

SOLVENCY II

TECHNICAL PROVISIONS UNDER SOLVENCY II DETAILED GUIDANCE

MARCH 2010



CONTACT DETAILS

For technical queries:

Henry Johnson, Market Reserving and Capital

020 7327 5235 henry.johnson@lloyds.com

Jerome Kirk, Market Reserving and Capital

020 7327 5812 jerome.kirk@lloyds.com

For general queries:

Please contact your Solvency II Account Manager, or email:

Solvency2@lloyds.com

CONTENTS

INTRODUCTION	6
Solvency II	6
Technical provisions	6
Lloyd’s dry run process and QIS5	7
Minimum segmentation	7
Best estimate cashflows	7
Recognition of contracts	7
Reinsurance	8
Expenses	8
Binary Events	8
Uncertainty	8
Wind-up basis	9
Risk margin (or Market Value Margin (MVM))	9
Process and methodology	9
Assumptions	9
Validation and back-testing	9
Data implications	10
Documentation	10
Actuarial function	10
General principles	10
POTENTIAL IMPACT AT LLOYD’S	11
Lloyd’s technical provisions	11
Impact on technical provisions in the balance sheet	12
GENERAL REQUIREMENTS	14
Basis of calculation	14
Use of adequate techniques	14
Appropriate valuation techniques	15
Future management actions	15
Proportionality	17
SEGMENTATION	20
Minimum lines of business (Non-Life)	20
Minimum lines of business (Health)	21
Minimum lines of business (Life)	21
Annuities relating to non-life and health policies	21
Contracts covering multiple lines of business and “unbundling”	21
Homogeneous risk groups for calculation of best estimates	22
Currency groups	22
Potential practical issues	23
Suggested approaches	23
CALCULATION OF BEST ESTIMATE AND CASHFLOWS	24
Requirements for cashflow projections	24
Non-life insurance obligations	25
Life insurance obligations	26
Substance over form in valuation methodologies	27
Health obligations	27
Uncertainty within future cashflows	27
Potential practical issues	27
Suggested approaches	28
GROSS OUTSTANDING CLAIMS PROVISIONS	29
Best estimate claims provisions	29
Potential practical issues	29

Suggested approaches.....	29
Indicative results.....	30
GROSS PREMIUM PROVISIONS	31
Best estimate premium provisions.....	31
Definition of existing contracts.....	32
Premium receivable	33
Future premium cashflows relating to incepted earned exposure	33
Potential practical issues	33
Suggested approaches.....	35
Indicative results.....	37
REINSURANCE RECOVERIES.....	38
Reinsurance recoveries within technical provisions	38
Segmentation of recoverables	38
Calculation of recoverables	39
Allowance for counterparty default	40
Potential practical issues	41
Suggested approaches.....	41
Indicative results.....	43
EXPENSES.....	44
Inclusion of expense cashflows	44
Allocation of expense cashflows.....	44
Calculation of expense cashflows.....	44
Potential practical issues	45
Suggested approaches.....	45
Indicative results.....	46
BINARY EVENTS	47
Allowance for all possible future outcomes	47
Illustration of ‘binary events’	47
Potential practical issues	48
Suggested approaches.....	48
Indicative results.....	49
DISCOUNTING	50
Calculation of discounted best estimate provisions	50
Risk-free interest rate term structures	50
Determining the risk-free interest rate term structure	50
Extrapolation for longer-term insurance liabilities	51
Other issues	51
Potential practical issues	51
Suggested approaches.....	51
Indicative results.....	52
RISK MARGIN.....	53
General requirements	53
Risks to take into account within the risk margin	54
Calculation of the risk margin.....	54
Cost of capital rate.....	55
Simplifications.....	55
Quarterly calculations	55
Potential practical issues	56
Suggested approaches.....	56
Indicative results.....	57
ASSUMPTIONS AND USE OF EXPERT JUDGEMENT	58
Assumptions underlying technical provision calculation.....	58
Appropriateness of assumptions	58
Assumptions consistent with generally available (re)insurance risks.....	58

Assumptions consistent with financial market information.....	59
Use of expert judgement	59
Potential practical issues	60
VALIDATION AND BACK-TESTING	61
Validation	61
Requirements for validation.....	61
Back-testing or comparison against experience.....	62
Potential practical issues	62
Suggested approaches.....	62
DATA IMPLICATIONS	63
Data quality requirements	63
Deficiencies in data.....	64
Data quality management.....	65
Internal processes on identification, collection and processing of data	65
Issues of data quality in the context of a provisioning analysis and review	65
Potential practical issues	66
Suggested approaches.....	66
DOCUMENTATION	67
Documentation of technical provision calculation	67
Potential practical issues	67
APPENDIX 1	68
Extracts from Directive and Level 2 text	68
APPENDIX 2	100
Definitions.....	100
APPENDIX 3	102
References.....	102

INTRODUCTION

Solvency II

Solvency II seeks to create a harmonised, risk-based approach to supervision, solvency and capital requirements for insurers within the EU. The detailed content of the Solvency II regime, which is due to be implemented from October 2012, is still being developed. Lloyd's dry run process begins in June 2010 and technical provision evaluation is part of the process. This guidance for managing agents is based on Lloyd's current (as at March 2010) interpretation and has been reviewed by the LMA Solvency II working group.

Technical provisions are the largest item on an insurance undertaking's balance sheet, meaning an undertaking's financial strength is sensitive to movements in their value. Under Solvency II, major changes are proposed to the evaluation of technical provisions and the impact on reserving processes will be marked.

This guidance is intended to assist managing agents in moving to a Solvency II basis when valuing technical provisions. The guidance offers practical solutions in places but these should not yet be taken as Lloyd's requirements or rules. The document is solely intended to offer guidance to managing agents in this important area.

Solvency valuations are required alongside the current valuation basis under UK GAAP for accounting purposes.

Because best practice and legislation continue to develop, the guidance should be seen as indicative of requirements only. It should not be seen as final advice and managing agents are advised to aim for flexible approaches that can adapt as the underlying requirements are finalised. The guidance includes extracts of the relevant level 1 and proposed level 2 texts in places for reference.

Lloyd's will inform the market of any significant changes as they occur, especially following the release of the QIS5 specification. This will be through the normal Solvency II communication channels.

Solvency II technical provisions will have significant differences from current provisions, both in terms of structure and calculations required.

Technical provisions

Whilst some of the approaches and techniques applied under Solvency II will be similar to those followed currently, there are other areas where there will be major changes. Some of the more important and challenging requirements are listed below. All of these are discussed in more detail in the main document.

- Movement to a cashflow basis for valuation of both gross business and reinsurance
- Removal of any implicit or explicit margins within technical provisions to give a "true best estimate", defined as the mean of the full range of possible future outcomes
- Introduction of the valuation of very low probability extreme events including latent claims, referred to as "binary events"
- Removal of the requirements to hold an unearned premium reserve and to allow for other non-monetary items. These are replaced by "premium provisions", valued on a best estimate basis. This also includes a requirement to take account of all future premium cash inflows
- Movement to recognising contracts on a "legal obligation basis". This will mean the inclusion of business currently not valued as part of technical provisions - for example 1st January renewals entered into prior to the balance sheet date
- The basis for recognising existing contracts will also impact reinsurance contracts and their expected cashflows
- Introduction of discounting, leading to increased volatility in reserves
- Introduction of the principle of a market consistent basis and calculation of a Risk Margin (or Market Value Margin)
- Valuation of liabilities segmented by Solvency II lines of business
- Introduction of governance requirements for an explicit "actuarial function" with defined responsibilities
- Introduction of explicit data requirements
- Significant increases to documentation and validation requirements

- Introduction of explicit links to other areas of Solvency II such as internal models
- Introduction of the principle of proportionality that underlies the calculations

Lloyd's dry run process and QIS5

The first main test for technical provisions during the dry run process in 2010 will be the completion of QIS5. This will be mandatory for all syndicates and the exercise is expected to run from August – October 2010. Following QIS5, syndicates will have to calculate Solvency II technical provisions for each year-end and mid-year during the dry run process.

Though QIS4 was completed on a "best efforts" basis, such an approach will not be acceptable for QIS5. Syndicates are expected to complete QIS5 on as close to a full Solvency II basis as possible, i.e. aiming at the same standard as a formal regulatory return (e.g. the current FSA return). This document is designed to assist syndicates in completing QIS5 on a suitable basis.

The main elements of the guidance are summarised below and covered in more detail in the main guidance document.

Minimum segmentation

Solvency II requires technical provisions to be segmented by defined lines of business. There are also requirements to value the best estimate in all (significant) currencies.

Lloyd's view is that the fundamental underlying principle to ensure suitable and accurate assessment of best estimate technical provisions is to value the liabilities by homogeneous risk group, at least for calculation of undiscounted best estimates. Results on this basis may then require further allocation to significant currencies or aggregation to lines of business to finalise the calculation.

The Solvency II lines of business represent the minimum level of granularity at which to perform the calculation.

Best estimate cashflows

The technical provisions must be calculated gross using a cashflow basis with a separate explicit calculation for reinsurance, also using a cashflow basis. Further to the minimum segmentation noted above, the best estimate must also be split between claims and premium provisions for non-life business.

The cashflows will include future cash in-flows. Provisions are therefore net of future premium receipts which can make them negative. The inclusion of premium provisions and move to a cashflow basis is a major change to the Solvency I basis.

The best estimates must not include margins for optimism or conservatism. Reserves held in excess of the best estimate must be excluded from the technical provision calculation for solvency. Note that, under current proposals, any future profits recognised through the calculation of a best estimate premium provision (rather than the current unearned premium reserve approach) will be eligible as tier 3 capital only.

Cashflows must be discounted for the time value of money. The yield curves for major currencies to apply by currency will be supplied by supervisors and will be fixed for each valuation date.

Recognition of contracts

Another major change to the current basis is the system for recognising existing contracts. Under the legal obligation basis of Solvency II, all existing contracts must be valued, whether the contracts have incepted or not.

Distinct areas to be considered can be split into:

Business incepted at valuation date

- Gross claims cashflows within claims provisions (earned incepted business)
- Gross claims cashflows within premiums provisions (unearned incepted business)
- Gross future premium receivable (incepted business)

Business not incepted at valuation date

- Gross future premium and claims cashflows for policies not yet incepted by the valuation date, but already forming part of contractual obligations ("unincepted" business). These will form part of the premium provision.

For a 31 December valuation this will generally **include the 1st January renewals for the coming year.**

Reinsurance

The technical provisions are calculated gross, with reinsurance calculated separately under the same principles. Reinsurance recoveries will continue to allow for expected non-payment whether caused by default or dispute.

The Solvency II principles will introduce a number of new challenges, including:

- Considering different cashflows for gross claims and reinsurance recoveries including the timing of defaults or disputes
- Valuation of high layer non-proportional covers allowing for “all possible future outcomes”. This may require significant changes to some current techniques
- Recognition of existing contracts

Lloyd's view is that the **principle of correspondence** should underlie the calculation of reinsurance recoveries in the best estimate when considering which contracts to include. Two specific areas this would apply to under current proposals are:

1. Future reinsurance cover not yet bought that will cover existing inwards contracts (e.g. LOD cover incepting in the following year). Correspondence would include these contracts, as a future management action (assuming sufficient justification), and the expected proportion of the premium that applies to the existing inwards contracts would be included. By adopting this approach syndicates' technical provisions would typically increase.
2. Existing reinsurance contracts that will provide recoveries from inwards contracts that are NOT “existing” at the valuation date (e.g. RAD cover already purchased for the forthcoming year or existing LOD covers). Correspondence would only include expected recoveries on existing inwards contracts. Similarly to 1, any future premium should be apportioned to include only the expected cost relating to current existing inwards contracts. This is irrespective of the accounting treatment adopted by the managing agent to allocate reinsurance costs equitably across years of account.

Having an approach that relies on correspondence between the gross and net estimates is important in ensuring the calculation remains consistent.

Expenses

Managing agents should take into account all expenses that would be incurred in running-off the existing business, including a share of the relevant overhead expenses e.g. professional fees. This share should be assessed on the basis that the syndicate continues writing new business. Expense provisions under Solvency II would include items such as investment manager's costs that would not be covered under the current basis.

It is expected that expense provisions will be higher under Solvency II.

Binary Events

Under current approaches technical provisions only make allowance for items that are implicitly included within the data or are “reasonably foreseeable”. Under Solvency II the best estimate must have reference to “all possible outcomes”. This will include latent claims or very extreme high severity, low probability claims.

These items (both latent claims and extreme events) have been labelled “binary events” and adjustment will need to be made to ensure that they are included in technical provisions. This will lead to an increase in technical provisions.

Uncertainty

Gross and reinsurance cashflows should adequately recognise the uncertainty inherent within them, though not through the use of implicit or explicit prudence. This includes:

- Considering timing of cashflows
- Links between loss size, timings and reinsurance defaults
- Binary events

The recognition of uncertainty does not imply stochastic methods are necessary. It is envisaged that initially most current techniques will be adequate to fulfil the majority of Solvency II technical provision requirements (with adjustments to output). There may be requirements where existing methods will not be adequate in all circumstances and adjustments to existing methods or stochastic approaches may then need to be applied.

Wind-up basis

The calculations of technical provisions will be conducted on a going concern basis. However, a parallel exercise on a wind-up basis will need to be conducted. This needs to be done to assess available capital. If the value of technical provisions on a wind-up basis exceeds those on a going concern basis then the difference will not be eligible as tier 1 capital and rather will be classed as tier 3.

The wind-up basis will affect some elements of the calculation significantly, though it is currently envisaged that for non-life business the technical provisions assessed on a wind-up basis would normally be lower than on a going concern basis. This is an area where standardisation of approaches will see further development.

Risk margin (or Market Value Margin (MVM))

A risk margin increases the overall value of the technical provisions from the discounted best estimate to an amount equivalent to a theoretical level needed to transfer the obligations to another insurance undertaking.

Where the best estimate and risk margins are calculated separately, which is the case for the vast majority of non-life business, risk margins should be calculated using a cost of capital approach.

The cost of capital approach requires the risk margin to be calculated by determining the cost of providing an amount of eligible own funds equal to the Solvency Capital Requirement (SCR) necessary to support the current obligations over their lifetime. The introduction of a risk margin is a new concept compared to current practice.

It is envisaged that risk margins will be calculated, to some extent, using suitable simplifications.

Current proposals require the risk margin to be calculated at a line of business level, though this requirement is still being considered.

Process and methodology

Valuation of technical provisions requires the collection of qualitative and quantitative information on the underlying liabilities and the application of expert judgment to that information. Valuation of technical provisions should, therefore, not be entirely model-driven.

The valuation process includes the following elements:

- Collection and analysis of data
- Determination of assumptions
- Modelling, parameterisation and quantification
- Expert review of estimation
- Controls
- Documentation

Assumptions

Assumptions used within the calculation of Solvency II technical provisions must be consistent both with financial market information and “generally available” insurance risk data. They must be documented, justified and validated in line with the validation and back-testing requirements.

Validation and back-testing

Validation techniques are defined as the tools and processes used throughout the process to ensure that the valuation methods, assumptions and results of the technical provision calculation are appropriate and relevant.

Actual versus expected analyses will form a significant part of the validation process.

The whole valuation process itself should also be reviewed and verified by someone who has adequate knowledge and skills and is independent of the process of valuation.

Data implications

The data underlying the calculation needs to be accurate, complete and appropriate.

The appropriateness and completeness of the data is the responsibility of the actuarial function while the accuracy is the responsibility of the internal audit function.

Data requirements will need careful consideration and may require changes to current methods or data sources. Also the data that needs to be collected, for example to include valuation of unaccepted business, will certainly need to be expanded when compared to current reserving exercises.

Documentation

As with all other processes under Solvency II, all steps in the technical provisions valuation process will need to be thoroughly documented. The results should be shared with relevant business experts and their views should be captured and included in the feedback loop, where appropriate.

The test standard that may be applied is whether another, suitably skilled, individual could reproduce the results based on the documentation and data alone.

Actuarial function

Solvency II explicitly requires firms to have an actuarial function with defined responsibilities.

The valuation of technical provisions must be overseen by an actuarial function, though this does not need to be an individual. The actuarial function does not necessarily need to be an actuary, but must possess and be able to demonstrate sufficient relevant qualifications, experience and knowledge of actuarial approaches, including;

- An understanding of the stochastic nature of insurance and the risks inherent in assets and liabilities, including the risk of a mismatch between assets and liabilities
- An understanding of the use of statistical models
- Experience of and expertise in the setting of provisions for non-life insurance business (and life business at Lloyd's where relevant)

So far there has been no detailed guidance on the actuarial function although this is covered within Lloyd's main dry run guidance.

General principles

There are a number of general principles which underlie Solvency II and several of these will apply in the calculation of technical provisions. The key principles for calculation of technical provisions are listed below and then discussed further as part of the detailed guidance:

- The selection and use of adequate and appropriate valuation techniques
- The use of expert judgement, which must be justified
- Allowing for future management actions, the effect of which are likely to be disclosed
- Proportionality, for which any simplifications must be justified in some detail

POTENTIAL IMPACT AT LLOYD'S

Lloyd's technical provisions

The impact on technical provisions can be significant. QIS4 saw a reduction of £5.1bn in technical provisions at an aggregate Lloyd's Market level when moving to a "Solvency II basis". However, QIS4 was valued as at 31 December 2007, on a best efforts basis and elements of the underlying requirements have changed since QIS4.

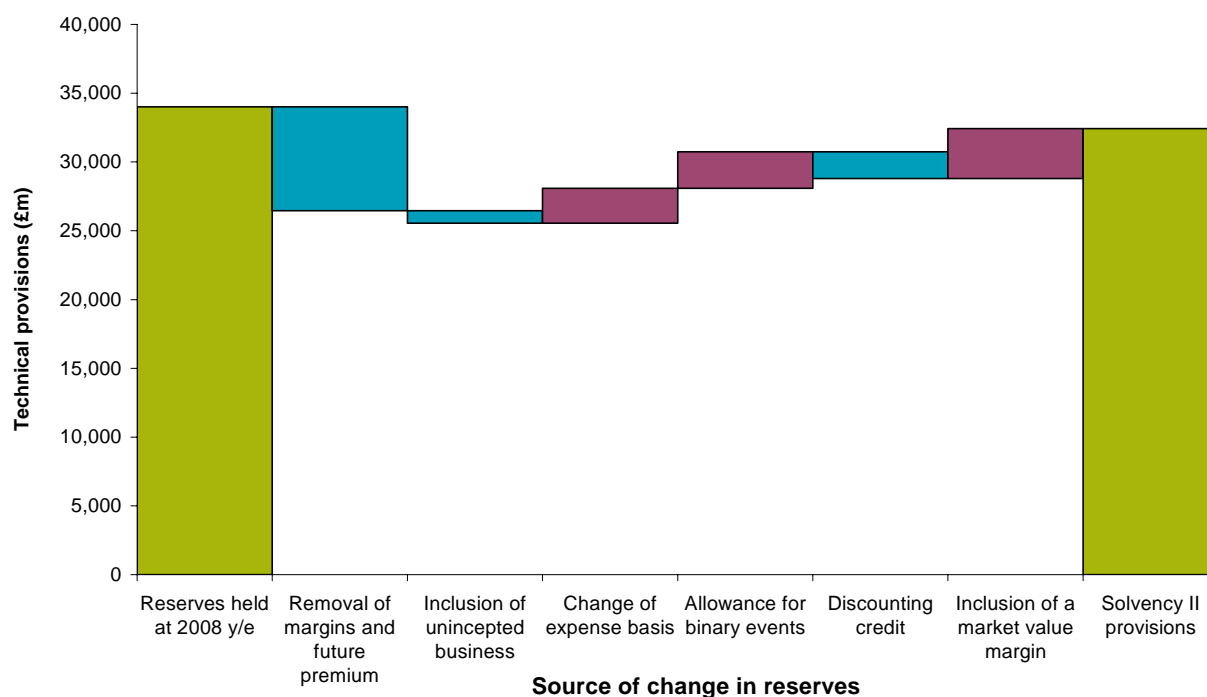
Since year-end 2007 there has been a reduction in fixed interest yields which will impact discounting significantly. Lloyd's has estimated the aggregate Solvency II technical provision requirements as at 31 December 2008. Lloyd's has also estimated the impact of changing from yield curves as at 31 December 2007 to 31 December 2008. All currently held reserves have been reallocated into the appropriate Solvency II lines of business. The results are as follows:

Lloyd's net technical provisions as at 31 December 2008, by Solvency II class of business Estimated Solvency II basis

Solvency II class of business	Solvency II basis £m	Currently held £m	% Change
Third-party liability	11,563	11,729	(1%)
Marine, aviation and transport (MAT)	6,426	7,221	(11%)
Fire and other damage to property	6,002	6,109	(2%)
Non proportional reinsurance – Property	4,406	3,976	11%
Motor, other classes	1,203	1,288	(7%)
Non proportional reinsurance – MAT	1,093	1,096	(0%)
Health (other)	748	996	(25%)
Credit and suretyship	646	803	(19%)
Non proportional reinsurance - Casualty	516	408	27%
Motor, third party liability	402	446	(10%)
Assistance	36	8	347%
Legal expenses	31	36	(14%)
Miscellaneous non-life insurance	-	(110)	(100%)
Total	33,071	34,006	(3%)

Source: Lloyd's Market Reserving and Capital Department, January 2010. Large relative differences on Assistance and Miscellaneous non-life insurance are caused by data mapping rather than valuation differences on these small classes.

Change from reserves held at 2008 year-end to Solvency II basis reserves



Impact on technical provisions in the balance sheet

The impact on a Solvency II balance sheet is also marked with a number of items appearing or disappearing from technical provisions. For example, unearned premium items do not exist under Solvency II.

For illustration purposes only, Lloyd's has estimated an aggregate Solvency II balance sheet for technical provisions as at 31 December 2008. This is based on a number of broad assumptions and simplifications and is therefore only designed to illustrate the potential for change in the balance sheet under Solvency II. Note that the premium provision is negative, due to the requirement to allow for future premium cash in-flows and future profits. The composition of the balance sheet is also key to internal models under Solvency II given they are designed to project the balance sheet in 1 year's time following a 1:200 year event.

Market Solvency II balance sheet as at 31/12/2008

Solvency II balance sheet	Expected cashflows £m
Gross reserves	
Gross outstanding claims provisions	38,810
Gross premium provisions	(919)
Total gross reserves	37,891
Recoverables from reinsurance contracts and special purpose vehicles	
In respect of outstanding claims provisions	(10,059)
In respect of premium provisions	1,607
Total recoverables	(8,452)
Risk margin	3,632
2008 year-end Solvency II net technical provisions	33,071

Source: Lloyd's Market Reserving and Capital Department, January 2010

GENERAL REQUIREMENTS

There are a number of general requirements that underlie the calculation of technical provisions for Solvency II:

Basis of calculation

The underlying basis of calculation of technical provisions under Solvency II is an on-going basis which values undertakings as going concerns. In the context of technical provisions, the main impact is to assume contracts run to their maturity and a proportion of expected future costs (such as general overheads) will be covered by future business. If an undertaking is not expecting to write future business then the relevant basis would be a run-off basis. The main difference of a run-off basis from an on-going basis is that future costs cannot be assumed to be proportionally covered by future business. In general the expense provisions are higher under a run-off basis. This basis is consistent with current UK GAAP.

An additional requirement under Solvency II is to also value technical provisions on a wind-up basis. If the wind-up basis is higher than the on-going (or run-off) basis then the difference will not be eligible as tier 1 capital and rather will be classed as tier 3.

A wind-up basis differs significantly to an on-going basis with key differences of:

- Assuming that no future business is written
- Not assuming the business is transferred to a reference undertaking
- Valuing all unexpired exposures on a replacement basis
- Valuing earned exposure as the expected cost of settling obligations

The underlying assumptions for calculating a wind-up basis will differ significantly from an on-going basis. The assumptions are the responsibility of the actuarial function and should be documented clearly.

Use of adequate techniques

The responsibility for the choice of adequate techniques for the best estimate liability calculation rests with the managing agent and specifically the actuarial function. However, Lloyd's may require, giving reasons, the reassessment of the technical provisions, using an alternative technique, if this reassessment or the use of a different technique is believed to better reflect the objective of the valuation. This is consistent with current practice where Lloyd's Valuation of Liabilities Rules can, but rarely do, impose specific requirements.

The valuation of the best estimate shall meet the following requirements:

- The managing agent must be able to demonstrate appropriateness of the valuation, including the robustness of the techniques and assumptions used, having regard to the nature, scale and complexity of risks. In order to meet this requirement, a managing agent must be able to provide sound rationale for the choice of one technique over other relevant techniques.
- The managing agent must assess the degree of judgment required in each method and to what extent it is able to carry out such judgment in an objective and verifiable manner.
- The managing agent must be able to demonstrate that the valuation techniques and underlying assumptions are realistic and reflect the uncertain nature of the cash-flows (but without the addition of prudence).
- Valuation techniques must be chosen on the basis of the nature of the liability being valued and from identification of risks which materially affect the underlying cash-flows. For example, it may be appropriate to use different techniques for attritional, major and catastrophe losses.
- The assumptions underlying the valuation technique must be validated and reviewed by the managing agent.
- Any valuation technique and its results must be capable of being audited.
- If data is grouped, the managing agent must be able to demonstrate that the grouping process appropriately creates homogeneous risk groups that allow for the risk characteristics of the individual policies. This applies to either claims or policy data.
- Having regard to the previous bullet points, i.e. having ensured that valuation techniques are appropriate and robust given the nature, scale and complexity of the risk, managing agents must ensure that their capabilities (e.g. actuarial expertise, IT systems) are commensurate with the actuarial and statistical techniques used.

The assumptions must appropriately reflect the uncertainty inherent in the cashflows (though without the addition of prudence). Note that this does not necessarily imply best estimates have to be calculated using a stochastic methodology and the only requirement is correspondence to the probability-weighted average. Also, the best estimate must be the average of the discounted cashflows and not the discounted average of the cashflows, where this is different.

Appropriate valuation techniques

Valuation techniques considered to be appropriate actuarial and statistical methodologies to calculate the best estimate include simulation, deterministic and analytical techniques, or a combination thereof.

When considering the valuation technique, managing agents shall consider the following factors, subject to proportionality:

- Whether or not the cash-flows are materially path-dependent.
- Whether there are material non-linear inter-dependencies between several drivers of uncertainty.
- Whether the cash-flows are materially affected by potential future management actions.
- The presence of risks having a material asymmetric impact on the value of the cash-flows. In particular, this would include contracts with embedded options and guarantees or if there are “complex” reinsurance contracts in place.
- Whether the value of options and guarantees is materially affected by the policyholder behaviour assumed in the model.
- The availability of relevant data.

For the estimation of non-life best estimate liabilities, deterministic and analytical techniques may be more appropriate than simulation techniques. This may be the case because:

- Deterministic methods are usually the starting point for any estimation of best estimate. The application of simulation techniques can add useful insight into ranges around the mean and measures of uncertainty but they will not necessarily produce more accurate estimates of the best estimate due to the significant degree of uncertainty in the calibration of stochastic models.
- The best estimate of simulation and deterministic methods may well be the same, not least because deterministic results are often used to calibrate simulation methods, meaning that the best estimate for Solvency II purposes will be the same for either method.

Both deterministic and simulation models are parameterised by the historic data available. Therefore, regardless of whether a deterministic or simulation model is used, the resulting mean estimates will normally be based on development seen in the history and will not contain "all possible future outcomes".

Also, regardless of the technique, judgment is required in making additions or adjustments to the estimates to allow for circumstances not included in the history that need to be incorporated into the best estimates (for example, latent claims and binary events – see Binary Events section). In all the methods, judgment is a fundamental requirement.

Use of simplified methods

The term "simplified method" refers to a situation where a specific valuation technique has been simplified in line with the proportionality principle, or where a valuation method is considered to be simpler than a certain reference or benchmark method. In practice, every method is likely to have some degree of simplification.

The set of available methods needs to be categorised as "simplified" or "non-simplified".

Future management actions

The methods and techniques for the estimation of future cash-flows, and hence the assessment of the provisions for insurance liabilities, may take account of future management actions. Any allowance should include the time taken to implement the underlying actions.

In particular, buying of future reinsurance is a future management action and can be included in an assessment of technical provisions. Existing inwards business is normally written on the assumption that future reinsurance will be purchased to cover its run-off. Therefore, in calculating the net best estimate, the costs of future reinsurance should be included if this represents a reasonable assumption about future management actions. Supporting evidence will be required for such assumptions. An agent should make allowance for the proportion of the reinsurance to be purchased in the future that would provide cover for the risks that are "existing" as at the valuation date. Managing

agents have primary responsibility for verifying whether their future management actions are objective, realistic and verifiable. If these criteria cannot be demonstrated, the management action should not be taken into account.

The assumptions used to project the cash-flows should reflect the actions that management would reasonably expect to carry out in the circumstances of each scenario over the duration of the projection. This implies that future reinsurance should be anticipated in calculating gross and (by extension) net best estimates.

Objectivity

Objectivity means that for the purpose of the calculation of the best estimate the managing agent should define what future management actions will be taken and when each would be taken. This will need to cover all scenarios which are relevant for the valuation of the best estimate.

For example, future reinsurance costs will necessarily reflect events in the period before the reinsurance is purchased. The assumptions used at the valuation date should include allowance for all scenarios and sufficient evidence for those assumptions will be required.

For this purpose, managing agents should maintain a comprehensive plan which outlines the future management actions which may be used and the extent/circumstances to which they can expect to be used. The plan should include:

- Documentation with a clear description of the situations that trigger the future management actions and their rationale.
- Documentation of the processes by which the future management actions will be carried out.
- Documentation of the ongoing work required to ensure that the managing agent is in a position to carry out the management action in question.
- Description of the order of exercise of the future management actions where the order of application has an influence on the outcome.
- Identification of the persons whose responsibility it is to ensure that the future management actions are carried out.
- Clarification of how the planned action has been reflected in the calculation of the best estimate.
- Sign-off from the board or delegated sub-committee on each of the above points.
- Description of the back-testing controls.
- Description of the reporting procedures to apply, which should include at least an annual report to the board of the managing agent.

For a reinsurance undertaking, the liability will depend on the future management actions taken by the cedant undertaking as well. In this case, the reinsurer's technical provisions could be larger than the insurer's credit taken for the same block of business. Moreover, the reinsurer may consider the future management actions of the cedant insurer as "policyholder's behaviour", provided the assumptions in this respect meet the requirements generally set out for the rest of assumptions used in the calculation of the technical provisions.

Realism

Realism should be interpreted as meaning that the managing agent considers it both possible and also realistic that it will carry out such actions in the circumstances being considered. Realism also implies consistency with the managing agent's current principles and practices in running its business, unless there is sufficient current evidence that the managing agent will change its practice and has taken the necessary steps to implement this change.

Future management actions in different scenarios shall be internally consistent when calculating the best estimate. Furthermore, extreme scenarios shall consider the effect of future management actions consistently with the recalculation for the SCR. In particular, the future management actions shall also consider that, in some scenarios, such actions may be not applied due to practical considerations.

The managing agent should also estimate the time taken to implement changes, any costs associated with these actions, and any likely changes to policyholder behaviour following these future management actions. The cash-flows included in the technical provisions should reflect this accordingly.

Verifiability

Verifiability should be interpreted as meaning that there is sufficient evidence to demonstrate that the future management actions are objective and realistic. In particular, the assumptions should be verifiable from the following:

- The comprehensive plan and documentation discussed under objectivity.
- From public indications, if available, that it would expect to take (or not take) the action in the type of circumstance being considered.
- Through the comparison of assumed future management actions and management actions actually taken by the managing agent in previous years; the managing agent should document and be able to explain any relevant deviations.
- Through the comparison of future management actions taken into account in the current and in the past valuations; the (re)insurance undertaking should document and be able to explain any significant change in the expected future management actions.
- Through the quantification of the effect of future management actions either individually or in aggregate.

The level of justification required for a given management action will depend on the impact of that management action. The effect of management actions assumed within the determination of the technical provisions may have to be publically disclosed.

Proportionality

The principle of proportionality underpins Solvency II and is intended to support the consistent application of the principle-based solvency requirements for all insurance and reinsurance undertakings. The application of proportionality can have a very significant impact on expected actions and managing agents need to consider the application carefully.

The managing agent is responsible for applying appropriate methods to calculate the technical provisions taking into account the **nature, scale and complexity** of the risks. The risks to be considered, in this context, include all those which materially affect the amount or timing of cash-flows required to settle the contracts in the portfolio to be valued. The managing agent should be able to explain what methods are used and why the specific methods are selected.

In assessing whether a valuation method could be considered proportionate to the underlying risks, the managing agent should have regard to the following steps:

Step 1: Assessment of nature, scale and complexity

The managing agent should assess the nature, scale and complexity of risks underlying an undertaking's insurance obligations

Assessment of nature and complexity

The nature and the complexity of a risk are closely related, and for the purposes of an assessment of proportionality could best be characterised together. Indeed, complexity could be seen as an integral part of the nature of a risk, which is a broader concept. In mathematical terms, the nature of the risks underlying the insurance contracts could be described by the probability distribution of the future cash flows arising from the contracts. This encompasses the following characteristics:

- The degree of homogeneity of the risks
- The variety of different sub-risks or risk components of which the risk is comprised
- The way in which these sub-risks are interrelated with one another
- The level of certainty, i.e. the extent to which the future cash flows can be predicted
- The nature of the occurrence or crystallisation of the risk in terms of frequency and severity
- The type of the development of claims payments over time
- The extent of potential policyholder loss, especially in the tail of the claims distribution

The first three bullet points in the previous paragraph are related to the complexity of risks generated by the contracts, and are difficult to separate in practice.

When assessing the nature and complexity of the insured risks, additional information in relation to the circumstances of the particular portfolio should be taken into account. This could include:

- The type of business from which the risks originate (e.g. direct business or reinsurance business)

- The degree of correlation between different risk types, especially in the tail of the risk distribution
- Any risk mitigation instruments applied, and their impact on the underlying risk profile

The managing agent should also seek to identify factors which would indicate the presence of more complex and/or less predictable risks. The degree of complexity or uncertainty of the risks is associated with the level of calculation sophistication and/or level of expertise necessary to carry out the valuation. In general, the more complex the risk, the more difficult it will be to model and predict the future cash flows required to settle the obligations arising from the insured portfolio.

To analyse and quantify more complex and/or less predictable risks, more sophisticated and elaborate tools will generally be required, as well as sufficient actuarial expertise. However this needs to be balanced against the available data (which may be sparse) and emphasises the need for appropriate actuarial expertise in these circumstances.

Assessment of scale

Assigning a scale introduces a distinction between "small" and "large" risks. The managing agent may use a measurement of scale to identify (sub-)risks where the use of simplified valuation methods would likely to be considered proportionate to the underlying risks, provided this is also commensurate with the nature and complexity of the risks.

A measurement of scale may also be used to introduce a distinction between material and non-material risks. Introducing materiality in this context would provide a threshold or cut-off point below which it would be regarded as justifiable to use simplifications for certain risks.

To measure the scale of risks, further than introducing an absolute quantification of the risks, the undertaking will also need to establish a benchmark or reference volume which leads to a relative rather than an absolute assessment. In this way, risks may be considered "small" or "large" relative to the established benchmark. Such a benchmark may be defined, for example, in terms of a volume measure, such as premiums or technical provisions that serves as an approximation for risk exposure.

To determine an appropriate benchmark for a relative measurement of scale, it is important to specify at which level the assessment is carried out; a risk which is small with regard to the business as a whole may still have a significant impact within a smaller segment, e.g. a certain line of business.

At least the following four different levels may usefully be distinguished in the context of a calculation of technical provisions:

- Individual homogeneous risk groups;
- Individual line of business;
- The business of the syndicate as a whole; and
- The group to which the syndicate belongs.

Following this principles-based framework, managing agents would be expected to use an interpretation of scale which is best suited to the specific circumstances of each managed syndicate and to the risk profile of their portfolio. Whatever interpretation of scale for risks or obligations is followed, this should lead to an objective and reliable assessment.

Step 2: Assessing model error

The managing agent should assess whether a specific valuation method can be regarded as proportionate to the nature, scale and complexity of the risks identified in Step 1. Where simplified approaches are used, this could introduce additional model error. The higher the model error, the less reliance can be placed on the suitability of the estimate derived from that model to represent a market-consistent valuation.

The managing agent shall assess the error that results from the use of a given valuation method and should be considered proportionate if the model error is non-material. For this purpose the managing agent should define a concept on materiality which specifies the criteria on the basis of which a decision on the materiality of a potential misstatement of technical provisions is made. The materiality concept should be reflected in the undertaking's ORSA.

When determining how to address materiality, the managing agent should have regard to the purpose of the work and its intended users. For a valuation of technical provisions and, more generally, for a qualitative or quantitative assessment of risk for solvency purposes, this should include both Lloyd's and the FSA.

An assessment of the model error may be carried out, by:

- Sensitivity analysis in the framework of the applied model: this means to vary the parameters and/or the data thereby observing the range where a best estimate might be located.
- Comparison with the results of other methods: applying different methods gives insight into potential model errors. These methods would not necessarily need to be more complex.
- Descriptive statistics: in some cases the applied model allows the derivation of descriptive statistics on the estimation error contained in the estimation. Such information may assist in quantitatively describing the sources of uncertainty.
- Back-testing: comparing the results of the estimation against experience may help identify systemic deviations which are due to deficiencies in the modelling.

The managing agent is not required to quantify the degree of model error in precise quantitative terms, or to recalculate the value of its technical provisions using a more accurate method in order to demonstrate that the difference between the result of the chosen method and the result of a more accurate method is immaterial. Instead, it would be sufficient for the undertaking to demonstrate that there is reasonable assurance that the model error implied by the application of the chosen method (and hence the difference between the two amounts) is immaterial.

Where several valuation methods are appropriate, the managing agent should normally apply the one which is most appropriate but retain a regard for consistency over time. Where a valuation technique is expected to lead to a significant degree of model error then, where practicable, an alternative, more appropriate method should be applied instead.

In some circumstances, it may be unavoidable to apply a valuation method that has material model error. In such cases, the managing agent should document that this is the case and consider the implications with regard to the reliability of the valuation and its overall solvency position. In particular, it should assess whether the increased level of estimation uncertainty is adequately addressed in the determination of the SCR and the setting of the risk margin in the technical provisions.

Step 3: Back-testing

The actuarial function should track the appropriateness of best estimates over time. Where such back-testing identifies systematic deviation between best estimate expectations and experience, the steps to assess whether the chosen valuation methodology is appropriate should be performed again. If it is deemed not to be appropriate, the managing agent should switch to a more appropriate method.

Such a check should also take place following a significant change in risk profile. The scope and the frequency of back testing should be proportionate to the materiality of assumptions and the size of the deviation.

SEGMENTATION

The majority of this section's requirements are based on paragraphs 3.35 to 3.52 of CEIOPS final advice DOC 22/09.

As a minimum, managing agents must segment each managed syndicate's obligations into the prescribed lines of business when calculating their technical provisions. Further segmentation into homogeneous risk groups should be applied, as appropriate. A homogeneous risk group is set of obligations which are managed together and which have similar characteristics. The classification will be specific to each syndicate.

The use of apportionments from internal class used to manage business to Solvency II line of business is expected. Lloyd's view is that the **fundamental split** that should drive the calculation of best estimates within technical provisions is a split into **homogeneous risk groups**. This will ensure results of any such assessments will be as reliable and credible as is possible.

The principle of substance over form should be followed in segmenting contracts between lines of business. In other words, the segmentation should reflect the nature of the risks underlying the contract (substance), rather than the legal form of the contract (form). This means an approach of calculation at a homogeneous risk group and then appropriate allocation, with justification, would be acceptable.

Minimum lines of business (Non-Life)

The minimum lines of business for which non-life technical provisions must be calculated under Solvency II are:

1 Accident

Obligations caused by accident or misadventure, but excluding obligations considered as workers' compensation insurance.

2 Sickness

Obligations caused by illness, but excluding obligations considered as workers' compensation insurance.

3 Workers' compensation

Obligations covered with workers' compensation insurance, which insures accident at work, industrial injury and occupational diseases.

4 Motor vehicle liability

Obligations which cover all liabilities arising out of the use of motor vehicles operating on the land, including carrier's liability.

5 Motor, other classes

Obligations which cover all damage to or loss of land motor vehicles, land vehicles other than motor vehicles, and railway rolling stock.

6 Marine, aviation and transport

Obligations which cover all damage or loss to river, canal, lake and sea vessels, aircraft, and damage to or loss of goods in transit or baggage, irrespective of the form of transport. Also obligations which cover all liabilities arising out of the use of aircraft, ships, vessels or boats on the sea, lakes, rivers or canals, including carrier's liability irrespective of the form of transport.

7 Fire and other damage

Obligations which cover all damage to or loss of property other than motor, marine, aviation and transport due to fire, explosion, natural forces including storm, hail or frost, nuclear energy, land subsidence and any event such as theft.

8 General liability – Third party liability

Obligations which cover all liabilities, other than those included in motor vehicle liability and marine aviation and transport.

9 Credit and suretyship

Obligations which cover insolvency, export credit, instalment credit, mortgages, agricultural credit and direct and indirect suretyship.

10 Legal expenses

Obligations which cover legal expenses and cost of litigation.

11 Assistance

Obligations which cover assistance for persons who get into difficulties while travelling, while away from home or while away from their habitual residence.

12 Miscellaneous non-life insurance

Obligations which cover employment risk, insufficiency of income, bad weather, loss of benefits, continuing general expenses, unforeseen trading expenses, loss of market value, loss of rent or revenue, indirect trading losses other than those mentioned before, other financial loss (not trading), as well as any other risk of non-life insurance business not covered by the lines of business mentioned before.

Inwards proportional non-life reinsurance must be segmented, as a minimum, into the lines of business above. Inwards non-proportional reinsurance must be segmented, to a minimum level, into the following lines of business:

13 Property

14 Casualty

15 Marine, aviation and transport

Further detail on each line of business is available in Appendix 1.

Minimum lines of business (Health)

Health insurance obligations written on a similar technical basis to non-life insurance are known as Non-SLT Health obligations ("Similar to non-Life Techniques") and must be segmented into Accident, Sickness or Workers' compensation lines of business, as above.

Health insurance obligations pursued on a similar technical basis to that of life insurance are known as SLT Health obligations and should be segmented and valued according to the segmentation for life insurance obligations.

Minimum lines of business (Life)

Life insurance and reinsurance business shall be segmented into 16 lines of business, as follows:

- 1 Contracts with profit participation clauses
- 2 Contracts where policyholder bears the investment risk
- 3 Other contracts without profit participations clauses
- 4 Accepted reinsurance.

Each of these should further be segmented into:

- a Contracts where the main risk driver is death
- b Contracts where the main risk driver is survival
- c Contracts where the main risk driver is disability/ morbidity risk
- d Savings contracts (contracts that resemble financial products providing no or negligible insurance protection).

Life insurance obligations shall be allocated to the line of business that best reflects the technical nature of the underlying risks.

Annuities relating to non-life and health policies

If non-life or health insurance policies give rise to the payment of annuities whose estimate requires the use of appropriate life actuarial techniques, the provisions for claims outstanding should be carried out separately for annuities and other claims. For premium provisions, a separate calculation of annuity obligations should be performed if a substantial amount of incurred claims will give rise to the payment of annuities.

Significant changes to the discount rates used (which will have to be risk-free) to value these liabilities will have major effects on the provisions required under Solvency II.

Contracts covering multiple lines of business and "unbundling"

Contracts covering risks from non-life and life business should be unbundled into their life and non-life parts. Contracts covering risks under different lines should be unbundled or allocated into the appropriate lines of business.

A contract covering life obligations should always be unbundled according to the top-level segments (life minimum lines of business 1-4) defined above. It should be further unbundled to the second level of segmentation in circumstances where it:

- covers a combination of risks relating to different lines of business; and
- could be constructed as stand-alone contracts covering each of the different risks.

Subject to the principle of proportionality, unbundling may not be required in cases where there is one major risk driver. In this case, the contract may be allocated according to the major risk driver. The principle of substance over form should also be applied in allocating each of the unbundled components to different lines of business.

Homogeneous risk groups for calculation of best estimates

The principle of substance over form should be followed in segmenting contracts between lines of business. In other words, the segmentation should reflect the nature of the risks underlying the contract (substance), rather than the legal form of the contract (form).

Syndicates are expected to further split lines of business beyond the prescribed minimum lines of business into homogeneous risk groups for calculation and projection purposes. These are sets of obligations which are managed together and which have similar characteristics. This classification is specific to each syndicate.

The risks within each group should be sufficiently similar as to allow for a reliable valuation of technical provisions. This will require segmentation of risks of the same line of business and written in the same currency but with different underlying risk profiles (see below).

As with standard actuarial techniques, large individual claims will be separated from the remainder of the homogeneous risk group if this would otherwise distort results or be considered to produce a more reliable valuation.

Homogeneous risk groups should be considered the most important segmentation level for modelling technical provisions and it is this level that should be considered first by agents. In the event that a homogeneous risk group contains risks falling to more than one of the minimum Solvency II lines of business, agents should use reasonable methods to allocate the results of the calculation to these lines of business.

Currency groups

The best estimate should be calculated separately for obligations of different currency. This should be on a settlement currency basis, reflecting the best estimate of how the cash flows will be settled.

The requirement for best estimates to be calculated by currency shall have proportionality applied. Lloyd's current view is that calculating best estimates by homogeneous risk groups is a key principle. This means that syndicates must have the ability to provide best estimates split by significant currency; this split may be based on an allocation. The definition of significant currency will vary by syndicate but in most cases this will include USD, GBP, CAD, EUR, JPY, CHF, AUD, ZAR and HKD. "Other" currencies can be then grouped into a single group or combined with an existing significant currency e.g. GBP.

Agents should consider whether exchange rates used to convert to settlement currencies (the level at which technical provisions are calculated) are consistent with financial market data on future rates, as per the requirements for validation and selection of assumptions.

Cashflows are required to be discounted using a risk-free interest rate term structure that is appropriate to the currency¹. Homogeneous risk groups will therefore also need to be defined by or allocated to currency.

Syndicates should consider where risks have a mismatch between currency of settlement and location of risk. Segmenting by homogeneous risk group may require that such risks are separated out. This may affect, for example, business located outside the USA that is written in USD, or business written in the Eurozone but in locations where underlying risk characteristics are significantly different.

Syndicates should also consider data availability in setting up homogeneous risk groups by currency, to ensure that appropriate discount rates are available.

¹ See article 77 (2) of the Framework directive (November 2009 version)

Potential practical issues

Homogeneous risk groups

The required high level segmentation may not match the way the business is managed, either in relation to technical provisions or capital modelling. For instance, some syndicates may not separate proportional reinsurance from other reinsurance in such a way that allows allocation to the required lines of business. If changes are required, historic data will need to be rebased in line with required segmentation.

Data may not currently be collected at the level required for mapping risks to a single Solvency II line of business which would require apportionments for some classes of business until the required data can be obtained. As part of QIS4 Lloyd's issued a document detailing how current Lloyd's risk codes map to the required Solvency II lines of business, though some classes may still require approximate apportionment under the current risk code system. An updated version will be provided as part of the QIS5 preparation.

It will be the actuarial function's responsibility to decide on applying proportionality with regard to segmentation.

Unbundling multiple lines of business

Unbundling life and non-life parts of some policies may be challenging. This may affect business such as Accident & Health or Travel insurance, where there may also be an amount of life cover. There may also be problems when unbundling non-life contracts where a single policy has constituent parts falling within different Solvency II lines. For example, motor policies may cover both property and liability risks. Where more than one of these parts is material, the proportionality principle means that the unbundling requirement cannot be ignored.

There may be large changes in reserving practices for any Health policy that would fall into the Solvency II "SLT Health" line of business where these would have to be valued in line with Solvency II life valuation requirements.

Suggested approaches

Possible methodologies

Technical provisions must be calculated using at least the level of segmentation detailed above, and for obligations of different currency. Homogeneous risk groups will need to be defined at a lower level of granularity. These requirements may mean that class of business groupings used by syndicates need to be adjusted, as well as historic data used as part of the reserving process.

Syndicates should start with their current classes of business and currency splits. The high level considerations will then be:

- Do these classes allow for the business to be directly segmented into Solvency II lines of business?
- Do these splits result in all significant currencies being calculated separately?
- Do these splits involve bundled contracts?
- Does the current split leave homogeneous risk groups?
- Are there any additional data requirements to meet the Solvency II splits
- Are the proposed splits consistent with the internal model?

The actuarial function will need to consider all these points.

CALCULATION OF BEST ESTIMATE AND CASHFLOWS

Solvency II technical provisions are made up of the sum of a best estimate and a risk margin. This section gives an overview of the approach for calculating the best estimate. The risk margin is discussed in a separate section of this document.

The majority of this section's requirements are based on paragraphs 3.79 to 3.117 and 3.28 to 3.38 of CEIOPS final advice DOCs 33/09 and 21/09 respectively.

The best estimate must be valued on a cashflow basis, incorporating all expected cash inflows and outflows related to existing obligations. This is a major change from the current requirements.

Extract from Level 2 text Article 77(2): Calculation of the technical provisions

The best estimate shall correspond to the probability-weighted average of future cashflows, taking account of the time value of money (expected present value of future cashflows), using the relevant risk-free interest rate term structure.

The calculation of the best estimate shall be based upon up-to-date and credible information and realistic assumptions and be performed using adequate, applicable and relevant actuarial and statistical methods.

The cash flow projection used in the calculation of the best estimate shall take account of all the cash in- and out-flows required to settle the insurance and reinsurance obligations over the lifetime thereof.

The best estimate shall be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. Those amounts shall be calculated separately, in accordance with Article 81.

Requirements for cashflow projections

The best estimate must be calculated gross, with separate calculation of the amounts recoverable from reinsurance contracts and special purpose vehicles. In the case of co-insurance the cash-flows of each co-insurer should be calculated as their proportion of the expected cash-flows without deduction of the amounts recoverable from reinsurance and special purpose vehicles.

As discussed in the Segmentation section, there are minimum requirements for the segmentation of technical provision calculation by line of business, currency and homogeneous risk group.

The cashflow projection used in the calculation of the best estimate shall take account of all potential cash in- and out-flows required to settle the insurance and reinsurance obligations over their lifetime. Therefore all cashflows incurred in meeting liabilities should be identified and valued but there is no explicit requirement to calculate all cashflows separately.

Examples of cash in- and out-flows which must be taken into account are shown below:

Inwards cashflows

- Future premiums due for incepted contracts (on both earned and unearned business)
- Future premiums due for unaccepted contracts (see Premium Provisions section)
- Adjustment premiums
- Inwards reinstatement premiums due
- Recoverables for salvage and subrogation
- Recoverables from reinsurance contracts and special purpose vehicles (for calculation of net best estimates)
- Cashflows relating to investment returns should NOT be included.

Outwards cashflows

- Benefits (including claims payments) payable to policyholders or beneficiaries
- Expenses incurred in servicing (re)insurance obligations (see Expenses section)
- Other gross cashflows, such as taxation directly relating to settling of insurance obligations (though this is unlikely to be an issue for most of Lloyd's business)

- Premiums payable in respect of reinsurance contracts and special purpose vehicles (for calculation of net best estimates).

Projected cashflows must also take into account the time value of money to give discounted best estimate provisions, as described further in the Discounting section.

Appropriate allowances for future inflation must be included within the cashflow projections. Care should be taken to identify the type of inflation to which particular cash flows are exposed (i.e. consumer price inflation or salary inflation), which may differ significantly by class of business. Development factor methods are normally based on implicit assumptions regarding claim inflation. Agents should consider whether historic inflation assumptions implicit within the data are appropriate for future cashflows.

Best estimate cash-flow projections should make appropriate allowances either implicitly or explicitly for the following:

Possible changes in future cashflows due to claims environment

- Demographic
- Legal
- Medical
- Technological
- Social or economic

Contract features

- Options or guarantees
- Policyholder behaviour (such as likelihood of lapse or cancellation)
- Future management actions (discussed in General Requirements section)
- Distribution of benefits

Time horizon

The time horizon used in the calculation of the best estimate should be the full lifetime of the existing (re)insurance contracts on the date of valuation. The determination of the lifetime of the (re)insurance portfolio should be based on up-to-date and credible information and realistic assumptions about when the existing contracts will be discharged, cancelled or expired. Cancellation assumptions are often implicit in premium projections under current practice and can be material in some classes, for example, motor business. Any cancellation assumptions should be capable of being validated including the use of expert judgement and reference to past data.

Options and guarantees

Insurers are required to identify all contractual options and financial guarantees (and the risk drivers that materially affect their cost or frequency of take-up) embedded in their insurance contracts. The best estimates must take into account the uncertainties behind the total cost.

Non-financial guarantees, such as reinstatement premiums and experience adjustments should also be taken into account within valuation of technical provisions. Where relevant, these should be valued like financial guarantees.

Policyholder behaviour

Managing agents must identify where future policyholders' behaviour can affect the value of contractual options or guarantees. Where the cash-flows of a contract change if an option is exercised, the valuation should allow for the probability that policyholders exercise the option.

Though more material for life lines of business, this may also affect cancellation and lapse assumptions in some non-life lines of business, such as Motor. Where credible and relevant discontinuance experience is available, managing agents should make use of it.

Non-life insurance obligations

The best estimate should be calculated separately in respect of premium provisions and claims provisions.

Premium provisions

The best estimate of premium provisions is the expected present value of the following cash in-flows and cash out-flows:

- cashflows from future premiums relating to any period of exposure, in-force or otherwise (including adjustment premiums from expired policies, cashflows due from premium debtors, reinstatement premiums or premiums expected from in-force policies);
- cashflows arising from future claims events;
- cashflows arising from allocated and unallocated claims administration expenses in respect of claims events occurring after the valuation date;
- cashflows arising from ongoing administration of in-force policies; and
- cashflows arising from subrogation and salvage.

The cash inflows and outflows in respect of premium provisions need not be calculated separately.

Premium provisions should take account of expected profits during remaining periods on risk and of the time value of money over the period until settlement of relevant cash out-flows. In such circumstances the best estimate may be negative. This is acceptable and undertakings are not required to set the value of the best estimate to zero. The normal current practice is to reserve to ultimate on an underwriting year basis and to split the ultimate between earned and unearned.

Managing agents need to further consider any differences in the average duration of earned and unearned provisions. The process of deriving, validating and applying different cashflow patterns to earned and unearned provisions is likely to be a significant change from current practice.

Claims provisions

The best estimate of provisions for claims outstanding is the expected present value all future claim payments (and claims administration expenses) arising from claims events that have occurred before or at the valuation date. These may include inflows arising from subrogation and salvage. Cash inflows and outflows in respect of claims provisions need not be calculated separately.

Life insurance obligations

As a starting point, the cash-flow projection should be based on a policy-by-policy approach, but reasonable actuarial methods and approximations may be used. In particular the projection of future cash-flows based on suitable model points can be permitted if the following conditions are met:

- 1 The grouping of policies and their representation by model points is acceptable provided that it can be demonstrated by the undertaking that the grouping does not misrepresent the underlying risk and does not significantly misstate the costs.
- 2 The grouping of policies should not distort the valuation of technical provisions by, for example, forming groups containing life policies with guarantees that are "in the money" and life policies with guarantees that are "out of the money".
- 3 Sufficient validation should be performed by the undertaking to be reasonably sure that the grouping of life policies has not resulted in the loss of any significant attributes of the portfolio being valued. Special attention should be given to the amount of guaranteed benefits and any possible restrictions (legislative or otherwise) for an undertaking to treat different groups of policyholders fairly (e.g. no or restricted subvention between homogeneous groups).
- 4 The projection on a policy-by-policy basis would be an undue burden on the undertaking compared to the projection based on suitable model points.

In certain specific circumstances, the best estimate element of technical provisions may be negative (e.g. for some individual contracts). This is acceptable and undertakings should not set the value of the best estimate to zero with respect to those individual contracts.

No implicit or explicit surrender value floor should be assumed for the amount of the market consistent value of liabilities for a contract. This means that if the sum of a best estimate and a risk margin of a contract is lower than the surrender value of that contract there is no need to increase the value of insurance liabilities to the surrender value of the contract.

Substance over form in valuation methodologies

Under the principle of substance over form, the choice over whether life or non-life valuation methodologies should be used must be based on the nature of the obligation and identification of the risks that materially affect the underlying cashflows.

Health obligations

Health insurance obligations are defined as all types of insurance compensating or reimbursing losses caused by illness, accident or disability. Agents should be aware that this is currently grouped with non-life but will need to be categorised separately under Solvency II.

- Health insurance obligations pursued on a similar technical basis to that of life insurance (SLT Health) should be valued in accordance with sub-section "Life insurance obligations"; and
- Health insurance obligations not pursued on a similar technical basis to that of life insurance (Non-SLT Health) should be valued in accordance with sub-section "Non-life insurance obligations".

Agents need to categorise standard health insurance classes written at Lloyd's. There may be significant changes to the existing reserving basis for any health classes falling into the SLT category. This applies equally to obligations that have been or will be settled as annuities. Significant changes to the discount rates used (which will now have to be risk-free) to value these liabilities will have major effects on the provisions required under Solvency II.

Uncertainty within future cashflows

The best estimate must correspond to the probability-weighted average of future cash-flows and will therefore allow for uncertainty in these future cash-flows. In this context, allowance for uncertainty refers to the consideration of the variability of the cash-flows necessary to ensure that the best estimate represents the mean of the full distribution of those cash-flows. Allowance for uncertainty does not suggest that additional margins should be included within the best estimate.

Causes of uncertainty in the cash-flows that shall be taken into consideration in the estimation of the best estimate and the application of the valuation technique, where relevant, may include the following:

- Fluctuations in the timing, frequency and severity of claim events.
- Fluctuations in the period needed to settle claims.
- Fluctuations in the amount of expenses.
- Changes in the value of an index/market value used to determine claim amounts.
- Changes in both entity and portfolio specific factors such as legal, social, or economic factors, where relevant.
- Uncertainty in policyholder behaviour (which may be of relevance to non-life policies as well as life policies).
- The exercise of discretionary future management actions.
- Path dependency, where the cash-flows depend not only on circumstances such as economic conditions on the cash-flow date, but also on those circumstances at previous dates.
- Interdependency between two or more causes of uncertainty.

Potential practical issues

Calculation of best estimates separately for obligations of different currencies could be challenging. Though data will improve over time (and syndicates should be planning to increase the detail of data collected), it is possible that credible best estimates may not be currently calculated for all significant currencies separately (even after allowing for proportionality).

Quantification and validation of the inflation implicitly included within common reserving methodologies is also challenging. Assessment of the precise measures of inflation against which to validate these implicit assumptions is not trivial.

Assumptions about whether policies are likely to be cancelled before natural expiry may be needed for determination of the lifetime of obligations. In line with other assumptions made (see Assumptions section), these will need to be documented and validated. Lapse rates are unlikely to be always captured for non-life obligations.

Where appropriate, large and catastrophe claims should be separated from other data to allow more reliable calculation of technical provisions. The derivation and validation of assumptions required to project the explicit timings of cashflows for these types of claims will involve subjective assumptions.

Stochastic approaches

The Solvency II best estimate provision must correspond to the probability-weighted average of the discounted projected cashflows which may be read as suggesting that stochastic reserving may be a preferred approach. Any method of calculating provisions that takes into account variability and uncertainty should be considered but it is important to stress stochastic methods are not currently mandated.

As developments in stochastic reserving take place more emphasis will naturally be placed on these approaches and active research is being undertaken in these fields. Therefore, stochastic approaches may be performed in parallel. Currently, a common approach is to 'scale' the output from a stochastic method to align the mean with a best estimate from a deterministic approach (which often place reliance on actuarial judgement). This would not change the mean best estimates but can add to understanding the uncertainties.

It is important that whatever method is used meets the requirement for best estimates to correspond to probability-weighted average of future cashflows.

Suggested approaches

Possible methodologies

More detailed discussion of requirements and methodologies can be found in the sections relating to each individual component.

Current methodologies are expected to form the base for Solvency II technical provisions as other methods continue to be developed.

Some general considerations relating to cashflows are set out below. This is not intended to be exhaustive.

- The time period for cashflow projections must be selected. This will primarily depend on the granularity at which undiscounted cashflows can be produced and sufficient detail must be included to be able to calculate technical provisions in a reliable and credible manner. Lloyd's expect that the majority of syndicates would aim to produce cashflows at a quarterly level of granularity although this can vary.
- Each element of Solvency II technical provisions must be calculated and projected on a cashflow basis. Many of these cashflows are interdependent and all require discounting. This means that a model is set up that is capable of showing all of the cashflow patterns projected into the future.
- As discussed in the Segmentation section, large and catastrophe-type claims should be separated from the remainder of claims cashflows. The cashflows for large claims will be subjective.
- There will be elements for which it is difficult to derive a cashflow pattern (for example, claims projections for a class of business with sparse development data). Reasonable assumptions would have to be made to give a suitable pattern and these assumptions may be based on another cashflow projection that would be expected to have similar features (such as the same class of business in a currency with a more material volume of business).

GROSS OUTSTANDING CLAIMS PROVISIONS

The majority of this section's requirements are based on paragraphs 3.69, 3.108, 3.113 and 3.114 of CEIOPS final advice DOC 33/09.

Best estimate claims provisions

The value of non-life insurance obligations should be calculated (and reported) separately for provisions for claims outstanding and premium provisions. Cashflows must be separated into those that apply to each.

Provisions for claims outstanding relate to the cashflows in respect of claims events occurring before or at the valuation date, whether the claims arising from those events have been reported or not. The cashflows projected comprise all future claims payments, often described as:

- Claims Outstanding (case reserves)
- Incurred But Not Reported claims ("IBNR")
- Incurred But Not Enough Reported claims ("IBNER")

Claims provisions cashflow projections should also include all claims management and claims administration expenses arising from these events.

As outlined in the Segmentation section, claims provisions are required separately for homogeneous risk groups and this will normally be the level of the underlying calculations. Cashflows are also required by (significant) currency and to obtain these there may involve allocation from homogeneous risk groups.

Where claims events that have occurred give rise to the payment of annuities, these should be treated as life insurance obligations and calculated separately using appropriate techniques

Under Solvency II, best estimates must not include margins for optimism or conservatism. Reserves held in excess of the best estimate must be excluded from the technical provision calculation for solvency. This may also mean that negative IBNRs are to be held for risk groups where there are expectations that future profits will emerge from claims provisions.

Potential practical issues

Claims provisions relate to accident year calculation whilst syndicates commonly calculate provisions on an underwriting year basis.

Where allocation to significant currency is required, the basis for allocation will require consideration.

Current methods do not adequately allow for latent or extreme claims (termed binary events by the Groupe Consultatif). This is discussed later in the Binary Events section.

Suggested approaches

Possible methodologies

It is anticipated that, although current methodologies will be used at the commencement of Solvency II, stochastic methodologies that allow explicitly for uncertainty in timings and amounts of reinsurance will develop over time. Syndicates should expect the underlying calculation to change in the medium to long term.

The main changes to the projections themselves will be to remove prudence and produce a cashflow. The underlying requirement to use homogeneous risk groups is not expected to be a change to current practice but allocating results to all significant currencies is.

The projection methods will be similar to those used currently, such as chainladder development factor models, Bornhuetter-Ferguson estimates and many other commonly used actuarial methods. The difference will be the production of expected cashflows. Large claims will be stripped out of past data and valued separately.

There will need to be an explicit assessment of reinsurance recoveries and their timings (relative to the gross).

Main modifications required compared to current approaches

Some of the reserving process changes required under Solvency II will depend upon whether syndicates currently use accident year or underwriting year data (and the processes used to adjust underwriting year data for reporting). Some adjustments are described in more detail in other sections of this document.

- 1 Margins within reserves must be removed (and held outside of the Solvency II technical provisions). This will require removal of prudence within reserving methods and assessment of what methodologies and processes are compatible with deriving a best estimate.
- 2 Cashflows will be required for all lines of business/homogeneous risk groups/significant currencies. For classes that cannot be projected using a method which also gives cashflows (such as for classes with very limited data), an assumption about cashflow patterns must be made.
- 3 If using an underwriting year basis, syndicates must consider how cashflow patterns for claims provisions differ from those assigned to premiums provisions, rather than simply applying a proportion to split total reserves.
- 4 All cashflows must be adjusted for the time value of money and cashflows are to be generated by currency. This may require grouping of classes of business to a different level from current approaches.
- 5 Additions for binary events (on both claims and premiums provisions) need to be included. These additions would reflect the possibility for latent claim events and are discussed further in the Binary Event section.
- 6 Indirect expenses, as well as many additional expense items, are required to be projected alongside claims cashflows and are discussed further in the Expenses section.
- 7 Inflation associated with claims and claims handling expenses is usually implicitly allowed for in data, with the assumption that future inflation will continue in the same way as historical inflation. Any deviation from this assumption should be considered and documented carefully.

Indicative results

Cashflow components of Solvency II gross outstanding claims provisions as at 31/12/2008

Components of gross outstanding claims provisions	Expected cashflows £m
Gross future claims payments (incl. uplift for binary events)	40,085
Gross future expenses	795
Discounting credit	(2,071)
2008 year-end Solvency II gross outstanding claims provisions	38,810
2008 year-end UK GAAP gross claims outstanding provisions	38,420

Source: Lloyd's Market Reserving and Capital Department, January 2010 and Lloyd's Annual Report 2008

GROSS PREMIUM PROVISIONS

The majority of this section's requirements are based on paragraphs 3.109 to 3.114 and 3.32 to 3.38 of CEIOPS final advice DOCs 33/09 and 25/09 respectively.

Best estimate premium provisions

Premium provisions relate to claims events occurring after the valuation date and during the remaining in-force coverage period of policies. The cashflow projections should comprise all future claims payments and claims management expenses arising from those events, cashflows arising from ongoing administration of the in-force policies and expected future premiums stemming from existing policies. As with claim provisions, the valuation should take account of the time value of money and the best estimates must not include margins.

The calculation of premium provisions is a major change from current practice.

Policies to include

The definition of which policies to include in the technical provisions is one major change under Solvency II.

The best estimate should include all future cash-flows associated with "existing" contracts. This is on a **legal obligation basis** and is discussed later. However, this is likely to include prospective 1/1 renewals for a valuation as at 31 December.

Items to include

The best estimate of premium provisions should be calculated as the expected present value of future in- and out-going cashflows, being a combination of:

- Future premium receivable;
- Cashflows resulting from future claims events;
- Cashflows arising from allocated and unallocated claims management expenses; and
- Cashflows arising from ongoing administration of the in-force policies.

Premium provisions should be calculated in accordance with the general provisions for the determination of technical provisions as set out in Articles 75 to 78 of the Level 1 text. Such a valuation would take account of expected profits (premiums exceeding costs) during remaining periods on risk.

In many circumstances the best estimate may be negative (there is no requirement to set the value to zero) which is another major change from current practice.

There is no longer a concept of items such as Unearned Premium Reserve (which is currently set at 100% of the unearned portion of the unexpired risk from business incepted prior to the valuation date). Under Solvency II the unearned business is instead held on a best estimate basis (and therefore takes account of profit to be earned in the future).

A major change is that premium provisions are reduced by the amount of expected future premium cash inflows. Future premiums will offset the expected future claims payment cashflows and lower the overall premium provisions.

As covered in the Reinsurance section, the principle of correspondence means that future premiums should only be included to the extent that any associated liabilities are also included in the technical provisions. If a contractual liability does not exist (so is not taken into account in the technical provisions), then the associated future premium cashflows should not be taken into account.

The valuation of premium provisions should take account of future policyholder behaviour such as the likelihood of policy lapse during the remaining period (where this has a material effect). This may only have a material effect for a few classes of non-life business but will be required if material profit on contracts is assumed to emerge (as lapsed policies would not generate these profits).

Where a material amount of claims arising from premium provisions are expected to give rise to the payment of annuities, an appropriate assessment should be made. These annuities should be treated as life insurance obligations and calculated separately using appropriate techniques.

Definition of existing contracts

Contracts are recognised as an 'existing contract' once the syndicate becomes a party to the contract. Tacit renewals which have already taken place at the valuation date should lead to recognition of the renewed contract. A contract is derecognised as an existing contract only when the obligation specified in the contract is discharged, cancelled or expired.

For the calculation of the best estimate, the boundaries of an existing contract can be defined as follows:

- Where the insurer has a unilateral right to cancel the contract, reject the premium, or an unlimited ability to amend the premium or the benefits (or otherwise re-underwrite the risk) at some point in the future, any premiums received beyond that point (and any resulting cash out-flows) do not belong to the existing contract. If these rights relate only to a part of the contract, only this part should be excluded from the existing contract.
- Future premiums and any resulting cash out-flows which relate to an option or guarantee that provides rights under which the policyholder can renew the contract, extend the insurance coverage to another person, extend the insurance period, increase the insurance coverage or establish new insurance cover, belong to the existing contracts. These are not likely to be a material issue for Lloyd's.
- All other cashflows relating to the contract should be included in the calculation of the best estimate. In particular, future premiums (and any resulting cash out-flows) should be included if their payment by the policyholder is legally enforceable.

In principle, this boundary assessment should be done for each (re)insurance contract individually. In practice, where this is not workable, a less detailed level of granularity can be used if this does not lead to materially different results. The granularity should be at least at the minimum segmentation level detailed in the Segmentation section.

Future premiums can be split into two categories:

Future Premiums that relate to incepted exposure

This can either be on earned exposure or unearned exposure. For example:

- Late paid premiums
- Premiums paid in instalments
- Inwards reinstatements from an incurred reinsurance claim
- Other M&D adjustment premiums
- Profit-related or swing premiums

Premiums that relate to 'unincepted' exposure (i.e. attaching after the valuation date)

This could be due to:

- "Tacit" renewals
- Premiums written before a valuation date, but incepting afterwards
- Binder business. The authority to write exposure has been given, but individual policies may not have been written by the date of the valuation.

As mentioned above, the crucial consideration is whether or not the contracts are legally enforceable or on what terms a (re)insurer could avoid the liability associated with the exposure. For example, a binding authority may be cancellable, but with a notice period before which this can be carried out and 1/1 renewals already signed and subjected to contract certainty can be seen as legally enforceable contract.

<p>Current Proposal: Bound renewals, for example 1/1 renewals for a 31/12 valuation, WILL be included in the valuation of technical provisions under Solvency II</p>

The allowance of profit from future exposures on existing contracts means there requires an allowance for cancellations or lapses. In the situation of a policyholder not paying a premium, the policies may be automatically cancelled and no longer represent a liability for an insurer. Any such assumptions shall be realistic and based on current experience and anticipated future experience. This is unlikely to be part of the current valuation process for Lloyd's.

Binder business is also likely to be affected, though only to the extent that some period of underwriting in the period following the valuation date may take place before the authority to write business on behalf of the (re)insurance undertaking can be legally withdrawn. For example, binders having a one month cancellation clause are common; therefore one month of new business under the binder would be included in the technical provision valuation. The allowance for binders business may rely on future management actions.

Premium receivable

The best estimate premium provisions must be based on projection of all relevant cashflows, including premiums to be received in the future from existing policies. Some premium receivable may be in respect of policies that have not yet incepted at the valuation date.

Future premium cashflows relating to incepted earned exposure

Some future premiums will relate to earned exposures. A reasonable interpretation of the latest CEIOPS advice would be that they should all fall to premium provisions:

Premium provisions *“relate to claims events occurring after the valuation date and during the remaining in-force period (...) of the policies held by the undertaking (existing policies). The cash-flow projections should comprise all future claims payments and claims administration expenses arising from those events, cash-flows arising from the ongoing administration of the in-force policies and expected future premiums stemming from existing policies.”*

Potential practical issues

The major change in the calculation basis of premium provisions will bring a number of practical issues. These are:

The Solvency II approach will require further calculation on sufficiency of premium provisions compared to current techniques.

The payments patterns of earned and unearned business are required to be considered separately.

Inclusion of expected profits over the remaining periods of risk is a significant change. Given all expected profit from existing business would be acknowledged at the valuation date this is likely to be most significant for long-tail business where upfront premiums may be followed by claims payments far into the future (with significant discounting credit).

The requirement for taking account of future premium cashflows is now not in line with the most recent discussions around Phase II of IFRS 4: Insurance Contracts¹. As things currently stand, this means that technical provisions will need to be calculated on different bases for accounting and solvency.

In respect of future premiums owed by the insured (such as adjustment premiums, or late paid premiums), an allowance may need to be made for the possibility of default before receipt. This allowance would need to take into account the effect of such a default on the obligations of the insurer.

Lapse data is unlikely to be currently considered as part of the reserving process and may not be available.

Inclusion of “unincepted” business

The inclusion of unincepted business needs to be linked to the capital calculation kernel. It is important not to double-count such policies or their expected outcomes (profit). An explicit link to the internal model will need to be considered.

Depending on the line of business, the inclusion of unincepted business may represent a substantial additional volume of business in the premium provisions (though the net effect on the amounts may be small or even negative).

¹ Details available at <http://www.iasb.org/Current+Projects/IASB+Projects/Insurance+Contracts/Insurance+Contracts.htm>

It may be difficult to determine what portion of projected binder business should be included as “existing” contracts. For example, it may be possible for a binding authority to be cancelled, though there may be a period of time before legal obligations on the contracts written can be removed completely.

The effects of contract certainty should be considered. There may need to be a standard methodology for determining what policies should and should not be included with respect to Lloyd's business.

Data for determination of what is an ‘existing’ policy, particularly for those not yet incepted, will be required. Legal interpretation of standard contract terms may be needed.

Illustrative example of the impact of changes to unearned provisions methodology

The following is a simple, manufactured example to illustrate the fundamental differences between UK GAAP provisions for unearned exposures and Solvency II premium provisions (and in particular to illustrate the impact of future premiums). Discounting, risk margins and unaccepted business are deliberately ignored for simplicity – this example is purely illustrative.

Assuming a single policy:

- Running from 1 July to 30 June, with uniform risk
- With claims payments paid in the month following the quarter of occurrence
- With a total premium of 100, payable by 40 on day 1 and 3 equal payments of 20 on the 15th of the month following each quarter
- With a claims ratio of 72%
- With a valuation date of 31st December

The cashflows and the premium earning pattern can be summarised as follows:

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Premiums	(40)	0	0	(20)	0	0	(20)	0	0	(20)	0	0	0	(100)
Paid claims	0	0	0	18	0	0	18	0	0	18	0	0	18	72
Cashflow	(40)	0	0	(2)	0	0	(2)	0	0	(2)	0	0	18	(28)
Premium Earning	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	0	(100)

The resulting Solvency ‘balance sheets’ under UK GAAP and under Solvency II principles are then as follows

UK GAAP		Solvency II principles	
Assets	82	Assets	42
Cash	42	Cash	42
Receivables	40		
Liabilities	68	Liabilities	14
OS claims	18 (on earned)	Claim reserve	18 (to be paid in Jan)
UPR	50	Premium reserve	(4)
Available profit	14	Available profit	28

The main observations from a move from UK GAAP to Solvency II in this stylised example are that

- The overall quantum of the provisions are smaller
- The entire profit is acknowledged in the year the policy is written
- The premium reserve is negative
- There is no concept of non-monetary items such as UPR

If discounting were applied, the premium reserve shown in this example would reduce and become more negative. This is because the duration of cash in-flows (premiums) is usually smaller than the duration of cash out-flows (claims payments) and could have a significant impact for longer tailed classes.

Suggested approaches

Possible methodologies

The projection of cashflows associated with premium provisions is likely to be significantly different from current processes. There are three main reasons for this, in addition to those discussed for claims provisions (segmentation and removal of prudence):

- 1 There is no longer a requirement to hold a provision for 100% of unearned premium (and an Additional Unexpired Risk Reserve if expected claims and expenses are greater than unearned premiums). Provisions for claims on unearned premiums must be held at a best estimate.
- 2 In addition, premium provisions are reduced by the amount of expected future premium cash inflows.
- 3 Expected cashflows in respect of policies that have not yet incepted but for which a contractual obligation has started must be included. These would normally be assigned to the following underwriting year (with the exception of those for binder business) and excluded from the current valuations.

There will need to be an explicit assessment of reinsurance recoveries and their timings (relative to the gross).

Cash inflows

Projections of cashflows associated with premium cash inflows are likely to be similar, in many respects, to current methodologies for projecting premiums. It is likely that triangulated data will be projected forward using approaches such as chainladder development factor models and many other commonly used actuarial methods.

However, there will need to be a few modifications to allow for the additional requirements of Solvency II. These assume that all contracts that are not classed as “existing” have been excluded from the calculation.

- Margins must be removed. This means “haircuts” on expected premium inflow will not be permitted.
- An additional year of account may need to be added in, for expected cashflows in respect of business which is a contractual obligation but has not yet incepted by the valuation date.
- Where possible, the implicit effects of lapses should be extracted and analysed separately.
- Cashflows will be required for all lines of business/homogeneous risk groups/currencies. For classes that cannot be projected using a method which also gives cashflows (such as for classes with very limited data), an assumption about cashflow patterns must be made.
- For most unincepted contracts, there will be some information available about what policies have been written. Assumptions will need to be made about claim and premium cashflows and used to calculate best estimate provisions (which may turn out to be negative). This could be linked to the premium pricing basis. For others, the expected income can be extrapolated from earlier years of account or inception rates by month.

Cash outflows

An allowance for binary events in assessment of claims for future premiums should also be included. This is covered in the Binary Events section.

As with claims outstanding, the majority of the assessment will be undertaken using current standard techniques, with projections using approaches similar to current, such as chainladder development factor models, Bornhuetter-Ferguson estimates and many other commonly used actuarial methods. Large claims will be stripped out of past data.

The main modifications from current practice to allow for additional requirements are shown below. Note that some of the reserving process changes required under Solvency II will depend upon whether syndicates currently use accident year or underwriting year data (and the processes used to adjust underwriting year data for reporting).

- 1 Margins within reserves must be removed (and held outside of the Solvency II technical provisions). Provisions for unearned premiums will no longer be held at a 100% loss ratio. This will require explicit assessment of expected claims from unearned exposures.
- 2 Cashflows will be required for all lines of business/homogeneous risk groups/significant currencies. For classes that cannot be projected using a method which also gives cashflows (such as for classes with very limited data), an assumption about cashflow patterns must be made.
- 3 If using an underwriting year basis, syndicates must consider how cashflow patterns for claims provisions differ from those assigned to premiums provisions, rather than simply applying a proportion to split total reserves.
- 4 An additional year may need to be added into projection methodologies for expected claims in respect of business as described above.
- 5 All cashflows must be adjusted for the time value of money and cashflows are to be generated by currency. This may require grouping of classes of business to a different level from current approaches.
- 6 Additions for binary events (on both claims and premiums provisions) should be added. For premium provisions, these additions would include the possibility for “mega” catastrophe-type claim events and are discussed later.
- 7 Indirect expenses, as well as many additional expense items, are required to be projected alongside claims cashflows and are discussed further in the Expenses section.
- 8 Inflation associated with claims and claims handling expenses is usually implicitly allowed for in data, with the assumption that future inflation will continue in the same way as historical inflation. Any deviation from this assumption should be considered and documented carefully.

Existing contracts

It is important that syndicates clearly define and document what business should be included and excluded from the technical provision calculation. This requires consideration of which contracts can be defined as “existing”.

The first step in determining whether cashflows should be included may be to group contracts together and:

- If the contract relates to incepted exposure, the cashflows should be included within claims provisions
- If the contract relates to unaccepted exposure and cannot legally be cancelled by the (re)insurer, the cashflows should be included within premium provisions
- If the contract relates to unaccepted exposure but can legally be cancelled by the (re)insurer, the cashflows should not be included within the provisions.

If contracts can be cancelled, but not until after a period of time has elapsed, then cashflows relating to policy inceptions during that period of time should also be included.

This definition will be the responsibility of the actuarial function.

Indicative results

Cashflow components of Solvency II gross premium provisions as at 31/12/2008

Components of gross premium provisions	Expected cashflows £m
Gross future claims payments	10,888
Unearned incepted business	7,301
Unincepted business	3,325
Allowance for unearned binary events (latent claims)	263
Gross future premiums	(14,568)
Unearned incepted business	(8,535)
Unincepted business	(6,034)
Allowance for unearned binary events	-
Gross future expenses	3,164
Discounting credit	(403)
2008 year-end Solvency II gross premium provisions	(919)
2008 year-end UK GAAP gross provision for unearned premium	9,043

Source: Lloyd's Market Reserving and Capital Department, January 2010 and Lloyd's annual report 2008

REINSURANCE RECOVERIES

The majority of this section's requirements are based on paragraphs 3.197, 3.210 to 3.223 and 3.219 of CEIOPS final advice DOC 33/09.

Reinsurance recoveries within technical provisions

The held technical provisions for Solvency II correspond to the probability-weighted average of all future cashflows including cashflows recoverable from reinsurance contracts and special purpose vehicles. This should take account of the time value of money, using the relevant risk-free interest rate, and the adjustment for the expected losses due to the default of the counterparty.

Recoverables from reinsurance contracts, including recoverables from any special purpose vehicles should be shown separately on the asset side of the balance sheet (as "recoverables from reinsurance contracts and special purpose vehicles"). Recoveries due on paid claims (i.e. those where collection notes have been sent out but not received – reinsurance accruals) do not sit within the technical provisions.

Calculation of amounts recoverable from reinsurance contracts and special purpose vehicles must be performed under the same principles as for calculation of the gross best estimates. Risk margins are not required in respect of reinsurance and special purpose vehicle recoverables (as risk margins are calculated at a net level).

What contracts to include?

Lloyd's view is that the **principle of correspondence** should underlie the calculation of reinsurance recoveries in the best estimate when considering which contracts to include. There are two specific areas this current proposal would apply to:

1. Future reinsurance cover to be bought that will cover existing inwards contracts (e.g. LOD cover incepting 1st April)

Correspondence would include these contracts, as a future management action (assuming sufficient justification) and the expected proportion of the premium that applies to the existing inwards contracts would be included. On a best estimate basis the reinsurers would aim to make a profit and so premium outgo would be expected to exceed recoveries. By adopting this approach syndicates' technical provisions would increase. Lloyd's do not expect syndicates to anticipate making money from buying reinsurance on a best estimate basis unless there is very strong evidence to support this.

- 2, Existing reinsurance contracts that will provide recoveries from inwards contracts that are NOT "existing" at the valuation date (e.g. RAD cover already purchased for the forthcoming year).

Correspondence would only include expected recoveries on existing inwards contracts. Similarly to 1, any future premium should be apportioned to only include the expected cost relating to existing inwards contracts.

Having an approach that relies on correspondence between the gross and net estimates ensures the calculation remains realistic.

Lloyd's current proposal is that anticipated reinsurance purchases can be included in the calculation of technical provisions to the extent they would cover existing contracts. Any assumptions and associated risks need to be documented carefully.

Segmentation of recoverables

Recoverables for special purpose vehicles and finite reinsurance should be calculated separately from the balance of reinsurance recoverables.

Recoverables in respect of non-life business must be calculated separately for claims provisions and premiums provisions. Those calculated for claims provisions should reflect the compensation payments for the claims accounted for in the gross claims provisions. All other recoverables, as well as reinstatement premiums, should be allocated to premium provisions.

Debtors and creditors relating to settled claims should not be included within the reinsurance recoverables, but shown as separate items in the balance sheet including the corresponding counterparty risk.

Best estimate liabilities are required to be at least segmented by Solvency II line of business. Lloyd's view is that the most important element when calculating the gross technical provisions is having data split into homogeneous risk groups. In some cases, this will mean results are allocated to Solvency II line of business. The same concept should apply to expected reinsurance recoveries.

Ideally, the calculation of reinsurance recoveries would apply using an identical split to the calculation of the inwards gross losses. This may not be realistic in some cases, for example to Whole Account Stop loss covers. In such instances, it is acceptable to calculate the expected cashflows at a more suitable level (likely to be at the level the cover works at) and then allocate to the Solvency II lines of business as appropriate. The methods for allocation should remain constant over time and the choice documented clearly.

Calculation of recoverables

Cashflows

The calculation of recoverables can be performed either directly as the probability-weighted average of future recoverable cashflows or indirectly as the difference between the gross and net best estimates. The indirect method should only be used if it is expected to produce a corresponding result to the direct method.

Calculation of recoverables should include at least:

Cash inflows

- Recoverables from reinsurance and SPV contracts in respect of claims payments
- Recoverables from reinsurance and SPV contracts in respect of allocated claims expenses
- Revenues from reinsurance commission and profit sharing arrangements (from technical sources relevant to individual reinsurance contracts)

Cash outflows

- Future premiums payable for or in respect of reinsurance and SPV contracts
- If relevant, outflows from profit sharing arrangements.

The time value of money must be taken into account in the calculation of reinsurance recoveries.

Expenses related to the internal processes for reinsurance and SPVs (such as administration or management) should be allowed for in the expenses forming part of the gross best estimate.

Where recoverables from special purpose vehicles depend upon external indicators (such as a parametric trigger), rather than directly indemnifying for losses, allowance for recoveries related to either claims or premiums provisions should only be taken into account to the extent that they can be verified in a "deliberate, reliable and objective manner". The basis risk of the contract not being triggered must also be considered. In addition, only payments related to underwriting risk should be accounted for in recoverables. All payments that do not relate to underwriting risk (for example those that relate to market risk) should be accounted for elsewhere.

Adjustments

Reinsurance recoverables should be calculated assuming no counterparty default. An adjustment for counterparty default should then be explicitly calculated and applied separately.

Deposits made in respect of the reinsurance cash inflows or outflows must be shown separately in the balance sheet. Suitable adjustment must be made to the recoverables to avoid any double-counting.

Gross to net techniques for calculating recoverables

Gross to net techniques¹ may be used as long as the particular methodology selected is proportionate to the underlying risks. Any methods used must ensure that:

- 1 there is correspondence between gross and net best estimates of a homogeneous risk group
- 2 claims provisions and premium provisions are calculated separately
- 3 the net calculation is performed at a level that adequately matches the granularity of relevant reinsurance programmes

¹ See paragraphs 3.434 to 3.443 and Annex E of CEIOPS final advice DOC 72/10

- 4 the allowance for counterparty default is reflected appropriately
- 5 calculation methodologies distinguish at least between lines of business for premium provisions
- 6 calculation methodologies distinguish at least between lines of business and between accident years not fully developed for claims provisions

Simplifications in calculation of recoverables

Where the timing of gross claim payments and corresponding recoveries is markedly different, this should be reflected in the projection of cashflows. Where the timings can be shown to be sufficiently similar, they may be assumed to correspond and projections can use the timing of direct payments. Reinsurance and SPV cashflow projections must take into account the effects of discounting.

Allowance for counterparty default

Recoverables from reinsurance and SPVs must be adjusted for expected losses due to counterparty default. This adjustment should approximate the expected present value of the losses in the event of default, weighted by the probability of default for each counterparty. The adjustment should be made for expected losses whether due to insolvency, dispute or any other reason.

The adjustment must be based on a market-consistent assessment of the probability of default and the average loss following such a default. For example, in a stress scenario the probability of default or the loss given default may be greater than the long term averages. The assessment of such an adjustment should be based upon current, reliable and credible information. This requirement still applies when the information is sourced from a third party.

The determination of the adjustment should take account of default events during the whole run-off period of the recoverables. The adjustment for default must take into account the risk that counterparties survive some years and default at some other point in the whole run-off period of the recoverables. In particular, it is not sufficient to multiply the expected loss due to immediate default by the probability of default over the current year.

Instruments used to mitigate the effects of counterparty default risk (for example, collateral or LOCs) may be taken into account in the adjustment, but any associated credit risk must also be taken into account. The default risk of the underlying instrument should be included as equivalent to the default risk of the reinsurance.

The counterparty default adjustment should be calculated separately at least for each line of business, counterparty and (for non-life) separately for premium provisions and claims provisions. This is likely to require the allocation of reinsurance premiums and claims to class of business. An allowance must also be made for the reinsurance recoveries assumed on additional provisions in respect of future and unaccepted premiums.

A separate calculation of default by counterparty may be onerous, especially if the expected loss is small. Where the probability of default and recovery rate of several counterparties coincide, and if calculations at the level of individual counterparty are an undue burden, then the adjustment for these counterparties could be calculated together.

Loss given default

The loss given default is the expected present value of the change in recovery cashflows, resulting from a default of the counterparty. If no reliable estimate of the recovery rate for a counterparty is available, the rate used should be no higher than 50%.

Probabilities of default

Where possible, estimates of the probability of default should reflect the point-in-time impact of the insurance cycle, rather than long-term averages. If it is not possible to calculate such estimates in a reliable, objective and prudent manner, through-the-cycle estimates of the probability of default might be used with appropriate justification. Techniques in current use, such as transition matrices, are appropriate. The assessment of the probability of default should take into account the fact that the probability increases with the time horizon of the assessment.

Possible sources of data for assumptions include:

- Credit spreads;
- Credit ratings;
- Solvency assessment information; and
- Financial reporting information.

Application to claims and premium provisions

For claims provisions, details of the counterparties underlying notified outstanding reinsurance recoveries will be available. Assumptions will need to be applied for the counterparties (or rating group if simplification is followed) involved with recoveries on IBNR. Assumptions here may use the same proportions of reinsurance by credit rating as for reinsurance on outstanding claims, paid reinsurance recoveries or reinsurance premium for recent years. Assumptions regarding reinsurance recoveries for premium provisions may need to take into account similar historic proportions but will also include assumptions underlying business plans. Any change in the distribution of reinsurers by rating must be taken into account.

Potential practical issues

Recoverables from reinsurance and special purpose vehicles

Net best estimates will need to be produced by line of business. Calculation of reinsurance recoverables at the minimum levels of segmentation may be difficult for reinsurance spanning multiple lines of business/currencies.

The recoverables expected from whole account reinsurances will need to be allocated to lines of business to be able to calculate net best estimates at the level of segmentation required. Expert judgement will be required and underlying assumptions documented, including validation of assumptions.

Multi-year reinsurance contracts may be in place, but may be covering policies that are not yet a contractual obligation of an undertaking. Any (future) premium for reinsurance that covers future contracts as well as existing contracts should have such costs apportioned and only the proportion relating to existing contracts (whether inception or not) included.

This is consistent with the principle of correspondence that underlies the calculation of reinsurance recoveries.

Allowance for counterparty default

A full calculation by individual counterparty will be time-consuming and potentially complex. It is expected that many undertakings will elect to use the simplifications suggested and group reinsurers by rating. This will result in similar groupings to current practice.

The simplified approach based on credit ratings will not work for unrated reinsurers. CEIOPS guidance on counterparty default risk in the SCR¹ suggests alternative methodologies for deriving default probabilities. CEIOPS suggest factors to apply to unrated reinsurers based on their Own Funds and last reported SCR figure. For unrated reinsurers not regulated by Solvency II, a default probability of 10% is suggested.

As with the current approach for Solvency, Lloyd's security would be treated as 100% for syndicate level calculations.

Suggested approaches

Possible methodologies: reinsurance recoveries

CEIOPS suggests two main methods for deriving reinsurance recoveries:

- 1 Calculated directly as the probability-weighted average of future recoverable cashflows
- 2 Calculated indirectly as the difference between the gross and net best estimate

If the timings of gross payments and recoveries can be shown to be sufficiently similar, an undertaking may use the timing of gross payments in the cashflow projection for recoverables. Where timings are different, cashflow projections must allow for these differences between gross payments and recoveries. For example, this can be achieved by assuming a lag between the gross payments and associated recoveries. This can be based on an analysis of historical differences.

It is expected that in most cases current approaches would be followed. For example net to gross ratios are expected to be widely used and in some cases, direct net projections would be favoured.

Exact calculation of expected reinsurance recoveries for large or exceptional claims will be expected, this is also consistent with current approaches.

¹ See paragraphs 3.243 to 3.247 in CEIOPS final advice DOC 23/09

One area that would require a different approach is non-working non-proportional reinsurances. The probability weighted mean of recoveries will be non-zero. However, current approaches may assume a zero recovery as a best estimate. To overcome this either a stochastic approach or method that results in non-zero expected recoveries (for example ratios based on premium) would be required.

It is anticipated that, although current methodologies will be used at the commencement of Solvency II, stochastic methodologies that allow explicitly for uncertainty in timings and amounts of reinsurance will develop over time. Syndicates should expect the underlying calculation to change in the medium to long term.

Possible methodologies: reinsurance counterparty default

Calculation of an allowance for counterparty default within reinsurance recoverables will be more detailed than current methods unless expected reinsurance recoveries are small. The counterparty default adjustment must be calculated separately for each line of business, counterparty and (for non-life) separately for premium provisions and claims provisions.

For premium provisions, assumptions will need to be made for the proportion of reinsurance recoverables that will be attributed to each counterparty or group of counterparties. A possible approach would be to apply the same proportion as seen in the claims provisions or based on reinsurance premiums by credit rating.

Counterparties will be grouped by credit rating if applying the simplification suggested by CEIOPS. This will assume that default rates and recovery percentages across rating groups are the same. As the 50% minimum recovery rate is likely to apply for all counterparties, this simplification should hold.

To correctly allow for the risk of counterparty default over the run-off of reinsurance recoverables, the cashflows of reinsurance recoverables are required over time (as they are assumed to increase over time). The probabilities of default used will depend on credit rating group meaning reinsurance cashflows need to be split by rating group. However, simple apportionments may be applied. If it is assumed that reinsurance payment patterns are homogeneous across the credit ratings of counterparties (note that these patterns are already separated out by class of business), then a simple proportion of the overall reinsurance cashflow could be taken for each rating group.

Probabilities of default are required by credit rating by duration (consistent with the cashflow projection time period). The cashflow time period assumptions are expected to be consistent with the gross projections – expected to be quarterly, half yearly or annual. The default probabilities are likely to be based on credit rating information such as S&P default rates that are currently available.

A derivation of losses given default for each credit rating group is needed. In the absence of credible information, a recovery rate of 50% can be assumed.

The process results in an expected probability of default and loss given default for each future time period for each line of business and each rating group. This is more detailed than current approaches.

Indicative results

Components of Solvency II expected reinsurance cashflows as at 31/12/2008

Components of expected reinsurance cashflows	Expected cashflows (£m)
Reinsurance cashflow for earned business	(10,059)
Recoverables for future claims	(10,644)
Counterparty risk adjustment	94
Discounting credit	491
Reinsurance cashflow for unearned business	1,607
Recoverables for future claims	(1,119)
Future reinsurance premium	2,738
Reinsurance acquisition costs	(57)
Counterparty risk adjustment	(1)
Discounting credit	45
2008 year-end Solvency II expected reinsurance cashflows	(8,452)
2008 year-end UK GAAP reinsurers' share of technical provisions	(11,671)
Claims outstanding	(10,504)
Unearned premiums	(1,167)

Source: Lloyd's Market Reserving and Capital Department, January 2010 and Lloyd's annual report 2008

EXPENSES

The majority of this section's requirements are based on paragraphs 3.54 to 3.56, 3.88 to 3.99 and 3.219 of CEIOPS final advice DOC 33/09.

Inclusion of expense cashflows

The best estimate should reflect all cashflows arising from expenses that will be incurred servicing existing policies during their lifetime.

Expenses include both allocated and unallocated expenses. Allocated expenses are those that are directly assignable to individual claims. Unallocated (or overhead) expenses comprise all other expenses which the undertaking incurs in settling its obligations which will include some costs not directly attributable to settling claims. Current "ULAE" would naturally make up part of the total unallocated expense cashflows.

Unallocated expenses must now be projected as for the cashflow projections and allocated between business lines, homogeneous risk groups and currency. They should also be allocated between earned and unearned exposure. Previously, these indirect expenses could be included at a whole business level.

Examples of expense items to include are:

- Acquisition expenses including commissions
- Salaries
- Property costs (rent, depreciation, heating, lighting, cleaning)
- Other administration expenses
- IT costs
- Investment management expenses
- Claims management expenses
- Expenses in relation to the management/admin of reinsurance contracts and SPVs.

Allocation of expense cashflows

Those expenses which cannot be directly allocated to claims should be allocated using professional judgement and realistic assumptions to lines of business or homogeneous risk group. Such allocation should be done on an economic basis following realistic and objective principles. The principles and their application should be documented, as should the explanation for any changes. The split of unallocated claim expenses should only be changed if a new split will better reflect the current situation.

For non-life business, syndicates should further split expenses between premium and claims provisions. For example:

- Claims management and administration expenses arising from claim events that have occurred prior to the valuation date (earned) should be allocated to claims provisions.
- Expenses (including commissions) connected with ongoing administration of the in-force policies should be allocated to premium provisions.
- Claims management and administration expenses connected with future claims events stemming from in-force policies should be allocated to premium provisions.

Future premiums and associated claims are also included within the best estimate technical provisions. Expenses related to future premiums on existing policies must also be taken into account. This will include acquisitions costs as well as the costs of administering the expected claims associated with the future premiums.

Calculation of expense cashflows

Expense provisions should reflect the undertaking's own data and any relevant market data. Expense cashflows must take into account assumptions about how expenses will develop in the future. In particular, assumptions should be made for inflation. For example, the future expense assumptions must use an inflation rate appropriate to

the driver of the expense, with different assumptions for wage or goods inflation. Inflation assumptions should be consistent with economic assumptions.

Assumptions about cashflows must consider future changes in the environment (such as legal, demographic, medical, technological, social or economic).

Future cost reductions should not be incorporated, except where they have already been realised by the valuation date. Newly established syndicates may make allowance for cost reduction in their first five years, but the assumptions underpinning any such cost reductions should be realistic, objective and based on verifiable data.

Ongoing business basis

Undertakings should take account of all expenses that would be incurred in running-off the existing business, including direct expenses and a share of the relevant overhead expenses.

Expenses should be calculated on the assumption of an ongoing business basis. Indirect overhead expenses should be allocated on this basis with the assumption that the syndicate continues writing new business. The syndicate should assume that volumes continue at the same level (unless the syndicate is ceasing to write new business). This assumed new business may support an increasing share of the overheads into the future, with less allocated to the business existing at the valuation date.

A going concern basis is more consistent with the concept of a notional transfer to a reference undertaking. However, if it is thought very likely that a firm may close in the near future, a "run-off" assumption should apply with expenses calculated accordingly.

Potential practical issues

Some allowance for expenses may implicitly be included in claims projections. Methodologies used for expense projection must avoid double-counting.

If expenses are assumed to develop in line with a specific development pattern, such as for claims, there may be an implicit assumption that inflation applying to expenses is the same as that applying within the claims development pattern. It may be difficult to assess whether this is reasonable and, if not, an adjustment would be required.

Projections using paid chainladder methods may give ultimate claims including implicit allowance for some expenses. Outstanding claims reserves would need to ensure a consistent approach or incurred projections may include only a partial allowance for expenses.

Best estimates of expenses will need to be associated with a cashflow pattern. These patterns, if not derived as part of the best estimate calculation methodology will be challenging and involve judgement.

Including investment management expenses as a separate cashflow rather than an offset to investment returns may be a change in approach for most syndicates. It is important to make sure investment expenses are not double counted.

Methods of allocating indirect expenses and overheads are likely to incorporate a large degree of judgement and there may be many ways of performing the allocation. The most appropriate allocation methodologies may require data that is not available.

The actuarial function needs to decide and document the rationale for the allowance for expenses in the technical provision calculations.

Suggested approaches

Possible methodologies

Best estimates are required at a line of business level and so expenses will need to split appropriately between lines of business and currency. Different expense items will need different allocation and projection methodologies and these expenses must also be allocated to either claims or premiums provisions.

There may be information already produced within an insurance undertaking to appropriately allocate claims expenses (such as financial information, accounts or business planning data).

If not performed previously, an expense investigation is required to assess the most appropriate method of allocating expenses across lines of business and into the future.

The list below suggests possible methods by which different expenses could be allocated.

- Investment management expenses: these could be allocated based on the level of funds under management. A measure for allocation may be the relative sizes of reserves within different lines.
- Administration expenses: Depending on the source of administration expenses, these could be allocated using in-force policy counts, relative staff hours spent on different lines, unearned premiums or volumes of reserves.
- ULAE could be allocated by the underlying best estimate provisions.

Assuming an uplift for binary events is applied to technical provisions, these uplifts should consider whether additional expenses may be incurred during the run-off of such expected claims amounts.

If a proportional method is used to run off expenses (such as running off claims expenses in line with reserves), agents should consider what level of implicit inflation is being applied to such an expense run off and whether this is appropriate.

Indicative results

Expected total future expenses cashflows as at 31/12/2008 (Solvency II basis)

Components of future expenses	Expected cashflows £m
Gross expenses on earned business	795
ULAE	597
Investment management	17
Admin/overheads	169
Allowance for inflation	12
Gross expenses on unearned business	3,164
ULAE	211
Investment management	14
Admin/overheads	190
Acquisition costs	2,742
Allowance for inflation	6
Reinsurance acquisition costs	(57)
2008 year-end future expenses	3,902

Source: Lloyd's Market Reserving and Capital Department, January 2010 and Lloyd's annual report 2008

BINARY EVENTS

Allowance for all possible future outcomes

Under Solvency II, technical provisions are calculated on a different basis when compared to current approaches. There is also a subtle but potentially significant impact on quantum as the basis for “best estimate” has changed:

- the framework directive requires a probability weighted average of all possible future outcomes
- UK GAAP requires technical provisions to include all items that are “reasonably foreseeable” It also comments that technical provision should have regard to historic levels claims and development.
- GN20 is consistent with UK GAAP in as much as, unless explicitly measurable, any allowance for latent claim types should be included to the level they have historically been observed.

Regardless of the technique used (whether stochastic or deterministic) to calculate the mean best estimates, parameterisation using historic data will only allow for the scale of events that have been observed within the history. Even if an attempt were made to explicitly adjust for this, it would be difficult to fully capture the effects of “all possible future events”. Many methods would result in an underestimation of the “true” mean.

Judgement is required in making additions or adjustments to the estimates to allow for circumstances not included in the history that will need to be incorporated into the best estimates (for example, latent claims or binary events)¹. In all the methods, judgement is a fundamental requirement.

This can leave a gap between the current basis for technical provisions and that expected under Solvency II. The gap relates to events or circumstances that are not reasonably foreseeable (i.e. have low probabilities) and are at levels not contained in historical data (i.e. have a very large severity). These have been called “binary events” by the Groupe Consultatif² and this term is used going forwards.

An allowance for “binary events” would attempt to fill part of the gap between the current approach and the Solvency II requirements. Allowance for binary events would need to be made within both claims provisions in a similar fashion to a latent claim allowance and premiums provisions with the added risk of a “mega” catastrophe.

Illustration of ‘binary events’

There is a very large range of possible events that could fall into this category. For illustrative purposes, the following list gives some ideas of events that could (but not necessarily would) fall into the category of binary events. Also, depending on an insurer’s risk profile, some of the events may not even give rise to significant losses at all.

It is also worth noting some historic events that might fall into this category, the health hazard type of losses such as asbestos and US pollution of the 1980s are prime examples. Other such as the LMX or PA spirals may also be considered to be in this category.

There is also the risk of extreme events not included in pricing assumptions impacting the premium provisions for unexpired exposures. Examples of these could be meteor strike, tsunami hitting Florida and unexpected volcanic eruptions.

Products impacting health

- Nanotechnology
- Aspartame
- Electro Magnetic Fields
- GM Crops
- Nuclear waste

¹ See paragraph 3.38 of CEIOPS final advice DOC 21/09

² See paragraph 3.2.1.5 in the “Interim report to CEIOPS on Valuation of Best Estimate under Solvency II in Non-Life insurance” (dated 11 November 2008) and answer to question 6 in the “Response to CEIOPS’ request for further advice on issues raised in Groupe’s report on best estimates” (dated 4 February 2009). These documents are respectively available online at http://www.gcactuaries.org/documents/gc_valuation_best_est_nl_111108.pdf and http://www.gcactuaries.org/documents/response_ceiops_BE_040209.zip.

Social/environmental issues

- Global warming linked to current polluters
- Director liabilities widened

Legislative/political changes

- Step change in court rulings (e.g. Ogden tables)
- Political intervention
- Rulings that ignore underwriting conditions “for the greater good”

Contact/wording issues

- Removal of claims made wordings
- Retrospective change in conditions (e.g. surplus lines in Florida)
- Specific exclusions removed
- Not fully understanding exposures

Events

- Meteor strikes
- Mega volcanoes
- Florida tsunami

This list is illustrative but certainly not exhaustive.

Potential practical issues

There is a need under the framework directive that undertakings will make some allowance for latent claims and binary events when setting technical provisions. This requirement has been confirmed by CEIOPS, the European Commission and Groupe Consultatif. However, there is significant uncertainty around any such requirements.

Calibrating the requirements in respect of binary events is extremely subjective and would involve significant judgement. Results of any such methodology would be extremely sensitive to assumptions made.

Meeting validation, back-testing and data requirements for the assumptions underlying the methodology will also be very difficult.

Suggested approaches

General methodologies

The basic idea behind allowing for binary events is to remove the truncation inherent in a parameterisation based only on observed historic data. In practice, such an allowance could typically be done in one of three ways:

- 1 Adjusting the underlying assumptions within the best estimate to ensure the likely impact of the event is included in the projection.
- 2 Calculating the best estimate reserve separately under the assumptions that a binary event either does or does not occur. The two projections could be combined with a probability weighting.
- 3 Adding an explicit amount or load to the best estimate excluding binary events.

Currently, methods similar to the first are the most common way of allowing for events outside of the scope of historic data. That is, some allowance for latent claims is often made by selecting more prudent assumptions to take account of the possibility of losses of a scale not contained in the history. In the first and third methods, events would not necessarily be identified explicitly.

One of the underlying principles of Solvency II is transparency, meaning any load or assumption to adjust for binary events should be explicit. The methods chosen should also be relatively simple to avoid spurious results. In most circumstance this would rule out the first method of “just being more prudent” to allow for uncertainty.

Practical suggestions

In reality there are many possible approaches to allowing for binary events. Three are highlighted below:

1. Use history as a guide

Investigate the historical proportional impact on reserves of latent or extreme events. This could be conducted at a line of business level over the last 30 or 40 years. This would be mainly health hazard type claims such as: asbestos, pollution, tainted blood products, silicone implants, Agent Orange, DES etc

The result is an estimate of frequency (e.g. X latent claims in 30 years) and severity, average impact is y% of average reserves over the period.

Advantages of this type of approach are that it would give an explicit load for latent/binary claims and is relatively straight-forward to calculate. Disadvantages are that historic events may not be a good guide to future events and that it may not cover "all possibilities". It would also not necessarily provide an allowance for large events in unearned provisions.

2. Estimate vulnerability to a range of current threats – 'scenario' approach

Build a probability and severity database of current possible binary events. These could be explicitly valued and included within the technical provisions calculations.

Advantages of this type of approach are that it would give an explicit load for latent/binary claims and is relatively straight-forward to calculate once assumptions have been made. However, it would be almost impossible to assign realistic probability/severity assumptions for such losses. It would also, by definition, be impossible to allow for "all possible" outcomes.

3. Uplift reserve to allow for limited range of understanding

Actuarial functions use their expert judgement in setting technical provisions and will aim for mean reserves. The resulting mean is expected to underestimate a true mean as it will only include information which is realistically foreseeable. If an assumption is made about the level at which events are realistically foreseeable (for example, up to a 1:200 year level) then derived uplifts could be applied to estimate a mean allowing for incomplete information.

Using a combination of data available and judgement for fitting a tail, an assumption can be made about the distribution of reserves. This could also be derived using a bootstrap-type methodology.

An assumption can then be made about the likelihood of events included within the data (the 1 in X year events). For consistency with capital setting, this level for "realistically foreseeable" events could be assumed to be 1 in 200. An uplift factor can be derived as the ratio of the "true mean" to the "mean only including realistically foreseeable events". Reserves are calculated using standard techniques and the uplift factor applied.

This type of approach would be subjective and rely on the assumptions made to fit a distribution, approximate the tail of the "true" distribution and about the level of likelihood of events seen in the data. It would be very sensitive to any of these assumptions.

It is proposed that, unless further developments are made, method 3 is used and reserves are explicitly uplifted at a Solvency II line of business level to allow for binary events.

Separate uplifts will apply to claims and premium provisions.

Validation

Any method to allow for such binary events would be very subjective and rely on significant levels of judgement. Validation against data would be extremely difficult. However, it would be possible to look at a number of scenarios to check the reasonableness of proposed binary event adjustments. These could be based on the opinions of a number of experts about frequency and severity of different binary events (much like method 2 suggested above).

Indicative results

Based on work carried out to date, Lloyd's expects that the allowance for binary events is likely to increase expected claims associated with premium provisions by somewhere between 2%-5% and claims provisions by 5%-10%. However, these figures are only indicative, and this is still an area where further work is required.

DISCOUNTING

The majority of this section's requirements are based on paragraphs 3.42 to 3.65 and 3.71 to 3.74 of CEIOPS final advice DOC 34/09.

Calculation of discounted best estimate provisions

The best estimate shall correspond to the probability-weighted average of future cashflows, taking account of the time-value of money using the relevant risk-free interest rate term structure.

The introduction of discounted cashflows brings a major change compared to current approaches.

For each currency, a risk-free interest rate term structure will be defined following a uniform methodology. This interest rate term structure should be used to measure the time value of cash-flows payable in the currency. The requirement implies that there should be as many term structures used as there are currencies in which business is written. This creates an additional layer of segmentation when calculating the Best Estimate.

Investment expenses should be allowed for in the cashflows underlying the calculation of technical provisions and not within the risk-free interest rates used for discounting. This will avoid double counting of investment expenses.

Risk-free interest rate term structures

Term structures will be available for all relevant currencies, for all relevant maturities and to all insurers, whatever their size. For each valuation date, the risk-free interest rate term structure will be determined on the basis of market data at that date and will consist of rates for all durations. This means that for a given currency and valuation date, each syndicate will use the same risk-free interest rate term structure.

CEIOPS will provide the risk-free interest rate structures at least on a quarterly basis for all currencies of the European Economic Area (EEA), which includes all EU member states plus Iceland, Liechtenstein and Norway. CEIOPS will also publish the methodology used to derive these structures. When market conditions are more volatile, the term structures may be provided more frequently.

Where, for a given currency and valuation date CEIOPS will not be providing risk-free interest rate term structures, [Lloyd's should determine the appropriate term structure following the method provided and provide these quarterly.](#)

For any currencies where term structures have neither been provided by CEIOPS nor Lloyd's, then agents will have to establish the capability to provide them themselves following the methodology provided. The methodology will be sufficiently detailed to ensure consistency between undertakings.

Further guidance on the treatment of non-Euro currencies will be announced at Level 3.

Determining the risk-free interest rate term structure

Government bond rates of AAA-rated governments should be considered as the benchmark for credit risk free rates.

For each currency, CEIOPS will follow a three stage approach to determine the risk-free interest rate term structure:

- 1 When government bonds are available and do meet the prescribed risk-free criteria (no credit risk, realism, reliable determination of rates, high liquidity and no technical bias), these should be used to derive risk-free rates.
- 2 When government bonds are available but they do not meet the prescribed risk-free criteria, their rates should be adjusted to approximate bond rates that do meet these criteria and then used to derive the term structure.
- 3 When there are no government bonds or they cannot be adjusted, other financial instruments should be considered (as similar to government bonds as possible). Their rates should be adjusted for credit risk and any other deviations from the criteria. In particular, swap rates may not be used to discount technical provisions without adjustment for credit risk.

If government bonds meet the criteria for some maturities but not others, they should be used to derive rates for these maturities only.

A process will be established at Level 3 to ensure that the risk-free interest rate term structure meet, as well as possible, the benchmark of risk-free government rates.

The government yield curve based on AAA rated government bonds and published daily by the ECB will be used as the relevant risk-free interest rate term structure for the Euro.

The FSA acknowledges that government bonds labelled in GBP do not meet all the risk-free criteria and recommends basing the risk-free term structure on the swap curve adjusted for credit risk. Provision of a method to

derive this adjustment will be covered by the FSA at a later date, probably not before the issuance of Level 3. However, a majority of CEIOPS' Members consider that GBP liabilities should be discounted according to the government bond curve, as for other currencies.

Extrapolation for longer-term insurance liabilities

A term structure necessarily contains a finite number of points, and (re)insurers may need to either interpolate between points or extrapolate beyond the horizon for which a sufficient degree of liquidity exists (i.e. beyond the "final liquid point").

As the discount factor increases with time to maturity, the extrapolation of the risk-free curve significantly impacts the present value of long term insurance liabilities. Therefore, the technique of extrapolation needs to adhere to the desired risk-free criteria set out in this advice (in particular the criterion of realism), with the exception of liquidity.

During the Level 3 process, CEIOPS will develop a set of principles for the choice of an appropriate extrapolation method and will, based on these principles, choose for each currency the method deemed most appropriate.

Interpolation or extrapolation at longer durations is unlikely to be material for Lloyd's business (life or non-life).

Other issues

There will be situations when estimated liabilities do not exhibit reliable cashflow patterns, such as very large claims or low-volume lines of business.

This would require some subjective selection of payments amounts and dates and to discount at those points in time.

For (re)insurers with low-volume of business in an "unusual" currency which represents a small share of their total business, proportionality would imply that it is not necessary to comply with the requirements. Two solutions would be:

- Grouping this business with similar business labelled in one of the main global currencies. This would introduce a mismatch between the term structure used and the actual assets held by the undertaking, while keeping homogeneity.
- Grouping this business with a larger homogeneous line of business labelled in the same currency but with different risk attributes. This would dilute homogeneity while avoiding any risk of asset/liability mismatch.

The selected approach must be chosen by the actuarial function.

When an internal model is used, the assumptions in the economic scenario generator need to be consistent with the term structure used to discount the Technical Provisions, even though there is no requirement to use a risk-free term structure when calculating the SCR. In particular, the use of unadjusted swap rates should be justified.

This will also be a consideration for internal model development as the term structures for technical provisions are effectively fixed and consistency is required between technical provisions and internal models.

Potential practical issues

Best estimate provisions will be sensitive to the risk-free interest rate term structures used to discount. The means technical provisions will be significantly more volatile than they are currently.

Explicitly considering cashflows will require a change to the reserving practices.

It is possible there will be some currencies may not have term structures published and would require ones to be constructed.

Results will be sensitive to the interpolation of discount rates to use between points of a term structure, especially in year 1. The early sections of an interest rate term structure would need to use as much detail as possible.

Suggested approaches

Possible methodologies

Assess which currencies are to be used. Solvency II requirements state that the best estimate should be calculated separately for obligations of different currencies. However, some currencies are likely to be immaterial and proportionality means analysis is not performed separately for these.

Decide on the time period granularity. This will depend on the granularity of the undiscounted cashflows produced and the availability of term structure data. Cashflows are likely to be calculated quarterly or annually.

Derive term structures for the main currencies, for the required granularity. These are to be provided either by CEIOPS or Lloyd's.

The actuarial function should consider whether a stochastic method is required to vary the cashflows (term structures are fixed). This is unlikely to be required.

Discounting of cashflows can be either deterministically or stochastically.

Term structures will be provided for all major currencies under QIS5 by either CEIOPS or Lloyd's.

Sensitivity testing of different discount rates will be important, considering the potential volatility of technical provisions to these assumptions. This would give syndicates an idea of how liabilities could move at different valuation dates.

Indicative results

Impact of change of discount rates on Lloyd's Solvency II net technical provisions as at 31/12/2008

Upward/downward shock on risk-free interest rate term structure (basis points)	Change in total net technical provisions
200	+6%
100	+3%
50	+2%
0	-
(50)	(2%)
(100)	(3%)
(200)	(6%)
Undiscounted	(7%)

Source: Lloyd's Market Reserving and Capital Department, January 2010

RISK MARGIN

The majority of this section's requirements are based on paragraphs 3.41 to 3.46, 3.136 to 3.144 and Annex A of CEIOPS final advice DOC 36/09.

General requirements

Level 1 text: Article 77(3): Calculation of technical provisions

The risk margin shall be such as to ensure that the value of the technical provisions is equivalent to the amount insurance and reinsurance undertakings would be expected to require in order to take over and meet the insurance and reinsurance obligations.

Technical provisions for non-life business written at Lloyd's should be calculated as the sum of an explicit best estimate and an explicit risk margin. Risk margins should be calculated using a cost of capital approach.

The cost of capital approach requires the risk margin to be calculated by determining the cost of providing an amount of eligible own funds equal to the Solvency Capital Requirement (SCR) necessary to support the obligations over their lifetime¹. This approach is intended to reflect the costs incurred by a notional reference undertaking in raising capital to accept a transfer of liabilities. Calculation of SCRs is covered in Lloyd's detailed dry run guidance.

The underlying approach is to calculate the insurer's technical provisions and SCR for each year in the future until the business is fully run off.

In general the overall risk margin according to the Cost of Capital methodology ("CoCM") should be calculated as follows:

$$CoCM = \sum_{LOB} CoCM_{LOB} = \sum_{LOB} \left\{ CoC * \sum_{t \geq 0} \frac{SCR_{RU,LOB}(t)}{(1 + r_{t+1})^{t+1}} \right\}$$

Where:

- $SCR_{RU,LOB}(t)$ is the SCR for the given line of business for year t, as calculated for the reference undertaking notionally receiving the transferred liabilities (NB: SCR relates to existing business only);
- r_t is the risk-free rate for maturity t; and
- CoC is the cost of capital rate

If the SCR of the original undertaking is calculated using the standard formula as opposed to an internal model, all SCRs (for t greater than 0) for a given line of business should be calculated as follows:

$$SCR_{RU,LOB}(t) = BSCR_{RU,LOB}(t) + SCR_{RU,LOB,Op}(t) - Adj_{RU,LOB}(t)$$

Where:

- $BSCR_{RU,LOB}(t)$ is the Basic SCR for the given line of business for year t as calculated for the reference undertaking notionally receiving the transferred liabilities;
- $SCR_{RU,LOB,Op}(t)$ is the partial SCR regarding operational risk for the given line of business for year t, as calculated for the reference undertaking; and
- $Adj_{RU,LOB}(t)$ is the adjustment for the loss absorbing capacity of technical provisions for the given line of business at year t, as calculated for the reference undertaking.

Under the standard formula, the Basic SCRs for a given line of business should be calculated by using the relevant SCR modules and sub modules per line of business (i.e. by restricting the input to be used in the relevant modules to the line of business in question). Moreover, the calculation of the Basic SCRs should be based on the correlation assumptions laid down in the Level 1 text, although only the unavoidable market risk and the default risk in respect of ceded reinsurance are taken into consideration. These correlation assumptions may be different from those used within the internal model (but only apply if using the standard formula to estimate the cost of capital).

¹ See article 77 (5) of the Framework directive (November 2009 version)

Risks to take into account within the risk margin

Only the business existing at the valuation date ($t=0$) is taken into account in the SCR used for calculation of the risk margin. It will include all 'existing' business that is to be taken into account in technical provision best estimates (including any policies not yet incepted by the valuation date). The underwriting risk in respect of non-obligated future business (also not included within the technical provision best estimate) is not taken into account.

The SCR used for calculation of the risk margin should consist of:

- 1 Underwriting risk (both reserve and premium risk) with respect to the existing business. This includes any business associated with future premiums, as set out in the Premium Provisions section
- 2 Counterparty default risk with respect to the ceded reinsurance and special purpose vehicles
- 3 Operational risk
- 4 Unavoidable market risk

This is therefore a subset of the actual SCR, ignoring new business and some portion of market risk.

"Unavoidable market risk" must be included. Though assets are assumed to be de-risked under the notional transfer, there would still be some market risk following an assumed inability to perfectly match the cashflows of long term liabilities. It is not necessary to fully replicate cashflows to eliminate the market risk SCR. Replication of best estimate cashflows is sufficient to reduce market risk SCR to an immaterial level for the purposes of the risk margin calculation. For non-life liabilities and short-term life insurance obligations, the market risk SCR for the risk margin calculation can usually be reduced to zero and hence is all "avoidable".

Internal models (partial or full) may be used to calculate the SCR as long as at least the risks listed above are included.

Where used, the internal model needs to be able to pull out this subset from the total SCR. This is a further difference from current ICA models which would ordinarily consider the policies signed but not yet incepted as part of the following year's business plan and not part of the existing liabilities.

Calculation of the risk margin

The SCR for each future year until business is run off must be projected. Each of the future SCRs (strictly, subsets of the SCRs) will be multiplied by the cost of capital rate to get the cost of holding these future SCRs.

Each amount will be discounted to the valuation date ($t=0$) using a risk free yield curve. The sum of the discounted values is the risk margin.

CEIOPS' Advice assumes that the undertaking accepting the transferred obligations takes these for each business segment in isolation. Therefore, insurers are required to carry out the calculations at a line of business (LoB) level. For aggregation purposes syndicates must assume no diversification benefits and sum the risk margins. The overall risk margin shall be the sum of risk margins as calculated for each line of business according to the prescribed segmentation.

For the purpose of the calculation of the risk margin, the calculation of the SCR of the reference undertaking (using a standard formula or an internal model) should be done at least at Solvency II minimum line of business level, based on the segmentation laid down by the implementing measures. If the SCR of the original undertaking is calculated by using an internal model, the segmentation may differ from the one laid down by the implementing measures. However, the risk margin shall always be valued at least at the lines of business laid down by those implementing measures.

It is likely that agents will need to aggregate risk groups used within the internal model to the Solvency II minimum lines of business before applying risk margin calculations. The exact allowance for diversification within risk margin calculations, for example between Solvency II lines of business, remains under discussion.

With respect to non-life business, the risk margin should not be calculated separately for premiums provisions and claim provisions.

The Cost-of-Capital risk margin is defined net of reinsurance only. Some forms of whole account reinsurance will therefore have to be allocated in a pragmatic and justifiable way to the lines of business for calculation of risk margins (as with the calculation of the best estimate). If an internal model is used, the risk margins can be calculated on gross and RI separately, if necessary.

Cost of capital rate

The cost of capital rate used is an additional annual rate, above the relevant risk-free rate, that a (re)insurance undertaking would incur holding an amount of eligible own funds equal to the SCR necessary to support the run-off of its obligations. In the general methodology set out above, this rate is applied to the subset SCR in each future period. The risk margin should ensure the technical provisions can be transferred even in a stressed scenario. The cost of capital rate should therefore be a long-term rate, reflecting both periods of stability and stress, and should not be adjusted to follow market cycles.

The rate will be the same for all (re)insurance undertakings and will be calculated periodically by CEIOPS according to a standard methodology. Based on current information, the Cost-of-Capital rate will be no less than 6%.

CEIOPS will apply the following three-step procedure for calculating the Cost-of-Capital rate:

- 1 Shareholder return models used to derive an initial rate (such as the CAPM or multifactor models);
- 2 Objective criteria used to adjust this rate both upwards (for factors such as fees for raising capital or taxes) and downwards (if rate of return required on liability transfer is thought to be lower than in a going concern); and
- 3 A final calibration performed to ensure risk margins are consistent with observable prices in the market, to avoid the calculated capital bases being consistently lower than those assessed in real-world transfers.

Simplifications

The requirements on simplifications set out below are derived from corresponding CEIOPS final advice¹.

In general, the risk margin calculations and, accordingly, the underlying projection of future SCRs should be as accurate as possible. If a managing agent is able to carry out a full projection of all future SCRs, for any or all lines of business, then it is expected to do so.

However, precise calculation of risk margins is likely to be difficult for many managing agents. Simplified methods for the risk margin are expected to be widely used in practice. To allow for this, the following hierarchy of simplifications regarding the methods to be used for projecting SCRs for each line of business should be used. Ranging from the most complex to the simplest, these are:

- 1 Make a full calculation of all future SCRs without using simplifications
- 2 Approximate the individual risks or sub-risks within some or all modules and sub-modules to be used for the calculation of future SCRs
- 3 Approximate the whole SCR for each future year, e.g. by using a proportional approach
- 4 Estimate all future SCRs at once, e.g. by using an approximation based on the duration approach
- 5 Approximate the risk margin directly as a percentage of the best estimate

Before applying a simplified method to calculate the risk margin, managing agents must ensure that the method is proportionate to the underlying risks and compatible with the Solvency II valuation principles.

Decisions as to whether to use a simplified valuation technique for the risk margin and, if so, what simplification methodology to use, should be made for each line of business independently. In making this assessment, managing agents should consider which simplified methods would be most appropriate for each given line of business, and should ensure that the chosen method is proportionate to the nature, scale and complexity of the risks in the line of business in question.

When a managing agent has decided to use a simplified method for a given line of business, it should also consider whether the method could be used for the projections of the overall SCR for that line of business or if the relevant sub-risks (e.g. underwriting, operation, reinsurance counterparty default) should be projected separately. In this context, the managing agent should also consider whether it should carry out the simplified projections of future SCRs individually for each future year or if it is possible to calculate all SCRs for that line of business in one step.

Quarterly calculations

The following requirements are derived from corresponding CEIOPS final advice².

Quarterly recalculations of the MCR will require details of the current level of the risk margin. In making these quarterly recalculations, the risk margin for an individual line of business may be simplified as follows:

¹ See paragraphs 3.366 to 3.372 of CEIOPS final advice DOC 72/10

² See paragraphs 3.459 to 3.461 of CEIOPS final advice DOC 72/10

$$CoCM_{LOB}(t) = CoCM_{LOB}(0) * \frac{BE_{Net,LOB}(t)}{BE_{Net,LOB}(0)} \text{ for } 0 < t < 1$$

Where:

- $CoCM_{LOB}(0)$ is the risk margin, as calculated at time $t=0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business.
- $BE_{Net,LOB}(0)$ and $BE_{Net,LOB}(t)$ are the best estimate net technical provisions, as assessed at times $t=0$ and t respectively, for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business.

This simplification should not be applied in cases where the best estimates are expected to decrease, in relative terms to the business (e.g. in cases where significant new business may generate best estimates that are close to zero or negative). Such cases may lead to significant underestimation of the risk margin.

Potential practical issues

If the internal model is used to derive the SCRs underlying the risk margin calculation, the SCRs will need to be output by Solvency II line of business, as used for technical provision best estimates. This may be difficult if the segmentation used for the SCR in the internal model doesn't match the way risks are modelled in the internal model.

Outputting an SCR that is essentially a subcomponent of the actual internal model SCR (i.e. excluding new business, market risk, non-reinsurance counterparty default risk) may require extra flexibility in model design.

Decisions over use of simplifications should be made independently for each line of business. Use of different methodologies for different lines could prove to be complicated.

Using the higher-tier methods for calculating SCRs (shown in the list of simplifications shown above) may prove to be difficult for many syndicates. The full methods will require sophisticated calculations and will probably need intensive computing power. Appropriate simplifications are still being developed.

CEIOPS advice suggests that the 6% minimum Cost-of-Capital may need to be adjusted upwards to allow for methodologies applied when calculating the capital bases (future SCRs) underlying the risk margin calculation. In particular, the cost of capital should be set higher if methods give lower capital bases than observed in the market through real insurance portfolio transfers. It is not clear how any such adjustments should be applied.

Suggested approaches

Possible methodologies

Methodologies will vary greatly by the level of sophistication of an internal model and the outputs it is able to produce. The hierarchy of simplifications suggested by CEIOPS (shown above) should be used to determine what approach should be followed. Decisions about the use of simplifications should be made independently for each line of business.

Using the higher-tier methods for calculating SCRs (shown in the list of simplifications shown above) may prove to be difficult for many syndicates. The full methods will require sophisticated calculations and will probably need intensive computing power.

All methods will need to consider the following steps:

Estimate an SCR for existing business and for the risk modules required

This will exclude new business, market risk, non-reinsurance counterparty default risk.

Estimating an SCR for existing business will need to adjust the SCR from an internal model to ensure there is no benefit of diversification between business lines.

An appropriate adjustment should be made for any unaccepted business (if not already incorporated within the SCR)

Project what this SCR will be at each future point in time

A likely simplified approach for many syndicates will then be to project an SCR into the future proportionally in line with best estimate provisions.

Note that CEIOPS has stated that simplifications should be a first step and undertakings should try and build more sophisticated methods where possible.

Apply the cost of capital and discount to the valuation date.

Discounting should be based on the appropriate risk-free interest rate term structure for the currency of obligations being considered.

Lloyd's proposes that unless an internal model that is capable of producing projected SCRs at a line of business level is available, then the simplified method 3 (proportionate) is applied. This was done for QIS4.

Indicative results

Share of the risk margin within Lloyd's Solvency II net technical provisions as at 31/12/2008, by Solvency II line of business

Solvency II line of business	Net technical provision £m	Risk margin £m	Risk margin as % of net technical provisions
Third-party liability	11,563	1,341	12%
Marine, aviation and transport (MAT)	6,426	458	7%
Fire and other damage to property	6,002	370	6%
Non proportional reinsurance – Property	4,406	863	20%
Motor, other classes	1,203	80	7%
Non proportional reinsurance – MAT	1,093	228	21%
Health (other)	748	110	15%
Credit and suretyship	646	70	11%
Non proportional reinsurance - Casualty	516	85	17%
Motor, third party liability	402	23	6%
Assistance	36	0	0%
Legal expenses	31	3	11%
Miscellaneous non-life insurance	0	0	N/A
Total	33,071	3,632	11%

Source: Lloyd's Market Reserving and Capital Department, January 2010

ASSUMPTIONS AND USE OF EXPERT JUDGEMENT

The majority of this section's requirements are based on paragraphs 3.241, 3.265 to 3.279 and 3.286 to 3.290 of CEIOPS final advice DOC 33/09.

Assumptions underlying technical provision calculation

Assumptions used within the calculation of technical provisions must be set consistently both with information provided by financial markets and "generally available" data on (re)insurance risks. All assumptions, both explicit and implicit, must be considered through all stages of the best estimate calculation:

- Data
- Analysis
- Modelling
- Validation

Appropriateness of assumptions

Certain general principles apply in assessing the appropriateness of an assumption:

- 1 Assumptions must be set in a realistic manner.
- 2 Assumptions should be derived consistently over time without arbitrary changes. Any changes made, and the impact of these changes, should be traced, explained, documented and quantified.
- 3 Expert judgement should be taken into account when setting assumptions; this is explained further below.
- 4 Assumptions should be documented, including details of the suitability of data sources, derivation of assumptions and limitations in the results.
- 5 The level of documentation should reflect the materiality of the assumption.
- 6 The data on which the assumption is based should be credible for the purpose and meet the statistical quality standards with regard to appropriateness, completeness and accuracy.
- 7 Where external data is used to support an assumption, the external data source should satisfy the criteria set out below:
 - The documentation of any assumptions or methodologies underlying any external data used should be available so that the data can be validated. In particular, it should be possible to assess the relevance of the data given the characteristics of the underlying insurance portfolio.
 - When external data is relied upon in preference to internal data, the managing agent should be able to demonstrate that the external data better reflects the underlying risk profile.
 - When data is produced sufficiently frequently, it should be analysed for trends, variations over time and variations between observations. Depending on the results of this analysis, adjustments to the data may be required.
 - Appropriate methods should be used to validate external data, with standards equivalent to those applying to the validation of internal data.

Assumptions consistent with generally available (re)insurance risks

Generally available data refers to a combination of:

- Internal data, consisting of undertaking-specific data and portfolio-specific data.
- External data sources such as industry or market data.

All relevant data (whether internal or external), to which an agent has reasonable access, should be taken into account to arrive at the assumption best reflecting the characteristics of the underlying insurance portfolio.

The extent to which external data is taken into account should be based on the availability, quality and relevance of external data and the amount and quality of internal data. Assumptions should be based solely on external (or internal) data only if there is no relevant internal (or external) data which could be used. Where both are available, expert judgement should be applied in deciding whether to use internal data, external data or a blend of both.

Appropriateness of assumptions

The appropriateness of any assumption should be determined according to the principles set out below.

- 1 Assumptions should be derived consistently across homogeneous risk groups and lines of business.
- 2 Assumptions should use the managing agent's knowledge of the business and practices for managing the business.
- 3 Assumptions should be based on credible information which is relevant to the cashflows.
- 4 Managing agents should consider whether assumptions adequately reflect the uncertainty underlying the cashflows.
- 5 Assumptions shall make appropriate allowance for possible trends or future changes (undertaking/portfolio specific factors as well as legal, social, economic or environmental factors).
- 6 Assumptions should be easy for third parties to understand, well documented and should consider the internal/external data or qualitative information used as a basis. Reasons for making the assumptions should be sufficiently documented.

Assumptions consistent with financial market information

Assumptions used must be consistent with financial market information. Such assumptions include:

- Interest rate term structures
- Currency rates of exchange
- Market inflation rates (CPI, Wage etc)
- Economic scenario files

Managing agents will need to demonstrate that assumptions are calibrated appropriately relative to information provided by financial markets. Any implicit assumptions within reserving methodologies will need to be considered. For example, the implicit claims inflation within commonly-used chain ladder techniques. Methods must be capable of applying different assumptions within the calculation if financial market information suggests that implicit assumptions are not appropriate.

Market-consistent asset models used to produce assumptions must reproduce prices that can be verified in the market, and be arbitrage free. These market-consistent asset models must take into account the nature and term of liabilities, the current risk-free term structure and an appropriate volatility measure.

The calibration process should use market prices from financial markets that are deep, liquid and transparent. If that is not possible, other market prices may be used. In this case, any distortions should be identified and corrected for in a deliberate, reliable and objective manner. A financial market is deep, liquid and transparent if it meets the requirements set out in CEIOPS-DOC-35/09. Where calibration cannot be carried out against a deep, liquid and transparent market, the managing agent must be able to demonstrate that the calibration is appropriate and in line with the criteria set out in the Level 1 text.

The calibration of such assumptions may be based on adequate actuarial and statistical analysis of economic variables.

Use of expert judgement

Expert judgment may apply in respect of data used in the calculation of the best estimates, the assumptions underlying the calculations, and the method applied to derive the best estimate. Expert judgement is a key element when setting technical provisions.

General conditions about the application of expert judgement

Expert judgement may be used as long as a number of conditions are met:

- Expert judgement should be compatible with all CEIOPS advice regarding technical provisions.
- Use of expert judgement should not replace appropriate collection, processing and analysis of data according to CEIOPS' advice on data quality standards.
- Expert judgement should not be used in isolation unless there is no reliable alternative.
- If expert judgement is applied in isolation or has a significant impact on the best estimates, managing agents must test reasonable alternative assumptions to ensure the selected assumption appropriately reflects uncertainty in the outcome.
- Persons applying expert judgment should have adequate experience and sufficient relevant knowledge and understanding of the subject.

The actuarial function will decide on the application of expert judgement.

Documentation on the use of expert judgement

Expert judgement should be justified, explained and validated. According to the proportionality principle, the process leading to the use of expert judgment should be documented in such a manner that the document makes possible the accountability and verification of the expert judgment. The documentation should reflect:

- the inputs on which expert judgment is based;
- the objectives and decision criteria used;
- any material limitations and the steps taken, if any, to mitigate the effect of such limitations; and
- the validation and back-testing envisaged or carried out for the expert judgment.

Users of results of expert judgement should receive clear and comprehensive information of the existence of the expert judgement and any relevant information on its content, degree of reliance and limitations (including appropriate sensitivity analysis).

Tests of the expert judgement

Expert judgement should:

- Be back-tested with additional experience gained or any emergent information.
- Be, where possible, benchmarked by comparing it with other expert opinions, either internally (provided the expert is independent of the original expert) or externally (taking due account of any potential conflicts of interest).
- Significant elements of expert judgment should be subject to a sensitivity analysis.

Potential practical issues

It will be challenging to adequately quantify, validate and document the assumptions implicit within certain reserving methodologies. Different homogeneous risk groups are likely to have significantly different assumptions implicit within the reserving methodologies.

It is accepted that insurance data may not always be fully appropriate, complete and accurate. Therefore judgement will almost always be needed.

Processes for quantifying impact of changes in assumptions can be complex.

Assumptions used should be consistent with those used in the internal model.

Consideration of the assumptions at every stage of the process is likely to involve significantly more work than current practices.

The selection of best estimates will always be subjective and will in reality lead to a range of best estimates.

Use of external data requires that reliance can be placed on the data provider's data validation processes. Even if it cannot be adequately validated, external data may still be better than internal data.

Documenting proportionality for assumptions will be challenging.

VALIDATION AND BACK-TESTING

The majority of this section's requirements are based on paragraphs 3.35, 3.312 to 3.334 and 3.343 to 3.355 of CEIOPS final advice DOC 33/09.

Validation

Validation techniques are defined as the tools and processes used throughout the setting of technical provisions to ensure that the valuation methods, assumptions and results of the technical provision calculation are appropriate and relevant. They can be qualitative as well as quantitative.

Managing agents must use validation techniques throughout the calculation of the best estimate in order to:

- Validate the amounts of the technical provisions.
- Ensure the applicability and relevance of the methods and assumptions applied.
- Ensure that the actuarial methods and statistical methodologies are appropriate to the nature, scale and complexity of the risks supported by the syndicate.
- Regularly compare against experience the best estimate and assumptions underlying the calculations.

Validation methods assist in the calculation of the best estimate by:

- Encouraging understanding of how the cash-flows may emerge in the future and tracing any flaws in the valuation process.
- Justifying the applicability and relevance of methods used in the calculation of the best estimate.
- Validating the appropriateness, completeness and accuracy of assumptions and modelling used in the calculation
- Testing the valuation process itself

Managing agents must consider the validation methods which are most appropriate to ensure the above requirements are met.

The validation process should include appropriate documentation and should be overseen by an expert who fulfils requirements specified for providing expert judgement. The actuarial function is responsible for the validation process.

Requirements for validation

Validation should be carried out at sufficient granularity. For non-life insurance, this would ideally be at the level of homogeneous risk groups. For life insurance, this is at least at the level of product types. The validation should be carried out separately for the gross best estimate and for reinsurance recoverables, and also for claims provisions and premium provisions.

All relevant and material assumptions should be validated and, to the extent that it is statistically feasible, for each such assumption separately. The appropriateness of assumptions should be determined according to the following criteria:

- Assumptions must be realistic.
- Assumptions should be derived consistently from year to year without arbitrary changes.
- Expert judgement may be used.
- The data on which assumptions are based should be appropriate, complete and accurate.
- Assumptions must be documented, and the level of supporting documentation must be consistent with materiality.
- When based on external data, a number of checks must have been carried out.

Validation should be used to identify emerging features and trends in the historical data, to validate underlying assumptions, to test the quality of fit and appropriateness of the valuation model etc.

Validation should be carried out at least once a year and in any case where there are indications of substantial changes. Validation may be needed between best estimate calculations in response to significant changes in the external environment, assumptions or results of goodness of fit test results. This, however, may not involve a "full

validation” but rather monitor for possible items requiring validation (through monitoring experience versus expectations).

Back-testing or comparison against experience

Back-testing techniques must be applied to ensure that the best estimate and the assumptions underlying its calculation are regularly tested against emerging experience.

This is useful for two purposes:

- As a posterior validation of expert judgement
- To check the validity of the usual underlying assumption that past performance is a good indicator of future performance

Any significant deviations between actual and predicted values identified through back-testing must be analysed to determine their underlying causes. The cause may be a consequence of random variation, a systemic effect, assumption error, parameter error or a combination of factors. Depending on the cause identified in each instance, the back-testing may imply that an adjustment to the calculation method is needed.

Potential practical issues

Back-testing and analysing the causes of significant deviations between actual and expected experience is likely to lead to additional work for many syndicates. The requirement to include appropriate documentation and evidence of peer review is also likely to increase workloads.

The validation needs to be completed by an “independent” function not directly involved in setting the technical provisions. This may not be possible for smaller syndicates where proportionality may apply. However, objective challenge must be retained. For larger syndicates, the validation process will need to be carefully considered.

Suggested approaches

Possible methodologies: Validation

There are many validation tests currently available and selection of these will be part of the reserving process. For example

- Chain-ladder: the assumption on a unique loss development factor from one column to another can be tested by plotting cumulative values of column k and $k+1$ on the x and y axes, plotting the line $y = a \cdot x$ (where a is the LDF), and see if the points roughly align on the line
- Chain-ladder: if no explicit inflation assumption is made, it should be demonstrated that the implicit assumption of a uniform inflation is valid
- Individual large loss selections can be compared to underlying exposures
- Expense assumptions can be compared to budgets

Possible methodologies: Back-testing

One of the strongest tools for back-testing is to use comparisons of actual and expected experience. Use of these techniques will increase under Solvency II. The selected models need to be demonstrably suitable for projecting liabilities.

It is expected the actual versus expected analyses would be conducted gross (and undiscounted) but can be net results. The segmentation should be at least by Solvency II line of business level.

Other tools used for back-testing will include analysis of change and unwinding of discount rates.

DATA IMPLICATIONS

The majority of this section's requirements are based on paragraphs 3.56 to 3.90 of CEIOPS final advice DOC 37/09.

Data quality requirements

Level 1 text: Article 82 – Data quality and application of approximations, including case-by-case approaches, for technical provisions

Member States shall ensure that insurance and reinsurance undertakings have internal processes and procedures in place to ensure the appropriateness, completeness and accuracy of the data used in the calculation of their internal provisions.

Definition of the term “data”

“Data” in this context refers to all the non-qualitative information needed to carry out a valuation of technical provisions. Assumptions are not regarded as data, but data is normally key to the development of assumptions.

General requirements on data quality in the context of valuing technical provisions

Managing agents should make all efforts to ensure that the data available for the valuation of technical provisions is as appropriate, complete and accurate for that purpose as possible. The combination of accuracy, completeness and appropriateness of the data should be sufficient to support the application of adequate provisioning methodologies.

Managing agents should assess and monitor the quality of the data used in the valuation of technical provisions (including data used to set a particular assumption). This assessment should be carried out on the basis of the three criteria: appropriateness, completeness and accuracy. Such assessment and monitoring is likely to be a significant step up from current practice.

Internal processes and procedures need to cover the systems for data quality management and the collection, storage and processing of the data. These data management systems will usually need to be formalised.

The degree of appropriateness, completeness and accuracy of the data should be consistent with the principle of proportionality. However, application of the proportionality principle should not lead to lower incentives for improving data quality.

Assessment of data quality with regard to appropriateness and completeness should be done at portfolio level, consistent with the level of segmentation applied in the calculation of technical provisions. It should also be performed at a more granular level where relevant including, if necessary, analysis relating to individual items.

Assessment of data quality with regard to accuracy should be done at the level of individual data items. The assessment of data accuracy should include appropriate cross-checks and tests as to its consistency with other relevant data and with the same data at different points in time.

Under Solvency II, the responsibility of the appropriateness and completeness of the data for technical provision lies with the actuarial function. Responsibility for the accuracy of data lies with the internal audit function.

Appropriateness of data

Data is considered appropriate if:

- It is suitable for the intended purpose; and
- It is relevant to the portfolio of risks being analysed.

Hence, to be appropriate for valuation purposes, data needs to be representative of the portfolio of liabilities being valued and suitable to be used to estimate the cash-flows from the liabilities (consistent with a prospective view on the behaviour of the relevant risks).

For elements of the calculation of technical provisions, fully appropriate data may not exist. In this circumstance expert judgement is required to determine the most appropriate data available (allowing for realistic costs considerations), to factor in the limitations arising from any data shortfall in the calculation and results. It is important that expert judgement and limitations are adequately communicated.

Completeness of data

Data is considered complete if:

- It allows for the recognition of all the main homogeneous risk groups within the liability portfolio;
- It has sufficient granularity to allow for the identification of trends and to the full understanding of the behaviour of the underlying risks (to a level sufficient for valuation purposes); and
- If sufficient historical information is available for the application of adequate valuation methodologies.

Accuracy of data

Data is considered accurate if:

- It is free from material mistakes, errors and omissions;
- The recording of information is adequate, performed in a timely manner and is kept consistent across time;
- A high level of confidence is placed on the data; and
- The managing agent is able to demonstrate that it recognises the data set as credible by using it throughout its operations and decision-making processes.

The assessment of data accuracy should include appropriate cross-checks and tests as to its consistency with other relevant data and with the same data at different points in time.

Keeping the recording of data consistent across time will be a significant challenge. For example, adjustments made can be very different across time, IT systems may change (or have changed historically), the data of newly acquired entities may be brought into the main system. It is also important to note situations where data recording is not kept consistent, but there is no impact on accuracy. Expert judgement is again key in this area.

Deficiencies in data

Not all data may meet these criteria, either because of:

- the nature or size of the portfolio, for example:
 - A low number of claims due to low frequency;
 - Insufficient history in a new company or line of business;
 - Small volume of business;
 - Historical data no longer adequate due to environment changes; or
- deficiencies in internal processes, for example:
 - IT mistakes;
 - High collection costs; or
 - A lack of control over data due to outsourcing of services or sales channel involving intermediaries.

Where a syndicate's internal data provides an inadequate basis for calculating technical provisions, the managing agent should assess the reasons and what it can do to increase the quality and quantity of the data. This is likely to require a more formal process than current practice.

The suggested courses of action following such an assessment are:

- Where the lack of data is related to deficiencies in processes and procedures (both internal and those involving third parties): prepare and implement an appropriate plan to remedy the situation and improve the collecting, storing and validation of the data.
- Where the deficiency related to the quality of the data: the managing agent should consider if adjustments could be made to the data to improve its quality. Any such adjustments should be carefully justified and documented and the integrity of the raw data should be protected. Agents should also consider whether any external data could be used.
- Where there is an unavoidable lack of internal data affecting appropriateness or completeness, evaluate if further judgemental adjustments or assumptions may need to be applied to allow the valuation to be performed (using appropriate approximations).

In no case should the use of approximations be seen as an alternative to implementing appropriate systems and processes for collecting material relevant information, building historical databases and improving data quality.

The principle of proportionality means that where the nature, scale and complexity of risks are high, companies should pay increased attention to the standards and requirements regarding data management.

Data quality management

The process of data quality management is likely to be more rigorous than current practices. There will be large challenges in implementing the process, though ongoing management may be significantly less difficult. Data quality management should be an ongoing process comprising the following phases:

Definition of the data

Definition of the data comprises the identification of the needs in terms of data, a detailed description of the items that should be collected and the eventual relations between the different items. Managing agents should consider the difference between items that should be collected and items that are actually collected.

Assessment of the quality of the data

Assessment of the quality of the data involves the verification of its appropriateness, completeness and accuracy for the purpose of calculating technical provisions. This assessment should have due regard to the quality and performance of the channels used to collate, store, process and transmit data (including third party data). Checking the appropriateness criteria will require checking that the assumptions adequately reflect the uncertainty of cashflows (this can be done by carrying out goodness of fit tests). As well as objective measures and indicators, expert judgement is required to carry out this assessment.

Resolution of the problems identified

Any material problems arising from the above analysis should lead to the managing agent trying to solve them. The agent should then work towards the improvement of data collection, storage and other relevant processes so as to ensure the quality of future data. The data problems should be documented, including a description of possible solutions and assignment of responsibilities for actioning the selected solution.

Monitoring data quality

Data quality should be monitored periodically, focussing in particular on the relevant IT systems and the processes used to collect, store, transmit and process data. Where appropriate, adjustments or corrections should be applied, either qualitatively or quantitatively, depending on circumstances. The process of monitoring data quality can, to some extent, be based on objective measures; however, expert judgment is a key requirement.

Lloyd's expects that full data quality assessments should take place at least annually, with monitoring performed quarterly to determine whether updates of full assessments are required.

Internal processes on identification, collection and processing of data

Data should be identified, collected, stored and maintained on a comprehensive basis and the underlying processes and procedures should be transparent.

Data should be collected at a sufficiently granular level to support the application of adequate provisioning methodologies and to generate results of sufficient detail and robustness. Since provisioning sometimes needs to be done at contract or event level, this means that, normally, data will need to be available at contract or event level.

Relevant historical data should be retained and remain available.

Any adjustments to the original data, in particular the correction of any data errors and omissions, must be documented, as must the reasons for the adjustments. The original database should be maintained.

Issues of data quality in the context of a provisioning analysis and review

Considerations of data quality for the purpose of setting technical provisions, and any adjustments subsequently deemed appropriate, must necessarily be carried out at a level of granularity that reflects the specific methodology, assumptions or parameters under review.

However, the requirement to set up internal processes and procedures adequate to deliver quality data does not relate to such a granular level. This should be considered from the perspective of calculating technical provisions, without necessarily relating it to the application of particular methodologies.

In the particular case of external and market information, the verification of the three criteria implies:

- Appropriateness and completeness: the assessment of these criteria is normally performed at the portfolio level. Where relevant, however, the assessment shall also be performed at a more granular level, including, if necessary, analysis relating to individual items. Managing agents are expected to verify that the inclusion of individual items of

external and market information contribute towards the enhancement of the appropriateness and completeness criteria, having regard to the intended purpose of the analysis.

- Accuracy: as individual items of external and market information have not been collected and compiled by the managing agent itself, the assessment of their accuracy is likely to be challenging. The verification of this criterion will have to consider the reliability of the sources of information and the consistency and stability of its process of collecting and publishing information across time.

Moreover, measurement of the quality and credibility of internal data should have regard to available industry or market data which is deemed comparable. Any material deviations should be identified and interpreted, for instance by referring to the specificities of the own portfolio being valued.

Role of internal/external auditors and actuarial function

External auditors will audit specific sets of data, in line with current techniques. However, the actuarial function is expected to review data to check it is appropriate and consistent for the purposes of the analysis. The actuarial function should also judge how much credibility should be placed on historic data and other assumptions. The actuarial function should analyse unusual observations and outliers.

External data and benchmarks must be reviewed to ensure they are reliable enough to be used.

The internal audit function is responsible for the accuracy of the data

Potential practical issues

Data quality

Assessing precisely whether the data quality is sufficient is likely to be judgemental and involve heavy use of the proportionality principle. It will be difficult to define an exact threshold of data quality which must be passed. This means documentation of decisions is essential.

In many cases, fully appropriate data will not be available and, in others, there may not be anything other than partially suitable data available. Deciding on whether the data quality requirements are met, given application of proportionality, will be a difficult task. This is no different to the current situation.

Data systems

In some syndicates, an extensive review and possible overhaul of data systems may be required. There may also be a need for bringing in data from underwriting systems for use as part of the technical provisions calculation.

Data systems will need to be fully understood by those who will be using them in technical provision calculations (particularly where new data items are being considered) and precise definitions of data items will be needed. For example, those working with "paid" claims data to project claims payment cashflows would need to know whether the data shows true cashflows or just the designation of a claim as ready for payment.

There needs to be consistency with technical provisions data and the internal model data.

Suggested approaches

Possible methodologies

The current processes for data storage should be reviewed. Areas for particular attention should be:

- Formation of data dictionary
- Integration of data systems for different uses (ideally a single source)
- Define roles (actuarial function and internal audit)
- Test for appropriateness/completeness against proposed methods

Additional data requirements

Lloyd's will consider introducing new risk codes to allow easier mapping to Solvency II requirements.

Prospective methods, potentially based on accident year projections, will need additional data items. Where possible, data should be stored at as granular a level as possible, to allow future modification to extracts.

DOCUMENTATION

The majority of this section's requirements are based on paragraphs 3.32 to 3.37 and 3.360 of CEIOPS final advice DOC 33/09.

Documentation of technical provision calculation

Level 1 text: Article 84 - Appropriateness of the level of technical provisions

Upon request from the supervisory authorities, insurance and reinsurance undertakings shall demonstrate the appropriateness of the level of their technical provisions, as well as the applicability and relevance of the methods applied, and the adequacy of the underlying statistical data used.

All steps in the valuation process should be documented. Views of experts from other business areas should be built into a process of feedback.

Together with this documentation, agents should be able to demonstrate:

- The robustness of the valuation process
- The appropriateness of the level of technical provisions
- The applicability of methods and assumptions applied
- The adequacy of underlying data used.

All documents produced and used during the process of valuation of the best estimate of technical provisions that enable assessment of the appropriateness of the level of best estimate, as well as the applicability and relevance of the methods used, should be stored and made immediately available to the supervisor on request.

Potential practical issues

Documenting specific exclusions and selections is onerous due to the potential volumes involved. Establishing a formal documentation and feedback process may be a large step for some syndicates.

Proportionality is a key concept within Solvency II. However, the test standard that may be applied is whether another, suitably skilled, individual could reproduce the results based on the documentation and data alone.

The documentation standards are more specific than current requirements which may, in turn, lead to more formal procedures to be put in place.

Extracts from Directive and Level 2 text

Level 1 text

Directive of the European Parliament and of the Council on the taking-up and pursuit of the business of insurance and reinsurance (Solvency II)(Recast) – 25/11/2009

Extracts from Article 76: General provisions

1. *Member States shall ensure that insurance and reinsurance undertakings establish technical provisions with respect to all of their insurance and reinsurance obligations towards policyholders and beneficiaries of insurance or reinsurance contracts.*
2. *The value of technical provisions shall correspond to the current amount insurance and reinsurance undertakings would have to pay if they were to transfer their insurance and reinsurance obligations immediately to another insurance or reinsurance undertaking.*
3. *The calculation of technical provisions shall make use of and be consistent with information provided by the financial markets and generally available data on underwriting risks (market consistency).*

Extracts from article 77: Calculation of technical provisions

1. *The value of technical provisions shall be equal to the sum of a best estimate and a risk margin (...)*
2. *The best estimate shall correspond to the probability-weighted average of future cash-flows, taking account of the time value of money (expected present value of future cash-flows), using the relevant risk-free interest rate term structure.*

The calculation of the best estimate shall be based upon up-to-date and credible information and realistic assumptions and be performed using adequate, applicable and relevant actuarial and statistical methods.

The cash-flow projection used in the calculation of the best estimate shall take account of all the cash in- and out-flows required to settle the insurance and reinsurance obligations over the lifetime thereof.

The best estimate shall be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. Those amounts shall be calculated separately (...).

5. *Where insurance and reinsurance undertakings value the best estimate and the risk margin separately, the risk margin shall be calculated by determining the cost of providing an amount of eligible own funds equal to the Solvency Capital Requirement necessary to support the insurance and reinsurance obligations over the lifetime thereof.*

The rate used in the determination of the cost of providing that amount of eligible own funds (Cost-of-Capital rate) shall be the same for all insurance and reinsurance undertakings and shall be reviewed periodically.

The Cost-of-Capital rate used shall be equal to the additional rate, above the relevant risk-free interest rate, that an insurance or reinsurance undertaking would incur holding an amount of eligible own funds (...) equal to the Solvency Capital Requirement necessary to support insurance and reinsurance obligations over the lifetime of those obligations.

Extracts from article 80: Segmentation

Insurance and reinsurance undertakings shall segment their insurance and reinsurance obligations into homogeneous risk groups, and as a minimum by lines of business, when calculating their technical provisions.

Extracts from article 129: Calculation of the Minimum Capital Requirement

4. *Insurance and reinsurance undertakings shall calculate the Minimum Capital Requirement at least quarterly and report the results of that calculation to supervisory authorities. (...)*

Level 2 text: implementing measures

Former Consultation Paper 26 on elements of actuarial and statistical methodologies for the calculation of the best estimate (CEIOPS-DOC-21/09)

[...]

- 3.28 *The Level 1 text states that the best estimate shall correspond to the probability weighted average of future cash-flows taking account of the time value of money, using the relevant risk-free interest rate term structure. This in effect acknowledges that the best estimate calculation shall allow for the uncertainty in the future cash-flows used for the calculation of the best estimate.*
- 3.29 *In the context of this advice, allowance for uncertainty refers to the consideration of the variability of the cash-flows necessary to ensure that the best estimate represents the mean of the cash-flows. Allowance for uncertainty does not suggest that additional margins should be included within the best estimate.*
- 3.30 *Causes of uncertainty in the cash-flows that shall be taken into consideration in the estimation of the best estimate and the application of the valuation technique, where relevant, may include the following:*
- Fluctuations in the timing, frequency and severity of claim events.*
 - Fluctuations in the period needed to settle claims.*
 - Fluctuations in the amount of expenses.*
 - Changes in the value of an index/market value used to determine claim amounts.*
 - Changes in both entity and portfolio specific factors such as legal, social, or economic environmental factors where relevant. For example, in some countries, this may include changes as a result of legislation such as Ogden rates, periodical payments, taxation or cost of care.*
 - Uncertainty in policyholder behaviour.*
 - The exercise of discretionary future management actions by the (re)insurance undertaking (to the extent they may depend on the abovementioned causes of uncertainty and also on entity specific factors). The allowance of these future management actions should be subject to the requirements set out in CEIOPS' advice on actuarial and statistical methodologies to calculate the best estimate.*
 - Path dependency, where the cash-flows depend not only on circumstances such as economic conditions on the cash-flow date, but also on those circumstances at previous dates.*
 - Interdependency between two or more causes of uncertainty*
- 3.31 *The responsibility for the choice of adequate techniques for the calculation of the best estimate liability rests with the (re)insurance undertaking subject to the requirements set out in the Level 1 text as well as those requirements set out in this advice below. However, the supervisor should be able to require, stating the reasons, the reassessment of the technical provisions which may involve the use of an alternative technique, if this reassessment or the use of a different technique is believed to better reflect the objective of the valuation (prudent, reliable and objective).*
- 3.32 *The valuation of the best estimate shall meet the following requirements:*
- The (re)insurance undertaking shall be able to demonstrate the appropriateness, including the robustness of the techniques and assumptions used, having regard to the nature, scale and complexity of risks. In order to meet this requirement, a (re)insurance undertaking shall be able to provide sound rationale for the choice of one technique over other relevant techniques. This also applies to simplified techniques, approximations.*
 - The (re)insurance undertaking shall assess the degree of judgement required in each method and to what extent the undertaking is able to carry out such judgement in an objective and verifiable manner according the requirements set out in CEIOPS' advice on actuarial and statistical methodologies to calculate the best estimate.*
 - The (re)insurance undertaking shall be able to demonstrate that the valuation technique and the underlying assumptions are realistic and reflect the uncertain nature of the cash-flows.*

- *The valuation technique shall be chosen on the basis of the nature of the liability being valued and from the identification of risks which materially affect the underlying cash-flows.*
 - *The assumptions underlying the valuation technique shall be validated and reviewed by the (re)insurance undertaking.*
 - *The valuation technique and its results shall be capable of being audited.*
 - *If policy data is grouped, the (re)insurance undertaking shall be able to demonstrate that the grouping process appropriately creates homogeneous risk groups that allow for the risk characteristics of the individual policies. This applies to either claims or policy data.*
 - *Having regard to the previous bullet points, (i.e. having ensured that the valuation technique is appropriate and robust given the nature, scale and complexity of the risk), (re)insurance undertakings shall ensure that their capabilities (e.g. actuarial expertise, IT systems) are commensurate with the actuarial and statistical techniques used.*
- 3.33 *Valuation techniques considered to be appropriate actuarial and statistical methodologies to calculate the best estimate as required by Article 86(a) include: simulation, deterministic and analytical techniques or a combination thereof.*
- 3.34 *When selecting the valuation technique, (re)insurance undertakings shall consider the following factors and the material impact on the value of the liability, subject to proportionality:*
- *Whether the cash-flows are materially path dependent.*
 - *Existence of material non-linear inter-dependencies between several drivers of uncertainty.*
 - *Whether the liability cash-flows are materially affected by the potential future management actions.*
 - *Presence of risks that have a material asymmetric impact on the value of the cash flows, in particular if contracts include material embedded options and guarantees or if there are complex reinsurance contracts in place.*
 - *Whether the value of options and guarantees is materially affected by the policyholder behaviour assumed in the model.*
 - *The availability of relevant data taking into account the requirements on data quality set out in CEIOPS' advice on standards for data quality*
- 3.35 *For certain life insurance liabilities, in particular the future discretionary benefits relating to participating contracts, especially those depending on assets performance, or other contracts with embedded options and guarantees, simulation may lead to a more appropriate and robust valuation of the best estimate liability. In such circumstances simulation techniques would normally be required.*
- 3.36 *For the estimation of non-life best estimate liabilities as well as life insurance liabilities not covered by the previous paragraph, deterministic and analytical techniques can be more appropriate. Some reasons are:*
- *Deterministic methods are usually the starting point for any estimation of best estimate. The application of simulation techniques can add useful insight into ranges around the mean and measures of uncertainty but they will not necessarily produce more accurate estimates of the best estimate because of the significant degree of uncertainty in the calibration of stochastic models.*
 - *The mean of both the application of the simulation and deterministic method may well be the same under both methods (not least because deterministic results are often used to calibrate simulation methods) meaning that the best estimate for Solvency II purposes will be the same for either method (before any judgment is applied).*
- 3.37 *Both deterministic and simulation models are parameterised by the historic data available. Regardless of whether a deterministic or simulation model is used, the resulting mean estimates will therefore be based on development similar to that seen in the history and not contain "all possible future outcomes".*
- 3.38 *Regardless of the technique, judgement is required in making additions or adjustments to the estimates to allow for circumstances not included in the history that need to be incorporated into best estimates (for example emergence of latent claims, binary events, etc...). In all the methods judgement is an additional element in satisfying article 76 of the Level 1 text.*

Former Consultation Paper 27 on lines of business on the basis of which (re)insurance obligations are to be segmented (CEIOPS-DOC-22/09)

[...]

A. General principles of segmentation

- 3.35 *The Level 1 text requires that (re)insurance obligations are segmented as a minimum by line of business in order to calculate technical provisions. Insurance and reinsurance undertakings should further segment prescribed lines of business into more homogenous risk groups according to the risk profile of the obligations.*
- 3.36 *CEIOPS defines a homogenous risk group as a set of (re)insurance obligations which are managed together and which have similar risk characteristics in terms of, for example, underwriting policy, claims settlement patterns, risk profile of policyholders, likely policyholder behaviour, product features (including guarantees), future management actions and expense structure. The risks in each group should be sufficiently similar to allow for a reliable valuation of technical provisions. The classification is undertaking-specific.*
- 3.37 *The principle of substance over form should be followed in determining how contracts with risks from different lines of business should be treated. In other words, the segmentation should reflect the nature of the risks underlying the contract (substance), rather than the legal form of the contract (form).*

B. Segmentation of non-life insurance obligations

- 3.38 *The lines of business (LoB) for non-life obligations shall be defined as follows :*

- Accident

This line of business includes obligations caused by accident or misadventure but excludes obligations considered as workers compensation insurance;

- Sickness

This line of business includes obligations caused by illness, but excludes obligations considered as workers compensation insurance;

- Workers' compensation

This line of business includes obligations covered with workers compensation insurance which insures accident at work, industrial injury and occupational diseases;

- Motor vehicle liability -- Motor third party liability

This line of business includes obligations which cover all liabilities arising out of the use of motor vehicles operating on the land including carrier's liability;

- Motor, other classes

This line of business includes obligations which cover all damage to or loss of land motor vehicles, land vehicles other than motor vehicles and railway rolling stock;

- Marine, aviation and transport

This line of business includes obligations which cover all damage or loss to river, canal, lake and sea vessels, aircraft, and damage to or loss of goods in transit or baggage irrespective of the form of transport. This line of business also includes all liabilities arising out of use of aircraft, ships, vessels or boats on the sea, lakes, rivers or canals including carrier's liability irrespective of the form of transport.

- Fire and other damage

This line of business includes obligations which cover all damage to or loss of property other than motor, marine aviation and transport due to fire, explosion, natural forces including storm, hail or frost, nuclear energy, land subsidence and any event such as theft;

- General liability - Third party liability

This line of business includes obligations which cover all liabilities other than those included in motor vehicle liability and marine, aviation and transport;

- Credit and suretyship

This line of business includes obligations which cover insolvency, export credit, instalment credit, mortgages, agricultural credit and direct and indirect suretyship;

- Legal expenses

This line of business includes obligations which cover legal expenses and cost of litigation;

- Assistance

This line of business includes obligations which cover assistance for persons who get into difficulties while travelling, while away from home or while away from their habitual residence;

- Miscellaneous non-life insurance

This line of business includes obligations which cover employment risk, insufficiency of income, bad weather, loss of benefits, continuing general expenses, unforeseen trading expenses, loss of market value, loss of rent or revenue, indirect trading losses other than those mentioned before, other financial loss (not-trading) as well as any other risk of nonlife insurance business not covered by the lines of business mentioned before.

3.39 *With regard to accepted proportional reinsurance business, non-life obligations shall be segmented as a minimum according to the segmentation for non-life insurance obligations described above.*

3.40 *With regard to accepted non-proportional reinsurance business, non-life obligations shall be segmented as a minimum into:*

- Property business;

- Casualty business;

- Marine, aviation and transport business.

C. Segmentation of life insurance obligations

3.41 *Life insurance and reinsurance business shall be segmented into 16 lines of business as follows:*

- Contracts with profit participation clauses

- Contract where policyholder bears the investment risk

- Other contracts without profit participations clauses

- Accepted reinsurance

which should be further segmented into:

- Contracts where the main risk driver is death;

- Contract where the main risk driver is survival;

- Contracts where the main risk driver is disability/morbidity risk;

- Savings contracts, i.e. contracts that resemble financial products providing no or negligible insurance protection relative to the aggregated risk profile.

3.42 *Life insurance obligations shall be allocated to the line of business that best reflects the technical nature of the underlying risks. CEIOPS considers that it should be possible to assign a homogeneous group of life insurance obligations to a given line of business at inception on the basis of the major risk driver for that group.*

D. Segmentation of health insurance obligations

3.43 *As defined in CEIOPS' Advice on the health underwriting risk, health insurance obligations shall be segmented into:*

- Health insurance obligations pursued on a similar technical basis to that of life insurance (SLT Health)

- Health insurance obligations pursued on a similar technical basis to that of non-life insurance (Non-SLT Health).

- 3.44 SLT health obligations should be further segmented, as a minimum, according to the segmentation for life insurance obligations described above.
- 3.45 Non-SLT health obligations should be further segmented, as a minimum, according to the segmentation for non-life insurance obligations described above (accident, sickness, workers compensation).

E. Unbundling insurance obligations

- 3.46 Where a contract covers risks across non-life and life (re)insurance, these contracts should be unbundled into their life and non-life parts.
- 3.47 Where a contract covers risks across different lines of business, these contracts should be unbundled into the appropriate lines of business.
- 3.48 A contract covering life (re)insurance business should always be unbundled according to the top-level segmentation defined above.
- 3.49 With regard to the second level of segmentation, unbundling should be applied to life (re)insurance contracts where those contracts:
- Cover a combination of risks relating to different lines of business; and
 - Could be constructed as stand-alone contracts covering each of the different risks.
- 3.50 Notwithstanding the above, unbundling may not be required where only one of the risks covered by a contract is material. In this case, the contract may be allocated according to the major risk driver.
- 3.51 The principle of substance over form should also be applied in order to determine how each of the unbundled components of a given contract should be allocated to different lines of business.

F. Cross-border activities

- 3.52 In the case of cross-border activities, (re)insurance undertakings shall first segment their (re)insurance obligations by country and then according to the requirements of this advice.

Former Consultation Paper 30 on the treatment of future premiums (CEIOPS-DOC-25/09)

[...]

- 3.32 The calculation of the best estimate should only include future cash-flows associated with existing insurance and reinsurance contracts, being these all the cash in- and out-flows required to settle the insurance and reinsurance obligations over the lifetime thereof.
- 3.33 A reinsurance or insurance contract should be initially recognized by insurance or reinsurance undertakings as an existing contract when the undertaking becomes a party of the contract. In particular, tacit renewals which have already taken place at the reporting date should lead to the recognition of the renewed contract.
- 3.34 A contract should be derecognized as an existing contract when, and only when, the obligation specified in the contract is discharged or cancelled or expires.
- 3.35 For the calculation of the best estimate, the boundaries of an existing insurance or reinsurance contract should be defined as follows:
- (a) Where the insurance or reinsurance undertaking has a unilateral right to cancel the contract, a unilateral right to reject the premium or an unlimited ability to amend the premium or the benefits (or otherwise reunderwrite the risk) at some point in the future, any premiums received beyond that point (and any resulting benefit payments to policyholders, expenses etc.) do not belong to the existing contract.
 - (b) Where the undertaking's right to cancel the contract or to reject the premium or the ability to amend the premium or the benefits relates only to a part of the contract, the same principle as defined in ((a)) should be applied to the part in question.

(c) Future premiums and any resulting benefit payments to policyholders, expenses etc. which relate to an option or guarantee that provides rights under which the policyholder can renew the contract (or a part of the contract) belong to the existing contract if, and only if, the inclusion of the renewals increase the best estimate. Stakeholder comments and guidance from the Commission point out an inconsistency of this treatment with the economic approach of Solvency II. CEIOPS stands ready to lead further work on this issue on the basis of clear guidance from the European Commission. Further work will necessarily include an assessment of changes to previous advice from CEIOPS, namely on SCR and own funds.

(d) The same principle as defined in (c) is applied to options or guarantees which allow the policyholder to extend the insurance coverage to another person, to extend the insurance period, to increase the insurance coverage or to establish new insurance cover.

(e) All other cash-flows relating to the contract should be included in the calculation of the best estimate. In particular, future premiums (and any other resulting benefit payments to policyholders, expenses, etc) should be included if their payment by the policyholder is legally enforceable. A vast majority of CEIOPS members fully endorse this proposal. The rest of members have, for the time being, some reservations about the content of the letters (c) and (d) of this paragraph.

- 3.36 The assessment of the boundary of insurance and reinsurance contracts should be made, in principle, per contract. Nevertheless where this approach is not workable, a higher level of granularity may be applied if this assessment does not lead to materially different results than an assessment per contract. The granularity should be maintained at least at the minimum level required in the CEIOPS' Draft Level 2 Advice on Segmentation.
- 3.37 Where future cash-flows relating to a policyholder option belong to the existing contract and are included in the best estimate, the option exercise rates for the valuation shall be realistic and based on current and credible information and be chosen with an assessment of actual experiences and anticipated future experiences. The assumptions on the option exercise rates shall take account, either explicitly or implicitly, of the impact that future changes in financial and non-financial conditions may have on the exercise of those options.
- 3.38 The exclusion of certain profitable future premiums from the existing contract does not imply that the risk connected to these potential premiums is not taken into account. The SCR should allow for the risk that if circumstances change the future premiums relating to an option may become unprofitable and the undertaking may incur a loss.

Former Consultation Paper 32 on assumptions about future management actions (CEIOPS-DOC-27/09)

[...]

A. General rules

- 3.23 The methods and techniques for the estimation of future cash-flows, and hence the assessment of the provisions for insurance liabilities, could take account of potential future actions. In any case Articles 84 to 85 of the Level 1 text should remain applicable, where the effect of considering the future management actions is material.
- 3.24 (Re)insurance undertakings have the primary responsibility of verifying whether their future management actions are objective, realistic and verifiable, as these criteria are defined in this advice. If these criteria cannot be demonstrated by the (re)insurance undertaking, the management action should not be taken into account. The assessment of the undertaking in respect of its future management actions shall be subject to supervisory review according articles 84 and 85 of the Level 1 text.
- 3.25 The assumptions used to project the cash-flows should reflect the actions that management would reasonably expect to carry out in the circumstances of each scenario over the duration of the projection.
- 3.26 Allowance should be made for the time taken to implement actions. In considering the reasonableness of projected future management actions, (re)insurance undertakings should consider their obligations to policyholders, e.g. through policy wordings, marketing literature.

B. Objectivity

- 3.27 *Objectivity means that for the purpose of the calculation of the best estimate the (re)insurance undertaking should define what future management actions will be taken and when each would be taken. This will need to cover all scenarios which are relevant for the valuation of the best estimate.*
- 3.28 *For the purpose of the previous paragraph, (re)insurance undertakings should maintain a comprehensive plan which outlines the future management actions which may be used and the extent/circumstances to which they can be expected to be used. The plan should include:*
- *Documentation with a clear description of the situations that trigger the future management actions and their rationale.*
 - *Documentation of the processes by which the future management actions will be carried out.*
 - *Documentation of the ongoing work required to ensure that the (re)insurance undertaking is in a position to carry out the management action in question.*
 - *Description of the order of exercise of the future management actions, as the order of application has an influence on the outcome.*
 - *Identification of the persons whose responsibility it is to ensure that the future management actions are carried out.*
 - *Clarification of how the plan has been reflected in the calculation of the best estimate.*
 - *Sign-off from the Board or delegated sub-committee on each of the above points.*
 - *Description of the back-testing controls.*
 - *Description of the reporting procedures to apply, which should include at least an annual report to the administrative or management body.*
- 3.29 *For the reinsurance undertaking, the liability will depend on the future management actions taken by the cedant undertaking as well. In this case, the reinsurer's technical provisions could be larger than the insurer's for the same block of business. Moreover, the reinsurer may consider the future management actions of the cedant insurer as "policyholder's behaviour", provided the assumptions in this respect meet the requirements generally set out for the rest of assumptions used in the calculation of the technical provisions.*

C. Realism

- 3.30 *Realism should be interpreted as meaning that the (re)insurance undertaking considers it both possible and also realistic that it will carry out such actions in the circumstances being considered (i.e. market conditions for sales or purchases of assets, any commitments given to customers and/or supervisors about how the business will be managed,...).*
- 3.31 *Realism should also be interpreted as meaning that assumed future management actions should be consistent with the (re)insurance undertaking's current principles and practices to run the business unless there is sufficient current evidence that the insurer will change its practice and has taken the necessary steps to implement this change.*
- 3.32 *It should not be assumed that (re)insurance undertakings would take future management actions if this is contrary to their obligations to policyholders. An insurer should consider its policy wordings, marketing literature, or other statements when considering its obligations to policyholders. This assessment should also take account of any relevant legal or regulatory constraints around the management action.*
- 3.33 *For a given scenario the assumed future management actions should reflect the trade-off between the degree of competitiveness aimed at by the undertaking and the risk of dynamic lapses. This trade-off should be consistent with corporate planning.*
- 3.34 *Future management actions in different scenarios shall be internally consistent when calculating the best estimate. Furthermore, extreme scenarios shall consider the effect of future management actions consistently with the recalculation for the SCR. In particular, the future management actions shall also consider that in some scenarios such actions may be not applied due to practical impediments.*
- 3.35 *The (re)insurance undertaking should also estimate the time taken to implement actions, for any costs associated with these actions and for any likely changes to policyholder behaviour following those future management actions. The cash-flows included in the technical provisions should reflect this accordingly.*

D. Verifiability

- 3.36 *Verifiability should be interpreted as meaning that there should be sufficient evidence to demonstrate that the future management actions are objective and realistic.*
- 3.37 *In particular, the assumptions should be verifiable from:*
- *The comprehensive plan and documentation discussed under objectivity.*
 - *If available, from public indications that it would expect to take (or not take) the action in the type of circumstance being considered.*
 - *Through the comparison of assumed future managements actions and management actions actually taken by the (re)insurance undertaking in previous years; the (re)insurance undertaking should document and be able to explain any relevant deviations.*
 - *Through the comparison of future management actions taken into account in the current and in the past valuations; the (re)insurance undertaking should document and be able to explain any significant change in the accounted future management actions.*
 - *Through the quantification of the effect of future management actions either individually or in aggregate.*
- 3.38 *The level of justification required for a given management action may depend on the impact of that management action. For example stronger justification may be required for future management actions considered in the extreme scenarios or where the management action changes more significantly the value of the best estimate. The effect of management actions assumed in the determination of technical provisions has to be publicly disclosed.*

Former Consultation Paper 39 on actuarial and statistical methodologies to calculate the best estimate (CEIOPS-DOC-33/09)

[...]

- 3.32 *Valuation of technical provisions is a process which requires expert judgement in a number of areas, for example, regarding the credibility to assign to historical data, to what extent reliance should be placed on prospective models and the requirement to consider uncertainty in the estimation. Valuation of technical provisions requires analysis of the underlying liabilities and the collection of qualitative and quantitative information.*
- 3.33. *The valuation of technical provisions (i.e. best estimate referred in Article 77(2) should therefore not rely solely on models but take into account a variety of techniques including the application of judgement based on sound reasoning and business logic.*
- 3.34. *The valuation of the technical provisions is a process that includes:*
- *Collection and analysis of data;*
 - *Determination of assumptions for valuation of technical provisions;*
 - *Modelling, parameterisation the model and running the model (quantification of technical provisions);*
 - *Assessment and appropriateness of estimations;*
 - *Controls*
 - *And documentation.*
- 3.35. *The valuation process should be carried out by a person who has knowledge of actuarial and financial mathematics, commensurate with the nature, scale and complexity of the risks inherent in the business of the insurance and reinsurance undertakings, and who are able to demonstrate their relevant experience with applicable professional and other standards.*
- 3.36. *All steps in the process of valuation of technical provisions referred to in paragraph 3.34 should be documented and results of experience analysis should be shared where appropriate with persons from other business areas such as underwriting, pricing, and claims. Views of these persons should be captured and included in the feedback loop where necessary. The whole process of valuation should also be revised*

and verified by person who has adequate knowledge and skills and is independent of the process of valuation.

- 3.37. Upon request from the supervisory authority the undertaking shall demonstrate the robustness of the valuation process including the appropriateness of the level of its technical provisions, as well as the applicability and relevance of methods applied, and the adequacy of underlying statistical and financial data used.

[...]

- 3.54. Due to the fact that the insurance and reinsurance obligations could be transferred to another undertaking, the expenses that should be taken into account are those which are directly related to the ongoing administration and management of (re)insurance contracts and those which are related to overhead expenses which should be assessed on the assumption that the undertaking continues to write further new business unless a decision has been made to cease writing further business.

- 3.55. CEIOPS believes that the option based on the “going concern” assumption is consistent with the concept of the transfer of the portfolio to a reference undertaking unless the risk of closure of the undertaking is imminent and is therefore appropriate for valuation of technical provisions.

- 3.56. CEIOPS considers that a “run-off” assumption should apply when an undertaking is in run-off or it is very likely that an undertaking will be in the near future.

[...]

- 3.69. Where non-life insurance policies give rise to the payment of annuities, following the principles of substance over form, the annuity obligations should be treated as life insurance obligations. Therefore, the value of the technical provision for such annuity obligations should be calculated separately using appropriate life actuarial techniques, and should be included as part of the life insurance obligations or health insurance obligations pursued on similar technical basis to that of life insurance. For premium provisions, its assessment should include an appropriate calculation of annuity obligations if a material amount of incurred claims is expected to give rise to the payment of annuities.

[...]

- 3.79. The cash-flow projection used in the calculation of the best estimate should take into account of all the cash in- and out-flows required to settle the obligations over their lifetime.

- 3.80. The best estimate should be calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. In the case of co-insurance the cash-flows of each co-insurer should be calculated as their proportion of the expected cash-flows without deduction of the amounts recoverable from reinsurance and special purpose vehicles..

- 3.81. Cash-flow projections should reflect expected realistic future demographic, legal, medical, technological, social or economical developments.

Time horizon

- 3.82. Appropriate assumptions for future inflation should be built into the cashflow projection. Care should be taken to identify the type of inflation to which particular cash-flows are exposed (i.e. consumer price index, salary inflation).

- 3.83. The projection horizon used in the calculation of best estimate should cover the full lifetime of all obligations related to existing insurance and reinsurance contracts on the date of the valuation.

- 3.84. The determination of the lifetime of insurance and reinsurance obligations shall be based on up-to-date and credible information and realistic assumptions about when the existing insurance and reinsurance obligations will be discharged or cancelled or expired.

Gross cash-in flows

- 3.85. To determine the best estimate the following non-exhaustive list of cash in-flows should be included:

- Future premiums; and
- Receivables for salvage and subrogation.

The cash in-flows should not take into account investment returns (i.e. interests earned, dividends...).

Gross cash-out flows

3.86. *To determine the best estimate the following non-exhaustive list of cash out-flows should be included:*

- benefits; and
- expenses
- other gross cash-flow items

Benefits

3.87. *The benefit cash out-flows (non-exhaustive list) should include:*

- Claims payments,
- Maturity benefits,
- Death benefits,
- Disability benefits,
- Surrender benefits,
- Annuity payments.

Expenses

3.88. *In determining the best estimate, the undertaking shall take into account all cash-flows arising from expenses that will be incurred in servicing all obligations related to existing insurance and reinsurance contracts over the lifetime thereof. This should include (non-exhaustive list):*

- Administrative expenses,
- Investment management expenses,
- Claims management expenses / handling expenses,
- Acquisition expenses including commissions which are expected to be incurred in the future.

3.89. *Expenses include both allocated and unallocated expenses. Allocated expenses are directly assignable to individual claims, policies or transactions. Unallocated (or overhead) expenses comprise all other expenses which the insurer incurs in settling its obligations.*

3.90. *Overhead expenses shall be allocated according to professional judgment and realistic assumptions.*

3.91. *The allocation of overhead expenses to lines of business, homogeneous risk groups or any other segments of the best estimate should be done on an economic basis following realistic and objective principles. The principles and their application should be documented and the undertaking should be able to explain changes in the principles or their application over time.*

3.92. *The predefined split of expenses which could not be directly allocated should only be changed if the new split will better fit the current situation.*

3.93. *For non-life insurance obligations, the undertaking will further need to allocate expenses between premium provisions and claims provisions where such allocation is appropriate.*

3.94. *For premium provisions, the valuation of the best estimate could take into account the following non-exhaustive list of expenses:*

- Administrative expenses including commissions connected with ongoing administration of the in-force policies,
- Claims administration expenses connected with future claims events stemming from in-force policies.

3.95. *For claims provisions, the valuation of best estimate could take into account the following non-exhaustive list of expenses:*

- claims administration expenses connected with unsettled claims that have occurred before the valuation date.

- 3.96. *To the extent that future premiums from existing insurance and reinsurance contracts are taken into account in the valuation of the best estimate, expenses relating to these future premiums should be taken into consideration.*
- 3.97. *Undertaking should consider their own analysis of expenses and any relevant market data. Expense assumptions should include an allowance for the expected future cost increase. These should take into account the types of cost involved. The allowance for inflation should be consistent with the economic assumptions made.*
- 3.98. *For the assessment of the future expenses, undertakings should take into account all the expenses that are directly related to the ongoing administration of obligations related to existing insurance and reinsurance contracts, together with a share of the relevant overhead expenses. The share of overheads should be assessed on the basis that the undertaking continues to write further new business unless a decision has been made to cease writing further business.*
- 3.99. *Assumptions about expenses based on their own analysis of expenses should not allow for future cost reductions where these have not yet been realised. Notwithstanding this principle, undertakings may anticipate an expected cost reduction relating to the first five years after licensing of the undertaking. Any assumptions about the expected cost reduction should be realistic, objective and based on verifiable data/information.*

Other gross cash- flow items

- 3.100. *Undertakings should also consider other cash-flow items such as (...) taxation payments which are charged to policyholders;*

[...]

Different cash-flow features

- 3.104. *When valuing potential future cash-flows, the following features of existing insurance and reinsurance contracts need to be take into account:*
- *Options and guarantees;*
 - *Policyholders behaviour;*
 - *Management actions;*
 - *Distribution of extra benefits.*

[...]

Non-life insurance obligations

- 3.108. *The valuation of the best estimate for provisions for claims outstanding and for premium provisions should be carried out separately.*
- 3.109. *With respect to the best estimate for premium provisions, the cash-flow projections relate to claim events occurring after the valuation date and during the remaining in-force period (coverage period) of the policies held by the undertaking (existing policies). The cash-flow projections should comprise all future claim payments and claims administration expenses arising from these events, cash-flows arising from the ongoing administration of the in-force policies and expected future premiums stemming from existing policies.*
- 3.110. *The best estimate of premium provisions from existing insurance and reinsurance contracts should be given as the expected present value of future in- and out-going cash-flows, being a combination of, inter alia:*
- *Cash-flows from future premiums;*
 - *Cash-flows resulting from future claims events;*
 - *Cash-flows arising from allocated and unallocated claims administration expenses;*
 - *Cash-flows arising from ongoing administration of the in-force policies.*
- There is no need that the listed items should be calculated separately.*

- 3.111. *Premium provisions should be calculated in accordance with the general provisions for the determination of technical provisions as set out in Articles 75 to 78 of the Level 1 text. Such a valuation recognise the possibility that cash in-flow could exceed cash out-flow i.e. would take account of expected profit (premiums exceeding costs) during remaining periods on risk. In such circumstances the best estimate may be negative. This is acceptable and undertakings are not required to set to zero the value of the best estimate. The valuation would take account of the time value of money where risks in the remaining period would give rise to claims settlements into the future.*
- 3.112. *Additionally, the valuation of premium provisions should take account of future policyholder behaviour such as likelihood of policy lapse during the remaining period.*
- 3.113. *With respect to the best estimate for provisions for claims outstanding, the cash-flow projections relate to claim events having occurred before or at the valuation date – whether the claims arising from these events have been reported or not (i.e. all incurred but not settled claims). The cashflow projections should comprise all future claim payments as well as claims administration expenses arising from these events.*

Substance over form

- 3.114. *The choice between life and non-life actuarial methodologies should be based on the nature of the obligation being valued and from the identification of the risks which materially affect the underlying cash-flows (principle of substance over form).*

[...]

Currency of the insurance obligations

- 3.117. *The best estimate should be calculated separately for obligations of different currency.*

[...]

- 3.197. (...) *For the calculation of amounts recoverable from reinsurance contracts and special purpose vehicles the same principle as for the calculation of best estimate of the technical provisions should be applied. There is no need to calculate a risk margin for amounts recoverable from reinsurance contracts and special purpose vehicles because the single net calculation of the risk margin should be performed, rather than two separate calculations (i.e. one for the risk margin of the technical provisions and one for the risk margin of recoverables from reinsurance contracts and special purpose vehicles). Where undertakings calculate a risk margin using an internal model, they can either perform one single net calculation or two separate calculations.*

[...]

- 3.210. *The amounts recoverable from reinsurance contracts and special purpose vehicles should be shown separately, on the asset side of undertakings' balance sheet as "recoverables from reinsurance contracts and special purpose vehicles".*
- 3.211. *The calculation of amounts recoverable from special purpose vehicles should be done separately. Moreover, the calculation of recoverable from finite reinsurance¹⁶ should be done separately.*
- 3.212. *The amounts recoverable from reinsurance contracts and special purpose vehicles for non-life insurance obligations shall be calculated separately for "premium provisions" and "claims provisions". The claims provision part of the recoverable should comprise the compensation payments for the claims accounted for in the gross claims provision excluding debt the cessionary owes to the ceded undertaking and is not held as a part of the gross technical provisions at the ceded undertaking. All other payments should be considered in the premium provision part of the recoverable.*
- 3.213. *For the calculation of amounts recoverable from reinsurance contracts and special purpose vehicles the same principle as for the calculation of best estimate of the technical provisions should be applied.*
- 3.214. *Where for certain types of reinsurance and special purpose vehicles, the timing of recoveries and that for direct payments of undertaking markedly diverge, this should be taken into account in the projection of cash-flows. Where such timing is sufficiently similar to that for direct payments, the undertaking shall have the possibility of using the timing of direct payments.*
- 3.215. *If payments of special purpose vehicles do not directly depend on the claims made on the undertaking by policyholders and beneficiaries but on external indicators, a compensation for past and future claims on the*

undertaking should only be taken into account to the extent it can be verified in a deliberate, reliable and objective manner.

3.216. *The amounts recoverable from existing reinsurance contracts and special purpose vehicles should be adjusted in order to take account of expected losses due to counterparty default, whether this arises from insolvency, dispute or another reason.*

3.217. *The amounts recoverable from reinsurance contracts and special purpose vehicles should be calculated:*

- As default method, as a probability-weighted average of future cashflows, taking account of the time value of money, which shall be adjusted to take account of expected losses due to default of the counterparty.

- As a simplification: As mentioned in CEIOPS Level 2 advice on simplifications (CEIOPS-DOC-76/09) it is possible to assess amounts recoverable from reinsurance contract and special purpose vehicles in an indirect manner as the difference between the best estimate and net best estimate, taking into account adjustments for the expected losses due to the default of the counterparty provided that it is expected that the simplification method will deliver sufficient similar amount than the default method. In both cases the adjustment for the expected losses due to the default of the counterparty needs to be calculated separately.

3.218. *For the probability-weighted average of future cash-flows of recoverables from existing reinsurance contracts and special purpose vehicles the following cash in- and out-flows should be taken into account:*

Cash in-flows should include at least

- Recoverables from reinsurance contracts and special purpose vehicles for claims payments or benefits and recoverable for related expenses; and

- Revenues from reinsurance commission and from shares in profit from technical sources relevant to individual reinsurance contracts.

Cash out-flows should include at least

- Future premiums for reinsurance contracts and special purpose vehicles,

- If relevant, shares in profit due to the reinsurance contract.

3.219. *Expenses which the undertaking incurs in relation to the management and administration of reinsurance and special purpose vehicle contracts should be allowed for in the best estimate, calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles.*

3.220. *Undertakings shall distinguish between events that relate to market risk and events that relate to underwriting risk. Only payments made in relation to compensation of insurance events shall be accounted for in the recoverables. All payments that relate to market risk and do not compensate insurance events should not be accounted as amounts recoverable from reinsurance contracts and special purpose vehicles.*

3.221. *Where a deposit has been made for the above mentioned cash-flows, the corresponding assets and liabilities should be shown separately in the balance sheet. The recoverable should be adjusted accordingly to avoid a double counting of assets or liabilities.*

3.222. *Debtors and creditors that relate to settled claims of policyholders or beneficiaries should not be included in the recoverable.*

3.223. *The net best estimate which takes into account adjustments for the expected losses due to default of the counterparty is given by the best estimate which takes into account the deduction of amounts recoverable from reinsurance contracts and special purpose vehicles adjusted for expected losses due to default of the counterparty. Hence, the net best estimate corresponds to the probability-weighted average of all future cash-flows including cash-flows related to recoverable from reinsurance contracts and special purpose vehicles, taking account of the time value of money, using the relevant risk-free interest rate, and the adjustment for the expected losses due to the default of the counterparty.*

[...]

3.241. *Assumptions consistent with information about or provided by financial markets include (non exhaustive list):*

- Relevant risk-free interest rate term structure,

- Currency exchange rates,

- Market inflation rates (consumer price index or sector inflation) and
- Economic scenario files (ESF).

As a general principle, the information should allow for the estimation of reliable assumptions when it is observed in deep, liquid and transparent markets. Nevertheless, information observed in other type of markets may be used provided, to the extent possible, that appropriate tests or adjustments can be applied to guarantee its reliability.

[...]

General

3.265 *In accordance with the Level 1 text, assumptions shall be set consistently with:*

- a) *Information provided by financial markets;*
- b) *Generally available data on insurance and reinsurance technical risks.*

3.266. *Consideration shall be given to both the explicit and implicit assumptions required throughout the different stages of the best estimate calculation. These stages may include following stages: data, analysis, modelling and validation.*

3.267. *The following general principles shall be taken into account in determining the appropriateness of an realistic assumption:*

a) *In order to comply with the requirements of the Level 1 text, assumptions should be set in a realistic manner.*

b) *Assumptions shall be derived consistently from year to year without arbitrary changes. The changes of assumptions from one period to another should be traced, explained and documented. The impact of all changes of assumptions from one period to another on the value of technical provisions should be quantified, traced, explained and documented.*

c) *Expert judgement may be taken into account under the conditions set out in section 3.10 of this advice (see below)*

d) *Assumptions shall be adequately documented including the suitability of data sources, the derivation of the assumptions and any limitations in the results.*

e) *The materiality of the assumption shall be taken into account in determining the level of supporting documentation required.*

f) *The data on which assumptions are based should be credible for the purpose used and meet the standards with respect to the appropriateness, completeness and accuracy of data (as defined by Article 86 (f)).*

g) *Where assumptions are based on external data such as industry or market data, the external data source should satisfy the following criteria:*

i. *Both the external data and the documentation of any assumptions or methodologies underlying the external data should be available to the insurer so that the external data source may be validated. In particular, it should be possible to assess the relevance of the data given the characteristics of the underlying insurance portfolio. Undertakings should be able to demonstrate that external data of the underwriting risk is more suitable in order to better reflect the risk profile thereof.*

ii. *Where relevant, the external data should be produced sufficiently frequently to permit an analysis of the data, for example to identify any trends in the underlying data, the variation of the data over time and the variation of the data between different observations. Depending on the results of the analysis, an adjustment to the data may be required.*

iii. *Assumptions or data supplied by external providers should be validated using appropriate validation methods as described in CEIOPS' advice on validation.*

Assumptions consistent with information provided by financial markets

3.268. *Where an assumption (e.g. an economic scenario file) is produced by a market consistent asset model, that model shall satisfy the following criteria:*

- a) *The asset model shall try to reproduce asset prices for the most significant liabilities by nature and term that can be directly verified by the market.*
- b) *The asset model shall be arbitrage free.*
- 3.269. *The following general principles shall be taken into account in determining the appropriate calibration of a market consistent asset model:*
- a) *The asset model shall be calibrated to reflect the nature and term of the liabilities particularly those liabilities giving rise to significant guarantee and option costs.*
- b) *The asset model shall be calibrated to the current risk-free term structure as defined in CEIOPS Level 2 advice on the risk free term structure (CEIOPS-DOC-34/09).*
- c) *The asset model shall be calibrated to an appropriate volatility measure.*
- 3.270. *In principle, the calibration process should use market prices only from financial markets that are deep, liquid and transparent. If the derivation of a parameter is not possible by means of prices from deep, liquid and transparent markets, other market prices may be used. In this case, particular attention should be paid to any distortions of the market prices. Corrections for the distortions should be made in a deliberate, objective and reliable manner.*
- 3.271. *A financial market is deep, liquid and transparent, if it meets the requirements specified in CEIOPS Level 2 advice on circumstances in which technical provisions shall be calculated as a whole (CEIOPS-DOC-35/09).*
- 3.272. *It may not be possible to calibrate to current market data, for example if no market exists, if markets are insufficiently deep and liquid or if there is insufficient reliable market data. The insurer should be capable of demonstrating that the calibration of models where markets are not deep and liquid is appropriate and in line with all the relevant criteria set out in the Level 1 text.*

Assumptions consistent with generally available data on insurance and reinsurance technical risks

- 3.273. *The calibration may be based on adequate actuarial and statistical analysis of economic variables.*
- 3.274. *Generally available data refers to a combination of:*
- *Internal data*
 - *External data sources such as industry or market data.*
- 3.275. *Internal data refers to all data which is available from internal sources and might be undertaking specific or portfolio specific data. Undertaking specific data is specific to insurer and thus with potential to differ from that of other market participant holding an obligation that is identical in all respects. Portfolio specific data depends on the characteristic of the liabilities being measured and need not be undertaking specific data.*
- 3.276. *All relevant available data whether external or internal data, should be taken into account in order to arrive at the assumption which best reflects the characteristics of the underlying insurance portfolio. In the case of using external data, only that which the undertaking can reasonably be expected to have access too should be considered.*
- 3.277. *The extent to which internal data is taken into account should be based on:*
- *The availability, quality and relevance of external data.*
 - *The amount and quality of internal data.*
- 3.278. *Assumptions should be based solely on external data only if there is no relevant source of internal information which could provide reliable input to the assumption setting process. Similarly assumptions should be based solely on internal data only if there is no relevant source of external data. Where internal and external data are available the most appropriate data, whether internal, external or a blend of both should be used having regard to the judgment and expertise of those using the data and the models to be employed..*
- 3.279. *The following general principles shall be taken into account in determining the appropriateness of an assumption:*
- a) *Assumptions shall be derived consistently:*

- b) Across homogeneous risk groups and lines of business.
- c) With the undertaking's knowledge of the business and practices for managing the business.
- d) Assumptions shall be based on credible information which is relevant to the cash-flows.
- e) Undertakings shall consider whether assumptions adequately reflect the uncertainty underlying the cash-flows.
- f) Assumptions shall make appropriate allowance for possible trends or future changes in both undertaking and portfolio specific factors as well as legal, social, economic or environmental factors.
- g) Assumptions should be easy to comprehend by third parties, well documented and reasons for them should be given sufficiently, considering the internal / external data or qualitative information used as a basis.

[...]

3.286. Scope of expert judgement. Expert judgement may apply both in respect of the data used in the calculation of the best estimates, or in respect of the assumptions underlying the calculations, or eventually regarding the method applied to base the calculations.

3.287. General conditions about the application of expert judgement.

- Expert judgement should be compatible with the full compliance of this advice and other CEIOPS' advices regarding technical provisions. In particular, the use of expert judgement should not be considered to replace appropriate collection, process and analysis of data according to CEIOPS-DOC-37/09 advice on data quality standards (mentioned previously).

- Expert judgement should not be applied in isolation, unless there is no reliable alternative, for example because of a scarcity of relevant data.

- Where expert judgement is applied in isolation or applied to an assumption which has a significant impact on the best estimate, undertakings shall be prudent in the selection alternatives considered as similar (i.e. undertakings shall be particularly careful in the selection of alternatives considered as similar and to give appropriate weight to potential adverse outcomes).

- Expert judgement shall only be applied by experts with the relevant knowledge, understanding and comprehension of the subject, and with adequate experience. Furthermore, CEIOPS-DOC-29/09 advice on governance (mentioned previously) shall apply where relevant.

3.288. Documentation on the use of expert judgement.

- Expert judgement should be justified, explained and validated.

- According the proportionality principle, the process leading to the use of expert judgement should be documented in such a manner that the documentation makes possible the accountability and verification of the expert judgement. Generally speaking, the documentation will reflect the process of expert judgement, in particular:

- v the inputs on which expert judgement is based

- vi the objectives and decisional criteria used,

- vii any material limitation and the steps taken, if any, to mitigate the effect of such limitations

- viii the validation and back-testing envisaged or carried out for the expert judgement

3.289. Test of the expert judgement.

- Expert judgement should be back-tested with the additional experience gained or any emergent information,

- Where possible, should be compared to external information and appropriately tested with sufficiently similar judgments, either internally (provided they are independent from the original expert) or externally (provided there is no commercial link that may endanger the unbiased opinion of the external expert),

- Should be accompanied with a sensitivity analysis carried out on parameters or any other significant element derived by expert judgement.

3.290. *Users of the result of expert judgement should receive clear and comprehensive information of the existence of expert judgement, any relevant information of its content, degree of reliance and limitations (including appropriate sensitivity analysis).*

[...]

3.312. *Many assumptions are set based on an analysis of historical data. There is therefore a presumption that past performance is a good indicator of future performance. Back-testing may be used to assess the validity of this underlying assumption.*

3.313. *In the case where expert judgment is used, back-testing is the common sense comparison between prediction and realization.*

3.314. *The back-testing results (any significant deviations between actual and predicted values) shall be analysed to identify the reason behind them.*

3.315. *Companies shall assess whether the deviation is, for example, the consequence of a random variation in experience or a more systematic effect such as a permanent change in the environment or an assumption error or parameter estimation error.*

3.316. *As mentioned under section 3.11.2 each (re)insurance undertaking shall consider which validation methods and techniques are the most appropriate.*

3.317. *Below is a non-exhaustive list of possible validation methods, that (re)insurance undertakings could use to validate their best estimate:*

Examples of methods, which can help identify emerging features and trends in the historical data:

3.318. *Percentiles and analysis of residuals can be used to detect influential observations, outliers or clustering of claims.*

3.319. *Ratios can be used to detect the drivers or causes for certain patterns. For example, we may have noticed an increase in claims. What is driving this -severity or frequency? For example, average cost per claim ratios or adjustments for inflation may give an indication of what the main drivers are.*

3.320. *Analysis of settled vs. reported or paid over incurred claims ratios, can be used to justify the level of the best estimate.*

3.321. *Graphs can be used to validate the use of a pattern. For example, the accident year patterns may be plotted against the final selected patterns. If there are any significant deviations, it may be necessary to investigate what is driving this deviation and make some adjustments which should be appropriately documented and justified.*

3.322. *Identifying the existence of any biases or other distorting effects within data which are not representative of future experience. For example, a company may have recently merged with another. As a result, a specific line of business may produce a distribution of reserves which is significantly skewed in comparison to the distribution prior to the merger. This may suggest the need to separate both portfolios, even if they are within the same line of business.*

Examples of methods and techniques can help validate underlying assumptions:

Stress and scenario testing

3.323. *Stress and scenario testing is one of the quantitative tools used in a validation process by the insurance companies in order to:*

- *Understand any non-linearity between different assumptions;*
- *Ensure the estimation is robust and weaknesses/uncertainty has been addressed;*
- *Get further insight into the tail of the loss distribution.*

Sensitivity analysis

3.324. *Sensitivity analysis can be used to assess the extent to which results are sensitive to the underlying assumptions and models. This can be performed by introducing small changes to parameters or additional data points.*

- 3.325. *When an undertaking does not have sufficient relevant and reliable data to be able to analyse its own historical claim development it may use a relevant market or portfolio development pattern as a suitable benchmark. These benchmarks may also be used for comparison, to demonstrate the appropriateness and relevance of specific assumptions.*
- 3.326. *Investigate the potential change in coverage, higher deductibles, or other external factors that could invalidate the underlying assumption that past development will be repeated in the future. The following methods and techniques can be used to test the quality of fit and/or appropriateness of the valuation model:*

The following methods and techniques can be used to test the quality of fit and/or appropriateness of the valuation model:

- 3.327. *Produce several sets of estimators (curves of distribution of the estimators) and assess how well they describe the data. There are several ways undertakings can do this before they calculate the best estimate of the provisions. For example, they can plot age to age factors against the estimators. From this they will be able to assess which curve fits best.*
- 3.328. *Test different curves and extrapolate a tail factor if necessary.*
- 3.329. *Statistical diagnostics techniques such as goodness of fit tests, including analysis of residuals, sum of squares, Akaike information criterion and non parametric smoothing, etc...*

Some of the tools or procedures that can be used in the validation of the outputs of models are:

- 3.330. *Analysis of movement – this is a comparison of actual surplus over the year with the expected surplus. The analysis can be grouped according to the drivers of surplus such as initial adjustments (impact of changes to model, methodology and data as well as any corrections made), new business effect (this will occur when the best estimate liability of the new business is not the same as the assets backing the new business), economic and insurance variances (impact of difference between best estimate assumption and experience), capital injections and any unexplained movements.*
- 3.331. *The following process can be used to undertake an analysis of movement:*
- i. Re-run the model used to calculate position at the beginning of this period.*
 - ii. Re-run model allowing for any initial adjustments (the difference two runs is impact of opening adjustments)*
 - iii. Re-run model updated for changes in non-economic assumption, the difference between subsequent runs is the impact of assumption change.*
 - iv. Roll forward model allowing for actual non-economic parameters, the difference between the last two runs is insurance variance.*
 - v. Roll forward model allowing for actual economic parameters, the difference between the last two runs is economic variance.*
 - vi. Re-run model updated for new business volumes, the difference between the last two runs is the impact of new business.*
 - vii. The difference between the results of last run and the previous run is unexplained movements. The undertaking should be able to demonstrate understanding of the causes of any deviation from expected experience and the underlying drivers of this deviation.*
- 3.332. *Parallel testing – this involves using simple but independent calculations to check the reasonableness of an output. An example of this is using a closed form formula such as Black-Scholes to calculate the cost of guarantee and compare it to the cost of guarantee produced by the model. Another example is independently calculating the value of simple liabilities (such as asset shares) and comparing it with that calculated by the model.*
- 3.333. *Cash-flow checks – this involves (re)insurance undertaking checks on sample cash-flows for reasonableness.*
- 3.334. *The assumptions used to estimate best estimate liabilities can be grouped into economic and non-economic (insurance) assumptions. Economic assumptions can be in the form of an Economic Scenario Generator (ESG) file or a set of deterministic scenarios.*

[...]

- 3.343. *Validation techniques are the tools and processes used by the (re)insurance undertaking to ensure valuation methods, assumptions and results of the best estimate calculation are appropriate and relevant. These methods can be quantitative as well as qualitative.*
- 3.344. *In line with actuarial best practice (re)insurance undertakings shall use validation techniques throughout the calculation of the best estimate in order to:*
- a) Validate the amounts of technical provisions.*
 - b) Ensure the applicability and relevance of the methods and assumptions applied and the appropriateness of the level of technical provisions.*
 - c) Ensure that the actuarial methods and statistical methodologies are appropriate to the nature, scale and complexity of the risks supported by insurance and reinsurance undertakings.*
 - d) Compare the best estimate and the assumptions underlying the calculations regularly against experience*
- 3.345. *Validation methods will assist (re)insurance undertakings throughout the best estimate calculation by:*
- a) Encouraging understanding of how the cash-flows may emerge in the future and tracing any flaws in the calculation process.*
 - b) Justifying the applicability and relevance of methods used in the estimation of the level of the best estimate.*
 - c) Validating the appropriateness, completeness and accuracy of the assumptions and modelling used in the calculation of the best estimate.*
- 3.346. *(Re)insurance undertakings shall consider the validation methods which are most appropriate in order to ensure the above requirements are met.*
- 3.347. *Back-testing techniques shall be applied in order to ensure that the best estimate and the assumptions underlying the calculation of the best estimate are regularly compared against experience..*
- 3.348. *The back-testing results (the significant deviations between actual and predicted values) shall be analysed to identify the underlying causes of such deviations.*
- 3.349. *Companies shall decide whether the deviation is for example the consequence of a random variation in experience, or a more systematic effect such as a permanent change in the environment, or an assumption error or parameter estimation error. The results of the back-testing may imply that an adjustment to the calculation method of the assumptions is required.*
- 3.350. *The validation shall be carried out at least once a year, and in any case where there are indications of substantial changes. The extent of the validation should be proportionate to the nature and purpose of the best estimate calculation.*
- 3.351. *Significant changes in the external environment as well as changes to assumptions or goodness of fit of probability distributions may necessitate additional ad hoc checks on the validity of the calculation.*
- 3.352. *The validation of the best estimate result shall be carried out at a sufficiently fine granularity to detect insufficiencies in the reserving of subportfolios of insurance obligations. For life insurance obligations, the validation should at least be made at the level of product types. For all other insurance or reinsurance obligations, the validation should be made at least at the level of homogeneous risk groups.*
- 3.353. *Furthermore, the validation should be carried out separately for best estimate and reinsurance recoverable, and in non-life insurance for premium provisions and claims provisions..*
- 3.354. *All relevant and material assumptions shall be appropriately validated. To the extent that it is statistically feasible, the validation should be carried out for each assumption separately.*
- 3.355. *The validation processes shall include appropriate documentation and should be overseen by the expert who fulfils requirements specified for providing expert judgment in order to insure that this will be done correctly.*

[...]

- 3.360. *The undertaking should store all documents produced and used during the process of valuation of the best estimate of technical provisions that enable to assess appropriateness of the level of best estimate, as well as the applicability and relevance of the methods applied, and the adequacy of the underlying statistical data used and make them available to the supervisor at request.*

Former Consultation Paper 40 on risk-free interest rate term structure (CEIOPS-DOC-34/09)

[...]

Relevant risk-free interest rate term structure for other currencies

- 3.42 *A vast majority of CEIOPS' Members considers that all risk-free interest rate curves should be based for all currencies on the 3-stage process described in this advice.*
- 3.43 *The UK supervisory authority provides the Annex C, concluding: Therefore, for pounds sterling, the risk-free term structure which best satisfies the criteria set out in this paper is the swap curve less an adjustment for credit risk (see C.32 in Annex C).*
- 3.44 *The vast majority of CEIOPS' Members considers that the rationale provide in Annex C does not justify the aforementioned proposal for pounds sterling, and that liabilities expressed in such currency should be discounted according the government curve described in the first stage of paragraph 3.62.*

Considerations regarding long maturities

- 3.45 *The appropriate risk-free interest rate term structure is necessarily constructed from a finite number of data points of sufficient liquidity. Therefore, both interpolation between these data points and extrapolation beyond the last available data point of sufficient liquidity is required.*
- 3.46 *As the discount factor increases with time to maturity, the extrapolation of the risk-free curve significantly impacts the present value of long term insurance liabilities. Therefore, the technique of extrapolation needs to adhere to the desired risk-free criteria set out in this advice (in particular the criterion of realism), with the exception of liquidity.*
- 3.47 *CEIOPS is aware that high volatility of long-term discount rates can cause substantial changes in the value of liabilities and thereby lead to procyclical effects. Therefore, next to meeting the above criteria, the choice of the extrapolation technique should take into account the effect on financial stability.*
- 3.48 *There are many techniques available for extrapolating the interest rate curve, and there is no consensus about which of them is the best in all circumstances and for all currencies. CEIOPS has analyzed the main families of methods and has concluded:*
- a) *There is an unanimous agreement that the same high-level principles should be applied to the extrapolated part of the curve as to the non-extrapolated curve, in particular its calculation by an EU institution (unbiased guarantee) and the use of the same extrapolated rates by all undertakings covering compromises in the same currency and the same long terms.*
 - b) *There is also wide support to allow for some mechanism in the method that may provide stability to the outcomes of the extrapolation, avoiding spurious movements in the long part of the curve. This is particularly important for currencies where liquid reference rates are only available for short term maturities and simple extrapolation of these short term interest rates may cause excessive volatility.*
 - c) *There is wide support for the view that it is not possible to identify a single method performing the best extrapolation for all currencies. For example, some currencies are poorly traded and subject to significant changes in macroeconomic expectations. In this case the macroeconomic approach may produce volatile results. Other currencies may be nearby the integration in the euro zone. Again other currencies may be actively traded and have stable macroeconomic expectations.*
 - d) *There is wide support for the view that it is not possible to guarantee that a certain method will perform appropriately for a given currency at all times.*
- 3.49 *Having in mind all these features, CEIOPS recognises the importance of the choice of the extrapolation technique and thus will not prescribe the method for extrapolating the interest rate curve at this stage. Instead, during the Level 3 process, CEIOPS will develop a set of principles for the choice of an appropriate*

extrapolation method and will, based on these principles choose for each currency the method deemed to be most appropriate. In the following paragraphs four alternative approaches are briefly sketched: simple extrapolation techniques, macroeconomic techniques, parameterisation techniques and a constant spread technique for non-Euro currencies. None of them are considered appropriate or robust by all of CEIOPS' Members.

- 3.50 Simple extrapolation techniques require no deeper analysis of the fundamentals or shape of the curve. In its purest form, the simple extrapolation technique assumes that the final liquid data point is also the long term interest rate level. From the final liquid point onwards, the curve is therefore a horizontal line.
- 3.51 Macroeconomic extrapolation techniques involve identifying a long term equilibrium interest rate, usually but not necessarily through economic analysis, and interpolating between the available data points and this additional long term equilibrium point. An example of this technique is the approach outlined in Annexes D and E based on a long-term unconditional forward interest rate.
- 3.52 Parameterisation techniques emphasise smoothing and provide an objective construction of the term structure if the parameterisation technique is fixed. They can be (but it is not necessarily the case) based on economic assumptions. This category of extrapolation techniques is the one currently most used in market practice. There are many types of parameterisation techniques: for example, constant forward rates, the Svensson method, the one-factor or Vasicek class of models, to mention only a few.
- 3.53 Constant or variable spread methods are alternative methods for non- Euro currencies: first an appropriate extrapolation technique for the Euro is defined, then the rates for the other currencies are extrapolated by using the Euro curve plus
- In the case of a constant spread method, the constant spread between the Euro and the relevant currency for the last available liquid data point of the relevant currency.
 - In the case of a variable spread, the spreads might be derived by fitting a curve to the spreads observed in the non-extrapolated part of the curve.
- This technique is based on one unique extrapolation technique for all non- Euro currencies. Annex F includes a short example of this method.

CEIOPS' advice

- 3.54 For each currency, a relevant risk-free interest rate term structure should be defined following a uniform methodology. This interest rate term structure should be used to measure the time value of cash-flows payable in the currency.
- 3.55 For each valuation date, the relevant risk-free interest rate term structure should be determined on the basis of market data relevant for the valuation date.
- 3.56 For a given currency and valuation date, each insurance and reinsurance undertaking should use the same relevant risk-free interest rate term structure.
- 3.57 The relevant risk-free interest rate term structure should consist of rates for all relevant maturities.
- 3.58 CEIOPS suggests that the investment expenses shall be allowed for in the cash-flows underlying the calculation of technical provisions and not in the risk-free interest rates (see CEIOPS-DOC-33/09 L2 advice on actuarial and statistical methodologies to calculate the best estimate).
- 3.59 CEIOPS believes that it is necessary to provide both the relevant risk-free interest rate term structure and the uniform methodology used to derive the term structure for all major currencies. The relevant risk-free interest rate term structure of the EEA currencies should be provided at least on a quarterly basis. Where market conditions are volatile, the term structures may be provided more frequently. Where for a certain currency and valuation date no relevant risk-free interest rate term structure is provided, insurance and reinsurance undertakings should determine the relevant term structure following the provided methodology. The methodology shall be sufficiently detailed to ensure consistency between undertakings.
- 3.60 The relevant risk-free interest rate term structure should ideally meet the following criteria ("risk-free rate criteria"):
- (a) No credit risk: the rates should be free of credit risk.
 - (b) Realism: it should be possible to earn the rates in practice.

(c) Reliability: the determination of the rates should be reliable and robust.

(d) High liquidity: the rates should be based on financial instruments from deep, liquid and transparent markets.

(e) No technical bias: the rates should have no technical bias.

3.61 *Government bonds rates of AAA rated governments should be considered as the benchmark for credit risk-free rates. Swap rates are not credit risk-free and for this reason unadjusted swap rates should not be used to discount technical provisions.*

3.62 *For each currency, CEIOPS proposes to follow a three stage approach to determine the relevant risk-free interest rate term structure:*

First stage:

If government bonds are available that meet the risk-free criteria as defined in section 3.1.2 and the above paragraph 3.60 then government bonds should be used to determine the relevant risk-free rates.

Second stage:

If government bonds are available, but they do not meet the risk-free rate criteria, then they should be adjusted for their deficiencies relating to these criteria. The adjusted rates should approximate government bond rates which meet the risk-free criteria. The adjusted rates should be used to determine the relevant risk-free rates.

Third stage:

If government bonds are not available or if government bond rates cannot be adjusted to meet the risk-free rate criteria for practical or theoretical reasons, other financial instruments can be used to derive the risk-free interest rates. These instruments should be as similar to government bonds as possible. Their rates should be adjusted for credit risk and any other deviations from the criteria with the objective to approximate government bond rates which meet the risk-free criteria.

3.63 *Where government bonds do meet the risk-free rate criteria (or can be adjusted to meet them) for some maturities but not for all maturities, they should be used to derive the relevant risk-free rate for these maturities only. At stage three, different financial instruments may be used to derive the relevant risk-free rates for different maturities.*

3.64 *A process should ensure at Level 3 that the relevant risk-free interest rate term structures for the different currencies meet in the best possible way the benchmark of risk-free government rates. In case unadjusted government rates were not used to derive the risk-free rate, this should be explained and justified by the Member States and revised regularly.*

3.65 *The government yield curve based on AAA rated government bonds and published daily by the European Central Bank should be used as the relevant risk-free interest rate term structure for the euro.*

[...]

3.71 *The appropriate risk-free interest rate term structure is necessarily constructed from a finite number of data points of sufficient liquidity. Therefore, both interpolation between these data points and extrapolation beyond the last available data point of sufficient liquidity is required.*

3.72 *As the discount factor increases with time to maturity, the extrapolation of the risk-free curve significantly impacts the present value of long term insurance liabilities. Therefore, the technique of extrapolation needs to adhere to the desired risk-free criteria set out in this advice (in particular the criterion of realism), with the exception of liquidity.*

3.73 *CEIOPS has analyzed the main families of methods and has concluded:*

a) There is a unanimous agreement on applying to the extrapolated part of the curve the same high-level principles as for the non-extrapolated curve, in particular its calculation by an EU institution (unbiased guarantee) and the use of the same extrapolated rates by all undertakings covering compromises in the same currency and the same long terms.

b) There is also a wide support to allow for some mechanism in the method that may provide stability to the outcomes of the extrapolation, avoiding spurious movements in the long part of the curve. This is

particularly important for currencies where liquid reference rates are only available for short term maturities and simple extrapolation of these short term interest rates may cause excessive volatility.

c) There is wide support for the view that it is not possible to identify a single method performing the best extrapolation for all currencies.

d) There is wide support for the view that it is not possible to guarantee that a certain method will perform appropriately for a given currency at all times.

- 3.74 CEIOPS recognises the importance of the choice of the extrapolation technique and thus does not prescribe the method for extrapolating the interest rate curve at this stage. Instead, during the Level 3 process, CEIOPS will develop a set of principles for the choice of an appropriate extrapolation method and will, based on these principles, choose for each currency the method deemed to be most appropriate.

Former Consultation Paper 42 on the calculation of the risk margin (CEIOPS-DOC-36/09)

[...]

- 3.44 A perfect replication of the liability cash flows is one that completely eliminates all risks (not only market risk) associated with the liability. In practise, perfect replication is expected to be relatively rare. It should therefore be noted that replication of cash-flows and elimination of market risk SCR are different concepts. It is not necessary to perfectly replicate the cash-flows of the obligations to eliminate the market risk SCR. It is sufficient to replicate the liability cash-flows on best estimate level to reduce the standard formula SCR to an immaterial level for the purposes of calculating the risk margin.

- 3.45 For non-life insurance obligations and short-term life insurance obligations the market risk SCR can usually be reduced to zero.

- 3.46 The Level 1 text defines the Cost-of-Capital rate as an additional rate above the risk-free interest rate that an undertaking would incur holding an amount of eligible own funds equal to the SCR. An underlying assumption there is that the assets that cover the SCR provide a return that equals the risk-free interest rate and therefore the cost of holding capital comprises only the additional rate above that. A consequence of this is that there may exist market risk or counterparty default risk linked to these assets.

The market risk or counterparty default risk linked to the assets that cover the SCR depends on the size of the SCR. While the size of the SCR in turn depends on the individual risk modules, there arises a circular definition of the SCR. In order to avoid this, it is assumed that the risk connected to the assets that cover the SCR is zero. This simplifying assumption leads to an understatement of the risk margin but it is useful for practicability reasons..

[...]

The reference undertaking

- 3.136 The reference undertaking assumed to take over and meet the insurance and reinsurance obligations of an insurance or reinsurance undertaking shall fulfil the following assumptions:

1. The reference undertaking is not the undertaking itself (the original undertaking), but another undertaking.

2. The reference undertaking is an empty undertaking in the sense that it does not have any insurance or reinsurance obligations and any own funds before the transfer takes place.

3. After the transfer the reference undertaking has eligible own funds corresponding exactly to the amount of SCR that is necessary to support the transferred obligations.

4. After transfer of the insurance obligations, the reference undertaking has assets to cover the Best Estimate net of reinsurance and SPVs, the Risk Margin and the SCR. For the purposes of calculating the risk margin these assets should be considered to minimize the market risk of the undertaking. The reference undertaking should only be subject to market risk that is unavoidable in practice.

5. SCR of the reference undertaking consists of

(a) Underwriting risk with respect to the existing business,

- (b) Counterparty default risk with respect to ceded reinsurance and SPVs,
- (c) Operational risk; and
- (d) Unavoidable market risk.
6. The loss absorbing capacity of technical provisions in the reference undertaking corresponds to those of the original undertaking.
7. There is no loss absorbing capacity of deferred taxes for (related to) the reference undertaking
8. The insurance and reinsurance obligations of each line of business (as defined in Article 86(e)) are transferred to the empty reference undertaking in isolation. Hence, there does not arise any diversification benefits between lines of business. For the purpose of the calculation of the risk margin, the calculation of the SCR of the reference undertaking (using a standard formula or internal model) should be done at least by line of business, based on the segmentation laid down by the implementing measures referred to in Article 86(e). If the SCR of the original undertaking is calculated by using an internal model, the segmentation may differ from the one laid down by the implementing measures referred to in Article 86(e). However, the risk margin shall always be valued at least at the level of lines of business laid down by those implementing measures.
9. The internal models of the original undertaking (partial or full) can be used to measure the SCR of the reference undertaking to the extent that these models cover at least the risks referred to in no. 5 (assumption 5 regarding the reference undertaking) as defined by the standard formula.
10. The Cost-of-Capital risk margin is defined net of reinsurance only.

The Cost-of-Capital rate

- 3.137 The Cost-of-Capital rate should be calibrated in a manner that is consistent with the assumptions made for the reference undertaking. In practise this means that the Cost-of-Capital rate should be consistent with the Value-at- Risk-assumption corresponding to a confidence level of 99.5 per cent over the stipulated one-year time horizon as laid down for the calculation of the Solvency Capital Requirement (SCR). Especially, the Cost-of-Capital rate should be independent of the actual solvency position of the original undertaking.
- 3.138 The risk margin should guarantee that sufficient technical provisions for a transfer are available in all scenarios. Hence, the Cost-of-Capital rate has to be a long-term average rate, reflecting both periods of stability and periods of stress.
- 3.139 In order to stipulate an adequate placeholder for the Cost-of-Capital rate in the Solvency II regulatory context, the following procedure should be applied:
- Shareholder return models should be used to provide the initial input.
 - Some objective criteria for upward and downward adjustments of the provided initial input should be established.
 - A final calibration of the Cost-of-Capital rate should be carried out in order to obtain risk margins consistent with observable prices in the marketplace.
- 3.140 Based on the information currently available a Cost-of-Capital rate of at least 6 per cent is assumed to reflect the cost of holding an amount of eligible own funds for an insurance or reinsurance undertaking being capitalised corresponding to a confidence level of 99.5 per cent Value-at- Risk over a one year time horizon.

Calculation of the risk margin

- 3.141 In general, the overall risk margin according to the Cost-of-Capital methodology (CoCM) should be calculated as follows:

$$CoCM = \sum_{LOB} CoCM_{LOB} = \sum_{LOB} \left\{ \frac{CoC * \sum_{t \geq 0} SCR_{RU,LOB}(t)}{(1 + r_{t+1})^{t+1}} \right\}$$

Where:

- $SCR_{RU,LOB}(t)$ = the SCR for a given line of business (lob) for year t as calculated for the reference undertaking,
- r_t = the risk-free rate for maturity t ; and
- CoC = the Cost-of-Capital rate.

3.142 If the SCR of the (original) undertaking is calculated using the standard formula all SCRs (for $t \geq 0$) for a given line of business should be calculated as follows:

$$SCR_{RU,LOB}(t) = BSCR_{RU,LOB}(t) + SCR_{RU,LOB,Op}(t) - Adj_{RU,LOB}(t)$$

Where:

- $BSCR_{RU,LOB}(t)$ = the Basic SCR for the given line of business (lob) and year t as calculated for the reference undertaking,
- $SCR_{RU,LOB,Op}(t)$ = the partial SCR regarding operational risk for the given line of business (lob) and year t as calculated for the reference undertaking; and
- $Adj_{RU,LOB}(t)$ = the adjustment for the loss absorbing capacity of technical provisions for the given line of business (lob) and year t as calculated for the reference undertaking.

It should be ensured that the assumptions made regarding loss absorbing capacity of technical provisions to be taken into account in the SCR-calculations per line of business, is consistent with the assumptions made for the overall portfolio (of the original undertaking).

The Basic SCRs for a given line of business ($BSCR_{RU,lob}(t)$ for all $t \geq 0$) should be calculated by using the relevant SCR-modules and sub-modules per line of business (i.e. by restricting the input to be used in the relevant modules to the line of business in question).

Moreover, the calculation of the Basic SCRs (as referred to in the previous paragraph) should be based on the correlation assumptions laid down in Annex IV of the Level 1 text although only the unavoidable market risk and the counterparty default risk with respect to ceded reinsurance is taken into consideration.

3.143 With respect to non-life insurance the risk margin as calculated per line of business should be attached to the overall best estimate, that is with no split between risk margins for premiums provisions and for provisions for claims outstanding. This does not preclude other treatments for other purposes.

The overall risk margin

3.144 Furthermore, the overall risk margin of the undertaking shall result as the sum of risk margins as calculated for each line of business or each homogeneous group of risks, according to the segmentation that follows from CEIOPS' advice on segmentation (CEIOPS-DOC-22/09). However, this does not preclude other treatments for other purposes.

Former Consultation Paper 43 on standards for data quality (CEIOPS-DOC-37/09)

[...]

Definition of the term 'data'

3.56 For the purposes of this advice, 'data' refers to all the information which is directly or indirectly needed in order to carry out a valuation of technical provisions, in particular enabling the use of appropriate actuarial and statistical methodologies, in line with the underlying (re)insurance obligations, undertaking's specificities and with the principle of proportionality. Moreover, data comprises numerical, census or classification information but not qualitative information. Assumptions are not regarded as data, but it is noted that the use of data is an important basis in the development of actuarial assumptions.

General requirements on data quality in the context of valuing technical provisions

3.57 As a general principle, undertakings should make all efforts to ensure that the data available for the valuation of technical provisions is as appropriate, complete and accurate for that purpose as possible.

3.58 Undertakings should assess and monitor the quality of the data used in the valuation of their technical provisions. An assessment of the quality of data should be carried out on basis of three criteria:

appropriateness, completeness and accuracy. This also applies to data used to set a particular assumption, as to ensure that the assumptions used in the valuation of technical provisions are as much as possible adequate, up-to-date, prospective, realistic and credible.

- 3.59 *In order to ensure the appropriateness, completeness and accuracy of the data used in the valuation of technical provisions, undertakings should have in place adequate internal processes and procedures. These processes and procedures shall cover the undertakings' systems used for data quality management and for the collection, storing and processing of the data.*
- 3.60 *In the context of the calculation of technical provisions, the degree of appropriateness, completeness and accuracy of data expected from the insurer should be consistent with the principle of proportionality, as with the other requirements set out in the present advice. However, the application of such principle should not lead to a lowering of the general standards for the collection of data procedures and on the efforts to ensure its appropriateness, completeness and, especially, accuracy.*

Appropriateness, completeness and accuracy of data

- 3.61 *The assessment of the quality of data used in the calculation of technical provisions – in particular, the criteria of appropriateness and completeness – should in principle be done at the portfolio level, and where relevant at a more granular level, including if necessary the analysis relating to the individual items. The assessment shall take into account the set of available data which is necessary and relevant to carry out the intended analysis. This includes both internal and external information to the undertaking. On the other hand, the assessment of the accuracy criteria should consider a more granular level, relating to the individual items.*
- 3.62 *Data is considered appropriate if:*
- *it is suitable for the intended purpose (i.e. the valuation of technical provisions, setting of assumptions); and*
 - *relevant to the portfolio of risks being analysed (i.e. directly relates to the underlying risk drivers).*
- 3.63 *Hence, to be appropriate for valuation purposes the data needs to be representative of the portfolio of liabilities being valued and suitable to be used to estimate the future in- and out-going cash flows from the liabilities (consistent with a prospective view on the behaviour of the relevant risks).*
- 3.64 *Data is considered to be complete if:*
- *it allows for the recognition of all the main homogeneous risk groups within the liability portfolio;*
 - *it has sufficient granularity to allow for the identification of trends and to the full understanding of the behaviour of the underlying risks; and*
 - *if sufficient historical information is available.*
- 3.65 *The assessment of the completeness criteria should include an analysis of whether the undertaking's information is comprehensive and a relative comparison with other data for similar lines of business and/or risk factors.*
- 3.66 *Data is considered accurate if:*
- *it is free from material mistakes, errors and omissions;*
 - *the recording of information is adequate, performed in a timely manner and is kept consistent across time;*
 - *a high level of confidence is placed on the data; and*
 - *the undertaking must be able to demonstrate that it recognises the data set as credible by using it throughout the undertakings operations and decision-making processes.*
- 3.67 *The assessment of the accuracy criteria should include appropriate crosschecks and internal tests to the consistency of data (i.e. with other relevant information or with the same data in different points in time).*
- 3.68 *The combination of accuracy, completeness and appropriateness of information collected should be such that it allows for the application of adequate provisioning methodologies.*

Data deficiencies

- 3.69 *Where the undertaking has only insufficient own data of appropriate quality available for the valuation of technical provisions, it should assess why this is the case and which options would be available to him to increase the quality and quantity of its data.*
- 3.70 *In particular, the undertaking should assess:*
- *whether the lack of data is related to deficiencies in the internal processes;*
 - *whether the lack of data is related to deficiencies in the data transmission process with third parties (including related entities);*
 - *whether the quality of the available data could be enhanced.*
 - *whether any external data supplied by third parties or market data could be used;*
- 3.71 *Where the data deficiency is related to insufficient internal processes, the undertaking should take appropriate measures to remedy this situation in due course and to ensure the adequacy of internal processes and procedures for collecting, storing and validating of data used in the valuation of technical provisions.*
- 3.72 *To enhance the quality of its data, it may be appropriate for the undertaking to apply adjustments to its data (e.g. to adapt historical data in case of changes in the operating environment or changes in legislation). These adjustments and the underlying assumptions should be carefully justified and documented, and should not overwrite the raw data.*
- 3.73 *In circumstances where (e.g. due to the nature or size of the portfolio) a lack of data for the valuation of technical provisions is unavoidable for the undertaking, further judgmental adjustments or assumptions to the data may need to be applied in order to allow the valuation to be performed (using appropriate approximations). The use of expert judgement and the assumptions applied for this purpose, shall meet the requirements set out in CEIOPS-DOC-33/09 advice on actuarial and statistical methodologies to calculate the best estimate.*
- 3.74 *However, in no case should the use of approximations be seen as an alternative to implementing appropriate systems and processes for collecting material relevant information and building historical databases.*

Systems of data quality management

- 3.75 *Data quality management is a continuous process that should comprise the following steps:*
- *Definition of the data;*
 - *Assessment of the quality of data;*
 - *Resolution of the material problems identified;*
 - *Monitoring data quality.*
- 3.76 *Definition of the data comprises the identification of the needs in terms of data, a detailed description of the items that should be collected and the eventual relations between the different items.*
- 3.77 *The assessment of the quality of data implies the verification of the features that data must possess in order to be able to produce credible estimates of technical provisions, i.e. the verification of the criteria of appropriateness, completeness and accuracy for the purpose of the analysis. Although such assessment may make use of adequate objective measures and indicators, it should also be subject to judgement.*
- 3.78 *The assessment of data quality should have due regard to the quality and performance of the channels used to collect, store, transmit and process data, in particular when data is provided by third parties (e.g. intermediaries) or through electronic sources (e.g. internet).*
- 3.79 *If material problems with the verification of the data quality criteria have been identified, the insurer should try to solve them within an appropriate timeframe (to the extent possible, but while keeping track of the raw data) and should work towards the improvement of the data collection, storage or other relevant internal processes, so as to ensure the quality of the future data. Those data limitations should be appropriately documented, including a description of how such situations can be remedied and the assignment of responsibilities within the undertaking.*

- 3.80 *Data quality should be monitored periodically, with due regard to the principle of proportionality. This involves, in particular, the monitoring of the performance of the relevant IT systems and of the channels used to collect, store, transmit and process data. This process could be based, namely, on data quality performance indicators, but expert judgement needs to play a key role in the analysis.*

Collection, storing and processing of data

- 3.81 *Data should be registered and maintained on a comprehensive basis and the underlying processes and procedures should be transparent.*
- 3.82 *Data collected should be sufficiently granular in order to apply adequate provisioning methodologies and generate results with a sufficient level of detail and robustness.*
- 3.83 *Where it remains useful for the purpose of valuing technical provisions, historical data should generally be kept and its availability should increase over time.*
- 3.84 *Any adjustments to the original data must be documented as well as its reasons, in particular the correction of any data errors and omissions, and the original database should be maintained.*
- 3.85 *Data quality assessments should be made periodically and, once the results have been obtained, corrections may take place in the form of suitable quantitative or qualitative changes.*

Issues of data quality in the context of a provisioning analysis and review

- 3.86 *Adjustments to the available data may be necessary in order to improve the reliability of the estimates derived from actuarial and statistical provisioning methodologies. In such a specific context, the assessment of data quality for the purpose of the analysis would necessarily be more granular, as it would be made with a view to fit a specific methodology or to review the appropriateness of specific assumptions and parameters.*
- 3.87 *The requirements to set up adequate internal processes and procedures, in the context of Article 82, should not relate to such a granular level, but it should consider data quality from an overall perspective for the purpose of the calculation of technical provisions, without necessarily relating it to the application of particular methodologies.*
- 3.88 *In the context of a provisioning analysis, it may be necessary to complement the internal data available with external data supplied by third parties or market data. When assessing the general requirements on data quality – appropriateness, completeness and accuracy – this external and market information should be part of the analysis.*
- 3.89 *In the particular case of external and market information, the verification of the three criteria implies:*
- *Appropriateness and completeness: the assessment of these criteria is performed at the portfolio level, considering the set of available data necessary to fully carry out the intended analysis (in particular, when setting one particular assumption). Where relevant, the assessment of appropriateness and completeness shall also be performed at a more granular level, including if necessary the analysis relating to the individual items. Undertakings are expected to verify that the inclusion of the individual items of external and market information contribute towards the enhancement of the appropriateness and completeness criteria having regard to the intended purpose of the analysis;*
 - *Accuracy: as individual items of external and market information have not been collected and compiled by the undertaking itself, the assessment of its accuracy is likely to be challenging. The verification of this criterion will have to consider the reliability of the sources of information and the consistency and stability of its process of collecting and publishing information across time.*
- 3.90 *Moreover, whenever adequate, measurement of the quality and credibility of the available data in the context of provisioning analysis should have regard to available industry or market data which is deemed comparable, having regard in particular to the requirements set in article 76(3). Any material deviations should be identified and interpreted, for instance by referring to the specificities of the own portfolio being valued.*

Former Consultation Paper 44 on counterparty default adjustment to recoverables from reinsurance contracts and SPV's (CEIOPS-DOC-38/09)

[...]

- 3.18 *Article 81 of the Level 1 text stipulates that recoverables from reinsurance contracts or special purpose vehicles shall take account of expected losses due to default of the counterparty. It further requires that the adjustment is based on a market consistent assessment of the probability of default of the counterparty and the average loss resulting from this default (loss-given- default).*
- 3.19 *The adjustment for counterparty default should approximate the losses-given-default of the counterparty, weighted with the probability of default of the counterparty. The loss-given default is the expected present value of the change in cash-flows underlying the recoverables, resulting from a default of the counterparty at a certain point in time.*
- 3.20 *The determination of the adjustment for counterparty default should take into account possible default events during the whole run-off period of the recoverables.*
- 3.21 *The assessment of the probability of default and the loss-given-default of the counterparty should be based upon current, reliable and credible information. Among the possible sources of information are: credit spreads, rating judgements, information relating to the supervisory solvency assessment, and the financial reporting of the counterparty. The applied methods should guarantee market consistency. The undertaking should not rely on information of a third party without assessing that the information is current, reliable and credible.*
- 3.22 *Where possible in a reliable, objective and prudent manner, point-in-time estimates of the probability of default should be used for the calculation of the adjustment. In this case, the assessment should take the possible time-dependence of the probability of default into account. If point-in-time estimates are not possible to calculate in a reliable, objective and prudent manner or their application would not be proportionate, through-the-cycle estimates of the probability of default might be used.*
- 3.23 *The assessment of the probability of default should take into account the fact that the cumulative probability increases with the time horizon of the assessment.*
- 3.24 *If no reliable estimate of the recovery rate of a counterparty is available, no rate higher than 50% should be used.*
- 3.25 *If the determination of the adjustment for counterparty default allows for the effect of risk mitigating instruments, for example collaterals or letters of credit, then the credit risk of the instruments as well as any other risk connected to them should also be allowed for. This allowance may be omitted where the impact is not material. To assess this materiality it is necessary to take into account the relevant features, such as the period of effect of the risk mitigating instrument.*
- 3.26 *The adjustment for counterparty default should be calculated separately at least for each line of business and each counterparty in order to be able to allocate the credit risk to the segments and be able to identify risk concentrations. For the same reason, the adjustment should be calculated separately for non-life premium provision and non-life claims provisions.*
- 3.27 *However, if the probability of default and the recovery rates of several counterparties coincide and if it is an undue burden to calculate the adjustment for counterparty default separately for each, the adjustment in relation to these counterparties might be calculated together.*

Former Consultation Paper 76 on simplified methods and techniques to calculate technical provisions (CEIOPS-DOC-72/10)

[...]

Simplifications regarding risk margin

- 3.366 *As a general principle, where an (re)insurance undertaking applies a simplified valuation method, this should be proportionate to the underlying risks and compatible with the Solvency II valuation principles.⁸⁵ This would apply irrespectively of whether the method is specified under Level 2 implementing measures or not.*

- 3.367 As aforementioned, and as a general approach, especially in respect of best estimates simplifications, CEIOPS advises not to introduce an exhaustive list of methods and techniques as level 2 implementing measures for the estimation of the best estimate, and would prefer to keep such methods and techniques as level 3 guidance.
- 3.368 However, CEIOPS recognizes that the risk margin is a specific area where additional considerations should be included in the level 2 text, due to the complexity and uncertainty around the calculation methodology, see para 3.369-3.372 below. Moreover, CEIOPS would support flexibility for undertakings to use other simplified methods or techniques, provided they can demonstrate that these are appropriate.
- 3.369 If a full projection of all future SCRs is necessary in order to capture the undertaking's risk profile – for all or some lines of business – the undertaking is expected to carry out these calculations.
- 3.370 When an undertaking considers whether or not it would be appropriate to apply a simplified valuation technique for the risk margin, it should carry out separate assessments at least for each line of business. This means that a decision to use simplifications in one line of business should have no definitive impact on the decisions made for other lines of business. As an integral part of this assessment, the undertaking should consider what kind of simplified methods would be most appropriate for the given line of business. The chosen method should be proportionate to the nature, scale and complexity of the risks in the line of business in question.
- 3.371 When the undertaking has decided to use a simplified method for a given line of business, it should consider whether the method could be used for the projections of the overall SCR (for the given line of business) or if the relevant (sub-)risks should be projected separately. In this context, the undertaking should also consider whether it should carry out the simplified projections of future SCRs individually for each future year or if it is possible to calculate all future SCRs in one step – but still for a given line of business.
- 3.372 Based on the general principles and criteria referred to above, the following hierarchy could be seen as a possible decision basis regarding the methods to be used for projecting future SCRs per line of business:
- (1) make a full calculation of all future SCRs⁸⁶ without using simplifications;
 - (2) approximate the individual risks or sub-risks within some or all modules and sub-modules to be used for the calculation of future SCRs;
 - (3) approximate the whole SCR for each future year, e.g. by using a proportional approach; and
 - (4) estimate all future SCRs “at once”, e.g. by using an approximation based on the duration approach.
 - (5) approximate the risk margin by calculating it as a percentage of the best estimate.

[...]

Simplifications regarding reinsurance recoverables, including adjustment for counterparty default

- 3.434 The determination of reinsurance recoverables should follow the same principles as for the determination of gross technical provisions (i.e. it shall comply with Articles 76 to 80 of the Level 1 text), with an additional adjustment (imposed by Article 81) to take into account of expected losses due to counterparty defaults.
- 3.435 As a simplification, reinsurance recoverables may be calculated in an indirect manner as the difference between the technical provisions gross of reinsurance and the technical provisions net of reinsurance given that the technical provisions net of reinsurance have been adjusted for the expected losses due to the counterparty default.
- 3.436 For the valuation of technical provisions gross and net of reinsurance, respectively, the same risk margin – based on a net calculation in accordance with the implementing measures on the risk margin – should be used, meaning that the calculation of the reinsurance recoverables (RR) could be further simplified as follows:

$RR = BE_{Gross} - BE_{Net}$, where

BE_{Gross} = the best estimate gross of reinsurance; and

BE_{Net} = the best estimate net of reinsurance.

Accordingly, the reinsurance recoverables should not include a risk margin component.

3.437 To calculate technical provisions net of reinsurance, (re)insurance undertakings should be allowed to apply gross-to-net techniques provided that:

- The criteria set out in this advice are met; and
- Further refinements have been made where this would be necessary to ensure that the gross-to-net technique applied is proportionate to the underlying risks.

The undertaking should assess the appropriateness of an application of gross-to-net techniques by conducting a proportionality assessment as outlined in section 3.1.

3.438 Within a given homogeneous risk group or line of business, the Gross-to-Net techniques shall be applied separately to each of the best estimate components gross of reinsurance, leading to the same best estimate components net of reinsurance as gross of reinsurance.

3.439 The reinsurance recoverables per homogenous risk groups (or lines of business) could then be calculated as the sum of the differences between the best estimate technical provisions gross and net of reinsurance for the premium provision and the claims provisions, respectively.

3.440 When applying Gross-to-Net techniques it should be assessed whether an allowance for the expected counterparty defaults is reflected in a satisfactory/sufficient manner in the best estimate net of reinsurance.

3.441 The calculation of the best estimate net of reinsurance and of the reinsurance recoverables should be carried out at a level being sufficiently granular with respect to the impact of reinsurance programmes within the various homogenous risk groups or lines of business and with respect to the impact of changes in the reinsurance program over time.

3.442 Where Gross-to-Net techniques are applied, the following conditions should be met:

- With respect to premium provisions, the applied Gross-to-Net techniques should as a minimum distinguish between lines of business.
- With respect to claims provisions, the applied Gross-to-Net techniques should as a minimum distinguish between lines of business and – for a given line of business – between the accident years not finally developed.

3.443 Appropriate level 3 guidance may be developed in respect the variables used in the simplifications regarding the adjustment of reinsurance recoverables to take into account the expected losses due counterparty default.

[...]

Quarterly calculations

3.459 In the application of the proportionality principle, the particular challenges of quarterly calculations of technical provisions should be taken into account.

3.460 Risk margin. Simplified calculations during the year. A likely candidate for these simplifications may be to stipulate the risk margin for an individual line of business at a given point in time during the forthcoming year (i.e. $CoCMlob(t)$) as follows:

$$CoCMlob(t) = CoCMlob(0) \cdot BENet,lob(t) / BENet,lob(0), \quad 0 < t < 1, \text{ where}$$

$CoCMlob(0)$ = the risk margin as calculated at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business,

$BENet,lob(0)$ = the best estimate technical provisions net of reinsurance as assessed at time $t = 0$ for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business; and

$BENet,lob(t)$ = the best estimate technical provisions net of reinsurance as assessed at time t for the reference undertaking's portfolio of (re)insurance obligations in an individual line of business.

3.461 It may be inappropriate to apply this formula in cases where the best estimates are expected to decrease, in relative terms to the business, e.g. in cases of negative best estimates or best estimates close to zero. Furthermore, there may be situations, such as run-off undertakings, that may deserve specific analysis. Therefore, level 3 guidance may be developed to define the features of the situations where this formula may or may be used or should not be used, as for all the other admissible simplifications.

Definitions

Best estimate

The technical provisions shall be equal to the sum of a best estimate and a risk margin. The best estimate is calculated gross, without deduction of the amounts recoverable from reinsurance contracts and special purpose vehicles. Where best estimate is mentioned without further detail, it is the gross best estimate.

Correspondence (principle of)

Principle whereby all cash in-flows and cash out-flows relating to existing (re)insurance obligations should be taken into account when valuing the liability.

Earned business

Portion of existing (re)insurance obligations relating to risk which is expired as at the valuation date.

Going concern assumption

The assumption that undertaking is going to continue in operation for the foreseeable future and that it has neither the intention nor the necessity of liquidation.

Homogeneous risk group

Homogenous risk group is a set of (re)insurance obligations which are managed together and which have similar risk characteristics in terms of, for example, underwriting policy, claims settlement patterns, risk profile of policyholders, likely policyholder behaviour, product features (including guarantees), future management actions and expense structure. The risks in each group should be sufficiently similar and the group sufficiently large that a meaningful statistical analysis of the risks can be done. The classification is undertaking specific.

Incepted business

This refers to business written by an undertaking and which cover start date falls before the valuation date.

Market consistency

Consistent with information provided by the financial markets and generally available data on underwriting risks (Article 76 Level 1 text).

Outstanding claims provisions

Provisions for claims outstanding relate to the claims events that have occurred before or at the valuation date – whether the claims arising from those events have been reported or not. The cash-flows projected should comprise all future claims payments as well as claims management expenses arising from these events.

Portfolio specific

Depending on the characteristics of the insurance portfolio, i.e. that the characteristic would apply irrespective of which undertaking holds the liability.

Premium provisions

Premium provisions relate to claims events occurring after the valuation date and during the remaining in-force period of existing policies held by the undertaking. The cash-flow projections should comprise all future claims payments and claims management expenses arising from those events, cash-flows arising from ongoing administration of the in-force policies and expected future premiums stemming from existing policies.

Proportionality (principle of)

The Level 1 Directive explicitly requires that implementing measures be applied in a manner which is proportionate to the nature, complexity and scale of the risks bearing upon an undertaking, in particular with regards to very small insurance undertakings. This principle lays ground for the application of simplifications.

Realistic

Aiming at identifying scenarios or parameters as they are or will be in the future, without distorting the situations and by neither underestimating nor overestimating the value of the parameters.

Signed business

(Re)insurance obligations that the undertaking has contractually accepted to bear as at the valuation date.

Substance over form (principle of)

The distinctions between life and non-life techniques are aimed towards the nature of the liabilities (substance), which may not necessarily match the legal form (form) of the contract that originated the liability. The principle of substance over form holds that the choice between life or non-life actuarial methodologies should be based on the nature of the liabilities being valued and from the identification of risks which materially affect the underlying cash-flows.

Undertaking specific

Specific to the undertaking and thus with potential to differ from that of other market participants holding an obligation that is identical in all respects.

Unearned business

Portion of existing (re)insurance obligations relating to risk which is unexpired as at the valuation date.

Unaccepted business

This refers to business written or signed by an undertaking and which cover start date falls after the valuation date.

Unsigned business

(Re)insurance obligations that the undertaking has not contractually accepted to bear as at the valuation date.

Validation techniques

The tools and processes used by the (re)insurance undertaking to ensure valuation methods, assumptions and results of the best estimate calculation are appropriate and relevant.

References

Publications from Groupe Consultatif

Interim report to CEIOPS on Valuation of Best Estimate under Solvency II in Non-Life insurance (11 November 2008)

(Available online at http://www.gcactuaries.org/documents/gc_valuation_best_est_nl_111108.pdf)

[...]

3.2.1.5 Best estimate – treatment of ‘binary’ events

With the best estimate being the probability weighted average of future cash-flows, some weight have to be given to losses with low probability but high cost within the best estimate valuation. We call these ‘binary events’. Examples of binary events include the occurrence of a new type of latent claims; a change in legislation impacting claims payment retrospectively; high inflation environment.

If the insurer has only a small number of such exposures, diversification is small and the insurer owns a liability with an essentially binary payout pattern. The best estimate is then – as before – defined as the sum of the product of the probability of the event occurring and the expected payment, discounted at the risk-free rate.

The most common practice today is not to make these types of allowance within the best estimate, but rather to consider the events as part of the downside risk considered within the assessment of the firm’s own economic capital requirements. (...)

Response to CEIOPS’ request for further advice on issues raised in Groupe Consultatif’s report on best estimates (4 February 2009)

(Available online at http://www.gcactuaries.org/documents/response_ceiops_BE_040209.zip)

[...]

Answer to Question 6 ‘Guidance on how in particular the “binary” events should be treated in the calculation of insurance liabilities and an explanation of the consistency of this treatment within the Solvency II directive proposal’

The “binary” events need to be considered independent of what type of reserving methodology (deterministic or stochastic) is used.

The events should be included within the calculation of the technical provisions by taking into account the probability that the event will occur. This would typically be done in one of two ways by

- adjusting the underlying assumptions within the best estimate to ensure the likely impact of the event is included in the projection; or*
- calculating the best estimate reserve separately under the assumption that the event does occur/ does not occur followed by a probability weighting of the two projections.*

It should be noted that today the first approach is more commonly used, although it is not often that the events are explicitly identified. The identification and treatment of ‘binary events’ are one of the many considerations taken into account, by the actuarial function, when setting the best estimate reserve. As discussed in our paper this links to the need for companies as part of Solvency II to become more transparent in their communication around key drivers of the results as well as the underlying assumptions. We have given some thoughts to how this might be encouraged through implementing measures in section 8.1.5 (implementing measures – reporting) of our report.

We note that the treatment of ‘binary’ events, as described above, is compatible with the Framework Directive. For further information see our discussion in Section 2.1 as well as Section 3.2.1.5.