
Solvency Assessment and Management

Third South African Quantitative Impact Study (SA QIS3)

Draft Technical Specifications

*Part 5 of 6:
SCR – Non-Life Underwriting Risk*



2 August 2013

SCR.8. Non-life underwriting risk

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SCR.8.1 Non-life underwriting risk module (SCR_{nl})

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Description

SCR.8.1.1 Non-life underwriting risk is the risk arising from non-life insurance obligations, in relation to the perils covered and the processes used in the conduct of business.

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SCR.8.1.2 Non-life underwriting risk also includes the risk resulting from uncertainty included in assumptions about exercise of policyholder options like renewal or termination options.

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SCR.8.1.3 The non-life underwriting risk module takes account of the uncertainty in the results of insurers related to existing insurance and reinsurance obligations as well as to the new business expected to be written over the following 12 months.

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SCR.8.1.4 The non-life underwriting risk module consists of the following sub-modules:

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(a) the non-life premium and reserve risk sub-module

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(b) the non-life lapse risk sub-module

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(c) the non-life catastrophe risk sub-module

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SCR.8.1.5 Impairments should be made to the risk mitigating effect of risk mitigating contracts as part of the capital requirement of each sub-risk of non-life underwriting risk as specified in SCR.5.75B.

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Input

SCR.8.1.6 The following input information is required:

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NL_{pr} = Capital requirement for non-life premium and reserve risk

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NL_{lapse} = Capital requirement for non-life lapse risk

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NL_{pr}	1		
NL_{lapse}	0	1	
NL_{CAT}	0.25	0	1

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SCR.8.2 **Non-life premium & reserve risk (NLpr)**

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Description

SCR.8.2.1 This module combines a treatment for the two main sources of underwriting risk, premium risk and reserve risk.

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SCR.8.2.2 Premium risk results from fluctuations in the timing, frequency and severity of insured events. For primary insurance business, premium risk relates to policies (or reinsurance agreements in the case of reinsurance business) to be written (including renewals) during the period, and to unexpired risks on existing contracts. Premium risk includes the risk that premium provisions turn out to be insufficient to compensate claims or need to be increased.

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~~For inward reinsurance business a different definition is required resulting from different valuation techniques. The first main difference relates to grouping of claims data by underwriting period as opposed to accident period. A further difference relates to contract recognition as defined in section V.2. Under this definition a potentially significant portion of inward reinsurance business incepting the day after the valuation date has to be included with technical provisions. The premium risk for inward reinsurance business relates to reinsurance contracts incepting or expected to incept during the year after the valuation date. It thus includes the risk that a portion of the premium provisions turn out to be insufficient to compensate claims or need to be increased. This portion relates to contracts incepting after the valuation date, which have already been entered into prior to the valuation date.~~

SCR.8.2.3 Premium risk also includes the risk resulting from the volatility of expense payments. Expense risk can be quite material for some lines of business and should therefore be fully reflected in the module calculations. Expense risk is implicitly included as part of the premium risk.

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SCR.8.2.4 Reserve risk results from fluctuations in the timing and amount of claim settlements. For primary insurance this relates to claim events that occurred prior to the valuation date. For inward reinsurance business this relates to claim events covered by reinsurance contracts with inception dates prior to the valuation date.

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SCR.8.2.5 Impairments should be made to the risk mitigating effect of risk mitigating contracts as part of the capital requirement of each sub-risk of non-life underwriting risk as specified in SCR.5.75B.

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SCR.8.2.6 In order to carry out the non-life premium and reserve risk calculation, insurers need to determine the following:

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~~*TPC_{lob}* = Claims provision portion of technical provisions for each LoB. This amount should be less the amount recoverable from reinsurance and special purpose vehicles.~~

~~*TPP_{lob}* = Premium provision portion of technical provisions for each LoB. This amount should be less the amount recoverable from reinsurance and special purpose vehicles.~~

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P_{lob}^{PP} = Present value of net premiums of existing contracts which are expected to be earned after the following year for each LoBs.

= Portion of relating to policies or contracts with inception/renewal dates after the valuation date (see example above).

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SCR.8.2.7 The term P_{lob}^{PP} is only relevant for contracts with a coverage period that exceeds the following year. For annual contracts without renewal options P_{lob}^{PP} is zero. Insurers ~~may not~~ need to calculate P_{lob}^{PP} where it is likely not to be material compared to $P_{lob}^{t,earned}$.

Calculation

SCR.8.2.8 The premium and reserve risk capital requirement delivers the following output information:

NL_{pr} = Capital requirement for premium and reserve risk

SCR.8.2.9 The capital requirement 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

$\rho(\sigma)$ = A function of the combined standard deviation

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SCR.8.2.10 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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SCR.8.2.11 The function $\rho(\sigma)$ is set such that, assuming a lognormal distribution of the underlying risk, a risk capital requirement consistent with the VaR 99.5% calibration objective is produced. Roughly, $\rho(\sigma) \approx 3 \cdot \sigma$

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SCR.8.2.12 The volume measure V and the combined standard deviation σ for the overall non-life insurance portfolio are determined in two steps as follows:

- For each individual LoB, the standard deviations and volume measures for both premium risk and reserve risk are determined;

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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 a combined standard deviation σ .

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

Step 1: Volume measures and standard deviations per LoB

SCR.8.2.13 The premium and reserve risk sub-module is based on the same segmentation into lines of business used for the calculation of technical provisions, with the exception of a number of subdivisions that are required for this sub module. These relate to Miscellaneous, Treaty proportional miscellaneous reinsurance and non proportional property reinsurance. However, an insurance line of business and the corresponding line of business for proportional reinsurance are merged, based on the assumption that the risk profile of both lines of business is similar. The lines of business for Non SLT health insurance and reinsurance are covered in the life underwriting risk module. That section should be completed by both life and short-term insurance companies writing short duration accident and medical expense type products.

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SCR.8.2.14 The following numbering of LoBs applies for the SCR calculation. The column "TP LoB" provides a mapping to the segmentation for Technical Provisions:

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Number	Line of business	TP LoB
1	Accident and Health	1

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estimated volumes, the volume measure is determined only with respect to estimated premium volumes, so that in this case:

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

SCR.8.2.18 The market-wide estimates of the net standard deviation for premium risk for each line of business are:

<i>LoB</i>	<i>standard deviation for premium risk (net of reinsurance)</i>
<i>Accident and Health</i>	$9.1\% \cdot NP_{lob}$

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commercial lines	
Tty Prop RI liability	13.912.8% NP_{lob}
personal lines	
Tty Prop RI liability	13.9% NP_{lob}
commercial lines	
Tty Prop RI trade credit, suretyship and guarantee	11.712.1% NP_{lob}
Prop RI Consumer credit	12.1% NP_{lob}
Prop RI Legal expenses	6.9% NP_{lob}
Tty Prop RI miscellaneous crop/travel	12.812.3% NP_{lob}
Tty Prop RI miscellaneous terrorism	14.916.9% NP_{lob}
Tty Prop RI miscellaneous legal expenses/warranty	6.513.9% NP_{lob}
Tty Prop RI miscellaneous other	12.89.1% NP_{lob}
-NP and Fae RI – MAT	16%
NP and Fae RI – property	17.5%
NP and Fae RI – terrorism	17.5%
NP and Fae RI – liability	17%

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SCR.8.2.19 The adjustment factor for non-proportional reinsurance NP_{lob} of a line of business allows insurers to take into account the risk-mitigating effect of particular per risk excess of loss reinsurance.

SCR.8.2.20 Insurers may choose for each line of business to set the adjustment factor to 1 or to calculate it as set out in Annex 8 in the NLUR Workbook spreadsheet.

SCR.8.2.21 The volume measure for reserve risk for each individual LoB is determined as follows:

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

For inward reinsurance business, where the volume measure is determined as follows:

$$V_{(res,lob)} = PCO_{lob} + PE_{lob}^{prior}$$

SCR.8.2.22 The market-wide estimate of the net of reinsurance standard deviation for reserve risk for each line of business are:

LoB_i	standard deviation for reserve risk (net of reinsurance)
Accident and Health	23.2%

$$DIV_{lob} = \frac{\sum_j (V_{(prem,j,lob)} + V_{(res,j,lob)})^2}{\left(\sum_j (V_{(prem,j,lob)} + V_{(res,j,lob)})\right)^2}$$

and where the index j denotes the geographical segments ~~as set out in Annex 7 in the spreadsheet~~ and $V_{(prem,j,lob)}$ and $V_{(res,j,lob)}$ denote the volume measures as defined above but restricted to the geographical segment j .

However, the factor DIV_{lob} should be set to 1 for the line of business credit and suretyship and where the standard deviation for premium or reserve risk of the line of business is an insurer-specific parameter.

Insurers may choose to allocate all of their business in a line of business to the main geographical segment in order to simplify the calculation.

Please note: This optional diversification benefit is not allowed for in the SA QIS3 as it is still being developed by the NLUR Working Group for South Africa.

SCR.8.2.27 The correlation matrix CorrLoB is defined as follows: (3 parts shown separately)

CorrLoB	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	<u>22</u>	<u>23</u>	
<u>1</u>	<u>1</u>																							

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<i>CorrLob</i>	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
14. Tty Prop RI motor personal lines	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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<i>CorrLob</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>	<i>13</i>
<i>14. Tty Prop RI — motor — personal lines</i>	<i>0.75</i>	<i>0.75</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	<i>0.5</i>	<i>0.5</i>

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Output

SCR.8.2.28 This module delivers the following output information:

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

SCR.8.3 **Lapse risk** (NL_{Lapse})

SCR.8.3.1 Non-life insurance contracts can include policyholder options which significantly influence the obligations arising from them. Examples for such options are options to terminate a contract before the end of the previously agreed insurance period and options to renew contracts according to previously agreed conditions. Where such policyholder options are included in a non-life insurance contract, the calculation of premium provisions is based on assumptions about the exercise rates of these options. Lapse risk is the risk that these assumptions turn out to be wrong or need to be changed.

SCR.8.3.2 Where non-life insurance contracts do not include policyholder options or where the assumptions about the exercise rate of such options have no material influence on premium provisions, the contracts do not need to be included in the calculations of the lapse risk sub-module. Where this is the case for the whole portfolio of an insurer (except for a non-material part) the three components of the sub-module can be set to zero.

SCR.8.3.3 The capital requirement for lapse risk should be calculated as follows:

$$NL_{\text{lapse}} = \max(Lapse_{\text{down}}; Lapse_{\text{up}}; Lapse_{\text{mass}}),$$

where

NL_{lapse} = Capital requirement for lapse risk

$Lapse_{\text{down}}$ = Capital requirement for the risk of a permanent decrease of the rates of lapsation

$Lapse_{\text{up}}$ = Capital requirement for the risk of a permanent increase of the rates of lapsation

$Lapse_{\text{mass}}$ = Capital requirement for the risk of a mass lapse event

SCR.8.3.4 The capital requirement for the risk of a permanent decrease of the rates of lapsation should be calculated as follows:

$$Lapse_{\text{down}} = \Delta BOF | \text{lapses shock}_{\text{down}},$$

where

ΔBOF = Change in the net value of assets minus liabilities (not including changes in the risk margin of technical provisions) value of Basic Own Funds (BOF).

$\text{lapses shock}_{\text{down}}$ = Reduction of 50% in the assumed option take-up rates in all future years for all policies adversely affected by such risk. Affected by the reduction are options to fully or partly terminate, decrease, restrict or suspend the insurance cover. Where an option allows the full or partial establishment, renewal, increase, extension or resumption of insurance cover, the 50% reduction should be applied to the rate that the option is not taken up.

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The shock should not change the rate to which the reduction is applied to by more than 20% in absolute terms.

SCR.8.3.5 The capital requirement for the risk of a permanent increase of the rates of lapsation should be calculated as follows:

$$Lapse_{up} = \Delta BOF | lapseshock_{up},$$

where

ΔBOF = Change in the value of Basic Own Funds (BOF), net value of assets minus liabilities (not including changes in the risk margin of technical provisions)

$lapseshock_{up}$ = Increase of 50% in the assumed option take-up rates in all future years for all policies adversely affected by such risk. Affected by the increase are options to fully or partly terminate, decrease, restrict or suspend the insurance cover. Where an option allows the full or partial establishment, renewal, increase, extension or resumption of insurance cover, the 50% increase should be applied to the rate that the option is not taken up.

The shocked rate should not exceed 100%.

SCR.8.3.6 Therefore, the shocked take-up rate should be restricted as follows:

$$R_{up}(R) = \min(150\% \cdot R; 100\%) \text{ and}$$

$$R_{down}(R) = \max(50\% \cdot R; R - 20\%),$$

where

R_{up} = shocked take-up rate in $lapseshock_{up}$

R_{down} = shocked take-up rate in $lapseshock_{down}$

R = take-up rate before shock

SCR.8.3.7 The capital requirement for the risk of a mass lapse event $Lapse_{mass}$ should be calculated as follows:

$$Lapse_{mass} = \Delta BOF | lapseshock_{mass},$$

where

ΔBOF = Change in the value of Basic Own Funds (BOF), net value of assets minus liabilities (not including changes in the risk margin of technical provisions)

$lapseshock_{up}$ = The surrender of 30% of the insurance policies with a negative best estimate for premium provision

Simplification

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SCR.8.3.8 ▲ If it is proportionate to the nature, scale and complexity of the risk, the calculation of the lapse risk sub-module might be made on the basis of homogeneous risk groups instead of a policy-by-policy basis. A calculation on the basis of homogeneous risk groups should be considered to be proportionate if

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(a) ▲ the homogeneous risk groups appropriately distinguish between policies of different lapse risk;

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(b) ▲ the result of a policy-by-policy calculation would not differ materially from a calculation on homogeneous risk groups; and

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(c) ▲ a policy-by-policy calculation would be an undue burden compared to a calculation on homogeneous risk groups which meet the two criteria above.

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SCR.8.4 **Non-life CAT risk**

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Description

SCR.8.4.1 Under the non-life underwriting risk module, catastrophe risk is defined in the Solvency II Framework Directive (Directive 2009/138/EC) 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.”

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SCR.8.4.2 CAT risks stem from extreme or irregular events that are not sufficiently captured by the capital requirements for premium and reserve risk. The catastrophe risk capital requirement is calibrated at the 99.5% VaR (annual view).

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SCR.8.4.3 The CAT risk sub-module under the standard formula should be calculated using one of the following alternative methods (or as a combination of both):

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1. Method 1: standardised scenarios

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2. Method 2: factor based methods

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~~Additional information should be provided for natural catastrophes using a “maximum event retention” (MER) approach. This information is needed as an MER approach is being investigated as an alternative to the Solvency II approach. The MER approach is described at the end of section SCR.9.4. However, Method 1 (or Method 2 where Method 2 is used as an alternative to Method 1) should form the base case for the calculation of the SCR.~~

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SCR.8.4.4 Insurers using the standard formula should use method 1 for all exposures where possible. Where the application of method 1 is not possible insurers should apply method 2 for the perils concerned. This may in particular be the case for the following exposures:

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- (a) natural catastrophe exposures outside of South Africa
- (b) miscellaneous insurance business
- (c) non-proportional reinsurance business

Input

SCR.8.4.5 The following input information is required:

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NL_CAT_1 = The catastrophe capital requirement under method 1

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NL_CAT_2 = The catastrophe capital requirement under method 2

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Calculation

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SCR.8.4.6
$$NL_CAT = \sqrt{(NL_CAT_1)^2 + (NL_CAT_2)^2}$$

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Output

SCR.8.4.7 NL_CAT will be the aggregation of the capital requirements for the method 1 and method 2. It is assumed both are independent.

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Method 1: standardised scenarios

Description

SCR.8.4.8 The non-life catastrophe sub-module is partly based on the guidance and advice of the Catastrophe Sub Working Group (Cat Sub WG) (for the natural catastrophe risk) and partly on

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the guidance from industry expert workshops in various lines of business (for the man-made catastrophe risk). Both were formed for SAM and chaired by the Non-Life Underwriting Risk Working Group (NLUR WG). A description of their work will in future be published as a discussion document. This will include detailed information on how scenarios have been calibrated.

The Cat Sub WG considered both the Solvency II and APRA approaches for guidance and advice when deriving the standardised scenarios that will apply to South Africa. In addition it relied on calibrations and advice from local catastrophe modelling companies and experts.

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SCR.8.4.9 The non-life catastrophe standardised scenarios considered in this document are outlined below.

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SCR.8.4.10 Natural catastrophes: extreme or exceptional events arising from the following perils:

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- (a) Windstorm
- (b) Flood and subsidence
- (c) Earthquake
- (d) Hail

SCR.8.4.11 Man-Made Catastrophes: extreme or exceptional events arising from:

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- (a) Motor
- (b) Fire ~~—agriculture and other~~ property (not including agriculture)
- (c) Marine
- (d) Aviation
- (e) Liability
- (f) Credit & Suretyship
- (g) Terrorism

The NLUR WG has redefined the man-made catastrophe scenarios for SA QIS ~~23~~. This was based on advice resulting from industry expert workshops. In most cases where parameters had to be recalibrated, those were either based on expert judgement or on the Solvency II QIS 5 parameters. Data will be requested as part of the SA QIS ~~2-3~~ exercise to assist the NLUR WG in recalibration those for ~~SA QIS 3~~ the final SAM standard formula.

SCR.8.4.12 For the natural catastrophe risk, the peak perils for South Africa are assumed to be Earthquake (non-motor property damage) and Hail (motor damage). These perils are individually considered when estimating a company's 1 in 200 year loss from a single event. The formula used in estimating the 1 in 200 year loss for both Earthquake and Hail is similar to the approach used in Solvency II QIS 5 and SA QIS 1. However, in the latter 2 cases the aggregate 1 in 200 year loss was estimated as opposed to the single event loss. This will be used to test a company's vertical exposure, net of risk mitigation.

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In addition, the horizontal exposure will be tested by considering various scenarios of losses of more frequent return periods occurring in the same year. In estimating these losses, exposure to all the perils listed in SCR.8.4.10 and SCR.8.4.11~~9-53~~ will be considered in combination, i.e. not per peril. Subsidence is included under the flood definition. Storm surge and tsunamis are included under the windstorm definition. The formula used in estimating losses for more frequent return periods is similar to the approach used in SA QIS ~~1-2~~ to estimate the 1 in 200 year loss. The company's horizontal exposure will also be assessed net of risk mitigation.

SCR.8.4.13 Furthermore:

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- (a) Scenarios are all South African-based.
- (b) Geographical specifications are recognised where appropriate.

- (c) Scenarios are provided gross of reinsurance and gross of all other mitigation instruments (for example national pool arrangements or cat bonds) unless otherwise stated. Insurers should take into account reinsurance and other mitigation instruments to estimate their net loss. Care should be taken to ensure no double counting.
- (d) Scenarios have been provided by peril or event and not by line of business. The approach is considered the most appropriate for the purpose of Catastrophe risk due to tail correlation across lines of business.
- (e) The scenarios are not appropriate for non-proportional reinsurance writers. The reason is that the relationship between total insured value and loss damage ratio (1 in 200 loss / total exposure) (and also premium and loss damage ratio) is more variable between reinsurers and from one year to the next, than for direct or proportional reinsurance writers. The relationship depends on the level of excess at which non-proportional business is written and the pattern of participation by (re)insurance layer. The complexity that would be introduced by attempting to allow for non-proportional business would be disproportional to the benefits gained.

SCR.8.4.14 The above selection was based on the likelihood of such events reaching extreme or exceptional levels, and therefore giving rise to losses, or adverse changes in the value of insurance liabilities.

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SCR.8.4.15 Insurers need to assess whether the standardised scenarios appropriately capture the risks to which they are exposed. Circumstances in which the standardised scenarios presented in this paper will be inadequate, include among others:

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- (a) natural catastrophe exposures outside of South Africa
- (b) miscellaneous insurance business
- (c) non-proportional reinsurance business

SCR.8.4.15—

Where insurers have non-life exposures outside South Africa.

SCR.8.4.16 ~~Where insurers write non proportional reinsurance business and this cannot be properly reflected by the standardised scenario.~~

Input

SCR.8.4.17 SCR.8.4.16 The following input information is required:

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$NL_CAT_{1NatCat}$ = Catastrophe capital requirement for Natural catastrophes net of risk mitigation

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$NL_CAT_{1Man\ made}$ = Catastrophe capital requirement for Man-made catastrophes net of risk mitigation

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Calculation

SCR.8.4.18 SCR.8.4.17 The NL_CAT_1 will be the aggregation of the capital requirements for Natural catastrophe and Man-made disasters net of risk mitigation. It is assumed both are independent:

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$$NL_CAT_1 = \sqrt{(NL_CAT_{1Nat_cat})^2 + (NL_CAT_{1Man_made})^2}$$

Output

SCR.8.4.18 The 1 NL₁ CAT will be the aggregation of the capital requirements for natural catastrophe and man made disasters net of risk mitigation. It is assumed both are independent:

Natural Catastrophes, NL₁CAT_{1Nat_cat}

SCR.8.4.19 All natural catastrophe perils are to be considered in the South African context.

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Calculation

SCR.8.4.20 The NL₁CAT_{1NatCat} will be given as:

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$$NL_CAT_{1NatCat} = Max \left(\sum_i MER_{1 in A_i} \right)$$

Where:

$NL_CAT_{1NatCat}$	=	Catastrophe capital requirement for non-life net of risk mitigation under method 1.
$MER_{1 in A_i}$	=	Maximum event retention net of risk mitigation for event i of the considered scenario, with return period A_i

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The maximum is taken over the defined scenarios, e.g. a 1 in 200 year event and a 1 in 20 year event in the same year, or 3 1 in 20 year events in the same year.

SCR.8.4.21 Insurers should net down for reinsurance appropriately depending on the type of protection they have.

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SCR.8.4.22 The assumption is that their natural catastrophe reinsurance programmes cover all perils. Where this is not the case, an appropriate allowance needs to be made.

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SCR.8.4.23 Insurers may estimate the net capital requirement for the relevant scenarios applying the following formulae:

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Where the XL cover follows a proportional cover:

$$MAX (L*QS-XLC, 0) +MIN (L*QS, XLF) + REINST$$

Where a proportional cover follows an XL cover:

$$MAX (L-XLC, 0) *QS +MIN(L, XLF) *QS + REINST$$

Where

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

SCR.8.4.24 However risk mitigation contracts can take a variety of forms and the above equation may often not be applicable. ~~Guidance is provided through a set of examples that show how insurers ought to net down their gross estimations and this is included in Annex 4 in the spreadsheet.~~ Moreover, insurers, including captives, should be able to take into account the risk mitigation effect of aggregate limits.

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SCR.8.4.25 ~~In South Africa there are a~~ variety of national arrangements which provide protection in different ways ~~may exist~~. Without going into the specifics of each arrangement, insurers should net down their gross estimation to reflect such protection, if applicable. Where Reinsurers provide or could potentially provide cover to the national arrangements, such reinsurance companies need to estimate a capital requirement for this exposure.

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SCR.8.4.26 In calculating net losses insurers should include consideration of reinstatement premiums directly related to the scenario. Both Outwards reinstatement premiums associated with reinstating risk transfer protection and Inwards reinstatement premiums in respect of assumed reinsurance business should be calculated.

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SCR.8.4.27 Insurers should provide the details of calculations and explain how they have arrived to the net estimation.

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Output

SCR.8.4.28 The module delivers the following output:

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$NL_CAT_{INatCat}$ Catastrophe capital requirement for non-life net of risk mitigation

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Cat_{Earthquake}, Cat_{Hail} and Cat_{1 in Ai}

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Input

SCR.8.4.29 Insurers need to provide the following information:

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TIV_{ZONE_LoB}	=	<p>This comprises the total insured values exposed to natural catastrophe risk in the following lines of business:</p> <p>$TIV_{ZONE_Comm\ build}$ = total insured value for Commercial buildings damage by zone. This includes business interruption and loss of rent.</p> <p>$TIV_{ZONE_Res\ build}$ = total insured value for Residential buildings damage by zone. This includes business interruption and loss of rent.</p> <p>$TIV_{ZONE_Engineering}$ = total insured value for Engineering property damage by zone. This includes Contractors All Risks, Plant All Risks, Machinery Breakdown and Electronic Equipment.</p> <p>TIV_{ZONE_MAT} = total insured value for Marine by zone. Within the Marine Class, the material components are Cargo (=static warehouse risks) and Marine XL. The Static Cargo sums insured can be entered into the CRESTA table as per the direct property. The Marine XL (= Reinsurance of direct marine insurers) have exactly the same issues as Property Treaty reinsurers in that the standardised method would not be appropriate.</p> <p>TIV_{ZONE_MPD} = total insured value for Motor property damage by zone.</p>
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		Inputs should be entered as gross figures unless otherwise stated.
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Calculation

SCR.8.4.30 A workbook is provided to assist insurers with the calculation. The formulae applied in the workbook for insurers' respective gross exposures are as follows:

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$$WTIV_{ZONE,LoB} = F_{ZONE,LoB} * TIV_{ZONE,LoB}$$

$$WTIV_{LoB} = \sqrt{\sum_{r,c} AGG_{r,c,LoB} * WTIV_{ZONEr,LoB} * WTIV_{ZONEc,LoB}}$$

$$CAT_x = Q_x \sqrt{\sum_{r,c} AGG_{r,c} * WTIV_{LoBr} * WTIV_{LoBc}}$$

where,

CAT _x	=	The estimation of the gross catastrophe capital requirement component relating to Earthquake, Hail and more frequent events respectively, where the first two relate to a 1 in 200 year single event.
Q _x	=	1 in 200 year factor for Earthquake and Hail, or 1 in A factor for all perils.
F _{ZONE,LoB}	=	relativity factors for each zone and line of business.
AGG _{r,c} AGG _{r,c,LoB}	=	Rows and columns of the aggregation matrices AGG. ¹
WTIV _{zoner,LoB} , WTIV _{zonec,LoB}	=	Geographically weighted total insured value by zone and line of business.
WTIV _{LoBr} , WTIV _{LoBc}	=	Weighted total insured value by line of business.

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SCR.8.4.31 Insurers should note that the output may be gross or net depending on whether the insurer has reinsurance protection and whether this should be applied at peril level. When netting down, insurers should take care to adjust and interpret formulae accordingly.

Output

¹ These values are provided in an excel spreadsheet « parameters for non life catastrophe »

CAT _{x_net}	=	Net catastrophe capital requirement for Man-made event x
x	=	Fire ₁ , Fire ₂ , motor, marine, credit & suretyship, terrorism, aviation and liability.

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SCR.8.4.35 Independence is assumed between the types of Man-made catastrophe events.

SCR.8.4.36 All scenarios, unless explicitly mentioned are described gross of risk mitigation. Insurers may estimate the net capital requirement for the relevant scenarios by applying the following formulae:

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)

SCR.8.4.37 However risk mitigation contracts can take a variety of forms and the above equation may not be applicable, e.g. additional allowance should be made for surplus reinsurance. Guidance is provided through a set of examples that show how insurers ought to net down their gross estimations and this is included in Annexure 4 in the spreadsheet. A helper tab will be included to illustrate such examples. Insurers should provide the details of calculations and explain how they have arrived to the net estimation.

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SCR.8.4.38 In South Africa there are a variety of national arrangements which provide protection in different ways, e.g. SASRIA and the RAF. Without going into the specifics of each arrangement, insurers should net down their gross estimation to reflect such protection, if applicable. Where Reinsurers provide or could potentially provide cover to the national arrangements, such reinsurance companies need to estimate a capital requirement for this exposure.

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SCR.8.4.39 Where there are separate reinsurance programmes per peril, the aggregation (across perils) are done net of reinsurance.

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SCR.8.4.40 In calculating net losses insurers should include consideration of reinstatement premiums directly related to the scenario. Both Outwards reinstatement premiums associated with reinstating risk transfer protection and Inwards reinstatement premiums in respect of assumed reinsurance business should be calculated.

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Output

SCR.8.4.41 The $NL_CAT_{ManMade}$ will be given as net catastrophe risk capital requirement for Man-made events.

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Fire

SCR.8.4.42 Insurers with exposures under the Fire and other damage line of business are exposed to this scenario.

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Method 1 (Default)

Input

SI_{fire}	≡	Largest fire concentration in respect of the fire peril within a radius of 200m. This is the maximum gross sum insured of the set of buildings fully or partly located within this radius.
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Calculation

$$CAT_{Fire\ Gross,\ Method\ 1} = SI_{fire} * 100\%$$

SCR.8.4.43 Insurers should then apply any adjustment due to risk mitigation to estimate the net sum insured.

$$CAT_{Fire\ Net,\ Method\ 1} = SI_{fire,\ net}$$

Output

$CAT_{Fire,\ net,\ Method\ 1}$	≡	Catastrophe capital requirement for Fire – Property net of risk mitigations
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SCR.8.4.44 Where this level of geo-locational data is not available, insurers should apply Method 2 instead

Method 2

SCR.8.4.43 SCR.8.4.45 Deleted There are two separate catastrophe events for the calculation of the risk capital requirement. One is linked to property exposures and the other to agricultural exposures. The Fire property event follows the same structure as in QIS 1, Option 2.

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Event 1: Property

Input

SCR.8.4.44 SCR.8.4.46 Insurers, will be required to provide the following inputs for each of the sub lines that they are exposed to:

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$LSR_{RES}SI_{FR}$	=	Maximum loss for the largest single risk in respect of residential business exposure Sum Insured for Fire for residential business
$LSR_{COMM}SI_{FC}$	=	Maximum loss for the largest single risk in respect of commercial business exposure Sum Insured for Fire for commercial business
$LSR_{CORP}SI_{FI}$	=	Maximum loss for the largest single risk in respect of corporate and industrial business exposure Sum Insured for Fire for corporate and industrial business
$LSR_{}$	=	Maximum loss of the Largest Single Risk across all sub lines. This refers to one single location, e.g. a building; however, it could be covered by one or more policies.

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Where LSR_{RES} should consider the higher of:

- Total residential exposure (SI) in a single high rise residential block
- Total residential exposure in a single complex or similar
- Exposure of the largest single residential property

Where LSR_{COMM} should consider the higher of:

- Total commercial exposure in a major shopping centre and surrounds
- Total commercial exposure in an office park
- Exposure of the largest single commercial risk

Where LSR_{CORP} should consider the higher of:

- Total corporate exposure in respect of a mine at a single location
- Total corporate exposure at a single location in respect of large corporate entities such as Eskom and Sasol
- Exposure of the largest single corporate risk at a single location

Calculation

SCR.8.4.45 SCR.8.4.47 A split according to residential, industrial and commercial business provides a more risk sensitive result. For residential risks, the underlying catastrophic scenario is a clash

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of many individual risks, whereas for industrial risks, the catastrophic scenario can be one single industrial plant suffering a large loss.

SCR.8.4.46 SCR.8.4.48 The QIS3 approach moves away from the aggregate sum insured calculation of QIS2 and aims to move the focus to an accumulation of risks within a portfolio. The Gross SCR is calculated as: The scenario incorporates both an extreme single event as well as a market loss event. The capital requirement is estimated as follows:

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$$CAT_{Fire\ Gross} = MAX (LSR_{Res\ Gross} , LSR_{Comm\ Gross} , LSR_{Corp\ Gross})$$

where,

$CAT_{Fire,t}$	=	the estimation of the gross Fire Property Cat capital requirement
SI_x	=	is the sum insured by sub line of business x, where x is residential, commercial, as well as corporate and industrial respectively,
F_x	=	are the Fire/Business Interruption market wide factors by sub-line of business x, where x is residential, commercial, as well as corporate and industrial respectively,
LSR_x	=	is the single largest risk across all sub-lines, where largest single risk refers to one single location for example a building; however, it could be covered by one or many policies.

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F_x are:
 Residential — 0.004%
 Commercial — 0.010%
 Industrial — 0.073%

SCR.8.4.47 SCR.8.4.49 Insurers should then apply any adjustment due to risk mitigation to estimate the net capital requirement. Details should be provided on this calculation. Each of LSR_{RES} , LSR_{COMM} , LSR_{CORP} should allow for the specific risk-mitigating effect of reinsurance, net of reinstatement premiums, resulting in $LSR_{RES\ NET}$, $LSR_{COMM\ NET}$, $LSR_{CORP\ NET}$:

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$$CAT_{Fire\ Net} = MAX (LSR_{Res\ Net} , LSR_{Comm\ Net} , LSR_{Corp\ Net})$$

Output

CAT_{Fire_net}	=	Catastrophe capital requirement for Fire – Property net of risk mitigations
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Event 2: Agriculture

Input

SCR.8.4.48SCR.8.4.50 The following input is required for each line of business: Deleted

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SI_C	=	Sum insured of largest known concentration of exposures, across the (re)insurer's largest footprint, to the crop line of business
SI_F	=	Sum insured of largest known concentration of exposures, across a 26kha footprint, to the forestry line of business
SI_{LS}	=	Sum insured of largest known concentration of exposures, across the (re)insurer's largest footprint, to the blood and livestock line of business
X_i	=	This is the estimated damage ratio factor, per business line i (i.e. crop, forestry and livestock), as detailed below

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Where:

- X_1 = 100% for the Crop and Forestry lines of business
- X_2 = 50% for the Blood and Livestock line of business

Calculation

SCR.8.4.49SCR.8.4.51 The calculation for the agricultural fire scenario is as follows: Deleted

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$$GAT_{Fire2} = \text{Max} (SI_C \times X_1, SI_F \times X_1, SI_{LS} \times X_2)$$

Where:

GAT_{Fire2}	=	the estimation of the gross Fire ₂ —Agriculture capital requirement
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SCR.8.4.50SCR.8.4.52 Insurers should then apply any adjustment due to risk mitigation to estimate the net capital requirement. Details should be provided on this calculation. Deleted

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Output

$GAT_{Fire2-net}$	=	the estimation of the net Fire ₂ —Agriculture capital requirement net of risk mitigation
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Motor

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Input

SCR.8.4.51-SCR.8.4.53 Below is an illustration of a possible Motor Man-made scenario:

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Commercial Motor Scenario:

A truck collides with a train, consider:

- Derailment;
- Loss of income;
- Damage to engine coach.

Commercial Motor Scenario B:

An explosion or fire at a depot or location with multiple insured vehicles, leading to a large accumulation of losses

SCR.8.4.52-SCR.8.4.54 Insurers will need to provide details of:

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LIM	=	Highest sum insured offered on commercial lines. For example if unlimited, insurers should type in "unlimited" or a monetary amount
VY	=	<u>Number of commercial motor vehicles insured in South Africa with liability insured limits greater than R50m</u> <u>Number of heavy commercial motor vehicles insured in South Africa</u>
LSR	=	<u>Largest possible loss accumulation from multiple insured vehicles in single location (if greater than R50m)</u>

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Calculation – Scenario A - SCR_{Collision}

SCR.8.4.53-SCR.8.4.55 The gross motor catastrophe risk capital requirement is then given by solving the formula: The gross motor catastrophe risk capital charge, CAT_{Motor}, is then the solution to the following equation:

$$-\log_e(0.995) = F_{UNLIM}(CAT_{Motor}) + F_{LIM}(CAT_{Motor})$$

where,

$$F_{UNLIM}(x) = F_{MTPL} * LIM_{FAIL} * VY * \left(\frac{GL_{MTPL}}{x}\right)^{ALPHA}$$

$$F_{LIM}(x) = F_{MTPL} * [(1 - LIM_{FAIL}) * VY] * \left(\frac{GL_{MTPL}}{x}\right)^{ALPHA}, \text{ where } x < LIM, \text{ and:}$$

LIM	=	Highest sum insured offered on commercial lines. For example if unlimited, insurers should type in "unlimited" or a monetary amount.
VY	=	Number of heavy commercial motor vehicles insured in South Africa by the insurer.

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CAT_{Motor}	=	Gross 1 in 200 year occurrence for an insurer, ignoring policy limits $CAT_{Motor} = \frac{GL_{MPTL}}{\left(\frac{-\log_e(0.995)}{F_{TOTAL}}\right)^{\frac{1}{ALPHA}}}$
F_{MPTL}	=	Frequency of the SA-wide Scenario per vehicle per annum $F_{MPTL} = \frac{-\log_e\left(1 - \frac{1}{RP_{MPTL}}\right)}{VY_{MPTL}}$
VY_{MPTL}	=	Total vehicle years (millions) assumed in SA-wide scenario = 3.2
RP_{MPTL}	=	Return Period of SA-wide Scenario = 50 years
GL_{MPTL}	=	Gross Loss of SA-wide Scenario = R100 million
F_{TOTAL}	=	Total expected frequency of scenario loss for insurer $F_{TOTAL} = F_{MPTL} * VY$
$ALPHA$	=	Pareto shape parameter = 2
LIM_{FAIL}	=	Proportion of 'limit failure losses' amongst the extreme losses = 6%

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SCR.8.4.54 SCR.8.4.56 The return period of 50 years should be amenable to some form of subjective real-world judgment when considered against the historic events. In addition, a 1-in-50 year South African loss should exceed the 1-in-200 year loss for any individual (re)insurer.

SCR.8.4.55 SCR.8.4.57 The underlying model for these extreme losses is being assumed to be a Poisson / Pareto model with vehicle years driving the Poisson frequency and the SA-wide scenario driving some Pareto parameters. The only other parameter needed is the pareto shape parameter, Alpha.

SCR.8.4.56 SCR.8.4.58 The underlying assumption is made that every insured heavy commercial motor vehicle insured in South Africa is equally likely to be involved in the types of incident envisaged in this scenario.

SCR.8.4.57 SCR.8.4.59 This enables the calculation of the frequency of the scenario per million vehicles.

$$F_{MPTL} = -\log_e\left(1 - \frac{1}{RP_{MPTL}}\right) / VY_{MPTL}$$

~~SCR.8.4.58~~SCR.8.4.60 In the absence of policy limits this can then be used with the insurer exposure to calculate the gross risk capital requirement for an insurer.

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$$F_{TOTAL} = F_{MTP L} * VY$$

$$GRC_{MTP L} = GL_{MTP L} / ((-\log_e(0.995) / F_{TOTAL}) ^ (1/ALPHA))$$

~~SCR.8.4.59~~SCR.8.4.61 However, the scenario must also consider limits of coverage provided by insurers.

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~~SCR.8.4.60~~SCR.8.4.62 The scenario therefore includes a 'limit failure factor' which represents a proportion of the extreme losses that are considered to occur in such a way that the cover under the original policy is unlimited. The suggested value of this parameter is 6%. (Note that this parameter has no effect if there are unlimited exposures.)

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~~SCR.8.4.61~~SCR.8.4.63 Allowing for the limits requires an additional input from the insurers, LIM, defined above.

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~~SCR.8.4.62~~SCR.8.4.64 The calculation of the gross risk capital requirement allowing for limits is more involved than for the no limits case. For ease of exposition this can be considered in two parts

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$F_{UNLIM}(x)$	=	Frequency of a loss of size x , ignoring limits
$F_{LIM}(x)$	=	Frequency of a loss of size x , allowing for limits

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$$F_{UNLIM}(x) = F_{MTP L} * (LIM_{FAIL} * VY) * (GL_{MTP L} / x)^{ALPHA}$$

$$F_{LIM}(x) = F_{MTP L} * (1-LIM_{FAIL}) * VY * (GL_{MTP L} / x)^{ALPHA}, \text{ if } x < LIM$$

~~SCR.8.4.63~~SCR.8.4.65 The gross risk capital requirement (CATMotor) can then be calculated as the solution of the following equation.

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$$-\log_e(0.995) = F_{UNLIM}(CAT_{Motor}) + F_{LIM}(CAT_{Motor})$$

~~SCR.8.4.64~~SCR.8.4.66 Insurers should then apply any adjustment due to risk mitigation to estimate the net capital requirement for Motor. Details should be provided on this calculation.

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~~SCR.8.4.65~~SCR.8.4.67 The net risk capital requirement should be calculated by the insurer allowing for any additional contingent premiums payable.

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Scenario B – Accumulation of exposures (LSR_{Net})

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~~SCR.8.4.68~~ ~~SCR.8.4.65b~~ Insurers need to consider the largest possible loss accumulation from multiple insured vehicles in single location net of risk mitigation. An example scenario would be an explosion or fire at a location that impacts a large commercial fleet insured by a single insurer.

~~SCR.8.4.69~~ ~~SCR.8.4.65e~~ The SCR for motor is then calculated as

$$SCR_{Motor\ Net} = MAX(SCR_{Collision\ Net}, LSR_{Res\ Net})$$

Output

CAT_{Motor_net}	=	Catastrophe capital requirement for Motor net of risk mitigation
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Marine

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~~SCR.8.4.66~~SCR.8.4.70 Insurers with exposures under MAT, in particular Marine property and liability are exposed to this scenario.

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Marine Collision

~~SCR.8.4.67~~SCR.8.4.71 Insurers should consider the scenario specification below:

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Scenario 1 Description: Collision between two container carriers. Cargo insurers should consider their largest gross lines in respect of container carriers.

Assume that a 100% loss occurs (based on total gross exposure) with no salvage.

Scenario 2 Description: Collision between either two pleasure crafts or commercial fishing vessels. Insurers should consider their largest gross exposures for hull cover and liability cover.

Scenario 3 Description: Insurers should consider their largest gross exposure to marine liability insurance~~Scenario Description: Collision between two container carriers. Cargo insurers should consider their largest gross lines in respect of container carriers.~~

Assume that a 100% loss occurs (based on total gross exposure) with no salvage.

Input

SCR.8.4.68 SCR.8.4.72 Insurers will need to provide details of:

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SI_{C1} & SI_{C2}	=	2 maximum gross exposures to marine cargo, measured per container carrier
SI_L	=	Maximum gross exposure to marine liability relating to cargo insurance
SI_{P1} & SI_{P2}	=	2 maximum gross exposure to hull insurance for pleasure craft or commercial fishing vessels
SI_{PL}	=	Maximum gross exposure to marine liability relating to pleasure craft or commercial fishing vessels
SI_{ML}	=	Maximum gross exposure to marine liability insurance
SI_{C1_net} & SI_{C2_net}	=	2 maximum gross exposures to marine cargo, measured per container carrier; netted down for risk mitigation
SI_{L_net}	=	Maximum gross exposure to marine liability relating to cargo insurance; netted down for risk mitigation
SI_{P1_net} & SI_{P2_net}	=	2 maximum gross exposure to hull insurance for pleasure craft or commercial fishing vessels; netted down for risk mitigation
SI_{PL_net}	=	Maximum gross exposure to marine liability relating to pleasure craft or commercial fishing vessels; netted down for risk mitigation
SI_{ML_net}	=	Maximum gross exposure to marine liability insurance; netted down for risk mitigation

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Calculation

SCR.8.4.69 SCR.8.4.73 The formula to be applied by insurers in calculating their respective gross exposures is as follows:

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$$CAT_{Marine} = \max(SI_{C1} + SI_{C2} + SI_L, SI_{P1} + SI_{P2} + SI_{PL}, SI_{ML})$$

Where SI_{C1} , SI_{C2} , SI_L , SI_{P1} , SI_{P2} , SI_{PL} and SI_{ML} are as defined above.

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SCR.8.4.70 SCR.8.4.74 The net capital requirement for Marine will be estimated as:

$$CAT_{Marine_net} = SI_{C1_net} + SI_{C2_net} + SI_{L_net}$$

$$CAT_{Marine_net} = \max(SI_{C1_net} + SI_{C2_net} + SI_{L_net}, SI_{P1_net} + SI_{P2_net} + SI_{PL_net}, SI_{ML_net})$$

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SCR.8.4.71 SCR.8.4.75 Insurers should carry out the same calculation as above with netted down figures for SI_{C1} , SI_{C2} , SI_L , SI_{P1} , SI_{P2} , SI_{PL} and SI_{ML} , $SIC1$, $SIC2$ and SH to take account of risk mitigations. Insurers should net down accordingly for risk mitigation (with no allowance for salvage).

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Output

SCR.8.4.72 SCR.8.4.76 The outputs are:

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CAT_{Marine_net}	=	Catastrophe capital requirement for Marine net of risk mitigation
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Credit and Suretyship

SCR.8.4.73 SCR.8.4.77 Insurers with exposures under the Credit and Suretyship line of business are exposed to this scenario.

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Input

$SCR_{CAT_individual_max_loss_net}$	=	Net capital requirement of the maximum loss of the individual (group) exposures.
$SCR_{CAT_recession_net}$	=	Net capital requirement of the recession based scenario described below.

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Calculation

$$SCR_{CAT_credit_net} = \sqrt{(SCR_{CAT_individual_max_loss_net})^2 + (SCR_{CAT_recession_net})^2}$$

where

- (a) The $SCR_{CAT_credit_net}$ scenario is designed to adequately consider the risk at a gross level and the mitigating effects of proportional and non-proportional reinsurance as well.
- (b) The $SCR_{CAT_recession_net}$ scenario is the capital requirement after allowing for proportional and non-proportional reinsurance for a recession scenario. It should be calculated as the loss suffered ~~after allowing for proportional and non-proportional reinsurance~~ based on a gross loss equal to $V_{prem}^{gross,credit} \times LR_{Recession}$ ~~after allowing for proportional and non-proportional reinsurance~~.
- (c) $SCR_{CAT_individual_max_loss_net}$ should be calculated as the maximum loss derived from one of the two following cases:

~~estimate factor in the workbook. Scenario Description: Mid-air collision of the insurer's two largest total gross exposures (including the exposures in respect of public and passenger liabilities)~~

~~Assume that a 100% loss occurs (based on total gross exposure)~~

Input

~~SCR.8.4.76~~ SCR.8.4.80 For Scenario A, insurers will need to provide the following information. ~~Insurers will need to provide the following information:~~

SHARE _{Hull}	=	Insurer's share for hull of the insurer's two largest aircrafts in terms of the total gross exposure Insurers share for hull of both aircrafts
MIT _{Hull}	=	Mitigation / Reinsurance cover for hull of the insurer's two largest aircrafts Mitigation / Reinsurance cover for hull of both aircrafts
SHARE _{Liability}	=	Insurer's share for liability (Legal Liability to Third Party and Passengers Liability) of the insurer's two largest aircrafts Insurers share for liability (Legal Liability to Third Party and Passengers Liability) of both aircrafts
MIT _{Liability}	=	Mitigation / Reinsurance cover for liability hull of the insurer's two largest aircrafts Mitigation / Reinsurance cover for liability hull of both aircrafts
WAP	=	Whole account protection, if applicable

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Calculation

~~SCR.8.4.77~~ SCR.8.4.81 The gross capital requirement for aviation will be estimated as:

$$CAT_{Aviation} = SHARE_{Hull} + 10\% \cdot SHARE_{Liability}$$

where

CAT _{Aviation}	=	the estimation of the gross Aviation catastrophe capital requirement
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SCR.8.4.78SCR.8.4.82 The net capital requirement for aviation will be estimated as:

$$CAT_{Aviation_net} = \left[(SHARE_{Hull} - MIT_{Hull}) + (SHARE_{Liability} - MIT_{Liability}) \right] - WAP$$

SCR8.4.79b For Scenario B, insurers will need to provide:

<u>LSR_{gross}</u>	≡	Maximum exposure to hull losses arising from single event impacting a single location with multiple insured vessels, assuming 100% of insured values destroyed.
<u>DF</u>	≡	Insurers view of damage factor, i.e. the proportion of gross exposure possible from single event.
<u>MIT</u>	≡	Mitigation / Reinsurance cover for hull arising from above mentioned event.

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The net capital requirement for aviation Scenario B will be estimated as:

$$CAT_{Aviation\ Net} = (LSR_{Gross} \times DF) - MIT$$

Output

SCR.8.4.79SCR.8.4.83 The output is:

CAT _{Aviation_net}	=	Catastrophe capital requirement for Aviation net of risk mitigation, taken as the maximum net impact of Scenario A and Scenario B. Catastrophe capital requirement for Aviation net of risk mitigation
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Liability

SCR.8.4.80SCR.8.4.84 The liability scenarios need to cover the following lines of business:

- (d) Professional Indemnity
- (e) General Public Liability
- (f) Employer's Liability
- (g) D&O
- (h) Product Liability

Input

<u>GWP_{PI}</u>	=	Gross written premium for Professional Indemnity (PI) business
<u>GWP_{GPL}</u>	=	Gross written premium for General Public Liability (GPL) business

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<u>PI</u>	<u>150%</u>
<u>GPL</u>	<u>80%</u>
<u>EL</u>	<u>200%</u>
<u>D&O</u>	<u>300%</u>
<u>PL</u>	<u>60%</u>

Table B: Correlations between sub-classes of business

	<u>PI</u>	<u>D&O</u>	<u>GPL</u>	<u>PL</u>	<u>EL</u>
<u>PI</u>	1				
<u>D&O</u>	0.5	1			
<u>GPL</u>	0.25	0.25	1		
<u>PL</u>	0.25	0.5	0.25	1	
<u>EL</u>	0.25	0.25	0.25	0.25	1

SCR.8.4.83SCR.8.4.87 Insurers should net down accordingly for risk mitigation.

Output

CAT _{Liability_net}	=	Catastrophe capital requirement for Liability net of risk mitigation
------------------------------	---	--

Terrorism

SCR.8.4.84SCR.8.4.88 The total Terrorism capital requirement is based on one of three options:

- Scenario 1: 1 in 200 year individual loss
- Scenario 2: 1 in 200 year aggregate loss split in 2 events
- Scenario 3: 1 in 200 year aggregate loss split in 3 events

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SCR.8.4.85 SCR.8.4.89 The following 1 in 200 year loss table was calibrated using information from Sasria

Scenario	No. of events	Gross Loss (R billion)		
		Event 1	Event 2	Event 3
1	1	3.813		
2	2	3.200	0.678	
3	3	2.474	1.049	0.355

Calculation

SCR.8.4.86 SCR.8.4.90 Sasria, insurers that offer top up cover and reinsurers need to determine their share for each of the losses in the scenarios based on the structure of their contracts. The maximum loss to the (re)insurer across the 3 scenarios is taken as the catastrophe capital requirement for Terrorism gross of risk mitigation:

CAT_{Terr}	=	Catastrophe capital requirement for Terrorism gross of risk mitigation.
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SCR.8.4.87 SCR.8.4.91 (Re)insurers should net down each scenario for risk mitigation. The maximum net loss to the (re)insurer across the 3 scenarios is taken as the catastrophe capital requirement for Terrorism net of risk mitigation.

Output

SCR.8.4.88 SCR.8.4.92 The outputs are:

$$CAT_{Terr_net} = \text{Catastrophe capital requirement for Terrorism net of risk mitigation}$$

Illustration of Man-made scenarios used in SA QIS32

SCR.8.4.89 SCR.8.4.93 Below are illustrations of possible Fire Man-made scenarios:

- Fire Catastrophe Event 1: Property**
1. Residential line of business
 - o A high rise residential building block burns down
 2. Commercial line of business:
 - o A large fire in a major shopping centre and surrounds
 - o Exposure should include business interruption

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3. Corporate and Industrial line of business:

- Consider exposure to a large industrial corporate (e.g. Eskom, Sasol, Exposure to mines)
- A large fire in one of the major industrial plants/buildings

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Fire Catastrophe Event 2: Agriculture

1. Crop: Consider a large fire in the context of the largest exposure, within the largest footprint (Assume 100% loss)

2. Forestry: Consider a large fire in the context of the maximum exposure within a 26kha footprint (Assume 100% loss)

3. Blood and livestock (including, where applicable, feedlots or abattoir): Consider a large fire in the context of the maximum exposure within the largest footprint (Assume 50% loss)

4.1.

~~SCR.8.4.90~~SCR.8.4.94 Below are illustrations of possible Liability Man-made scenarios:

The following scenarios were used per line of business in order to dictate what could result in a catastrophic loss, representing a 1 in 200 year event:

Professional Indemnity

- Audit firm incorrectly interprets new legislation leading to significant tax implications for all their clients
- Inappropriate or unsound advice given by an Investment Firm leading to significant losses for all their clients.

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Directors & Officers (D&O) liability

- Chemical company not adhering to health and safety regulations leading to a major employers' liability claim - Directors and Officers are held responsible.
- Mass unfair layoff of miners employed by an international mining company – Directors and Officers are held responsible.

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General Public Liability

- Sulphur Fire at an explosives manufacturer resulting in the release of sulphuric acid. Rain follows and "acid rain" results in ground pollution. Loss of crops and/or contracts to supply goods. Ground conditions need to be monitored for years to come.
- Karoo 'Fracking' experimentation which could result in harmful chemicals entering the underground water supply and poisoning dependent communities..

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Products Liability

- Electro-magnetic fields (EMF) from cell phones are proven to significantly increase the risk of cancer.
- Pharmaceutical company releasing a new drug which is later found to be defective, resulting in adverse side-effects in many of the drug users. A significant products recall under the new Consumer Protection Act

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Employers Liability

- ~~• An asbestosis type claim that has developed over years~~

Directors & Officers (D&O) liability

- ~~• Chemical company not adhering to health and safety regulations leading to a major employers liability claim - Directors and Officers are held liable.~~

General Public Liability

~~Sulphur Fire at an explosives manufacturer resulting in the release of sulphuric acid. Rain follow and "acid rain" results in ground pollution. Loss of crops and/or contracts to supply goods. Ground conditions need to be monitored for years to come.~~

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Method 2: Factor based method

SCR.8.4.91SCR.8.4.95 Insurers should apply the factor based method in circumstances such as:

- (a) When Method 1 is not appropriate
- (b) When partial internal model is not appropriate
- (c) For the Miscellaneous line of business.

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SCR.8.4.92SCR.8.4.96 Circumstances in which the Method 1 may not be appropriate are stated above.

SCR.8.4.93SCR.8.4.97 To allow a practical combination of method 1 and 2, the method 2 factors should be considered country specific. This will allow integration with method 1 and will also be easier to net down for reinsurance.

SCR.8.4.94SCR.8.4.98 Losses are combined by assuming independence of events and 100% correlation between direct insurance, proportional reinsurance and non-proportional reinsurance for the same line of business.

SCR.8.4.95SCR.8.4.99 Assumptions include:

- (a) Factors represent a single event. This is a simplification of the standard formula.
- (b) The factors are gross.
- (c) The premium input is gross written premium.

SCR.8.4.96SCR.8.4.100 The capital requirement for the non-life CAT risk is determined as follows:

$$NL_{CAT} = \sqrt{\left(\left(\sqrt{\sum_{t=1,2,3,5} (c_t \times P_t)^2} + c_{11} \times P_{11} \right)^2 + \sum_{t=4,7,8,9,10,13} (c_t \times P_t)^2 + (c_6 \times P_6 + c_{12} \times P_{12})^2 \right)}$$

SCR.8.4.97SCR.8.4.101 The rationale for the formula is that it assumes events are independent, except for direct insurance and proportional reinsurance and the corresponding non-proportional reinsurance business, which are 100% correlated as per Solvency II's QIS4 (Major MAT disaster is correlated with non-proportional MAT reinsurance and the events that affect Fire

and property are added together assuming independence and then correlated with non-proportional property reinsurance).

Input

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~~SCR.8.4.99~~SCR.8.4.102 The following input information is required:

P_t = estimate of the gross written premium during the forthcoming year in the relevant lines of business which are affected by the catastrophe event.

Calculation

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~~SCR.8.4.99~~SCR.8.4.103 The capital requirement for the non-life CAT risk is determined as follows:

$$NL_{CAT} = \sqrt{\left(\left(\sqrt{\sum_{t=1,2,3,5} (c_t \times P_t)^2} + c_{11} \times P_{11} \right)^2 + \sum_{t=4,7,8,9,10,13} (c_t \times P_t)^2 + (c_6 \times P_6 + c_{12} \times P_{12})^2 \right)}$$

where

c_t = Are the calibrated gross factors by event and applicable to all countries

Events	Lines of business affected	Gross Factor c_t
Storm	<u>Motor – personal lines,</u> <u>Motor – commercial lines,</u> <u>Rail,</u> <u>Agriculture,</u> <u>Engineering,</u> <u>Property – personal lines, and</u> <u>Property – commercial lines</u>	175%

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Flood	<u>Motor – personal lines,</u> <u>Motor – commercial lines,</u> <u>Rail,</u> <u>Agriculture,</u> <u>Engineering,</u> <u>Property – personal lines, and</u> <u>Property – commercial lines and Crop</u>	113%
Earthquake	<u>Motor – personal lines,</u> <u>Motor – commercial lines,</u> <u>Rail,</u> <u>Agriculture,</u> <u>Engineering,</u> <u>Property – personal lines, and</u> <u>Property – commercial lines</u> <u>Motor, Engineering and Property</u>	120%
Hail	<u>Motor – personal lines,</u> <u>Motor – commercial lines,</u> <u>Agriculture,</u> <u>Property – personal lines, and</u> <u>Property – commercial lines</u> <u>Motor and Crop</u>	30%
Major fires, explosions	<u>Motor – personal lines,</u> <u>Motor – commercial lines,</u> <u>Rail,</u> <u>Agriculture,</u> <u>Engineering,</u> <u>Property – personal lines, and</u> <u>Property – commercial lines</u> <u>Engineering, Property and Crop</u>	175%
Major MAT disaster	<u>Aviation,</u> <u>Marine,</u> <u>Rail, and</u> <u>Transport MAT</u>	100%
Major third party liability disaster	<u>Third party Liability – personal lines,</u> <u>and</u> <u>Liability – commercial lines</u>	85%
Credit	<u>Consumer credit, and</u> <u>Credit, suretyship and guarantee – retail</u> <u>and commercial</u>	139%

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Miscellaneous	<u>Miscellaneous (excluding Crop, Legal Expenses, Warranty and Travel, as well as Terrorism not allowed for under method 1) – terrorism (not allowed for under method 1), Miscellaneous – warranty, and Miscellaneous - other</u>	40%
NPL MAT	<u>Non-proportional reinsurance – marine, aviation, transport (MAT)</u>	250%
NPL Property	<u>Non-proportional reinsurance – property</u>	250%
NPL MAT Terrorism	<u>Non-proportional reinsurance – terrorism</u>	250%
NPL Casualty Liability	<u>Non-proportional reinsurance – liability</u>	250%

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SCR.8.4.100 SCR.8.4.104 Insurers should net down their gross capital requirement for risk mitigation in the same way as under method 1.

Output

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$NL_{CAT,2}$ = The net capital requirement for the non-life catastrophe risk under method 2

Additional information required for natural catastrophe risk

~~SCR.8.4.101 Additional information should be provided for natural catastrophes using a “maximum event retention” (MER) approach.~~

~~SCR.8.4.102 This information is needed as the Australian Prudential Regulation Authority (APRA) approach to the determination of the catastrophe capital requirement for Natural catastrophes is being investigated as an alternative approach to the Solvency II approach~~

~~SCR.8.4.103 Insurers are referred to the technical paper entitled *Insurance Concentration Risk Capital Charge for General Insurers* for more information on this approach. (<http://www.apra.gov.au/Policy/upload/Insurance-Cone-Risk-charge.pdf>)~~

~~SCR.8.4.104 This approach combines both a vertical requirement and a horizontal requirement for determining the catastrophe capital requirement for Natural catastrophes net of risk mitigation.~~

~~SCR.8.4.105 For the purpose of determining VR, the probable maximum loss (PML) is defined as the gross loss arising from the occurrence of a single event with size equal to the 1 in 200 year whole of portfolio loss without any allowance for potential reinsurance assets. The maximum event retention (MER) is as the PML after netting out any potential reinsurance assets.~~

~~SCR.8.4.106 The horizontal requirement (HR) considers the expected net loss from the occurrence of several smaller size events in a given year on a whole of portfolio basis.~~

~~SCR.8.4.107 The capital requirement for Natural catastrophes net of risk mitigation is determined as:~~

$$NL_{CAT} + NatCat = \sqrt{VR^2 + HR^2}$$

Where:

VR = the vertical requirement, equal to the MER plus the cost of one full reinstatement of cover used to reduce an insurer’s exposure to concentration of risks;

HR = the horizontal requirement, equal to the greater of multiple event scenarios H(3) and H(4), less a deduction for a portion of natural catastrophe claim costs already allowed for in the determination of the prescribed capital amount.

That is $HR = \text{Max}\{H(3), H(4)\} - C$

H(3) = the net retained losses plus the cost of reinsurance reinstatements arising from the occurrence of three losses in a year, each loss of a size equal to the 1 in 10 year event, on a whole of portfolio basis;

H(4) = the net retained losses plus the cost of reinsurance reinstatements arising from the occurrence of four losses in a year, each loss of a size equal to the 1 in 6 year event, on a whole of portfolio basis; and

C = the annual allowance made by the insurer in insurance premiums for the expected cost of claims arising from accumulations of exposures to natural catastrophes, plus an allowance to reflect the premiums liability risk margin that would be applied in respect of these claims. No deduction would be allowed for the natural catastrophe capital requirement component of such accumulations of exposure.

Vertical requirement

~~SCR.8.4.108 The vertical requirement encourages the purchase of adequate levels of vertical reinsurance cover. The requirement is calculated based on a 1 in 200 year whole of portfolio loss, rather than based on the largest 1 in 200 year single site loss. VR would need to be re-assessed following the occurrence of an event. This will ensure that sufficient cover remains at all times during the year for a 1 in 200 year event, plus the cost of one full reinstatement of reinsurance cover.~~

~~SCR.8.4.109 However, in re-assessing the vertical requirement following the occurrence of an event, insurers must not take any aggregate stop-loss reinsurance cover into account. This aims to ensure that the capital requirement for Natural catastrophes focuses on events that may occur over the next full year. It also limits the potential for large changes in the capital requirement arising from the impact of catastrophe losses on the aggregate reinsurance program or from the aggregate program being reset to the original (or similar) level of retention at the end of the treaty year. Such an approach will ensure relative stability of the capital charge throughout the year. Aggregate cover may be allowed for in determining the horizontal requirement, as outlined below.~~

Horizontal requirement

~~SCR.8.4.110 The horizontal requirement should be set at the start of the applicable catastrophe reinsurance treaty year and held constant throughout the year. Each scenario considered in HR represents a combination of events of given frequency and size intended to represent a 1 in 200 loss scenario over one year. In selecting the scenarios, recognition was given for the fact that weather-related events at low return periods are likely to be correlated (hence complete independence was not assumed). The proposed approach for calculating the horizontal requirement is to take the greater of net losses plus the cost of reinstatement(s) derived from scenarios H(3) and H(4).~~

~~SCR.8.4.111 A portion of losses expected under scenarios H(3) and H(4) may already be allowed for in the premiums liability estimates and hence need not be provided for again in determining HR. Therefore, the horizontal requirement should be reduced by an allowance for these losses. As HR is determined at the start of the year, insurers should in determining HR deduct the annual allowance made by the insurer in insurance premiums for the expected cost of claims arising from accumulations of exposures to natural disasters, plus allowance to reflect the premiums liability risk margin that would be applied in respect of these claims (defined as 'C' above).~~

~~SCR.8.4.112 When determining scenarios H(3) and H(4), the cost of any reinsurance reinstatements needed to address the reinsurance requirements of the scenario would be included. The cost of reinstating reinsurance cover should be set equal to one full year's reinsurance premium each time a scenario loss exhausts a reinsurance layer, unless the insurer has prearranged reinstatements (in which case it would be the outstanding cost of any prearranged reinstatements required for the scenario being considered that are not already accounted for).~~

~~SCR.8.4.113 Where an insurer has aggregate stop-loss reinsurance cover for exposures to natural disasters, it may take this into account when determining the impact of the multiple event scenarios.~~

Aggregation

~~SCR.8.4.114 In aggregating the vertical requirement and horizontal requirement, allowance has been made for diversification through application of the square root of sum-of-squares formula. This reflects the reasonable likelihood that the loss in excess of the vertical limit~~

~~of reinsurance will not occur in conjunction with the accumulation of net losses arising from exposures to multiple events.~~

~~All classes and risks need to be considered~~

~~SCR.8.4.115 The intention is that insurers consider all classes of business when determining the insurance concentration risk capital charge. In estimating the probable maximum loss for exposures to natural disasters, the insurer would include:~~

- ~~(a) the impact of the natural disaster on all lines of business affected, including, for example, property and motor;~~
- ~~(b) an allowance for non-modelled risks, including demand surge and portfolio growth; and~~
- ~~(c) the impact of large single policy exposures.~~

~~SCR.8.4.116 The modelling of single large losses for natural catastrophes is likely to be done with the assistance of commercial catastrophe modellers. If this modelling does not include the impact of natural disasters on other classes of business (such as motor or workers compensation), an estimate for these losses would need to be added without allowance for diversification.~~

~~SCR.8.4.117 Where certain perils (such as bushfire, flood) are material but not included in the modelling of the single large loss, an allowance for losses in respect of these perils would need to be estimated. If it is not practical to calculate a loss exceedance curve for such perils, then the insurer would estimate a 1 in 200 loss separately for such perils and determine the whole of portfolio probable maximum loss by aggregating the 1 in 200 loss for each peril using the square root of sum of squares approach. A similar approach would also be taken in estimating the 1 in 6 and 1 in 10 loss scenarios.~~