricing, i.e. an understatement of the mean rather than indicating a change in risk. The prospective loss ratio for this class has therefore been increased.

Marine Cargo

Standalone volatility has increased from 340% to 436% as the Maximum Line size has increased from $5m to $10m, and the average line size from $2m to $4m, increasing the

large loss severity and hence volatility. The underwriting team for this class believes the pricing for the higher limits is showing some improvement relative to low limit policies, but this improved pricing will not be taken into account until it is evident within the emerging experience.

Casualty US

The book has been repositioned to smaller insureds within the same industry segment with lower line sizes and hence somewhat lower volatility - the average line size is projected to fall from $3m to $2m.

This is mainly a non-US book. The correlation previously included between attritional claims for this and other property classes was previously set at Medium (25%). After reviewing the drivers of correlation for this class, this has been downgraded to Low (15% correlation) and therefore the contribution percentile has reduced. The dependency driver analysis supporting this is included in Appendix X, with dependencies also being subject to a validation deep dive (Appendix Y of the validation report).

Comments on example

- The table and commentary provide explanations to movements in premium risk at class of business level.
- The comments cover both pre- and post-diversified risk, movements in cat risk and changes in the RI programme. Changes in both directions are covered, not just explanations of reductions in risk metrics.
- The movements are linked to model changes and there is a high-level explanation as to why the parameterisation has been updated.
- There is evidence that adverse experience compared to plan has been considered within the SCR.
- There is signposting to other areas of the report where further information can be found
- If movements in one-year premium risk was not consistent with movements in the ultimate, then additional analysis and explanation would be required

Example - Catastrophe Exposure

	Top Nat Cat Exposures					
	Old SCR (£m)		New SCR (£m)		Movement (£m)	
Threat	Gross (net of fac) 1 in 200 aggregate claims	Net 1 in 200 aggregate claims	Gross (net of fac) 1 in 200 aggregate claims	Net 1 in 200 aggregate claims	Gross	Net
Windstorm N Atlantic	200	125	150	50	(-50)	(-75)
Earthquake Australia	50	50	50	50	-	-
Windstorm Europe	50	25	50	25	-	-
Windstorm Japan	100	75	75	25	(-25)	(-50)
Total (undiversified)	**400**	**275**	**325**	**150**	**(-75)**	**(-125)**
Total (Diversified)	**259**	**174**	**203**	**90**	**(-56)**	**(-84)**

As mentioned in Section X on Premium Risk, the main cause in the reduction in Premium Risk volatility is the significant reduction in the net risk for Nat Cats, as illustrated in the table above – the other much less significant causes are included in the Premium Risk section. The majority of Nat Cat exposure is contained in the Property Account (model classes Property RI and Property Binders). The reduction was a decision by management as a result of a review of the pricing of higher layer XoL inwards covers.

Gross exposure at the 1 in 200 has reduced by approx. 25% to £203m. Increased reinsurance cover has been purchased so that Net Exposure falling even further by nearly 50% to £90m. A summary of the R/I covers purchased is given in Section Y, with the main changes being to the Cat XoL R/I cover placed with ABC Re.

RI credit risk has increased materially as a result of the increased RI purchases, this has been mitigated to a certain extent by the high rating and hence relatively low default probability of ABC Re. More details of this is contained in Section Y on RI Credit Risk.

Comments on example

- The table and commentary provide explanations to movements in catastrophe exposure.
- There is sufficient granularity in the table to see movements in key perils, and there is a distinction made between movements in gross and net.
- There is explanation as to why movements in the net exposure has been more than the gross by linking in to changes in the RI programme.
- There is evidence that consideration has been given as to how changes in this risk category might impact other risk categories (increased RI leading to higher RI credit risk)
- The report makes clear which classes have been impacted and explains how they tie in with Model Classes (which is not always obvious for an independent reviewer).

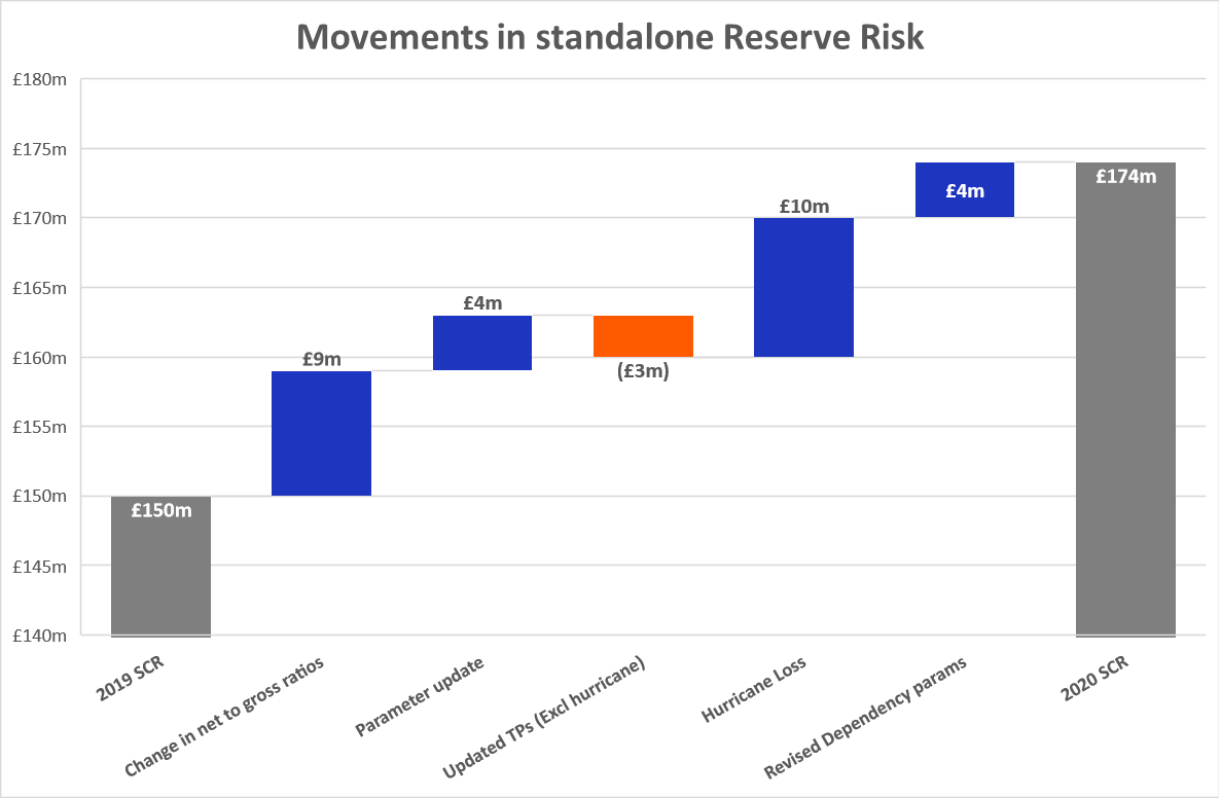
16.3.2 Reserve Risk

Lloyd's Expectations

Specific issues which may need identifying in respect of reserve risk include

- Inclusion or changes to specific modelling of large losses (e.g. following large natural catastrophe)
    - Impact of changes to gross volatility on the net volatility given any O/W RI protection
    - Dependencies between the large loss reserve risk and other reserve risk
- How changes in net to gross ratios (where applicable) have impacted reserve risk
- Changes to dependencies between years of account
- Changes to granularity of classes modelled or reported
- Changes to diversification between classes and their causes e.g. change to dependency structure or assumptions
- Modelling of the risk margin and how this been impacted by
    - Updates to data, such as TPs
    - Revised methodology

Example - Summary



The above waterfall shows the main drivers of the increase in Reserve Risk from £150m to £174m

Change to net to gross parameters
These were updated as part of a planned review and have led to slightly lower assumed R/I recoveries, particularly impacting the Casualty Treaty account. This is included in MC #A and covered in more detail in Section V.

Parameter update
A revised parameterisation exercise has led to increased volatility parameters across the majority of classes of business, with recent experience showing some adverse experience across a number of lines. This is included in MC #B and covered in more detail in section W.

Updated Technical Provisions
TPs (excluding the impact of the recent hurricane) have been relatively stable, with some reductions in higher volatility classes (MC #C).

Hurricane Loss
The recent hurricane is currently estimated to have cost £50m net of RI. There is significant uncertainty in both gross loss estimates and the extent to which losses will be recovered. This loss has therefore been modelled on an individual basis with an estimated impact of £10m on a pre-diversified reserve risk basis. The resultant change is covered in MC #D and covered in more detail in Section X below.

Revised dependency parameters
A planned review of the dependency structure for both premium and reserve risk has led to some specialty classes being assumed to have medium rather than low dependency with other classes, leading to a small increase in reserve risk. The dependency driver review is covered in section Y and a separate internal paper attached with this report. (MC #E)

Comments on example

- The table and commentary set out the main drivers to changes in Reserve Risk and links these to validation findings, changes in the risk profile (business plan), parameter change and changes to the outwards RI.
- There is reference to a large individual hurricane loss and how this has been allowed for with the SCR.
- The commentary signposts other areas of the document where more detail can be found, as this would not be sufficiently detailed in itself. For example, changes to volatility at class of business level would also need to be included.
- A similar table for movements in one-year reserve risk could be provided highlighting differences in movements compared to the ultimate

Example - Analysis by class of business

	Reserve Risk									
	Old SCR					New SCR				
Lines of Business	Net Reserves	Standalone 1 in 200 Net volatility	1 in 200/ mean	Contribution to 1 in 200	Contribution/ 1 in 200	Net Best Estimate	Standalone 1 in 200 Net volatility	1 in 200/ mean	Contribution to 1 in 200	Contribution/ 1 in 200
Med Mal US	600	400	67%	300	75%	650	440	68%	330	75%
Med Mal Non US	230	250	109%	197	79%	270	370	137%	320	86%
Casualty - International	500	275	55%	156	57%	416	240	58%	140	58%
Other PI	300	195	65%	50	26%	247	160	65%	50	31%
Property RI	450	167	37%	51	31%	435	132	30%	40	30%
Property Specialty	200	99	50%	24	24%	184	108	59%	22	20%
Energy	330	184	56%	39	21%	319	179	56%	24	13%
Mat	400	146	37%	29	20%	410	141	34%	40	28%
TOTAL	**3,010**	**1,716**	**57%**	**846**	**49%**	**2,931**	**1,770**	**60%**	**966**	**55%**
Diversification Credit		*51%*					*45%*			

As stated in the summary, reserve risk volatility has increased by 14% from £846m to £966m, despite a reduction in net reserves of 3% to £2,931m. The most significant driver of this is the increase in net reserves and volatility for the MedMal Non-US class.

Mean reserves have reduced generally in line with reduced premiums in the last two underwriting years. The notable exception is MedMal Non-US.

MedMal Non-US
As a result of judicial reform in countries A, B and C, there have been significant reserve deteriorations over the last 12 months in this class. As the reserve deterioration was over X%, this prompted a parameterisation review. A revised parameterisation exercise was carried out and following discussions with underwriters and claims handlers the expert judgement previously applied to remove certain extreme residuals was no longer applied. As shown above, this has resulted in significant increases in the standalone risk/mean figure from 109% to 137%. No change was made to the dependency structure between this and other risks, but as a result of this class now having larger volatility, the relative contribution has also increased.

Property RI
This has shown a reduction in standalone volatility / mean of 9%. On a gross basis, the modelling and parameterisation is unchanged. However, we have allowed for increased RI recoveries for Hurricane ABC following discussions with the O/W RI team in respect of the $10m xs $5m cover purchased for the last four U/W years. This led us to reduce the net to gross ratios used in the modelling of net reserves. The net reserves for this have fallen from $200m to $50m in the Old and New SCRs respectively.

This and other reserve risk changes are included in Model Change #9. The paper presented as part of the approval of the change is included in Appendix X of this report. The validator has carried out additional tests on this area and the results of this will be included in the Reserve Risk section of the validation report.

Brief descriptions of movements in classes where either the 1 in 200 mean or contribution/mean has changed by more than 5% are included below.

Comments on example

- The table and commentary provide explanations for movements in reserve risk at class of business level
- As for other areas, there is linkage to model changes and changes to the risk profile, and explanations as to why parameterisation has been changed. There is additional signposting to other documents available.
- The explanations include discussion of where movements in the net volatility have been caused by increased RI recovery assumptions and there is reference to significant historical losses – this would need to be expanded if the losses were more material.
- The commentary provides evidence that adverse experience has been considered and reflected in the SCR.
- Explanations have been provided, even though risk to exposure has increased – Lloyd's still needs to understand the changes.
- Movements in one-year premium risk also need to be included with additional analysis/explanation on any inconsistent movements or methodology updates.

16.4 RI Credit Risk

Lloyd's Expectations

Specific issues which may need identifying in respect of RI Credit risk are:

- Impact of changes to the reinsurer panel, e.g. writing more business with a highly rated counterparty
- Increases or decreases in collateral held as security
- Summarise changes to default parameters – split by rating
- Summarise changes to loss given default parameters
- Altering the "stressed scenario", where increased default is assumed following a severe event

Including a summary of the main RI Credit risk counterparties (either by counterparty or rating) used in the current and previous SCR, the probability of default, loss given default, and details of any collateral is essential in terms of Lloyd's review of this area.

Example – Credit Risk

	RI credit risk distribution value - Old SCR					
	Mean	50th	75th	90th	95th	99.5th
RI credit risk loss on RI recovery	0.3	(0.8)	2.1	5.1	7.6	15.4
RI recovery (gross) - all counterparties	67.3	62.5	64.5	65.1	79.3	102.5
RI recovery (gross) - Defaulting counterparties	3.5	1.3	4.1	10.1	15.1	30.7
RI credit risk loss vs. RI recovery (Gross) - all counterparties	0.4%	(1.3%)	3.2%	7.8%	9.5%	15.0%
RI credit risk loss vs. RI recovery (Gross) - defaulting counterparties	7.9%	(62.1%)	50.0%	50.0%	50.0%	50.0%

	RI credit risk distribution value - New SCR					
	Mean	50th	75th	90th	95th	99.5th
RI credit risk loss on RI recovery	0.3	(0.8)	2.1	5.2	8.0	16.9
RI recovery (gross) - all counterparties	70.6	64.1	67.7	70.0	87.3	123.0
RI recovery (gross) - Defaulting counterparties	3.6	1.3	4.2	10.4	15.9	33.8
RI credit risk loss vs. RI recovery (Gross) - all counterparties	0.4%	(1.3%)	3.1%	7.4%	9.1%	13.7%
RI credit risk loss vs. RI recovery (Gross) - defaulting counterparties	7.7%	(63.6%)	50.0%	50.0%	50.0%	50.0%

Pre-diversified RI Credit Risk has increased by 10% from £20m to £22m.

This was caused by an increase in RI recoveries of 20% in the tail of the SCR distribution (as shown above) following the purchase of a high layer catastrophe cover ($50m Xs $250m) protecting the Property Binders and Property RI account. The benefit to the SCR of £10m of this additional RI protection is included in the summary and premium risk sections.

The existing RI recoverable asset has remained stable.

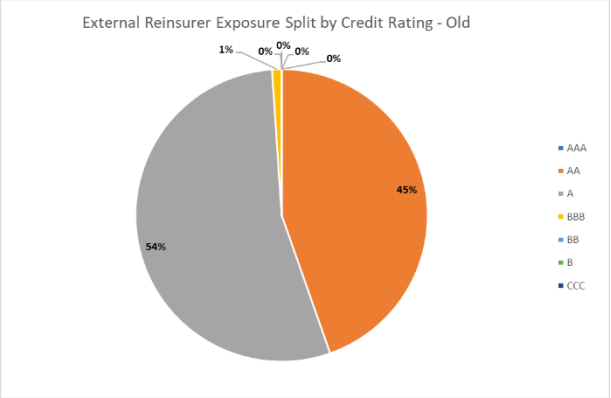
The increase in RI credit risk is less than the increase in recoveries as the counterparty of the cover, ABC Re is AAA rated and therefore has a relatively low probability of default.

The counterparty strength of the outwards RI recoveries is shown in the table and pie charts below. The weighted average probability of default, using 1 in 200 recoveries as the weight, has fallen from 0.68% to 0.62%, and this is consistent with the fall in the RI credit risk vs RI recovery ratio from 19.5% to 13.7%.

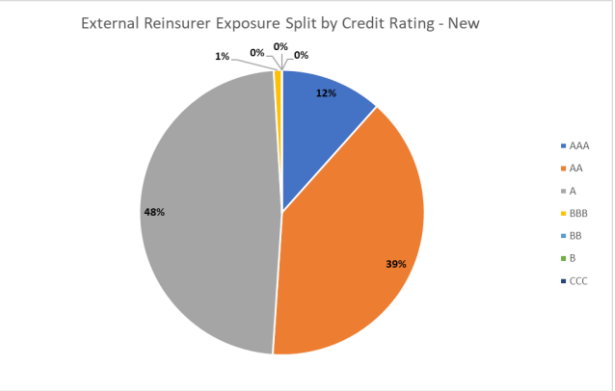
There have been no changes to default probabilities, LGD ratios, or dependencies between RI credit Risk and Insurance risk – which is modelled as a double downgrade following a £4bn insurance loss. No account has been taken of collateral held as this is not material.

The update to the RI panel described above is included in MC #A.

Old SCR				
Reinsurer Rating	RI exposure at 1 in 200	Prob of default	LGD	Exposure ($m)
AAA	0%	0.2%	50%	$0
AA	45%	0.5%	60%	$170
A	54%	0.8%	60%	$207
BBB	1%	1.8%	70%	$4
BB	0%	2.7%	50%	$0
B	0%	4.1%	50%	$0
CCC	0%	6.0%	50%	$0
Total		0.7%		$381



New SCR				
Reinsurer Rating	RI exposure at 1 in 200	Prob of default	LGD	Exposure ($m)
AAA	12%	0.2%	50%	$50
AA	39%	0.5%	60%	$170
A	48%	0.8%	70%	$207
BBB	1%	1.8%	75%	$4
BB	0%	2.7%	80%	$0
B	0%	4.1%	85%	$0
CCC	0%	6.0%	90%	$0
		0.6%		$431



Comments on example

- The table and commentary provide details of changes to RI Credit risk.
- There is a link made between the increased benefit taken in the SCR for outwards RI and increased credit risk.
- There is an explanation as to why the RI Credit Risk Loss vs RI recoveries ratio has reduced by showing at summary level the rating of outwards RI – this is shown at the stress 1 in 200 rather than the average level which in many cases would be more informative.
- A similar explanation for movements in one-year RI Credit Risk should be provided, highlighting differences in movements compared to the ultimate

16.5 Market Risk

Lloyd's Expectations

Specific issues which may need identifying in respect of Market risk are:

- Update to the ESG and how this has changed mean investment returns and volatility
- Material changes to asset allocation
- Any changes to dependencies between Market Risk and other risks

As for RI credit risk, a summary of the main exposures for the precious and current SCR is important in terms of Lloyd's review

- Asset allocation split by main currency and asset type
- For fixed interest securities a breakdown by currency, credit rating and duration

As part of Lloyd's review, it is helpful if changes in the above are linked to Form 314 table 2 on market risk.

Example – Market Risk

1 in 200 Risk	Ultimate SCR		
	Old SCR (£m)	New SCR (£m)	Change
Interest Assets	*38.7*	*24.1*	*(14.6)*
Interest Liabilities	*21.1*	*21.8*	*0.8*
Interest Rate Risk Total	17.8	3.7	(14.1)
Credit Risk	20.4	9.3	(11.1)
Equity Risk	0.0	0.0	0.0
Liquidity Risk	0.0	0.0	0.0
Other risk	0.0	0.0	0.0
FX Risk Assets	*9.3*	*9.3*	*0.0*
FX Risk Liabilities	*10.0*	*10.0*	*0.0*
FX Risk Total	0.3	0.3	0.0
Diversification benefit	(11.8)	(1.7)	10.1
Market Risk	**27**	**12**	**(15)**

As stated in the summary, there has been a material reduction in both standalone and diversified Market Risk as a result of a change to asset allocation. Dependencies between Market Risk and other risk categories are unchanged.

Standalone Market Risk has reduced by £15m to £12m. The main drivers of change have been:
- Update to the ESG: +£1m, as a result of slightly lower mean investment returns (MC #A). with the net impact on Market Risk from the effect on both assets and liabilities being small.
- A significant change to asset allocation: -£17m (MC #B)
- Changes to TPs: +£1m: Higher TPs result in a larger allowance for discounting in the opening balance sheet which emerges as a loss to ultimate (MC #C)

With much lower interest rate and credit risk, diversification benefit within Market Risk has fallen significantly.

Asset allocation
There has been a significant move from Corp Bonds to Government Bonds, which has the impact of reducing interest rate risk and credit risk. There has been little change to the mean duration of assets or liabilities or in currency allocation, both of which show close matching to liabilities.

The changes to asset allocation are given below:

	Total Asset Allocation			
	Old SCR alloc	Mean Duration	New SCR alloc	Mean Duration
Government bonds and cash	10%	1.50	60%	1.50
Corp bonds - Total	90%	2.25	40%	2.25
AAA	6%	2.25	10%	2.25
AA	7%	2.25	10%	2.25
A	30%	2.25	20%	2.25
BBB	33%	2.25	10%	2.25
BBB	8%	2.25	0%	2.25
BBB	6%	2.25	0%	2.25
CCC or lower	0%	2.25	0%	2.25

	Asset Currency Allocation		Liability currency	
	Old SCR	New SCR	Old SCR	New SCR
USD	90%	90%	89%	89%
GBP	3%	3%	3%	3%
EUR	3%	3%	3%	3%
CAD	3%	3%	3%	3%
AUD	1%	1%	2%	2%

Mean Investment returns

	Total Asset Allocation			
	Old SCR alloc	Mean Expected Return % p.a.	New SCR alloc	Mean Expected Return % p.a.
Government bonds and cash	10.0%	1.2%	60%	1.2%
Corp bonds - Total	90%		40%	0.0%
AAA	6%	1.7%	10%	1.7%
AA	7%	1.7%	10%	1.6%
A	30%	2.1%	15%	2.0%
A-	33%	2.6%	5%	2.4%
BBB+	8%	3.0%	0%	2.8%
BBB	6%	3.2%	0%	3.0%
CCC or lower	0%	5.0%	0%	4.8%
Weighted average		2.3%		1.4%
Weighted average (Old allocation)				2.1%

As noted above, there has been a slight reduction in assumed investment returns, with US and global interest rates trending down since the Old SCR. This is reflected in the small reduction in weighted average mean expected returns from 2.3% to 2.1% using the 2019 SCR asset allocation.

The majority of the total fall in mean expected returns using the New assumed asset allocation (1.4%) is due to the significant shift out of corporate bonds into US government bonds and cash. The reduction in market risk is consistent with this fall in expected returns.

Comments on example

- The tables and comments provide explanations to movements in Market Risk
- The key drivers to changes in Market Risk are identified and linked to Model Changes and changes to the risk profile.
- There is consistency between the information provided and LCR Form 314.2
- There is enough evidence provided in respect of the risk profile (asset allocation) for Lloyd's to gain initial comfort that the reduction in Market Risk may be justified
- There is a link between changes in Market Risk and changed mean return on assets. A counterintuitive movement e.g. Market Risk down but expected returns up, would require a more detailed explanation.
- If expected returns changed materially, Lloyd's would expect to see a more detailed discussion on this. Similar explanations for one-year Market Risk would also be required.
- A similar explanation for movements in one-year market risk should be provided highlighting differences in movements compared to the ultimate

16.6 Operational Risk

Lloyd's Expectations

Specific issues which may need identifying in respect of Operational Risk are:

- Updates to key scenarios driving capital, and how they link into the risk profile
- Additional Operational Risk scenarios and the reasons for them, e.g. change in view of Risk Management (updated risk register), change in risk profile
- Any changes to dependencies between Operational Risk and other risks

Example – Operational Risk

	Top Op Risk Risk Scenarios (£m)						
	Old SCR			New SCR			
Threat	Scenario 1 in 200 (pre mitigation)	Scenario 1 in 200 (post mitigation)	Share of Total 1 in 200 Net Operational Risk	Scenario 1 in 200 (pre mitigation)	Scenario 1 in 200 (post mitigation)	Share of Total 1 in 200 Net Operational Risk	Change in share
IT - Loss of Key systems (non Cyber)	70	60	40	70	60	40	0
Pandemic	60	50	30	60	50	29	-1
Loss of key U/W teams	50	40	15	50	40	13	-2
Failure of outsourced suppliers	40	30	10	45	35	11	1
Conduct Risk - internal	30	20	5	30	20	4	-1
Conduct Risk - delegated authority	20	20	5	20	20	5	0
Reputational hit	10	10	3	10	10	4	1
Cyber attack	10	10	10	30	25	18	8
Scenario - Inadequate software	10	10	3	10	10	3	0
Scenario - Damage to assets - TER	10	10	3	10	10	3	0
Total - undiversified	**310**	**260**	**N/A**	**335**	**280**	**N/A**	**N/A**
Total - diversified	**N/A**	**123**	**124**	**N/A**	**130**	**130**	**6**

As stated in the summary, pre-diversified Operational risk has increased 5% to £130m.

The Managing Agent risk team has carried out its annual review of Operational Risk scenarios following the update to the risk register. There were no additional scenarios required and with the stable exposure across the majority of metrics used to generate the Operational Risk loss estimates, the majority were unchanged.

However, discussions with risk owners in respect of the Conduct Risk – internal and Cyber-attack scenarios have led to changes in the expert judgements applied to the loss estimates which are reflected in the table above. (MC #A)

For the Cyber-attack scenario, the increase was substantial and reflected recent examples of Cyber-attacks on non-insurance entities which have caused material losses.

There has been no change in the dependencies between Operational Risk and other risk categories.

Comments on example

- The tables and comments provide explanations to movements in Operational Risk
- The key drivers to changes in Operational Risk are identified and linked to Model Changes and changes to the risk profile.
- As Operational Risk does not generally contribute significantly to the SCR, this level of commentary would be sufficient for a relatively minor change to Operational Risk. More significant changes to Operational Risk (e.g. material changes to loss estimates for a number of scenarios, a change to modelling approach) would require further detail.
- As for other risk types, commentary should be provided on movement in the one-year figure, highlighting differences to movements in the ultimate

17 Appendix B RICB adjustment

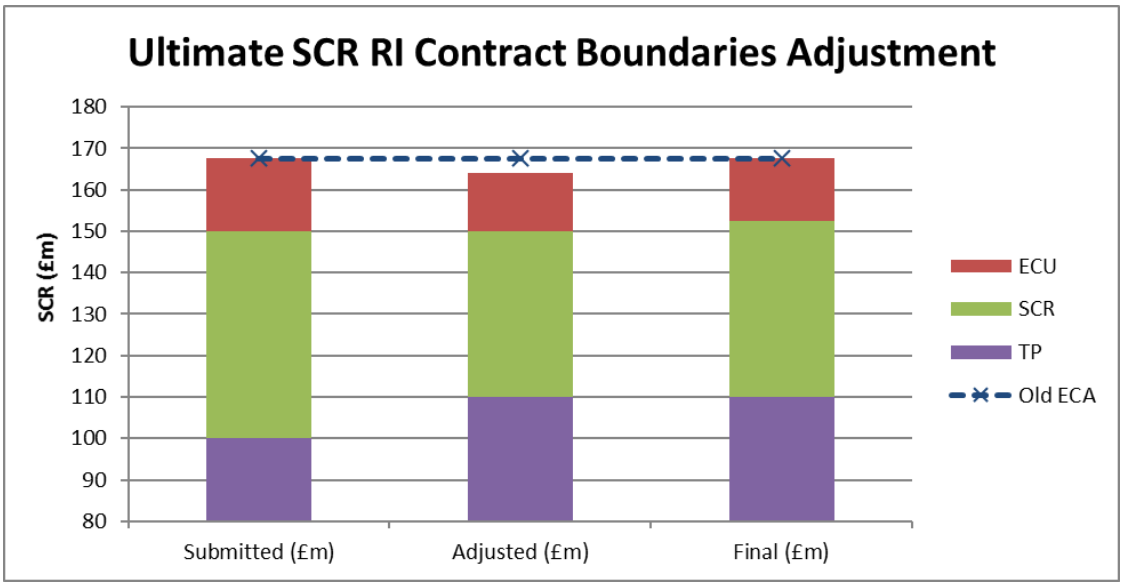
Inclusion of reinsurance premium in the technical provisions for legally obliged reinsurance has an impact on both the technical provisions and the ultimate SCR. The capital stack (technical provisions and ultimate SCR) remains unaffected by the adjustment. In other words, the increase in technical provisions has been offset by a decrease in capital of the same magnitude.

However, at Lloyd's the capital stack also includes the ECU so a decrease in the ultimate SCR leads to decrease in ECU and thus a decrease in the capital stack at Lloyd's. Lloyd's will adjust the ultimate SCR to ensure the capital stack remains unaffected by the allocation of reinsurance premiums to the technical provisions.

The table below shows the original capital stack at Lloyd's, the unadjusted capital stack (following allocation of reinsurance premiums to the technical provisions) and the adjusted capital stack. In each, the risk remains unchanged. Reinsurance premium of £10m is allocated to the technical provisions in this example.

	Submitted (£m)	Impact of change (£m)	Adjusted (£m)	Final (£m)
ECA	100.0	100.0	100.0	100.0
ECU	17.5	-3.5	14.0	14.9
SCR	50.0	-10.0	40.0	42.6
TP	100.0	10.0	110.0	110.0
Total (TP+SCR+ECU)	**167.5**	**-3.5**	**164.0**	**167.5**

RI CB adjustment	10
RI CB SCR adjustment (£m)	**2.6** = 3.5/1.35



18 Appendix C: Post-Diversification Amounts – Spread VaR

18.1 Purpose

Managing agents must use a standardised methodology for calculating the post-diversification contributions by risk type, as shown on LCR Form 309, and covered in section 8.8 of this guidance.

Lloyd's also strongly recommends using a spread VaR approach to calculate overall capital requirements and other relevant numbers in the LCR, as covered in section 8.8 of this guidance.

This appendix provides a step-by-step illustration of how to apply the spread VaR method. It refers to the post-diversification contributions to capital by risk type, but the approach can be used for other calculations.

18.2 Executive Summary

Form 309 provides columns for the post-diversified amounts of each SCR risk category. These post-diversified amounts are intended to represent the contribution of each risk category to the SCR.

In summary, in order to calculate these amounts on both a one-year and ultimate basis the following process should be used:

(i) Rank the simulated balance sheet positions

(ii) Calculate a proxy "Confidence Interval SCR" (CI SCR) by averaging over a range of simulations (guidance on the number of simulations is in section 18.6)

(iii) Calculate the average amounts for each risk category over the range of simulations used in (ii).

(iv) Calculate the post-diversified amounts for each risk category by scaling the averages by the ratio of the syndicate's selected post-diversified SCR to the proxy CI SCR (if required).

(v) Report the post-diversified amounts on form 309 columns E and I

The "proxy CI SCR" is an intermediate value to be discarded after being used to determine the post-diversified amounts for the SCR risk categories. If the spread VaR approach is used in the calculation of the SCR as well, then the "proxy CI SCR" and the SCR should be the same.

Lloyd's has defined a range of simulations to ensure that the "true" internal model 99.5th percentile SCR (i.e. the value that the SCR converges to as simulation error approaches nil) lies within the range at a 95% confidence level. Details are in section 18.6. There must be a high degree of confidence that the "true" model SCR lies within the range used for the calculations, and Lloyd's has determined that this high degree of confidence corresponds with a 95% probability. This confidence interval can be widened by managing agents with justification.

18.3 The Motivation Behind Spread VaR

The spread VAR methodology allows for a stable capital contribution that represents the average contribution to risk type within a window of simulations around the 99.5th percentile of model output. If the VaR is used to calculate the overall capital requirement, and results from that one simulation are used to calculate contributions to capital, the output will be meaningless and unstable: that one simulation might have happened to include large losses in premium risk but also reserve improvements, which would not be indicative of the risk profile of the syndicate.

Other methods can provide stable and meaningful contributions to capital. For example, the pre-diversified capital requirements by risk type (LCR Form 309 Column G) could simply be scaled down by a factor equal to the diversified capital (row 11) divided by the undiversified capital (row 9), with similar adjustments to split Insurance Risk into Premium Risk and Reserve Risk, and Credit Risk into RI Credit and Other Credit. However, this would not adequately represent the relationships between the different risk types, as they are not independent of each other.

18.4 Uses of Spread VaR

Lloyd's requires managing agents to use the spread VaR approach when calculating contributions of risk types to overall capital.

Lloyd's requires contributions to 99.5th deteriorations in claims in Premium Risk (excl. Cat), Premium Risk (incl. Cat) and Reserve Risk in LCR Form 500 Col I (i), Form 502 Col I (i) and Form 510 Col F (i). These numbers must be calculated using the spread VaR method.

These are the only two requirements for using the spread VaR methodology by Lloyd's.

However, Lloyd's also strongly recommends using a spread VaR approach to calculate overall capital requirements and other numbers in the LCR, where the approach is relevant. Managing agents must ensure that any movements in capital numbers are explainable and linked to risk profile. The spread VaR methodology results in more stable results, which could help ensure compliance with these requirements.

18.5 What agents must do: Simple Numerical Example

The purpose of the following example is to illustrate the methodology; it is not intended to provide a realistic example of syndicate model outputs or the number of simulations required. The example is shown for the ultimate case, where the agent uses a VaR (not spread VaR) amount for the overall SCR number.

Suppose the model was run for 100,000 simulations and the 1:200 pre-diversification amounts by risk category are as shown below. The ultimate SCR is £153.4m.

		Ultimate basis (Note 309.2)	
		Pre diversification	Post diversification
		GBP (m)	GBP (m)
		G	I
Insurance Risk			
1	**total: After diversification between Premium and Reserve risk**	147,700,000	
2	split: Premium Risk (see note above)	110,100,000	
3	split: Reserve Risk (Note 309.4)	89,700,000	
Credit Risk			
4	**total: After diversification between Reinsurance Credit Risk and Other Credit Risk**	14,100,000	
5	split: Reinsurance Credit Risk	10,000,000	
6	split: Other Credit Risk	4,100,000	
7	**Market Risk (see note above)**	26,900,000	
8	**Operational Risk**	15,000,000	
9	**TOTAL (Note 309.3)**	203,700,000	
10	**Diversification credit between risk categories**	(50,300,000)	
11	**DIVERSIFIED TOTAL (Note 309.3)**	153,400,000	

The steps to calculate the post-diversification amounts are as follows.

1. Rank the simulated balance sheet positions from smallest to largest.

Simulation No.	Risk Type: Premium	Reserve	Insurance	RI credit	Other credit	Credit	Market	Operat-ional	Balance sheet position	Balance sheet position rank
96,904	(70.8)	(109.3)	(180.2)	0.5	-	0.5	(16.2)	2.0	(193.9)	1
18,056	(75.3)	(99.4)	(174.7)	0.1	-	0.1	(19.8)	2.0	(192.4)	2
43,848	(61.9)	(102.7)	(164.6)	-	0.5	0.5	(23.5)	-	(187.6)	3
38,195	269.1	65.0	334.1	0.5	-	0.5	16.1	2.0	352.7	99,998
82,349	300.5	86.9	387.4	10.0	-	10.0	11.6	-	409.0	99,999
19,411	365.1	44.7	409.8	0.5	0.5	1.0	(1.6)	7.5	416.7	100,000

Simulations sorted based on size of simulated balance sheet position

2. Determine the appropriate range of simulations for the post-diversification calculations from ranges provided by Lloyd's. The simulation ranges have been selected to provide a 95% confidence interval for the "true" internal model SCR. See section 18.6 for details on the methodology. LCR Form 540 calculates the range, however, this confidence interval can be widened by managing agents with justification.

   Since 100,000 simulations have been run, the range for the post-diversification calculations would be from 99,457 to 99,544 *after* sorting by ascending size of the balance sheet position.

Post-diversification calculations: specification of ranges								
No. simulations	10,000	25,000	50,000	75,000	**100,000**	150,000	200,000	250,000
SCR percentile	99.5	99.5	99.5	99.5	**99.5**	99.5	99.5	99.5
Confidence level that SCR percentile lies in range	95%	95%	95%	95%	**95%**	95%	95%	95%
Range definition in terms of rank of SCR simulations								
upper bound	9,964	24,897	49,781	74,663	**99,544**	149,304	199,062	248,820
lower bound	9,937	24,854	49,720	74,588	**99,457**	149,197	198,939	248,681
range width	28	44	62	76	**88**	108	124	140

3. Determine the proxy CI SCR and average values for each SCR risk type over the specified range of simulations.

   The specified range from simulation 99,457 to simulation 99,544 is shown below.

Simulation No.	Risk Type: Premium	Reserve	Insurance	RI credit	Other credit	Credit	Market	Operational	Balance sheet position	Balance sheet position rank
96,904	(70.8)	(109.3)	(180.2)	0.5	-	0.5	(16.2)	2.0	(193.9)	1
18,056	(75.3)	(99.4)	(174.7)	0.1	-	0.1	(19.8)	2.0	(192.4)	2
.....										
86,218	74.2	49.1	123.3	17.2	-	17.2	8.8	2.0	151.3	99,457
97,644	78.7	65.7	144.3	0.1	0.5	0.6	4.4	2.0	151.3	99,458
.....										
93,101	54.8	103.7	158.5	0.1	0.1	0.1	(3.6)	-	155.0	99,543
76,539	119.4	40.3	159.7	-	0.5	0.5	(7.1)	2.0	155.1	99,544
42,734	117.0	50.8	167.8	-	0.5	0.5	(13.2)	-	155.1	99,545
.....										
82,349	300.5	86.9	387.4	10.0	-	10.0	11.6	-	409.0	99,999
19,411	365.1	44.7	409.8	0.5	0.5	1.0	(1.6)	7.5	416.7	100,000

Balance sheet position and risk types averaged over these simulations

For example, insurance risk would be averaged over the values 123.3, 144.3, …, 158.5, 159.7 = 144.8. This is just insurance risk averaged over the 88 simulations for which the rank of the balance sheet position falls within the defined range.

The proxy CI SCR would be the average of 151.3, 151.3, …, 155.0, 155.1 = 153.1.

The post-diversified insurance risk would be 144.8 * (selected SCR) / (proxy CI SCR) = 144.8 * (153.4 / 153.1) = 145.1. This is the amount that would be shown as post-diversified insurance risk on LCR Form 309. The results for the other risks are shown below. The scaling factor ensures that their sum is equal to the selected diversified

SCR of 153.4m shown in row 11 of column G of LCR Form 309. Please note that this scaling is only necessary if the spread VaR methodology is not applied to the SCR – otherwise the proxy CI SCR is the same as the selected SCR.

SCR before applying confidence interval	
SCR (£m):	153.4

SCR Risk Type	CI Value (m)	Scaling Factor	Post Diversified (m) (for Form 309 col I)
Insurance	144.8	100.2%	145.1
Premium	89.0		89.2
Reserve	55.8		55.9
Credit	2.2		2.2
RI credit	1.7		1.8
Other credit	0.5		0.5
Market	2.3		2.3
Operational	3.8		3.8
CI SCR	**153.1**		**153.4**

4. Populate rows 1-8 of col I of from 309 with the post-diversified amounts from step 3. Discard the CI SCR.

		Ultimate basis (Note 309.2)	
		Pre diversification	Post diversification
		GBP (m)	GBP (m)
		G	I
Insurance Risk			
1	**total: After diversification between Premium and Reserve risk**	147,700,000	145,100,000
2	split: Premium Risk (see note above)	110,100,000	
3	split: Reserve Risk (Note 309.4)	89,700,000	
Credit Risk			
4	**total: After diversification between Reinsurance Credit Risk and Other Credit Risk**	14,100,000	2,200,000
5	split: Reinsurance Credit Risk	10,000,000	
6	split: Other Credit Risk	4,100,000	
7	**Market Risk (see note above)**	26,900,000	2,300,000
8	**Operational Risk**	15,000,000	3,800,000
9	**TOTAL (Note 309.3)**	203,700,000	153,400,000
10	**Diversification credit between risk categories**	(50,300,000)	
11	**DIVERSIFIED TOTAL (Note 309.3)**	153,400,000	

The post-diversified values for reserve risk, premium risk, RI credit risk and other credit risk are reported in Form 540.

18.6 Methodology for Determining the Ranges[2]

Let:

- X be the random variable for the internal model balance sheet position
- n be the number of simulations
- π_p be the (100p)th percentile of X
- $X_1, X_2, \ldots, X_n$ be the n simulated balance sheet positions
- $Y_1 \le Y_2 \le \ldots \le Y_n$ be the ordered (ranked) X_k

We also assume that the simulations are independent and constitute a random sample from the model.

The expected number of simulated X_k less than or equal to the (100p)th percentile π_p is np. The probability of observing i simulations less than or equal to π_p out of the total of n simulations is given by a binomial distribution with mean np and variance $np(1-p)$.

$$\Pr(\textbf{no. simulations} \le \boldsymbol{\pi_p} = i) = n!/([i!]*[n-i]!)*p^i * [1-p]^{n-i}$$

The probability of observing *at least* i simulations and *at most* j-1 simulations less than or equal to π_p is

$$\Pr(i \le \textbf{no. simulations} \le \boldsymbol{\pi_p} < j) = \sum n!/([k!]*[n-k]!)*p^k * [1-p]^{n-k}, \quad k = i, i+1, \ldots, j-1 \qquad \textbf{(*)}$$

(*) can be approximated using the normal distribution:

$$\Pr(i \le \textbf{no. simulations} \le \boldsymbol{\pi_p} < j) \cong \Phi([(j-1+0.5) - np]/[np*(1-p)]^{0.5}) - \Phi([(i-0.5) - np]/[np*(1-p)]^{0.5}) \qquad \textbf{(**)}$$

(The "continuity correction" of +/-0.5 is made to improve the accuracy of the normal approximation.)

Let $j - 1 = np + \Delta$ and $i = np - \Delta$. We can rewrite **(**)** as

$$\Pr(i \le \textbf{no. simulations} \le \boldsymbol{\pi_p} < j) \cong \Phi([(\Delta+0.5]/[np*(1-p)]^{0.5}) - \Phi(-[\Delta + 0.5]/[np*(1-p)]^{0.5})$$

$$= 2 * \Phi([(\Delta+0.5]/[np*(1-p)]^{0.5}) - 1 \qquad \textbf{(+)}$$

We can use **(+)** to derive a confidence interval for π_p that is symmetric around the (100p)th percentile in terms of the numbers of simulations.

- Select the desired confidence level CL(Δ)
- Using (+), set $CL(\Delta) = 2 * \Phi([(\Delta+0.5]/[np*(1-p)]^{0.5}) - 1$
- Solve for $\Delta = \Phi^{-1}([CL(\Delta)+1]/2) * [np*(1-p)]^{0.5} - 0.5$
- Calculate $j = np + \Delta + 1$ and $i = np - \Delta$ (round to the nearest integer)
- $[Y_i, Y_j)$ is the CL(Δ) confidence interval (CI) for π_p

The boundaries Y_i and Y_j follow from the definition of **(*)**, which gives the probability of *at least i* simulations and *at most j*-1 simulations less than or equal to π_p. Since the Y_k are ordered, Y_i and Y_j are the smallest and largest simulations, respectively, consistent with our selected confidence level CL(Δ) for π_p and the number of simulations n.

18.7 Remarks

- The application of the methodology to form 309 would assume the following.
  - p = 0.995

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[2] Hogg, R., J. McKean and A. Craig. *Introduction to Mathematical Statistics* (6th ed.), Upper Saddle River, NJ: Pearson Prentice Hall, 2005.

Hogg, R., and S. Klugman. *Loss Distributions*, USA: John Wiley & Sons, 1984.

- π_p is the true internal model SCR
- CL(Δ) is 95%; (This confidence interval can be widened by managing agents with justification)
- $j = np + 1.96*[np(1-p)]^{0.5} + 0.5$
- $i = np – 1.96*[np(1-p)]^{0.5} + 0.5$

- $(j-i)/n \propto ([1-p]p/n)^{0.5}$ i.e. the width of the interval relative to the number of simulations decreases with the square root of the number of simulations (law of large numbers)
- The method for determining the CI is non-parametric and therefore independent of the form (shape, mean, variance, etc.) of the distribution for *X*. The values for *i* and *j* will therefore define a CL(Δ) interval for the percentile *p* for any other ranked random variable in the internal model (assuming *n* simulations).

18.8 Using a wider simulation range

Syndicates are permitted to choose a larger simulation range around the capital setting level to calculate contribution amounts. The scale and impact of the larger range must be justified and should be included in the MCT as a model change. This change in reporting is not expected to result in a change of the SCR – hence syndicates model change policies might not cater for this explicitly. Lloyd's expect syndicates to categorise this change (qualitatively) as a minor or major model change – depending on how materially the balance of risk types in their contribution to SCR is affected. If required a major model change application should be made. If a major model change is triggered then the application should be made before the submission of the LCR – in line with the deadlines outlined in the Model Change Guidance. The maximum simulation syndicate could extend the window to is effectively a Tail VaR at 99% approach. The approach taken must still be symmetrical around the capital setting 99.5% value at risk.

Lloyd's expects syndicates to submit a full documented justification for a change in approach and validation as part of the approval. The following should be included in any justification used to extend the simulation range:

- Motivation and rationale – it is generally expected that commentary includes more reasons than stability.
- Suitability to risk profile – for example, appropriateness of new range given shape of distribution, a wider window may be more appropriate for skewer distributions.
- Full comparison – contributions at both a risk category level and for material classes.
- Backtesting – the wider simulation range should be used to backtest stability and demonstrate where in the past movements would have been more appropriately in line with risk profile, i.e. show where the old measure was potentially misleading.
- Mix change – the updated measure may cause a change of balance between risk categories or classes, and this should be justified in correspondence to risk profile.

The following should also be kept in mind when using this for future LCRs:

- The first full LCR submitted after a change is required to include a like for like comparison, using the new measure consistently with last year. The analysis of change document should draw out the change in simulation window and analyse this separately.
- The updated range should be specified in the LCR Form 540.
- Stability testing will have to be updated for the following SCR and results should include consideration of the wider window.
- Validation of contributions must be carried out using a consistent measure with that used in the LCR.

Syndicates should notify Lloyd's of their intention to change their reporting basis. This amended reporting basis is not expected to have any impact on the SCR.

19 Appendix D: Sum of Squares Test

The Sum of Squares Test is one of the tools used by Lloyd's to assess dependencies. It is applied as a minimum test, aimed at identifying model output that appears to suggest a negative dependence between certain areas of the model. It is a low minimum test – it is not designed to be a test of appropriateness.

Lloyd's applies the test at the aggregation of Premium Risk and Reserve Risk to Insurance Risk (both including and excluding cat), and when Insurance Risk combines with RI Credit Risk, Market Risk and Operational Risk to Overall SCR level. It is also applied between classes of business within Premium Risk and within Reserve Risk.

This appendix provides the supporting mathematics, assumptions, advantages and limitations, along with examples.

19.1 Definitions

- X, Y and Z are random variables
- Z = X + Y
- ρ is the correlation between X and Y

19.2 Derivation of SST

- MEAN(Z) = MEAN(X) + MEAN(Y)
- VAR(Z) = VAR(X) + 2ρ*STDEV(X)*STDEV(Y) + VAR(Y)

The above is true in general and does not depend on the distribution assumptions (provided the moments exist). In the SST, we set $\rho = 0$.

- MEAN(Z) = MEAN(X) + MEAN(Y)
- VAR(Z) = VAR(X) + VAR(Y), or
- $STDEV(Z) = [STDEV(X)^2 + STDEV(Y)^2]^{1/2}$

In general, a given percentile p of a distribution will be equal to the mean plus some multiple k_p of the standard deviation.

- $X_p = MEAN(X) + k_p * STDEV(X)$ (*)

The value of k_p will depend on the distribution and the percentile. For example, for the Normal at the 99.5th, $k_{99.5} = 2.57$; for the lognormal for many insurance risk distributions, $k_{99.5} \sim 3.0$. The value of k_p will be negative for percentiles below the mean. In the following derivation, we will assume that the p^{th} percentile lies above the mean.

Rearranging (*) gives

- $STDEV(X) = [X_p - MEAN(X)]/ k_p$

If we assume that X, Y and Z all have the same distribution shape and (therefore k_p), then the p^{th} percentile for Z is

- $Z_p = [MEAN(X) + MEAN(Y)] + k_p * \{([X_p - MEAN(X)]/ k_p)^2 + ([Y_p - MEAN(Y)]/ k_p)^2\}^{1/2}$ (**)

The k_p cancel out to give:

- $Z_p = [MEAN(X) + MEAN(Y)] + \{[X_p - MEAN(X)]^2 + [Y_p - MEAN(Y)]^2\}^{1/2}$ (+)

The SST is applied by comparing the modelled result for Z_p with the result from (+). The latter is taken as the result that would be obtained assuming independence between X and Y. For example, if X and Y are premium and reserve risk (on an ultimate basis), then their means and 99.5th percentiles are shown in LCR Form 314 (A2, A3, C2, C3). If the 99.5th percentile for insurance risk (LCR Form 314 C1) is less than the result obtained from (+), then the SST is failed.

We can generalise (+) to more than two risks using matrix multiplication.

19.3 Advantages

The SST is a simple calculation that requires only the means and percentiles p of the marginal distributions. It is the only way to approximate the sum of two random variables without relying on simulation or the fast Fourier transform.

19.4 Limitations

The assumption supporting (**) above will be true if the distributions are normal. In this case the k_p of X and Y will be the same; furthermore, since the sum of two normally distributed random variables has a normal distribution, Z will have the same k_p as X and Y.

Conversely, the assumption supporting (**) will not be valid if:

- The distributions of X and Y are of different shape and their k_ps differ.
- The distributions of X and Y are the same/similar but skewed.

In the second case, the sum of two random variables with the same non-normal distribution cannot be assumed to have that distribution. The more skewed the distributions, the less valid the assumption. In addition, there is a greater risk that the mean for one of the distributions lies above the percentile at which the SST is applied. This will increase the error in (+).

In the first case, the degree of mis-estimation by the SST will depend in part on the relative size of the standard deviations for X and Y in (**). If one is much larger than the other, then it will dominate the result in (+) and the impact of the differences in k_p will be smaller, resulting in a smaller mis-estimation by the SST.

In summary, the limitations of the SST arise from approximating distributions using only the first two moments.

19.5 Demonstration of advantages and limitations

The advantages and limitations of the SST can be demonstrated with simulated outputs. Low-skewed risks were simulated from lognormals with means of 100 and standard deviations of 10; skewed risks were simulated from a frequency distribution with probability of a claim equal to 1/100 and a beta severity distribution with mean 10,000. The means of the low- and high-skewed distributions were therefore the same (100), but the standard deviations and skewness differed significantly. The lognormal resembles a distribution that could be appropriate for attritional claims or aggregate reserves; the discrete frequency/beta is more like the frequency/severity distribution for a natural cat portfolio. The low- and high-skewed distributions were simulated (n = 100,000) from independently in three different pairings; the results for the marginal risk distributions are shown below.

	Scenario 1 Both X and Y low-skewed		**Scenario 2** X skewed / Y low-skewed		**Scenario 3** Both X and Y skewed	
	Risk X	**Risk Y**	**Risk X**	**Risk Y**	**Risk X**	**Risk Y**
Mean	100.0	100.0	96.1	100.0	99.4	99.1
Std Dev	10.0	10.0	1089.8	10.0	1116.3	1068.4
COV	10%	10%	1135%	10%	1123%	1135%
Skewness	0.30	0.31	12.95	0.30	12.8	13.0
$k_{99.5}$	2.9	2.8	7.3	2.9	7.6	8.0

The second table shows the results for the aggregate of Risk X and Risk Y obtained from the SST compared to the simulated results in each of the three scenarios. Scenario 1 combines two low-skewed distributions; the error is negligible as expected. In Scenario 2, the % error is very high until above the 99th percentile. This is because the (unadjusted) SST implicitly assumes that these percentiles are above the mean; however, for the skewed risk, the expected probability of a claim is 1/100, and the mean occurs above the 99th percentile. The error is negligible above the 99th percentile because the skewed distribution completely dominates the low-skewed distribution. In Scenario 3, the error is high until above the 99th, for the same reason as in Scenario 1. The error remains significant at the 99.8th percentile, primarily because the high skewness increases simulation error.

Risk X + Risk Y: SST vs. Simulations									
	Scenario 1			Scenario 2			Scenario 3		
%ile	SST	Sim	%error	SST	Sim	%error	SST	Sim	%error
50.0%	200.7	199.5	0.6%	292.1	99.7	193.1%	330.4	0.0	N/A
75.0%	209.1	209.3	-0.1%	292.3	106.7	174.1%	330.4	0.0	N/A
90.0%	218.5	218.4	0.0%	293.0	113.7	157.8%	330.4	0.0	N/A
95.0%	224.4	224.2	0.1%	293.7	118.5	147.9%	330.4	0.0	N/A
97.5%	229.7	229.2	0.2%	294.4	123.5	138.4%	330.4	0.0	N/A
99.0%	236.1	235.2	0.4%	295.5	140.3	110.6%	330.4	9206.0	-96.4%
99.5%	240.5	239.0	0.6%	9270.5	9276.5	-0.1%	13105.3	13447.7	-2.5%
99.8%	246.2	244.4	0.7%	14662.4	14649.3	0.1%	20638.9	17144.6	20.4%

19.6 Use in the LCR

The SST is applied by Lloyd's in three places:

- The aggregation of Premium Risk and Reserve Risk to Insurance Risk (in the Sum of Squares Test Template, available on Lloyds.com)
- The aggregation of Insurance Risk, Credit Risk, Market Risk and Operational Risk to the Overall SCR (in the Sum of Squares Test Template)
- The aggregations of classes of business distributions to premium risk (incl. and excl. Nat Cats) and reserve risk (in the LCR Forms 501, 503, and 511)

Lloyd's uses the SST as a "first pass" test only. Passing the SST does not necessarily mean that the modelled level of diversification is appropriate.

If the SST is failed in either of the first two bullet points above, managing agents must provide further information on diversification, including the impact on Insurance Risk / Overall SCR of "scrambled sims", in the Sum of Squares Test Template. "Scrambled sims" refers to the reshuffling / randomising of the order of simulations for risk types and adding them together to produce an "independent" total distribution, which allows for the different shapes of the underlying risk type distribution. This provides a further useful "first pass" test of diversification.

In cases where any of the SSTs indicate near independence, other metrics or model outputs may be considered, such as joint exceedance probabilities.

20 Appendix E: Joint Exceedance Probabilities

20.1 Overview

The concept of Joint Exceedance Probabilities ("JEP"s) is one of the tools used by Lloyd's to assess dependencies.

Lloyd's collects Joint Exceedance Probabilities from syndicate model outputs in LCR Form 520 for the following pairs of risks:

- Premium Risk and Reserve Risk
- Insurance Risk and Market Risk
- Insurance Risk and RI Credit Risk
- Insurance Risk and Operational Risk

Lloyd's compares output JEP against theoretical JEPs for risks that are independent or fully dependent. Lloyd's expects model output to lie between independence and full dependence, across the output distribution (not just at the 99.5th percentile).

A primary advantage of JEPs is that they are simple to understand and calculate, allowing model output from different methods of aggregation to be compared to each other. A major limitation is that JEPs do not measure the contribution of each of two risks to the combined distribution, particularly if one of the two risks is considerably more material than the other.

This appendix provides precise definitions behind JEPs.

20.2 Definitions[3]

Given random variables X and Y with marginal distributions F(x) and F(y) and joint distribution F(x,y), the probability that X>x and Y>y is given by the survival or tail function S(x,y):

- $S(x,y) = 1 – F(x) – F(y) + F(x,y)$.

If F(x) and F(y) are chosen to equal a quantile or percentile *p*, then S(x,y) is the Joint quantile Exceedance Probability, or "JEP", at *p*.

The upper and lower bounds for F(x,y) are given by

- $F_u(x,y) = \min[F(x), F(y)]$
- $F_l(x,y) = \max[F(x) + F(y) – 1, 0]$

These correspond to full dependence and "negative" dependence, respectively. They are often referred to as the Frechet upper and lower bounds.

Similarly, the joint distribution corresponding to independent X and Y is

- $F_i(x,y) = F(x)*F(y)$

In general, Lloyd's does not consider levels of dependency below independence to be acceptable for LCR risks. The lower bound shown in the LCR graphs correspond to independent marginals:

- $S_i(x,y) = 1 – F(x) – F(y) + F_i(x,y) = 1 – F(x) – F(y) + F(x)*F(y)$.

The upper bound corresponding to full dependence is given by

- $S_u(x,y) = 1 – F(x) – F(y) + F_u(x,y) = 1 – F(x) – F(y) + \min[F(x), F(y)]$.

For example, at F(x) = F(y) = 0.900,

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[3] McNeil, A., R. Frey and P. Embrechts. *Quantitative Risk Management*, Princeton, NJ: Princeton University Press, 2005.

Wang, S.S., *"Aggregation of Correlated Risk Portfolios: Models and Algorithms"*, PCAS LXXXV, 1998, pp. 848 - 939

- $S_i(x,y) = 1 – 0.900 – 0.900 + 0.900^2 = 0.010$ and
- $S_u(x,y) = 1 – 0.900 – 0.900 + \min[0.900, 0.900] = 0.100$.

The values for $S_i(x,y)$ and $S_u(x,y)$ can also be derived using the rule of conditional probability:

$Pr(Y>y, X>x) = Pr(Y>y| X>x)*Pr(X>x)$, with $Pr(Y>y| X>x) = 1$ for full dependence and $Pr(Y>y | X>x) = Pr(Y>y)$ for independence.