

**CEIOPS' Advice for
Level 2 Implementing Measures on Solvency II:**

**SCR standard formula – Article 111
Non-Life Underwriting Risk**

(former CP 48)

October 2009

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1. Introduction

- 1.1. In its letter of 19 July 2007, the European Commission requested CEIOPS to provide final, fully consulted advice on Level 2 implementing measures by October 2009 and recommended CEIOPS to develop Level 3 guidance on certain areas to foster supervisory convergence. On 12 June 2009 the European Commission sent a letter with further guidance regarding the Solvency II project, including the list of implementing measures and timetable until implementation.¹
- 1.2. This Paper covers advice in respect of the design of the non-life underwriting risk module, in particular the methods, assumptions and standard parameters to be used when calculating this risk module, as required in Article 111 (c) of the Solvency II Level 1 text.²
- 1.3. Also covered in the scope of this Paper are the methods and assumptions in respect of implementing measure (d) of Article 111 of the Level 1 text relevant to the above scope.
- 1.4. This Paper does not include the following issues, which will be dealt with in later advice:
 - Calibration
 - Non-life premium risk and reserve risk market standard deviations
 - Catastrophe parameters/scenarios
 - Undertaking-specific parameters
 - Correlations
 - Simplifications
- 1.5. The term “undertakings” relates to both insurance and reinsurance undertakings unless otherwise explicitly mentioned, and the abbreviation “LoB” stands for “line of business”.

¹ See <http://www.ceiops.eu/content/view/5/5/>

² Latest version from 19 October 2009 available at <http://register.consilium.europa.eu/pdf/en/09/st03/st03643-re01.en09.pdf>.

2. Extract from the Level 1 text

Legal basis for implementing measure

According to the guiding principles referred to in the Commission's letter, the legal basis for the advice presented in this paper is primarily found in Article 111 of the Level 1 text, which states:

Article 111 – Implementing measures

In order to ensure that the same treatment is applied to all insurance and reinsurance undertakings calculating the Solvency Capital Requirement on the basis of the standard formula, or to take account of market developments, the Commission shall adopt implementing measures laying down the following:

(a) a standard formula in accordance with the provisions of Articles 101 and 103 to 108;

(b) any sub-modules necessary or covering more precisely the risks which fall under the respective risk modules referred to in Article 104 as well as any subsequent updates;

(c) the methods, assumptions and standard parameters to be used when calculating each of the risk modules or sub-modules of the Basic Solvency Capital Requirement laid down in Articles 104, 105 and 304, the symmetric adjustment mechanism and the appropriate period of time, expressed in the number of months, as referred to in Article 106, and the appropriate approach for integrating the method referred to in Article 304 in the Solvency Capital Requirement as calculated in accordance with the standard formula;

(e) where insurance and reinsurance undertakings use risk mitigation techniques, the methods and assumptions to be used to assess the changes in the risk profile of the undertaking concerned and adjust the calculation of the Solvency Capital Requirement

[...]

(l) the simplified calculations provided for specific sub-modules and risk modules, as well as the criteria that insurance and reinsurance undertakings, including captive insurance and reinsurance undertakings, shall be required to meet in order to be entitled to use each of these simplifications, as set out in Article 108;

[...]

Other relevant Articles for providing background to the advice

Article 101 Calculation of the Solvency Capital Requirement

1. *The Solvency Capital Requirement shall be calculated in accordance with paragraphs 2 to 5:*
2. *The Solvency Capital Requirement shall be calculated on the presumption that the undertaking will carry on its business as a going concern.*
3. *The Solvency Capital Requirement shall be calibrated so as to ensure that all quantifiable risks to which an insurance or reinsurance undertaking is exposed are taken into account. It shall cover existing business, as well as the new business expected to be written over the next twelve months. With respect to existing business, it shall cover unexpected losses only.*
It shall correspond to the Value-at-Risk of the basic own funds of an insurance or reinsurance undertaking subject to a confidence level of 99.5% over a one-year period.
4. *The Solvency Capital Requirement shall cover at least the following risks:*
 - (a) *non-life underwriting risk;**[...]*
5. *When calculating the Solvency Capital Requirement, insurance and reinsurance undertakings shall take account of the effect of risk mitigation techniques, provided that credit risk and other risks arising from the use of such techniques are properly reflected in the Solvency Capital Requirement.*

Article 104 - Design of the Basic Solvency Capital Requirement

1. *The Basic Solvency Capital Requirement shall comprise individual risk modules, which are aggregated in accordance with point 1 of Annex IV.*
It shall consist of at least the following risk modules:
 - (a) *non-life underwriting risk;*
 - (b) *life underwriting risk;*
 - (c) *health underwriting risk;*
 - (d) *market risk,*
 - (e) *counterparty default risk. [...]*
6. *With regard to risks arising from catastrophes, geographical specifications may, where appropriate, be used for the calculation of the life, non-life and health underwriting risk modules.*

Article 105 - Calculation of the Solvency Capital Requirement

The non-life underwriting risk module shall reflect the risk arising from non-life insurance obligations, in relation to the perils covered and the processes used in the conduct of business.

It shall take account of the uncertainty in the results of insurance and reinsurance undertakings related to the existing insurance and reinsurance

obligations as well as to the new business expected to be written over the next twelve months.

It shall be calculated, in accordance with point 2 of Annex IV, as a combination of the capital requirements for at least the following sub-modules:

(a) the risk of loss, or of adverse change in the value of insurance liabilities, resulting from fluctuations in the timing, frequency and severity of insured events, and in the timing and amount of claim settlements (non-life premium and reserve risk);

(b) the risk of loss, or of adverse change in the value of insurance liabilities, resulting from significant uncertainty of pricing and provisioning assumptions related to extreme or exceptional events (non-life catastrophe risk). [...]

3. Advice

3.1 Explanatory text

3.1.1 QIS4 outputs and industry feedback

3.1. Below a summary of the QIS4 approach, as presented in the QIS4 report is presented:

- For the non-life premium and reserve risk sub-module:
 - The design of the non-life underwriting modelling was based on crossing twelve individual lines of business with three sources of risk. The twelve retained lines of business were those existing in the Accounting Directive 91/674/EEC – less the accident and health modelled in the health risk module – with a more granular breakdown for inward reinsurance.
 - The three sources of risk were the premium risk the reserve risk and the catastrophe risk. Premium and reserve risks were combined at the line of business level – with an allowance for diversification effects between lines of business – and then the result of this aggregation was combined with the catastrophe risk component.
 - The QIS4 design for the premium and reserve risk was very similar to the one used for QIS3 (modular approach, aggregation through a correlation matrix of risk contribution assessed at the level of a line of business). Changes concerned the introduction of an element of geographical diversification, refinement and extension on the possibility of using an undertakings' own experience and a different catastrophic risk component assessment.
 - Three methods were defined for the catastrophe risk component, the first one based on standardised risk charges by lines of business, the second one based on standardised geographical catastrophe scenarios provided by the supervisors and the third relied on using personalised catastrophe scenarios.
 - Geographical diversification was recognised using a blending formula for business underwritten or commitments existing in different geographical areas.
 - Two possibilities to include undertakings' own experience in the calculation were provided. The first possibility was to mix, using weight depending on the length of available historical data, an undertaking own past experience with the QIS4 default parameters. This first possibility was only available for the premium risk valuation. The second possibility was to allow undertakings use their own parameters calculated using a methodology provided by CEIOPS for both the premium risk and the reserve risk valuations.

- For the non-life catastrophe risk sub-module:

Method 1: standard approach

- If no regional scenarios are provided, a standard formula is applied.

Method 2: scenarios

- If regional scenarios are available, provided by the local supervisor (the supervisor of the relevant territory, not necessarily the insurer's own supervisor), they replace the standard formula of method 1. Regional scenarios include natural catastrophes and man-made catastrophes.

Optional: personalised scenarios

- In addition, undertakings may, on an optional basis, use personalised catastrophe scenarios according to the classes of business written and geographic concentration, and explaining the appropriate definition for calculation purposes (Method 3). It was also assumed that where undertakings did not apply either of the above methods, the undertaking would have calculated the capital requirement through a partial internal model.

3.2. Feedback on QIS4 can be summarised as follows:

- For the non-life premium and reserve risk sub-module:
 - Most of the feedback from undertakings or supervisors concentrated on the new aspects of the non-life underwriting risk modules. These additions were generally welcomed, at least on the principle that they set (recognition of geographical diversification, blending or replacing default parameters with undertakings own experience).
 - Some undertakings have criticised the design of the current premium and reserve module for the following reasons:
 - a tariff increase leads to a higher SCR, disregarding the rationale for the increase which could be motivated either by a parallel increase in the underlying level of risks (or the cost of claims), or the aim to improve profitability.
 - the component of tariff adjustments not proportional to the variation of underlying risks (and costs of claims) induces an increase in historical volatility that lasts for the subsequent SCRs until the reference year disappears from the horizon of net loss-ratio time series. This could induce behaviour oriented toward smoothing the used loss ratios, and not toward better risk management.
 - Similar potential artefacts in case of the merger (or portfolio transfer) of two undertakings with different loss-ratios: the merger will create a step in the data series, thus an additional capital charge, and in the case of a change in the reinsurance program, in particular for non-proportional reinsurance treaties.
 - Inconvenient threshold effects when a catastrophe event disappears from the horizon of a loss-ratio time series.

- One issue receiving several comments was the methodology for credibility weighted averages for premium and reserve risk. Some doubts were expressed, including that this approach could lead to an overly smoothed result, within sufficient sensitivity to the size of the undertaking. However, it was noted that a large market player with long experience might be expected to have more credibility to its own data.
- Regarding the issue of non-proportional reinsurance a number of undertakings and supervisors outlined the difficulties in encompassing the potentially non-linear effects of these risk mitigating instruments in the standard approach. A greater use of undertaking own experience, or a (partial) internal model, was proposed as a possible way forward to overcome these difficulties.
- Many undertakings regretted the absence of an allowance for future profit or for the position in the underwriting cycle in the risk assessment, while some suggested that the formula should include a greater element of sensitivity to volume.
- Most undertakings welcome the possibility to use undertaking specific parameters. However few were able to test it in QIS4, mostly because the depth of the historic data necessary was not available.
- Many undertakings commented on issues relating to the choice, reliability and availability of suitable data to back entity-specific parameterisation. Several comments were made on the length of time series available and appropriateness for use in entity-specific parameterisation, influence of the underwriting cycle on entity specific data and the need for greater specification of criteria for assessment of data quality and validation was raised.
- Some undertakings would also welcome a greater granularity of the predefined line of business in order to better capture the diversification benefit. This request may be in reaction to the difficulties encountered by niche players, or providers of less mainstream insurance contracts to allocate their business within the predefined lines of business. These practical classification difficulties can have an impact on the assessed overall risk profile in particular when they trigger the use of different diversification assumptions with other risks.
- Some undertakings commented that applying the model seems to be easier when using accounting designed on an accident year basis, or conversely raises practical difficulties for undertakings with accounting systems based on underwriting years.
- For the non-life catastrophe risk sub-module:
 - No clear guidance was given to undertakings of which scenarios should be modelled. This led to potential cherry picking between scenarios where undertakings picked the scenarios that give them the lowest capital charge.

- Some undertakings stated that catastrophe exposure calculated on an aggregated annual method gave much higher capital requirements than individual scenarios.
- Undertaking's pointed out that the results between methods 1 to 3 will be substantially different for the same undertaking.
- Overall consensus was that method 1 could give the lower capital charge. The ORSA or some other method may therefore be necessary to ensure that undertakings have applied the most appropriate and accurate method.
- It was stated that if undertakings use the QIS4 rule to combine individual cat events (square root sum of squares of all cats within 25% of largest one), the catastrophe risk result was higher than direct modelling result (all cat events modelled together). There is therefore potential for bias in the risk combination methodology.

Method 1:

- Not sufficiently risk sensitive
- Does not allow correctly non-proportional reinsurance for risk mitigation
- Not a good fit for financial loss business
- Simple to apply for all undertakings.
- Provides a benchmark for comparison.

Method 2:

- Not relevant for all undertakings
- Encourages inappropriate risk management strategies (undertakings only write business outside the scenario footprint)
- CEIOPS would need to ensure consistency of scenarios between Member States.
- Resource intensive for regulators and undertakings to create and apply scenarios.

Method 3:

- Entity specific so likely to capture the risk properly.
- Resource intensive for insurers to come up with scenarios
- Undertakings may miss significant risks
- Lack of consistency between undertakings
- Out of scope of the standard formula.

3.1.2 Important considerations

3.3. For the purpose of implementing measure (d) of Article 111 of the Level 1 text, CEIOPS has allowed for risk mitigation within this module as follows:

- Allowance for proportional risk mitigation reinsurance is fully reflected through the use of net volume measures, via the design of the non life premium and reserve risk formula.

- An average level of risk mitigating effect of non-proportional reinsurance is implicitly allowed for in the calibration of the non-life premium and reserve risk module. A more accurate recognition is not possible with the current design of the non life premium and reserve risk formula. This assumption may underestimate or overestimate. It will be conservative, in particular for risk excess protections where we would expect the protection to reduce the net deterioration for the higher percentiles. CEIOPS has consulted extensively on this issue and welcomes specific proposals that can be easily incorporated into the standard formula and these may be further considered as part of implementing measure Article 111 (d). CEIOPS would encourage undertakings with complex risk mitigation arrangements to use partial internal models or undertaking specific parameters.
 - Allowance for reinsurance risk mitigation is fully reflected via the design of the non-life catastrophe sub-module.
- 3.4. CEIOPS has decided not to apply geographical diversification for non-life business across the globe. While this change is crucial for reinsurers and cross-border groups, it was seen as introducing unnecessary complexity at solo level, in view of the materiality of the reduction in capital requirement they could obtain from the calculation. CEIOPS has included geographical diversification as part of the impact assessment (see Annex).
- 3.5. CEIOPS considers that a risk that was missed under the QIS4 approach was the risk relating to the change in the premium provisions which is set up for multi-year contracts. If the outstanding period of an insurance contract is longer than one year at the valuation date t , then a part of the premium provision covers the cash-flows which relate to cover given from $t+1$ onwards. After one year (at $t+1$), a new premium provision needs to be set up. This premium provision may be higher (apart from discounting effects) because the assumptions about the cash flows may have changed from t to $t+1$. For example, if we let the outstanding term of the contract at t be two years. The contract is considered to be profitable and the insurer expects a profit of 10 for each of the following two years. Then the premium provision at t is -20 (ignoring discounting effects). After one year (at $t+1$) the insurer might be forced to revise its earlier assumptions and might expect a loss of 5 for the outstanding period of one year. A premium provision of +5 needed to be set up in this case. The insurer would incur a loss of 15 caused by this change in the premium provision. Under the QIS4 approach this loss is neither covered by the premium risk nor by the reserve risk part of the module.
- 3.6. During QIS4 the standard deviation for premium risk for each line of business was derived as a credibility mix of an undertaking-specific estimate and a market-wide estimate. The industry welcomed the inclusion of such approach. However after careful consideration, CEIOPS believes that the mechanic estimation of the standard deviation from loss ratios is not sufficiently robust and reliable unless the credibility factors are very low. Moreover, the loss ratios for the estimation may not be appropriate for reasons such as changes in the composition of the portfolio, product changes, portfolio transfers, change of reinsurance, etc. CEIOPS considers that the drawbacks of using such an approach outweigh the benefits, and

providing solutions would make the standard formula overly complicated, therefore the approach has not been retained.

- 3.7. QIS4 feedback as well as other industry papers has highlighted the importance of making a clear distinction between catastrophe risks and other risks in order to ensure that there is no double counting of Catastrophe risk in the capital requirements. CEIOPS agrees with this. However CEIOPS believes that the assumptions underlying the estimation of the premium risk capital charge, implicitly allow for double counting. The selection of a lognormal distribution for the underlying exposure was made under the assumption that such distribution would not capture extreme events and therefore would avoid double counting.
- 3.8. CEIOPS does not allow for expected profit or loss in the standard formula. Article 105(2) of the Level 1 text makes clear that the non-life underwriting risk module should take into account "uncertainty in the results of insurance and reinsurance undertakings related to the existing insurance and reinsurance obligations as well as to the new business expected to be written over the forthcoming twelve months", and would therefore by definition not cover expected profits and losses.

3.1.3 Non-life underwriting risk

- 3.9. The Level 1 text defines underwriting risk as:

The risk of loss, or of adverse change in the value of insurance liabilities, due to inadequate pricing and provisioning.

- 3.10. Furthermore the Level 1 text requires that the Solvency Capital Requirement charge in respect of the non-life underwriting risk module covers the risk of loss arising from non-life insurance obligations and this shall be calculated as a combination of at least the following sub-modules:

- **Non-life premium and reserve risk:** the risk of loss, or of adverse change in the value of insurance liabilities, resulting from fluctuations in the timing, frequency and severity of insured events, and in the timing and amount of claim settlements.
- **Non-life catastrophe risk:** the risk of loss, or of adverse change in the value of insurance liabilities, resulting from significant uncertainty of pricing and provisioning assumptions related to extreme or exceptional events.

- 3.11. Neither of the two sub-modules specified in the Level 1 text captures the option exercise risk inherent in non-life insurance obligations. Whether option exercise risk is material in non-life insurance depends crucially on the definition of the boundary of the existing insurance contract. (See CEIOPS advice on future premiums).³ The more future premiums belong to the existing contract and are taken into account in technical provisions, the

³ Former CP 30. See CEIOPS-DOC-25/09 at <http://www.ceiops.eu/index.php?option=content&task=view&id=578>.

more significant option exercise risk becomes. Depending on the final advice on future premiums CEIOPS may advice to include an explicit allowance for option exercise risk in the non-life underwriting risk module.

- 3.12. The capital charge for non-life underwriting risk is derived by combining the capital charges for the non-life sub-risks using a correlation matrix as follows:

$$SCR_{nl} = \sqrt{\sum_{rxc} CorrNL^{rxc} \cdot NL_r \cdot NL_c},$$

where

- SCR_{nl} = Capital charge for non-life underwriting risk
- $CorrNL^{rxc}$ = The cells of the correlation matrix CorrNL
- NL_r, NL_c = Capital charges for individual non-life underwriting sub-risks according to the rows and columns of correlation matrix CorrNL

- 3.13. For the entries of the correlation matrix $Corr_{NL}$ please refer to CEIOPS' draft advice on correlations.⁴ The matrix has a shape as follows:

$Corr_{NL}$	NL_{pr}	NL_{CAT}
NL_{pr}		
NL_{CAT}		

3.1.4 Non-life premium and reserve risk sub-module

- 3.14. Premium risk is understood to relate to future claims arising during and after the period until the time horizon for the solvency assessment. The risk is that expenses plus the volume of losses (incurred and to be incurred) for these claims (comprising both amounts paid during the period and provisions made at its end) is higher than the premiums received (or if allowance is made elsewhere for the expected profits or losses on the business, that the profitability will be less than expected).
- 3.15. Premium risk is present at the time the policy is issued, before any insured events occur. Premium risk also arises because of uncertainties prior to issue of policies during the time horizon. These uncertainties include the premium rates that will be charged, the precise terms and conditions of the policies and the precise mix and volume of business to be written.

- 3.16. Premium risk shall therefore cover:

⁴ CEIOPS-CP-74/09 Draft Level 2 Advice Correlation parameters (Art 109 c). <http://www.ceiops.eu//index.php?option=content&task=view&id=656>.

- the risk of loss because the premium provision at the start of the year proves inadequate - that is premium provision at the start of the year plus outstanding premiums receivable plus interest at risk free rate is insufficient to cover claims incurred during the year plus premium provision at end of year.
- the risk of loss on new contracts written during the year - that is premiums receivable during the year plus interest is insufficient to cover claims incurred during the year plus premium provision at the end of the year.

3.17. CEIOPS therefore identify 3 types of risk of loss:

- New premiums may be written at inadequate rates.
- The loss on exposure during the year may be more than expected.
- The provisions at the start of the year for exposure after the end of the year may need to be increased.

3.18. Premium risk relates to policies to be written (including renewals) during the period, and to unexpired risks on existing contracts.

3.19. Premium risk shall also allow for volatility of expense payments. Expense risk can be quite material for some lines of business and shall therefore be fully reflected in the module calculations. Expense risk is implicitly included as part of the premium risk.

3.20. Reserve risk stems from two sources:

- The absolute level of the claims provisions may be mis-estimated
- Because of the stochastic nature of future claims payouts, the actual claims will fluctuate around their statistical mean value.

Calculation

3.21. In order to carry out the non-life premium and reserve risk calculation, the undertaking shall be required to provide the following information:

PCO_{lob}	=	best estimate for claims outstanding for each LoBs
$p_{lob}^{t,written}$	=	estimate of net written premium for each LoB during the forthcoming year
$p_{lob}^{t,earned}$	=	estimate of net earned premium for each LoB during the forthcoming year
$p_{lob}^{t-1,written}$	=	net written premium for each LoB during the previous year
C_{lob}^{PP}	=	Expected present value of net claims and expense payments which relate to claims incurred after the following year and covered by existing contracts for each LoBs.

3.22. In respect of C_{lob}^{PP} the term relates purely to part of the premium provision brought forward, whereas the other term is a proxy for premiums to be written or premiums to be earned, noting that the risks relating to these are rather different and only partly overlap. It is not intended to cover random

events after the year but changes in provisions on claims after the year as a result of new information.

3.23. The premium and reserve risk capital charge delivers the following output information:

$$NL_{pr} = \text{Capital charge for premium and reserve risk}$$

3.24. The capital charge for the combined premium risk and reserve risk is determined as follows:

$$NL_{pr} = \rho(\sigma) \cdot V$$

where

V	=	Volume measure
σ	=	combined standard deviation, resulting from the combination of the reserve and premium risk standard deviations
$\rho(\sigma)$	=	A function of the standard deviation

3.25. The function $\rho(\sigma)$ is specified as follows:

$$\rho(\sigma) = \frac{\exp(N_{0.995} \cdot \sqrt{\log(\sigma^2 + 1)})}{\sqrt{\sigma^2 + 1}} - 1$$

where

$N_{0.995}$	=	99.5% quantile of the standard normal distribution
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3.26. The function $\rho(\sigma)$ is set such that, assuming a lognormal distribution of the underlying risk, a risk capital charge consistent with the VaR 99.5% standard is produced. Roughly, $\rho(\sigma) \approx 3 \cdot \sigma$.

3.27. The volume measure V and the combined standard deviation σ for the overall non-life insurance portfolio are determined in two steps as follows:

1. For each individual LoB, the standard deviations and volume measures for both premium risk and reserve risk are determined;
2. The standard deviations and volume measures for the premium risk and the reserve risk in the individual LoBs are aggregated to derive an overall volume measure V and an overall standard deviation σ .

The calculations needed to perform these two steps are set out below.

Step 1: Volume measures and standard deviations per LoB

3.28. The calculation of both premium and reserve risk shall be done for each LoB as defined below and consistently with the SCR, MCR and TP segmentation and numbering:

LoB number	
1	Motor, vehicle liability
2	Motor, other classes
3	Marine, aviation, transport (MAT)
4	Fire and other property damage
5	Third-party liability
6	Credit and suretyship
7	Legal expenses
8	Assistance
9	Miscellaneous
10	Non-proportional reinsurance – property
11	Non-proportional reinsurance – casualty
12	Non-proportional reinsurance – MAT

3.29. For each LoB, the volume measures and standard deviations for premium and reserve risk are denoted as follows:

$V_{(prem,LoB)}$ = The volume measure for premium risk

$V_{(res,LoB)}$ = The volume measure for reserve risk

$\sigma_{(prem,LoB)}$ = standard deviation for premium risk

$\sigma_{(res,LoB)}$ = standard deviation for reserve risk

3.30. The volume measure for premium risk in the individual LoB is determined as follows:

$$V_{(prem,lob)} = \max(P_{lob}^{t,written} ; P_{lob}^{t,earned} ; P_{lob}^{t-1,written}) + C_{lob}^{PP}$$

3.31. If the insurer has committed to its regulator that it will restrict premiums written over the period so that the actual premiums written (or earned) over the period will not exceed its estimated volumes, the volume measure is determined only with respect to estimated premium volumes, so that in this case:

$$V_{(prem,,lob)} = \max(P_{,lob}^{t,written} ; P_{lob}^{t,earned}) + C_{lob}^{PP}$$

3.32. The market-wide estimates of the standard deviation for premium risk for each line of business should be specified in the implementing measures. For

the estimates, please refer to CEIOPS' Advice on non-life underwriting risk calibration.

- 3.33. The volume measure for reserve risk for each individual LoB is determined as follows:

$$V_{(res,,lob)} = PCO_{,lob}$$

- 3.34. The market-wide estimate of the standard deviation for reserve risk for each line of business should be specified in the implementing measures. For the estimates, please refer to CEIOPS' Advice on non-life underwriting risk calibration.⁵

- 3.35. The standard deviation for premium and reserve risk for each LoB is defined by aggregating the standard deviations for both sub-risks under the assumption of a correlation coefficient of α :

$$\sigma_{(lob)} = \frac{\sqrt{(\sigma_{(prem,lob)} V_{(prem,lob)})^2 + 2\alpha \sigma_{(prem,lob)} \sigma_{(res,lob)} V_{(prem,lob)} V_{(res,lob)} + (\sigma_{(res,lob)} V_{(res,lob)})^2}}{V_{(prem,lob)} + V_{(res,lob)}}$$

- 3.36. For the specification of the correlation coefficient α , please refer to CEIOPS Advice on non-life underwriting risk calibration.

Step 2: Overall volume measures and standard deviations

- 3.37. The overall standard deviation σ is determined as follows:

$$\sigma = \sqrt{\frac{1}{V^2} \cdot \sum_{rxc} CorrLob_{r,c} \cdot \sigma_r \cdot \sigma_c \cdot V_r \cdot V_c}$$

where

- r,c = All indices of the form (lob)
- $CorrLob^{rxc}$ = the cells of the correlation matrix $CorrLob$
- V_r, V_c = Volume measures for the individual lines of business, as defined in step 1

- 3.38. For the entries of the correlation matrix $Corr_{Lob}$ please refer to CEIOPS' Advice on non-life underwriting risk calibration. The matrix has a shape as follows:

<i>CorrLob</i>	1	2	3	4	5	6	7	8	9	10	11	12
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⁵ CEIOPS-CP-71/09 Draft L2 Advice Calibration of the non-life underwriting risk. <http://www.ceiops.eu//index.php?option=content&task=view&id=653>.

1: M (3 rd party)												
2: M (other)												
3: MAT												
4: Fire												
5: 3rd party liab												
6: credit												
7: legal exp.												
8: assistance												
9: misc.												
10: reins. (prop)												
11: reins. (cas)												
12: reins. (MAT)												

3.1.5 Non-life catastrophe risk sub-module

3.39. Catastrophe risk is a considerable element within an undertaking's total insurance risk and it is important that it is appropriately treated under Solvency II.

3.40. CEIOPS has consulted extensively both internally and externally on this complex issue⁶:

- QIS4 exercise and report
- CEA response on the non-life catastrophe risk charge in the SCR
- AMICE response to health catastrophe risk
- Industry

3.41. As a result, CEIOPS has decided that the standard formula catastrophe risk sub-module capital charge shall be estimated through the application of standardised scenarios.

3.42. CEIOPS acknowledges the importance that:

- the scenarios reflect the risk of catastrophic events for all regions within the EU.
- the scenarios shall consider the potential for multiple events in a given year, and they shall reflect sufficiently extreme events, or combination of events, to be relevant at the 99.5th percentile.
- the process and methodology used to build the scenarios needs to be harmonised across all regions, to ensure that a level playing field is maintained

⁶Complementary Health Catastrophe Risk in the SCR, Amice, 22 April 2009
CEA response on the non-life catastrophe risk charge in the SCR, 20th March 2009
CEIOPS QIS4 EU report
Paper on the use of catastrophe scenarios by UK, May 2009

- the standardised scenarios might provide false confidence that all the relevant risks are captured, whereas they might not sufficiently reflect the risks attached to the each insurer's business. It is unlikely that it is possible to create enough scenarios that sufficiently capture all the specificities of an insurer's risk and loss drivers. Therefore CEIOPS supports in such circumstances that alternative methods are used as described in section 3.1.5.2.

A. Standardized scenarios

3.43. During QIS4, CEIOPS noted that under method 2:

- Member States did not have sufficient time or resource to co-ordinate the construction of the scenarios. This led to inconsistency between the scenarios in different EEA countries. The construction and specification of the scenarios varied markedly from state to state with some being purely description based, some very numerical and some in between. There is therefore also the possibility of the scenarios being designed to a different calibration.
- To reduce the risk that scenarios are not left open to abuse or possible cherry picking guidance shall be provided to (re)insurance undertakings on how to apply each scenario to their particular exposure profile.
- The scenarios were designed for undertakings with relatively standard portfolios of business written throughout a Member State. In particular, they may not be relevant for undertakings operating with a concentration of risk in their local area, undertakings writing business outside the EEA, or undertakings writing niche classes of business.
- Scenarios generally only considered one large event, rather than a possible accumulation of several medium sized events.
- There is a need for guidance on how to aggregate the results of multiple scenarios. It is unreasonable to assume that all the scenarios with impact an undertaking simultaneously.

3.44. CEIOPS proposes as follows:

- The standard formula catastrophe risk module shall result from the application of standardized scenarios.
- These scenarios will be developed by CEIOPS, with the help of industry.
- The standardized scenarios shall be more detailed and comprehensive compared to the "method 2" QIS4 specifications.
- CEIOPS will give more detail on the scenarios per LoB in future Level 3 guidance. The nature, size and complexity of risks are constantly evolving and therefore, it is necessary that the scenarios remain under on-going review. The standardized scenarios shall be reviewed annually to allow for new information and experience.

- Given the complexity of elaborating and calibrating the standardized scenarios, there is a high probability that these will not be delivered on time for QIS5. However CEIOPS shall work towards finalising all the standardised scenarios before the implementation of Solvency II. In the meantime, CEIOPS proposes that undertakings shall apply a specific alternative method called the Factor method, as described in section B hereunder.

3.45. To develop standardized scenarios, CEIOPS suggest the following key steps:

- Create a catastrophe working group that will aim to work with CEIOPS in constructing the required scenarios. CEIOPS would like to ask stakeholders to inform CEIOPS of their specific expertise in this area.
- Build a list of the natural perils and man-made events. Each peril or event shall have the corresponding lines of business it affects and other information such as measures of exposure. This list may be reviewed.
- Build a list of specific national arrangements that may mitigate the extent of the estimated standardized scenario. For example details of national pool arrangements.
- Build a database of historic EU catastrophic losses. Such database shall record catastrophic losses for the EU region for example by date, peril, location and LoB affected. This may also be done with help from the industry.

Criteria for building standardized scenarios

3.46. The SCR aims at covering the undertaking's unexpected losses with a confidence level of 99.5% over a one-year period. CEIOPS is aware that standardized scenarios aim at reproducing a 1 in 200 industry loss level, which would not necessarily represent a 1 in 200 year loss level for an individual undertaking. However, the modelling approach shall ensure in the best way possible, for example by regional differentiation or reflecting product characteristics that the event corresponds to a 1 in 200 loss level for the individual undertaking.

3.47. CEIOPS considers important to define a borderline between the non life premium and reserve risk and the non life catastrophe risk. For this reason, it is assumed that the non life premium and reserve risk module shall capture all the risks that have not been captured under the catastrophe risk sub-module. The specification of a standardized scenario shall include a definition of the risks captured by the capital requirement for the scenario.

3.48. Scenarios shall be constructed for at least the following minimum set of events:

Events	Lines of business affected
Natural perils	
Storm	Fire and property; Other motor

Flood	Fire and property; Other motor
Earthquake	Fire and property; Other motor
Hail	Fire and property; Other motor
Man Made disasters	
Major fires, explosions	Fire and property
Major MAT disaster	MAT
Major motor third party liability disasters	Motor third party liability
Major third party liability disaster	Third party liability

3.49. For credit and health CEIOPS shall define relevant at least some pan European events.

Pan European Events	Lines of business affected
Credit (recession, large exposures)	Credit
Health SLT /NSLT, example, pandemic, mass accident, recession, increase in incidence of terminal illness etc...	Health Non-SLT/SLT

3.50. Member States shall consider any other relevant scenarios that they shall apply. Where a member state does not believe a particular scenario applies, they shall describe by LoB the reasons why this particular scenario has not been constructed.

3.51. A prospective view shall be taken in the design of the event. It shall allow for changes due to the demographic, legal, medical, technological, social, economic, or ecologic developments. In particular, and as a consequence, the design shall account for the effect of the climate change.

3.52. The degree of involvement of the undertaking in the market, net of reinsurance, would need to be taken into account in deriving the capital requirements for that company. For example, we would use the regional or EU -wide market share, based on written premiums, for each LoB.

3.53. For a (re)insurance undertaking that operates in more than one Member State, standardized scenarios from all Member States would need to be considered in relation to the exposure in such countries. This also prompts consideration of cross border scenarios.

3.54. Each standardized scenario shall be designed, quantified and reported in line with a common set of definitions. This will increase harmonisation.

3.55. Scenarios will, where relevant be calibrated based on CRESTA⁷ zones and sum insured. CEIOPS would like to encourage undertakings to consider the collection of sums insured by CRESTA zones.

⁷ For further information on CRESTA zones, see www.cresta.org. Further guidance will also be provided by CEIOPS' CAT task force.

3.56. Information and detail on the design and quantification of each and every standardized scenario shall be disclosed within CEIOPS. For each designed event at least the following detailed information shall be disclosed:

- Description of the underlying sources of information, methods or expertise used.
- For natural catastrophe events: a description of each event, the risks exposed, the CRESTA zones, the underlying assumptions, details of the relevant foot print, the lines of business affected.
- For man-made events: identify exposure risks where there is a low frequency/high severity e.g. satellite or aviation, a description of each event, the underlying assumptions, details of the relevant measure of exposure, the lines of business affected and gross insured loss amount.

3.57. CEIOPS shall provide guidance in respect of the aggregation requirements between events and countries. Sample illustrations on how the standardized scenarios could be aggregated can be found in Annex to this paper.

B. Alternative method

3.58. In QIS4, the alternative method was called Method 1. This consisted in estimating a capital charge proportional to the net written premiums per LoB. CEIOPS will provide a revised calibration and consider making the formula more risk-sensitive in the calibration advice it will release for consultation in November 2009.

3.59. When undertakings have selected the standard formula, they shall apply the factor-based alternative method in two cases:

- When a standardized scenario is not relevant and a partial internal model is not proportionate.
- For the Miscellaneous line of business.

3.60. Circumstances in which the Factor method shall be used instead of a standardized scenario are:

- Undertakings with non material exposures outside the EU, in relation to these exposures.
- Undertakings writing non material non-proportional reinsurance, in relation to these exposures.
- The scenario is not applicable, but it has exposure.

3.61. When undertakings have to use the factor method they shall be required to apply the higher capital charge between the standardised scenario and the alternative method.

3.62. In all other circumstances, subject to proportionality, undertakings shall use partial internal models and are subject to such criteria.

Special case for captives

3.63. CEIOPS understands that particular factors may be required for captives. These are being calibrated and presented as part of the calibration advice released for consultation in November 2009.

C. Calculation

3.64. Undertakings are required to estimate their net catastrophe charge as described below. Undertakings shall consider:

3.65. Whether the perils or events are covered by their policy or whether some other arrangement provides cover instead, for example, in the case of the Consorcio de Compensacion de Seguros. Where undertakings have no or limited exposure to such peril or events, their catastrophe charge shall be reduced in proportion to their retained exposure.

3.66. Undertakings shall take into account of any reinsurance or other risk mitigation arrangement that provides cover against such events or perils, in estimating the net catastrophe charge. Reinsurance risk mitigation arrangements shall meet the criteria laid down in CEIOPS' advice on reinsurance mitigation techniques⁸:

- The net capital charge for Catastrophe Risk shall be calculated as follows:

Where the XL cover follows a proportional cover:

$$\text{MAX} ((L*MS*QS)-XLC, 0) + \text{MIN} ((L*MS*QS), XLF) + \text{REINST}$$

Where a proportional cover follows an XL cover:

$$\text{MAX} ((L*MS)-XLC, 0) *QS + \text{MIN}((L*MS), XLF) *QS + \text{REINST}$$

Where

L= the total gross loss amount. The total gross loss amount of the catastrophe will be provided as part of the information of the scenario.

MS= the market share. This proportion might be determined with reference to exposure estimates, historical loss experience or the share of total market premium income received. The total market loss amount of the catastrophe will be provided as part of the information of the scenario.

QS= quota share retention. Allowance must be made for any limitations, e.g. event limits which are frequently applied to QS treaties

XLC= the upper limit of the XL programme that is applicable in case of the scenario event

⁸ Former CP 52. See CEIOPS-DOC-44/09 at <http://www.ceiops.eu/index.php?option=content&task=view&id=603>.

XL= the XL retention of the XL programme that is applicable in case of the scenario event.

REINST = the reinstatement premium or premiums (in case of scenarios with a succession of 2 or more identical events)

- 3.67. Where an undertaking has to use the factor method, the catastrophe capital charge for a specific event type shall be the result of the maximum of the standardized scenario and factor:

$$CAT_{\text{event}} = \text{Max} (CAT_{\text{factor method}}, CAT_{\text{standardized scenario}})$$

The $CAT_{\text{standardized scenario}}$ and $CAT_{\text{factor method}}$ shall be both net of reinsurance.

- 3.68. The capital requirement for catastrophe risk for a line of business should not exceed the aggregate limit for a specific line of business. The aggregate limit shall represent the net retention per line of business, after reinsurance, taking into account the limits stated in acceptance as well as in reinsurance treaties, increased by a possible reinstatement premium. There may be limits in treaties accepted and in treaties reinsured, or in only acceptance or reinsurance. If for one line of business, several treaties are written but for one of them no limit can be defined, the aggregate limit shall not be taken into account. If an aggregate limit covers several lines of business (so called 'umbrella treaties', or 'multi-line treaties'), it should be assured that this overall limit is not taken into account for each line of business. Further work is necessary on the treatment of the aggregate limit at the level of a particular line of business in case of umbrella or multi-line treaties. CEIOPS welcomes stakeholders' feedback on this issue. The choice of the aggregate limit should ensure that the probability of a loss exceeding the aggregate limit has a zero probability.
- 3.69. Aggregation of the catastrophe risk charges across events or relevant countries, including definition of correlations shall be specified at the same time as the standardized scenarios. CEIOPS shall draw on the expertise of the industry for such exercise. The Annex includes two possible options.
- 3.70. The final capital charge, after aggregation, shall be represented by NL_{CAT} .
- 3.71. Furthermore undertakings shall consider the following criteria when considering standardized scenarios:
- The scenario event shall be considered to take place immediately after the valuation date and the undertaking's exposure at the valuation date shall be affected.
 - The application of the scenarios shall not be automatic; rather, consideration would need to be given to the appropriateness of the scenarios.
 - The assessment of catastrophe risks is part of a broader risk management framework / ORSA process. (Re) insurance undertakings shall review the scope of the scenario defined and assess the applicability of such scenario and range of possible outcomes that could arise on the occurrence of the scenario. The range (and probability distribution) of

possible outcomes shall determine the best estimate of loss from the scenario.

- (Re) insurance undertakings shall consider whether scenarios are applied adequately and seek to ensure that the limitations are addressed appropriately by the (re)insurance undertaking as part of their ORSA.
- The extent to which the risks covered by the scenario could deviate significantly from their risk profile (i.e. the extent of the “miss risk” for the individual undertaking as a result of using the specified regional loss scenarios). In doing this, they must be satisfied that they have captured all the main affected exposures and lines of business. Where this deviates significantly an alternative approach as the one described above shall be applied.
- (Re) insurance undertakings shall provide a breakdown of reinsurance recoveries by reinsure under each scenario. The figures shall reconcile roughly to the anticipated recoveries for both facultative and treaty (including stop loss) protections.
- Supervisors will apply judgement, interpretation, discretion and flexibility when assessing whether all the risks have been captured.

3.2 CEIOPS’ advice

3.72. This Paper provides advice in respect of the design of the non-life underwriting risk module, in particular the methods, assumptions and standard parameters to be used when calculating this risk module, as required in Article 111 of the Level 1 text. The advice also covers the methods and assumptions in respect of implementing measure (d) of Article 111 of the Level 1 text where relevant.

3.73. This Paper does not include the following issues, which are being dealt with in the advice released for consultation in November 2009:

- Calibration
- Non-life premium risk and reserve risk market standard deviations
- Catastrophe parameters/scenarios
- Undertaking-specific parameters
- Correlations
- Simplifications

Important considerations

3.74. For the purpose of implementing measure (d) of Article 111 of the Level 1 text, CEIOPS has allowed for risk mitigation within this module as follows:

- Allowance for proportional risk mitigation reinsurance is fully reflected through the use of net volume measures, via the design of the non life premium and reserve risk formula.

reinsurance is implicitly allowed for in the calibration of the non life premium and reserve risk module. A more accurate recognition is not possible with the current design of the non life premium and reserve risk formula. This assumption may underestimate or overestimate. It will be conservative, in particular for risk excess protections where we would expect the protection to reduce the net deterioration for the higher percentiles. CEIOPS has consulted extensively on this issue and welcomes specific proposals that can be easily incorporated into the standard formula and these may be further considered as part of implementing measure Article 111 (d). CEIOPS would encourage undertakings with complex risk mitigation arrangements to use partial internal models or undertaking specific parameters.

- Allowance for reinsurance risk mitigation is fully reflected via the design of the non life cat sub module.

3.75. CEIOPS has decided not to apply geographical diversification for non-life business across the globe. While this change is crucial for reinsurers and cross-border groups, it was seen as introducing unnecessary complexity at solo level, in view of the materiality of the reduction in capital requirement they could obtain from the calculation. CEIOPS has included considerations on geographical diversification as part of the impact assessment (see Annex).

3.76. CEIOPS considers that a risk that was missed under the QIS4 approach was the risk relating to the change in the premium provisions which is set up for multi-year contracts. If the outstanding period of an insurance contract is longer than one year at the valuation date t , then a part of the premium provision covers the cash-flows which relate to cover given from $t+1$ onwards. After one year (at $t+1$), a new premium provision needs to be set up. This premium provision may be higher (apart from discounting effects) because the assumptions about the cash flows may have changed from t to $t+1$. For example, if we let the outstanding term of the contract at t be two years. The contract is considered to be profitable and the insurer expects a profit of 10 for each of the following two years. Then the premium provision at t is -20 (ignoring discounting effects). After one year (at $t+1$) the insurer might be forced to revise its earlier assumptions and might expect a loss of 5 for the outstanding period of one year. A premium provision of +5 needed to be set up in this case. The insurer would incur a loss of 15 caused by this change in the premium provision. Under the QIS4 approach this loss is neither covered by the premium risk nor by the reserve risk part of the module.

3.77. During QIS4 the standard deviation for premium risk for each line of business was derived as a credibility mix of an undertaking-specific estimate and a market-wide estimate. The industry welcomed the inclusion of such approach. However after careful consideration, CEIOPS believes that the mechanic estimation of the standard deviation from loss ratios is not sufficiently robust and reliable unless the credibility factors are very low. Moreover, the loss ratios for the estimation may not be appropriate for reasons such as changes in the composition of the portfolio, product changes, portfolio transfers, change of reinsurance, etc. CEIOPS considers that the drawbacks of using such an approach outweigh the benefits, and

providing solutions would make the standard formula overly complicated, therefore the approach has not been retained.

3.78. QIS4 feedback as well as other industry papers has highlighted the importance of making a clear distinction between catastrophe risks and other risks in order to ensure that there is no double counting of Catastrophe risk in the capital requirements. CEIOPS agrees with this. However CEIOPS believes that the assumptions underlying the estimation of the premium risk capital charge, implicitly allow for double counting. The selection of a lognormal distribution for the underlying exposure was made under the assumption that such distribution would not capture extreme events and therefore would avoid double counting.

3.79. CEIOPS does not allow for expected profit or loss in the standard formula. Article 105(2) of the Level 1 text makes clear that the non-life underwriting risk module should take into account "uncertainty in the results of insurance and reinsurance undertakings related to the existing insurance and reinsurance obligations as well as to the new business expected to be written over the forthcoming twelve months", and would therefore by definition not cover expected profits and losses.

Standard formula non-life underwriting risk

3.80. The capital charge for non-life underwriting risk is derived by combining the capital charges for the non-life sub-risks using a correlation matrix as follows:

$$SCR_{nl} = \sqrt{\sum_{rxc} CorrNL^{rxc} \cdot NL_r \cdot NL_c},$$

where

SCR_{nl} = Capital charge for non-life underwriting risk

$CorrNL^{rxc}$ = The cells of the correlation matrix CorrNL

NL_r, NL_c = Capital charges for individual non-life underwriting sub-risks according to the rows and columns of correlation matrix CorrNL

3.81. For the entries of the correlation matrix $Corr_{NL}$ please refer to CEIOPS' draft advice on correlations(CEIOPS-CP-74-09). The matrix has a shape as follows:

$Corr_{NL}$	NL_{pr}	NL_{CAT}
NL_{pr}		
NL_{CAT}		

Non-life premium and reserve risk sub-module

- 3.82. Premium risk is understood to relate to future claims arising during and after the period until the time horizon for the solvency assessment. The risk is that expenses plus the volume of losses (incurred and to be incurred) for these claims (comprising both amounts paid during the period and provisions made at its end) is higher than the premiums received (or if allowance is made elsewhere for the expected profits or losses on the business, that the profitability will be less than expected).
- 3.83. Premium risk is present at the time the policy is issued, before any insured events occur. Premium risk also arises because of uncertainties prior to issue of policies during the time horizon. These uncertainties include the premium rates that will be charged, the precise terms and conditions of the policies and the precise mix and volume of business to be written.
- 3.84. Premium risk shall therefore cover:
- the risk of loss because the premium provision at the start of the year proves inadequate - that is premium provision at the start of the year plus outstanding premiums receivable plus interest at risk free rate is insufficient to cover claims incurred during the year plus premium provision at end of year
 - the risk of loss on new contracts written during the year - that is premiums receivable during the year plus interest is insufficient to cover claims incurred during the year plus premium provision at the end of the year
- 3.85. CEIOPS therefore identifies 3 types of risk of loss:
- the new premiums may be written at inadequate rates
 - the loss on exposure during the year may be more than expected
 - the provisions at the start of the year for exposure after the end of the year may need to be increased.
- 3.86. Premium risk relates to policies to be written (including renewals) during the period, and to unexpired risks on existing contracts.
- 3.87. Premium risk shall also allow for volatility of expense payments. Expense risk can be quite material for some lines of business and shall therefore be fully reflected in the module calculations. Expense risk is implicitly included as part of the premium risk.
- 3.88. Reserve risk stems from two sources:
- the absolute level of the claims provisions may be mis-estimated and
 - because of the stochastic nature of future claims payouts, the actual claims will fluctuate around their statistical mean value.

Calculation

3.89. In order to carry out the non- life premium and reserve risk calculation, the undertaking shall be required to provide the following information:

$PCO_{,lob}$	=	best estimate for claims outstanding for each LoBs
$P_{lob}^{t,written}$	=	estimate of net written premium for each LoB during the forthcoming year
$P_{lob}^{t,earned}$	=	estimate of net earned premium for each LoB during the forthcoming year
$P_{lob}^{t-1,written}$	=	net written premium for each LoB during the previous year
C_{lob}^{PP}	=	Expected present value of net claims and expense payments which relate to claims incurred after the following year and covered by existing contracts for each LoBs.

3.90. In respect of C_{lob}^{PP} the term relates purely to part of the premium provision brought forward, whereas the other term is a proxy for premiums to be written or premiums to be earned, noting that the risks relating to these are rather different and only partly overlap. It is not intended to cover random events after the year but changes in provisions on claims after the year as a result of new information.

3.91. The premium and reserve risk capital charge delivers the following output information:

NL_{pr}	=	Capital charge for premium and reserve risk
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3.92. The capital charge for the combined premium risk and reserve risk is determined as follows:

$$NL_{pr} = \rho(\sigma) \cdot V$$

where

V	=	Volume measure
σ	=	combined standard deviation, resulting from the combination of the reserve and premium risk standard deviations
$\rho(\sigma)$	=	A function of the standard deviation

3.93. The function $\rho(\sigma)$ is specified as follows:

$$\rho(\sigma) = \frac{\exp(N_{0.995} \cdot \sqrt{\log(\sigma^2 + 1)})}{\sqrt{\sigma^2 + 1}} - 1$$

Where

$N_{0.995}$	=	99.5% quantile of the standard normal distribution
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3.94. The function $\rho(\sigma)$ is set such that, assuming a lognormal distribution of the underlying risk, a risk capital charge consistent with the VaR 99.5%

standard is produced. Roughly, $\rho(\sigma) \approx 3 \cdot \sigma$.

3.95. The volume measure V and the combined standard deviation σ for the overall non-life insurance portfolio are determined in two steps as follows:

1. For each individual line of business (LoB), the standard deviations and volume measures for both premium risk and reserve risk are determined;
2. The standard deviations and volume measures for the premium risk and the reserve risk in the individual LoBs are aggregated to derive an overall volume measure V and an overall standard deviation σ .

The calculations needed to perform these two steps are set out below.

Step 1: Volume measures and standard deviations per LoB

3.96. The calculation of both premium and reserve risk shall be done for each LoB as defined below and consistently with the SCR, MCR and TP segmentation and numbering:

LoB number	
1	Motor, vehicle liability
2	Motor, other classes
3	Marine, aviation, transport (MAT)
4	Fire and other property damage
5	Third-party liability
6	Credit and suretyship
7	Legal expenses
8	Assistance
9	Miscellaneous
10	Non-proportional reinsurance – property
11	Non-proportional reinsurance – casualty
12	Non-proportional reinsurance – MAT

3.97. For each LoB, the volume measures and standard deviations for premium and reserve risk are denoted as follows:

$V_{(prem,LoB)}$ = The volume measure for premium risk

$V_{(res,LoB)}$ = The volume measure for reserve risk

$\sigma_{(prem,LoB)}$ = standard deviation for premium risk

$\sigma_{(res,LoB)}$ = standard deviation for reserve risk

3.98. The volume measure for premium risk in the individual LoB is determined as follows:

$$V_{(prem,lob)} = \max(P_{lob}^{t,written}; P_{lob}^{t,earned}; P_{lob}^{t-1,written}) + C_{lob}^{PP}$$

3.99. If the insurer has committed to its regulator that it will restrict premiums written over the period so that the actual premiums written (or earned) over the period will not exceed its estimated volumes, the volume measure is determined only with respect to estimated premium volumes, so that in this case:

$$V_{(prem,lob)} = \max(P_{,lob}^{t,written}; P_{,lob}^{t,earned}) + C_{lob}^{PP}$$

3.100. The market-wide estimates of the standard deviation for premium risk for each LoB of business should be specified in the implementing measures. For the estimates, please refer to CEIOPS' draft advice on non-life underwriting risk calibration (CEIOPS-CP-71-09).

3.101. The volume measure for reserve risk for each individual LoB is determined as follows:

$$V_{(res,,lob)} = PCO_{,lob}$$

3.102. The market-wide estimate of the standard deviation for reserve risk for each lob of should be specified in the implementing measures. For the estimates, please refer to CEIOPS' draft advice on non-life underwriting risk calibration (CEIOPS-CP-71-09).

3.103. The standard deviation for premium and reserve risk for each LoB is defined by aggregating the standard deviations for both sub-risks under the assumption of a correlation coefficient of $\alpha = 0.5$:

$$\sigma_{(lob)} = \frac{\sqrt{(\sigma_{(prem,lob)} V_{(prem,lob)})^2 + 2\alpha \sigma_{(prem,lob)} \sigma_{(res,lob)} V_{(prem,lob)} V_{(res,lob)} + (\sigma_{(res,lob)} V_{(res,lob)})^2}}{V_{(prem,lob)} + V_{(res,lob)}}$$

Step 2: Overall volume measures and standard deviations

3.104. The overall standard deviation σ is determined as follows:

$$\sigma = \sqrt{\frac{1}{V^2} \cdot \sum_{rxc} CorrLob_{r,c} \cdot \sigma_r \cdot \sigma_c \cdot V_r \cdot V_c}$$

where

r,c = All indices of the form (LoB)

$CorrLob^{xc}$ = the cells of the correlation matrix $CorrLob$

$V_r V_c$ = Volume measures for the individual lines of business, as defined in step 2

3.105. For the entries of the correlation matrix $Corr_{Lob}$ please refer to CEIOPS Advice on non-life underwriting risk calibration. The matrix has a shape as follows:

<i>CorrLob</i>	1	2	3	4	5	6	7	8	9	10	11	12
1: <i>M (3rd party)</i>												
2: <i>M (other)</i>												
3: <i>MAT</i>												
4: <i>Fire</i>												
5: <i>3rd party liab</i>												
6: <i>credit</i>												
7: <i>legal exp.</i>												
8: <i>assistance</i>												
9: <i>misc.</i>												
10: <i>reins. (prop)</i>												
11: <i>reins. (cas)</i>												
12: <i>reins. (MAT)</i>												

Non-life catastrophe risk sub-module

Standardized scenarios

3.106. CEIOPS proposes as follows:

- The standard formula catastrophe risk module shall result from the application of standardized scenarios.
- These scenarios will be developed by CEIOPS, with the help of industry.
- The standardized scenarios shall be more detailed and comprehensive compared to the "method 2" QIS4 specifications.
- CEIOPS will give more detail on the scenarios per LoB in future Level 3 guidance. The nature, size and complexity of risks are constantly evolving and therefore, it is necessary that the scenarios remain under on-going review. The standardized scenarios shall be reviewed annually to allow for new information and experience.
- Given the complexity of elaborating and calibrating the standardized

scenarios, there is a high probability that these will not be delivered on time for QIS5. However CEIOPS shall work towards finalising all the standardised scenarios before the implementation of Solvency II. In the meantime, CEIOPS proposes that undertakings shall apply a specific alternative method called the Factor method.

3.107. To develop standardized scenarios, CEIOPS suggest the following key steps:

- Create a catastrophe working group that will aim to work with CEIOPS in constructing the required scenarios. CEIOPS would like to ask stakeholders to inform CEIOPS of their specific expertise in this area.
- Build a list of the natural perils and man-made events. Each peril or event shall have the corresponding lines of business it affects and other information such as measures of exposure. This list may be reviewed.
- Build a list of specific national arrangements that may mitigate the extent of the estimated standardized scenario. For example details of national pool arrangements.
- Build a database of historic EU catastrophic losses. Such database shall record catastrophic losses for the EU region for example by date, peril, location and LoB affected. This may also be done with help from the industry.

Criteria for building standardized scenarios

3.108. The SCR aims at covering the undertaking’s unexpected losses with a confidence level of 99.5% over a one-year period. CEIOPS is aware that standardized scenarios aim at reproducing a 1 in 200 year industry loss level, which won’t necessarily represent a 1 in 200 year loss level for an individual undertaking. However, the modelling approach shall ensure in the best way possible, for example by regional differentiation or reflecting product characteristics that the event corresponds to a 1 in 200 loss level for the individual undertaking.

3.109. CEIOPS considers important to define a borderline between the non life premium and reserve risk and the non life catastrophe risk. For this reason, it is assumed that the non life premium and reserve risk module shall capture all the risks that have not been captured under the catastrophe risk sub-module. The specification of a standardized scenario shall include a definition of the risks captured by the capital requirement for the scenario.

3.110. Scenarios shall be constructed for at least the following minimum set of events:

Events	Lines of business affected
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Hail	Fire and property; Other motor
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Major fires, explosions	Fire and property
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Major motor third party liability disasters	Motor third party liability
Major third party liability disaster	Third party liability

3.111. For credit and health CEIOPS shall define at least some relevant pan European events.

Pan European Events	Lines of business affected
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Health SLT /NSLT, example, pandemic, mass accident, recession, increase in incidence of terminal illness etc..	Health Non-SLT/SLT

3.112. Member States shall consider any other relevant scenarios that they shall apply. Where a member state does not believe a particular scenario applies, they shall describe by lob the reasons why this particular scenario has not been constructed.

3.113. A prospective view shall be taken in the design of the event. It shall allow for changes due to the demographic, legal, medical, technological, social, economic, or ecologic developments. In particular, and as a consequence, the design shall account for the effect of the climate change.

3.114. The degree of involvement of the undertaking in the market would need to be taken into account in deriving the capital requirements for that company. For example, we would use the regional or EU -wide market share, based on written premiums, for each LoB.

3.115. For a (re)insurance undertaking that operates in more than one member state, standardized scenarios from all Member States would need to be considered in relation to the exposure in such countries. This also prompts consideration of cross border scenarios.

3.116. Each standardized scenario shall be designed, quantified and reported in line with a common set of definitions. This will increase harmonisation.

3.117. Scenarios will, where relevant be calibrated based on CRESTA zones (and sum insured. CEIOPS would like to encourage undertakings to consider the collection of sums insured by CRESTA zones. For further information on CRESTA zones, see www.cresta.org. Further guidance will also be provided by the CAT task force).

3.118. Information and detail on the design and quantification of each and every standardized scenario shall be disclosed within CEIOPS. For each designed event at least the following detailed information shall be disclosed:

- Description of the underlying sources of information, methods or expertise used.
- For natural catastrophe events: a description of each event, the risks exposed, the CRESTA zones, the underlying assumptions, details of the relevant foot print, the lines of business affected.
- For man-made events: identify exposure risks where there is a low frequency/high severity e.g. satellite or aviation, a description of each event, the underlying assumptions, details of the relevant measure of exposure, the lines of business affected and gross insured loss amount.

3.119. CEIOPS shall provide guidance in respect of the aggregation requirements between events and countries. Sample illustrations on how the standardized scenarios could be aggregated are in the Annex to this paper.

Alternative method

3.120. In QIS4, the alternative method was called Method 1. This consisted in estimating a capital charge proportional to the net written premiums per LoB. CEIOPS will provide a revised calibration and consider making the formula more risk-sensitive in the November 2009 advice.

3.121. When undertakings have selected the standard formula, they shall apply the factor-based alternative method in two cases:

- When a standardized scenario is not relevant and a partial internal model is not proportionate.
- For the Miscellaneous line of business.

3.122. Circumstances in which the factor method shall be used instead of a standardized scenario are:

- Undertakings with non material exposures outside the EU, in relation to these exposures.
- Undertakings writing non material non-proportional reinsurance, in relation to these exposures.
- The scenario is not applicable, but it has exposure.

3.123. When undertakings have to use the factor method they shall be required to apply the higher capital charge between the standardised scenario and the alternative method.

3.124. In all other circumstances, subject to proportionality, undertakings shall use partial internal models and are subject to such criteria.

Special case for captives

3.125.CEIOPS understands that particular factors may be required for captives. These shall be calibrated and presented as part of the advice on calibration to be released for consultation in November 2009.

Calculation

3.126.Undertakings are required to estimate their net catastrophe charge as described below. Undertakings shall consider:

3.127.Whether the perils or events are covered by their policy or whether some other arrangement provides cover instead, for example, in the case of the Consorcio de Compensacion de Seguros. Where undertakings have no or limited exposure to such peril or events, their catastrophe charge shall be reduced in proportion to their retained exposure.

3.128.Undertakings shall take into account of any reinsurance or other risk mitigation arrangement that provides cover against such events or perils, in estimating the net catastrophe charge. Reinsurance risk mitigation arrangements shall meet the criteria laid down in CEIOP-DOC-44/09:

- The net capital charge for Catastrophe Risk shall be calculated as follows:

Where the XL cover follows a proportional cover:

$$\text{MAX} ((L*MS*QS)-XLC, 0) + \text{MIN} ((L*MS*QS), XLF) + \text{REINST}$$

Where a proportional cover follows an XL cover:

$$\text{MAX} ((L*MS)-XLC, 0) *QS + \text{MIN}((L*MS), XLF) *QS + \text{REINST}$$

Where

L= the total gross loss amount. The total gross loss amount of the catastrophe will be provided as part of the information of the scenario.

MS= the market share. This proportion might be determined with reference to exposure estimates, historical loss experience or the share of total market premium income received. The total market loss amount of the catastrophe will be provided as part of the information of the scenario.

QS= quota share retention. Allowance must be made for any limitations, e.g. event limits which are frequently applied to QS treaties

XLC= the upper limit of the XL programme that is applicable in case of the scenario event

XLF= the XL retention of the XL programme that is applicable in case of the scenario event.

REINST = the reinstatement premium or premiums (in case of scenarios with a succession of 2 or more identical events)

3.129. Where an undertaking has to use the factor method, the catastrophe capital charge for a specific event type shall be the result of the maximum of the standardized scenario and factor:

$$CAT_{event} = \text{Max} (CAT_{factor\ method}, CAT_{standardized\ scenario})$$

3.130. The capital requirement for catastrophe risk for a line of business shall not exceed the aggregate limit for a specific line of business. The aggregate limit shall represent the net retention per line of business, after reinsurance, taken into account the limits stated in acceptance as well as in reinsurance treaties, increased by a possible reinstatement premium. There may be limits in treaties accepted and in treaties reinsured, or in only acceptance or reinsurance. If for one line of business, several treaties are written but for one of them no limit can be defined, the aggregate limit shall not be taken into account. If an aggregate limit covers several lines of business (so called 'umbrella treaties', or 'multi-line treaties'), it should be assured that this overall limit is not taken into account for each line of business. Further work is necessary on the treatment of the aggregate limit at the level of a particular line of business in case of umbrella or multi-line treaties. CEIOPS welcomes stakeholders' feedback on this issue. The choice of the aggregate limit should ensure that the probability of a loss exceeding the aggregate limit has a zero probability.

3.131. $CAT_{standardized\ scenario}$ and $CAT_{factor\ method}$ shall be both net of reinsurance.

3.132. Aggregation of the catastrophe risk charges across events or relevant countries, including definition of correlations shall be specified at the same time as the standardized scenarios.

3.133. The final capital charge, after aggregation, shall be represented by NL_{CAT} .

3.134. Furthermore, undertakings shall consider the following criteria:

- The scenario event shall be considered to take place immediately after the valuation date and the undertaking's exposure at the valuation date shall be affected.
- The application of the scenarios shall not be automatic; rather, consideration would need to be given to the appropriateness of the scenarios.
- The assessment of catastrophe risks is part of a broader risk management framework / ORSA process. (Re) insurance undertakings shall review the scope of the scenario defined and assess the applicability of such scenario and range of possible outcomes that could arise on the occurrence of the scenario. The range (and probability distribution) of possible outcomes shall determine the best estimate of loss from the scenario.
- (Re) insurance undertakings shall consider whether scenarios are applied adequately and seek to ensure that the limitations are addressed appropriately by the (re)insurance undertaking as part of their ORSA.
- The extent to which the risks covered by the standardized scenario could deviate significantly from their risk profile (i.e. the extent of the

"miss risk" for the individual undertaking as a result of using the specified regional loss scenarios). In doing this, they must be satisfied that they have captured all the main affected exposures and lines of business. Where this deviates significantly an alternative approach as described in section 3.1.5. (B) or partial internal model shall be applied.

- (Re) insurance undertakings shall provide a breakdown of reinsurance recoveries by reinsurer under each scenario. The figures shall reconcile roughly to the anticipated recoveries for both facultative and treaty (including stop loss) protections.

Supervisors will apply judgement, interpretation, discretion and flexibility when assessing whether all the risks have been captured.

Annex A Aggregation between events and countries

Illustration 1

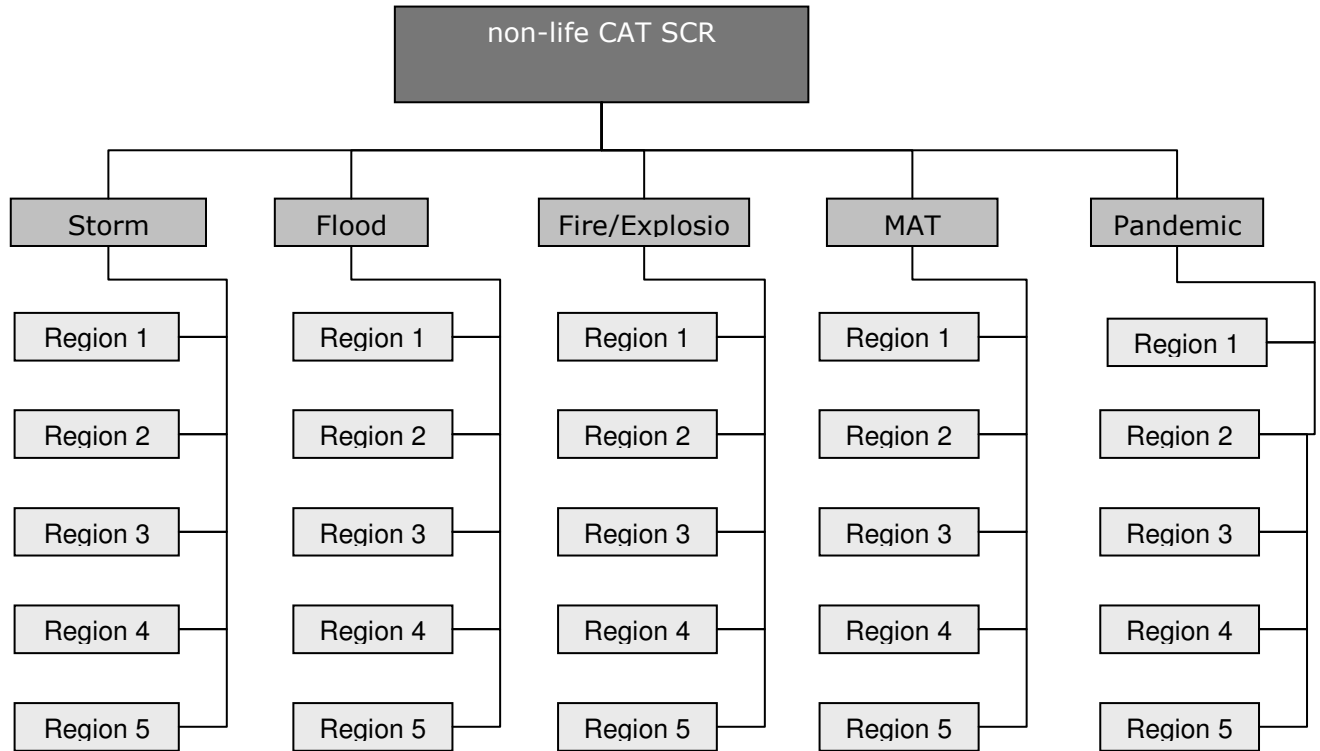
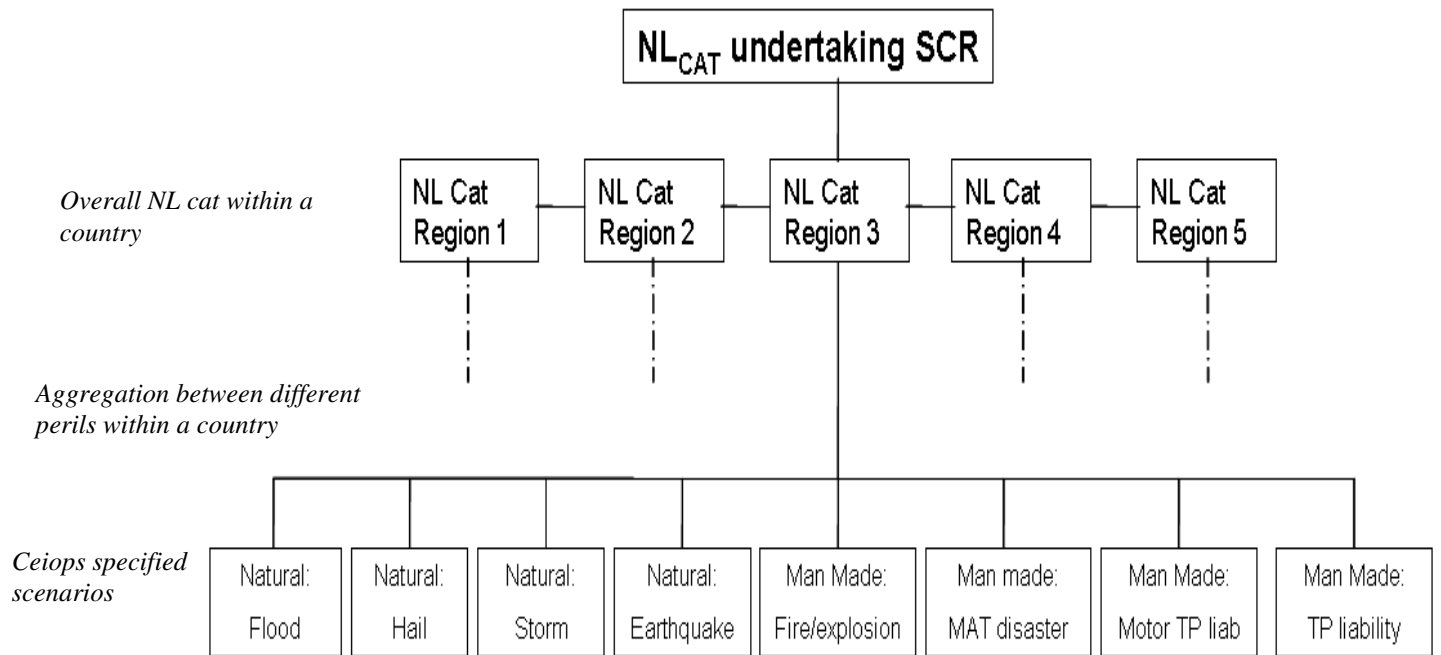


Illustration 2



Annex B Impact assessment on non-life underwriting risk

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures.⁹ To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment.¹⁰ On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made.¹¹ This impact assessment covers issue 12 (sub-issue A) of the list of policy issues and options. Two summary tables accompany the impact assessment, published in a separate excel document..

1. Description of the policy issue

- B.1. The non-life underwriting risk module reflects the risk arising from the underwriting of non-life insurance contracts, in relation to the perils covered and the processes used in the conduct of business. It is calculated as a combination of the capital requirements for (at least) the following sub-modules: non-life premium and reserve risk and non-life catastrophe risk.
- B.2. The issue concerns the calculation method to be adopted in Level 2 implementing measures for the non-life underwriting risk (other than catastrophe risk, which is being treated in Annex D) in the SCR standard formula
- B.3. This particular policy issue is in relation to the non-life premium and reserve risk, i.e. the risk of loss, or of adverse change in the value of insurance liabilities, resulting from fluctuations in the timing, frequency and severity of insured events, and in the timing and amount of claim settlements.
- B.4. The design of the standard formula SCR shall aim to be as risk sensitive as possible without becoming overly complex, achieving harmonization across Member States and incentivizing improved risk management.
- B.5. The choice of methodologies available under the standard formula plays a fundamental role in achieving such objective.
- B.6. In the options below, when reference is made to "life insurance", health insurance conducted on a similar basis to life insurance is assumed to be also included; similarly, when reference is made to "non-life insurance", health insurance conducted on a similar basis to non-life insurance is assumed to be also included.

⁹ <http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf>

¹⁰ http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf

¹¹ <http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf>.

2. Detailed description of policy options and assessment of the relative impacts on the different affected parties

- B.7. Option 1: Simulation of the impact of a pre-defined shock on the financial position of the (re)insurance undertaking (i.e. Scenario based approach).

A scenario-based modeling approach to non-life underwriting risk would require the definition of a set of scenarios that adequately describe any adverse development of the underwriting result of the insurers' portfolio. Given the heterogeneity that characterises the non-life underwriting risk, even within established classes of insurance business, the application of such an approach does not seem feasible in the context of the standard formula.

- B.8. Option 2: Closed formula calibrated to a VaR at the 99.5% confidence level over a one-year period (i.e. Factor based approach).

The method has been characterised by being simple, understandable, relatively easy to calibrate and consistent with other approaches applied by other regulatory frameworks such as ICA (UK) and the Swiss Solvency Test.

The factor based approach would result in a more proportionate solution for smaller firms.

- B.9. However such approach also presents drawbacks such as:

- Not being able to consider the full risk mitigation effect of particular risk mitigation arrangements, such as for example non-proportional reinsurance or finite reinsurance. This is particularly important for sophisticated firms with significant risk mitigation arrangements.
- Undertakings with activity in niche lines of business (e.g. in the 'miscellaneous' line of business) may find the calibration inadequate to their particular risk profile.

Impact on industry, policyholders and beneficiaries and supervisory authorities

Costs and benefits

- Industry

B.10. As mentioned under B.7, a scenario based approach for non-life premium and reserve risk is not feasible under the standard formula. Hence, the factor methodology used under QIS4 will be the only option.

B.11. It is likely however that undertakings would require a transparent calibration with clearly defined assumptions which tries to address some of the highlighted deficiencies that have been described in the QIS4 report.

B.12. Large undertakings as well as niche undertakings, will probably disagree with the calibration and design of the current premium and reserve module, as it may not adequately capture the risk profile and complexity of some of

their business, which may result in an overestimation of the capital requirements.

B.13. However, it is very difficult to calibrate a standard formula which is representative of all undertakings' risk profiles and which would allow for the complexity of every type of business. Overly complicating the standard formula would not be realistic; in circumstances where this method may be too simple or inappropriate, undertakings would be able to apply a partial internal model.

- Policyholders and beneficiaries

B.14. A more risk sensitive approach would be the preferred option, as this would aim to capture risks appropriately and would make sure firms are adequately capitalized, providing additional security to policyholders.

B.15. However for smaller - medium undertakings this method may be disproportionate compared to the nature, scale and complexity of their risks, resulting in increased costs and eventually leading to an increase in expenses that would ultimately be passed on to policyholders.

- Supervisory authorities

B.16. Supervisors require firms to hold adequate levels of capital as required by the Level 1 text. An overly complicated standard formula based scenarios would render the supervision more difficult. In particular, supervisors will require a transparent, well documented process carried out by the undertakings in their own risk and solvency assessment (ORSA), that will allow them to identify if firms require more sophisticated methods.

3. Relevant objectives

B.17. The determination of the method for the calculation of the non-life underwriting risk falls under the scope of the following operational objectives:

- Introduce risk sensitive harmonized solvency standards,
- Introduce proportionate requirements for small undertakings
- Harmonize supervisory powers, methods and tools.

4. Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives

- B.18. The comparison and ranking of the policy options is based on the effectiveness and efficiency of each option in reaching the relevant objectives. Effectiveness is defined as the extent to which options achieve the objectives of the proposal. Efficiency is defined as the extent to which objectives can be achieved at the lowest cost (cost-effectiveness).
- B.19. The standard formula needs to be sufficiently complex to capture the main underlying risks without becoming overly complex and burdensome for small undertakings.
- B.20. In light of this, in the context of the standard formula a scenario based approach would not be considered to effectively meet the objective of proportionate requirements for small undertakings.
- B.21. As to the objective of harmonized supervisory methods and tools, all approaches identified aim at achieving harmonization and this goal could be reached in a nearly identical fashion under all options.
- B.22. In conclusion, taking into account the potential cost and benefits for policyholders and beneficiaries, insurance and reinsurance undertakings and supervisory authorities, the effectiveness and efficiency level to meet the relevant objectives, and its sustainability and comparability levels, CEIOPS recommends Option 2 in its advice.

Annex C Impact assessment on geographical diversification

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures.¹² To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment.¹³ On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made.¹⁴ This impact assessment covers issue 10 (sub-issue B) of the list of policy issues and options. Two summary tables accompany the impact assessment, published in a separate excel document.

1. Description of the policy issue

- C.1. The structure of the standard formula, by aggregating correlated risk modules, enables the recognition of the benefit of the diversification of these risks. Besides, where appropriate, diversification effects are taken into account in the design of risk modules (i.e. across sub-modules, where applicable) or sub-modules (e.g. across lines of business and/or geographical areas).
- C.2. The calculation of the group solvency capital requirement based on the consolidated balance sheet position of the group will lead to the recognition of further diversification effects amongst the different entities of a group.
- C.3. The issue relates to the calibration of the various correlation parameters (and, where appropriate, design/calibration of the various interaction assumptions) underpinning the SCR standard formula, as well as their impact on the extent of diversification effects to be recognised at solo and group level. In this context, two sub-issues should be considered:
 - A. Calibration of correlation parameters across lines of business;
 - B. Design and calibration of the approach to geographical diversification in the non-life underwriting risk module
- C.4. CEIOPS will produce draft advice on the correlation parameters in Autumn 2009. Therefore, at this stage the impact assessment only deals with the design and calibration of the approach to geographical diversification in the non-life underwriting risk module.

¹² <http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf>

¹³ http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf

¹⁴ <http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf>

2. Detailed description of policy options and assessment of the relative impacts on the different affected parties

Detailed description of policy options

C.5. Option 1: No recognition of geographical diversification.

Under this option, diversification benefits originating from the geographical dispersion of the business are not taken into account.

C.6. Option 2: Recognition of geographical diversification as per QIS4 approach (TS.XIII.B; TS.XVI.B default method – accounting consolidation).

Under this option, diversification benefits originating from the geographical dispersion of the business are taken into account. The QIS4 approach on this issue consisted in using a blending formula for business underwritten or commitments existing in different geographical areas.

C.7. Option 3: Recognition of geographical diversification using a more granular approach than QIS4.

Under this option, diversification benefits originating from the geographical dispersion of the business are taken into account. In the QIS4 approach, the geographical areas used were unsatisfactory as the recognition of diversification benefits was unequally spread between areas privileging smaller countries. A solution to this problem would consist in the identification of smaller geographical areas.

Impact on industry, policyholders and beneficiaries and supervisory authorities

Costs and benefits

Option 1

C.8. QIS exercises have explored the recognition of diversification benefits through correlation matrices. In particular, QIS4 introduced geographical diversification in the non-life underwriting risk module. The formula used in QIS4 did not provide appropriate results and geographical diversification was seen as an area for potential improvement.

C.9. Non-recognition of geographical diversification implies that there would be no beneficial effect of the diversification on the capital requirement of undertakings that are geographically diversified. This may push undertakings towards the development of internal models that give proper recognition to diversification. This is particularly true for geographically highly diversified undertakings.

C.10. Higher capital requirements may result in higher premiums for the policyholders but at the same time would offer an enhanced protection of the policyholder.

- C.11. Smaller firms will in general see their competitive disadvantage reduced compared to well diversified larger firms as the former are less likely to have geographically diversified activities.
- C.12. The implicit recognition of geographical diversification (see here-under) may offer a suitable alternative to the explicit calculation as foreseen in QIS4. Provided the implicit calculation is sufficiently risk-sensitive, it benefits from the advantages of options 2 and 3. At the same time this calculation can contribute to the simplicity of the standard calculation of the SCR.
- C.13. In respect of non-life underwriting risks the direction and strength of geographical diversification depends to a great extent on the type of business and its geographical extension (e.g. credit insurance, general liability and fire insurance will likely present completely different degrees of diversification effects). Some types of business, such as for example credit insurance, did not benefit from geographical diversification during the current crisis, while other types of business, such as for example general liability, benefit from a limited geographical diversification within areas with some legislative harmonization (e.g the EU zone).
- C.14. Regarding the premium and reserve risk sub-modules, CEIOPS notes that the SCR of these sub-modules may be calculated either using the standard formula, or using entity-specific parameters (or internal models if applicable).
- C.15. Both in the premium and in the reserve risks sub-modules, assuming that the calculations are carried out for the whole business of the undertaking, parameters of the standard calculation of the SCR are calibrated using the historic volatility of the whole business of an average representative undertaking, and therefore those parameters already capture the average geographical diversification.
- C.16. In the case of entity-specific parameters, once again the SCR of each sub-module is calculated using the historic volatility of the whole business of the individual undertaking considered. This means that if an undertaking's business is geographically diversified, this feature will be reflected directly in a lower volatility of loss ratios and run-off ratios, and therefore in a lower SCR of these sub-modules.
- C.17. Summing up, both the standard calculation of the SCR and its calculation using entity-specific parameters already capture the geographical diversification as the methodology uses the historical volatility of loss ratios and run-off ratios with reference to the whole business of each undertaking.
- C.18. Therefore CEIOPS considers it is unnecessary to introduce an additional separate calculation to capture the effects of geographical diversification, since it is likely lead to a double counting of these effects.

Option 2

- C.19. The recognition of geographical diversification lowers the capital requirement and stimulates the further development of international activities. At solo

level the impact of diversification is limited. It becomes significant for geographically diversified solo undertakings such as reinsurers using the standard formula.

C.20. The practicability is problematic as the choice of geographical areas would be arbitrary and the level of granularity would have the potential of creating an unlevel playing field between undertakings. In particular, QIS4 has demonstrated that geographical diversification cannot be based on political areas.

C.21. An actual risk-based recognition of geographical diversification effects would require:

- The identification of homogeneous risk regions and frontiers, sufficiently representative of geographical diversification. It is likely this identification should be clustered around the intensity of geographical diversification of each non-life business (credit insurance versus general liability versus fire insurance,...)
- Furthermore, the calculation of premiums and reserve risk sub-modules would have to be carried out separately for each geographical area to avoid double counting of the diversification effect.

C.22. This alternative is however neither compatible with the necessary simplicity of the standard calculation of the SCR, nor would it be cost-efficient.

C.23. The aforementioned lower capital requirement may have an incidence on the premium level. This is however an uncertain effect. Lower capital requirements would also reduce the protection of the policyholder.

C.24. For the supervisor, the reduced protection may imply that the monitoring of the undertakings has to be stepped up.

Option 3

C.25. For this option the conclusions are identical to the ones under option 2. This option however also holds a risk of additional complexity.

3. Relevant objectives

C.26. The determination of the relevant risk-free interest term structure falls under the scope of the following operational objectives:

- Introduce risk-sensitive harmonized solvency standards
- Introduce proportional requirements for small undertakings
- Promote compatibility with the work of the IAIS and IAA
- Introduce risk-sensitive harmonized solvency standards

4. Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives

C.27. The comparison and ranking of the policy options is based on the effectiveness and efficiency of each option in reaching the relevant

objectives. Effectiveness is defined as the extent to which options achieve the objectives of the proposal. Efficiency is defined as the extent to which objectives can be achieved at the lowest cost (cost-effectiveness).

- C.28. Recognition of geographical diversification is justified as it translates the economic reality and the precise risk exposure of the undertaking. The influence of geographical diversification may be very different depending on the classes of business concerned. Further, the importance of the recognition of geographical diversification increases with the size and complexity of the undertakings - together with their likelihood of being geographically well diversified. However, introducing an additional separate calculation to capture the effects of geographical diversification would add undue complexity to the standard formula and hence the solution would fail to achieve the objective of proportionality for small undertakings.
- C.29. As to the compatibility of the prudential regime for EU insurers with the work of the IAIS and IAA, the thinking shows the preference of these international associations to recognise geographical diversification, which in theory seems appropriate and justified.
- C.30. However the QIS4 exercise has shown that at solo level the effect of geographical diversification is not only marginal, there are also substantial problems with the practicability of allowing for a straightforward method to assess the geographical diversification.
- C.31. Geographical diversification is considered to introduce unnecessary complexity at solo level, in view of the materiality of the reduction in capital requirement undertakings could obtain from the calculation. Regarding reinsurers and cross-border groups, where geographical diversification might be material for some classes of business, it is necessary to confirm that the considerations reflected in this advice are also applicable.
- C.32. The inclusion of geographical diversification is expected to have a higher impact on the groups than for most of the solo undertaking, but not more than for solo undertakings with significant cross-border activities such as large insurers. Furthermore, groups tend to have very different risk profiles which makes the calibration of a standard geographical diversification difficult. As regards groups, the use of group specific parameters or internal models seems more appropriate to allow for geographical diversification.
- C.33. In conclusion, taking into account the potential cost and benefits for policyholders and beneficiaries, insurance and reinsurance undertakings and supervisory authorities, the effectiveness and efficiency level to meet the relevant objectives, and its sustainability and comparability levels, CEIOPS decided not to introduce an additional calculation to capture the effects of geographical diversification in the SCR standard formula at solo level.
- C.34. The advice on Level 2 implementing measures regarding the SCR standard formula for the non-life underwriting risk module therefore takes into account take geographical diversification in an implicit manner and CEIOPS recommends Option 1 in its advice.

Annex D Impact assessment on catastrophe risk

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures.¹⁵ To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment.¹⁶ On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made.¹⁷ This impact assessment covers issue 12 (sub-issue C) of the list of policy issues and options. Two summary tables accompany the impact assessment, published in a separate excel document.

1. Description of the policy issue

- D.1. The SCR represents the unexpected losses of existing business corresponding to the Value at risk of the basic own funds of a (re)insurance undertaking subject to a confidence level of 99.5% over a one year period, as well as the losses attached to the new business expected to be written over the next twelve months. The SCR covers all quantifiable risks to which a (re)insurance undertaking is exposed, including catastrophe risk. Catastrophe risk is a sub-module of the three underwriting modules life, non-life and health.
- D.2. Catastrophe risk is defined as the risk of loss, or of adverse change in the value of insurance liabilities, resulting from significant uncertainty of pricing and provisioning assumptions related to extreme or exceptional events.
- D.3. The design of the standard formula SCR aims to be risk-sensitive without becoming overly complex, achieving harmonisation i.e. a level playing field across Member States and incentivizing improved risk management.
- D.4. The choice of methodologies available under the standard formula plays a fundamental role in achieving such an objective. The issue at hand concerns the calculation method to be adopted in Level 2 implementing measures for the life, non-life and health catastrophe risk in the SCR standard formula.

2. Detailed description of policy options and assessment of the relative impacts on the different affected parties

- D.5. Option 1: Simulation of the impact of a pre-defined shock on the financial position of the (re)insurance undertaking (Scenario-based approach).

¹⁵ <http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf>

¹⁶ http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf

¹⁷ <http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf>.

- D.6. For non-life and health, the scenario-based approach can be described as the application of standard scenarios constructed by CEIOPS. These standard scenarios aim at reproducing a 1-in-200-year industry loss level. The process and methodology used to build the scenarios will promote harmonisation and ensure a level playing field.
- D.7. The QIS4 personalised scenarios approach was considered complex, difficult for regulators to judge, not proportional and costly for firms. For these reasons personalisation has been considered to fall under the scope of partial internal models.
- D.8. For life insurance business, the scenario-based approach is a stress, based on an absolute increase in the rate of policyholders dying over the following year. The application of such an approach is seen to be consistent with market practices, promotes harmonisation, and ensures a level playing field as well as being risk sensitive.
- D.9. Option 2 : Definition of a closed formula calibrated to a VaR at the 99.5% confidence level over a one-year period (design and calibration of the closed formula to be determined) (i.e. Factor based approach).
- D.10. A closed formula would be applied, such as a percentage of premium income for each class written. This has the advantage of simplicity, being a single value applied to premium income, and does not require qualitative judgment of firm or supervisor.
- D.11. However it is recognized that it may be a rather blunt instrument, which is not risk-based, and does not necessarily allow for all outwards reinsurance. It may also understate risk for a minority of insurers.
- D.12. On the other hand, the method is seen as simple to apply and a preferred option for the less sophisticated insurance undertakings.
- D.13. Due to the particular nature of the risk and the lack of data, this calibration is challenging and in circumstances possibly may under- or over-estimate the capital requirements.
- D.14. In life, the application of shock scenarios is seen to adequately represent and capture the risk of a catastrophe, thus the need of a factor-based approach is seen as irrelevant.
- D.15. Option 3: A combination of the above methods.
- D.16. In particular for non-life and for the reasons mentioned above, a combination of options 1 and 2 could provide a robust framework to capture the underlying risk in line with the objectives and requirements set out by the Level 1 text.

Impact on the industry, policyholders and beneficiaries and supervisory authorities

Costs and benefits

- Industry

D.17. The industry is aware of the difficulty in calibrating a standard formula which captures adequately the nature and particularities of such a complex risk.

D.18. More sophisticated undertakings are likely to criticise the combination of methods, highlighting that even the most carefully drawn national scenario does not impact firms evenly. They may not be effective for international insurers (where single events can impact multiple territories, e.g. European windstorm, Central Europe river flood).

D.19. Undertakings are conscious that scenarios are an adequate way to take properly account for reinsurance arrangements and the actual risks they face. However, it must not be overly complex as it is part of a “standard” formula, and undertakings can always shift to a partial internal model if the method seems inappropriate in their particular circumstances.

- Policyholders and beneficiaries

D.20. The selection of a method which captures risk in an appropriate manner and provides a framework which does not result in disproportionate costs for the undertaking that may then be passed on to the policyholder, would be the preferred option for policyholders and beneficiaries.

- Supervisory authorities

D.21. Supervisors’ aim is to require firms to hold adequate levels of capital as required by the Level 1 text.

D.22. Supervisors understand that the assessment of catastrophe risks is part of a broader risk management framework / ORSA process. (Re)insurance undertakings shall review the scope of the method selected and assess the applicability of such method and range of possible outcomes that could arise on the occurrence of the scenario. The range (and probability distribution) of possible outcomes shall determine the best estimate of loss from the scenario. The ORSA will play a fundamental role in ensuring undertakings are adequately capitalised.

3. Relevant objectives

D.23. The determination of the method for the calculation of catastrophe risk falls under the scope of the following operational objectives: introduce risk sensitive solvency standards, introduce proportionate requirements for small undertakings, and finally assure harmonised supervisory powers, methods and tools.

4. Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives

- D.24. The comparison and ranking of the policy options is based on the effectiveness and efficiency of each option in reaching the relevant objectives. Effectiveness is defined as the extent to which options achieve the objectives of the proposal. Efficiency is defined as the extent to which objectives can be achieved at the lowest cost (cost-effectiveness).
- D.25. Factor-based models are considered to be less able to predict extreme catastrophic events. The impact of this kind of events on the risk situation of the insurer is considered to be better captured by stress and scenario techniques rather than by static factor-based methods. Furthermore their application allows full recognition of the impact of risk mitigation techniques.
- D.26. However, standardized scenarios may not always be relevant for all undertakings or types of risk exposure, and the requirement of an alternative method to be used in such circumstances seems necessary.
- D.27. The factor-based approach for catastrophe risk does not meet the objective of risk sensitivity. Option 1 based on standardised scenarios is therefore the preferred approach. The refinement of the methodology, compared to QIS4, should assure efficiency of the approach and the necessary harmonisation ensuring that all objectives are met with maximum efficiency.
- D.28. The QIS 4 conclusions on the suitability of the methodology of the life underwriting risk module confirms the very broad support for the scenario approach and reiterates earlier conclusions on the subject.
- D.29. In conclusion, CEIOPS clearly supports Option 1 as a general rule. However, on an exceptional basis, in certain specific circumstances that will be explicitly defined (exposures outside the EU, for example), option 3 (the combination would result in retaining as capital charge the higher result between a standardised scenario and a factor-based approach) is CEIOPS' preferred framework. Finally, for specific lines of business such as the Miscellaneous LoB, option 2 (Factor-based approach) is CEIOPS' recommendation.