EIOPA CAT Workstream - Fire risk submodule

June 2017

1. Introduction

The EIOPA Catastrophe Workstream (CAT WS) has been mandated to develop an alternative calculation for the fire risk submodule.

There are two aspects to the review of the submodule, the simplification of the volume measure and the calibration of the submodule. This paper assesses only the issue of simplification.

2. Existing calculations

Article 132 of the Delegated Regulation provides the existing specifications for the calculation of the fire risk SCR. In summary, the current capital requirement for fire risk is equal to the maximum amount of an (re)insurer's exposure (measured as sum insured) within any 200m radius.

It is understood that this approach was originally chosen because it provides a compromise between simplicity and risk sensitivity. The 200m radius was calibrated based on expert judgement, historical observation and vendor model output.

However, feedback provided in response to the questions on fire risk in the Discussion Paper on Solvency II Review showed that many insurers found it difficult to assess the value of exposure within a 200m radius. It was also noted that the calibration of the submodule was deemed to be overly conservative.

Further investigation by the CAT WS members (Insurance Europe) suggests that difficulties and cost in assessing the value of the exposure can arise from the following:

a) Technology to automate the 200m calculation based on a geocoded portfolio can be expensive, unavailable or lack accuracy
b) Insurers are manually assessing the exposure
c) Large amount of data cleansing/validation required due to;
    a. Inconsistencies between underwriting process and fire risk submodule calculations
    b. Incorrect data collection
    c. Changes or additions to address/postcodes

In addition, feedback was also provided on the use of Possible Maximum Loss and/or Estimated Maximum Loss measure instead of sum insured. However, the use of these measures is not within the scope of the CAT WS and have not been considered as part of this document.

3. Principles underlying any changes

The CAT WS has considered several simplifications and assessed these against the following criteria.

- Simplicity – the calculations should be straightforward to understand and implement.
- Risk sensitivity – there should be no loss in overall levels of risk sensitivity.
- Usability - any new calculations should be easily adopted by (re)insurers both in terms of cost and resource.

4. Alternative calculations

The following proposals were considered by the CAT WS. More details of each proposal, assessment against the above criteria and impact assessment are set out in the following sections.

1. Retain existing volume measure ie no change to current calculation
2. Using the largest exposure measure with an adjustment for conflagration
3. Using the simplification of QIS 5 (a factor based approach)
4. Alter the formula to reflect market share, building density and reconstruction costs
5. Offer simplification to determine exposure based on 200m radius around at minimum top 5 exposures

4.1. Retain existing volume measure ie no change

4.1.1. Description

No change is made to the existing modelling approach (although a calibration of the radius could be considered separately).

4.1.2. Discussion

The advantages of this approach include:

- The current level of risk sensitivity is maintained.
- The concept's simplicity is retained.
- Improvements in IT systems/programs could reasonably be expected to be developed over the coming years to enable most insurers to model the risk.
- It would encourage improved data recording.

The disadvantages of this approach include:

- There are some exposures which are still likely to be burdensome for insurers to geocode.
- Different simplifications adopted by different insurers may reduce consistency in modelling of the risk.
- The cost of modelling the portfolio in this way may continue to be burdensome for small and medium sized enterprises.

4.2. Using the largest exposure measure with an adjustment for conflagration

4.2.1. Description

The volume measure is altered to be the insurer's largest exposure with an adjustment made to reflect the possibility of conflagration.

Some possibilities of an adjustment could be simply a fixed factor eg

$$\mathbf{SCR_{fire} = 1.25 \cdot SI_{largest\_exposure}}.$$

Alternatively, it could be based upon the insurers' specific portfolio eg

$$\mathbf{SCR_{fire} = SI_{largest\_exposure} + \alpha_i \cdot Expo\_Ptf}$$

Where $SI_{largest\_exposure}$ = insurer's largest exposure
Expo_Ptf = insurer's total exposure in a given post code
α_i = damage rate, dependent upon density of postal code i

4.2.2. Discussion

The advantages of this approach include:

- Largest single exposure is easily identifiable
- Using a fixed factor as an adjustment would make the calculation very straightforward
- No geocoding of risks is required
- Expected to be low cost and easy to implement

The disadvantages of this approach include

- There could be a substantial loss of risk sensitivity.
- Calibration of the conflagration adjustment would likely prove difficult:
    - A simple factor-based adjustment is difficult to justify given the differing portfolio compositions across Europe.
    - A more complex approach reflecting building density in postcodes is likely to be burdensome to calibrate and may still be theoretically difficult to justify.

4.3. Using the simplification of QIS 5 (factor based approach)

4.3.1. Description

This approach separates the insurer's exposure into three subcategories (residential, commercial and industrial). The total value of exposure in each subcategory is multiplied by a factor and summed. The SCR_{fire} is then set as the maximum of this value or the largest sum insured eg

SCR_{fire} = max ($SI_{largest\_exposure}$, $\sum_x SIx \cdot Fx$)

Where

$SI_{largest\_exposure}$ = insurer's largest exposure (across all sublines)
SI_x = sum insured across subcategory x
F_x = market wide risk factors
X = Residential, Commercial and Industrial

The factors, F_x, used in QIS5 are as follows:

Residential	0.004%
Commercial	0.010%
Industrial	0.073%

4.3.2. Discussion

The advantages of this approach include

- Increased usability as factor-based approaches are easy to apply.
- Significantly reduced calculation burden.
- The costs of implementing this approach could be expected to be minimal..
- The largest sum insured underpin ensures a minimum capital requirement which is realistic (albeit arguably on the low-side ie if the underpin bites then there is no explicit capital requirement for the risk of conflagration).

The disadvantages of this approach include

- Loss of risk sensitivity.
- Categorisation between industrial and commercial exposure could be questionable in some cases.
- Difficult to justify the calibration of factors result in a level of capital which is consistent with the aim of Solvency II.

4.4. Alter the formula to reflect market share, building density and reconstruction costs

4.4.1. Description

Another proposal put forward in response to the Discussion Paper suggests adopting a model which includes market share, building density and reconstruction costs and would be calculated as follows.

$$\mathbf{SCR_{fire} = \%MS \cdot \%DS \cdot R^2 \cdot NF \cdot €/m^2}$$

Where

MS = market share of premiums of the insurer
DS = density of buildings in circle area
R = radius of a circle
NF = average number of floors per building
€/m² = average cost of reconstruction

4.4.2. Discussion

The advantages of this approach include

- Removes the need to geocode exposures

The disadvantages of this approach include

- Loss of risk sensitivity as the calculation averages an entire region
- Loss of simplicity through increased data requirements (cost of reconstruction, average number of floors etc.)
- The circle size would need to be calibrated
- Parameters would need to be updated regularly (average cost of reconstruction, market share of premiums.

4.5. Offer simplification to determine exposure based on 200m radius around at minimum top five exposures per risk type (Industrial, commercial, residential)

4.5.1. Description

This approach is theoretically consistent with the existing approach but restricts the calculation requirements to the 200m radius around the largest five exposures, per risk type, in the portfolio ie it assumes that the maximum exposure within a 200m radius will contain, as a central point, one of the largest five exposures, per risk type.

To counteract any unjustified reduction in the risk sensitivity for portfolios where there are no significant single exposures (eg portfolios of residential policies), an underpin is proposed.

The resulting formula would be $\mathbf{SCR_{fire} = max\ (SCR_{firei}, SCR_{firec}, SCR_{firer})}$

Where

$SCR_{firei} = \max(E_{1i}, E_{2i}, E_{3i}, E_{4i}, E_{5i})$

Commented [AS1]: This means that the simplification proposal would actually require companies to assess 15 data points (if they are doing commercial, industrial and retail business), rather than the original idea of only 5.

This approach is recommended to increase risk sensitivity across the different risk types by avoiding, for example, the following situation: an insurer has a portfolio with at 5 large but isolated industrial exposures and clusters of smaller commercial properties with the clusters creating a larger aggregate exposure than any of the individual large industrial exposures.

Commented [AS2]: ***Question 1a for CAT WS*** **-** Is this increased risk sensitivity warranted?
Question 1b for CAT WS **-** Is any further element needed to cover the risk that a retail portfolio has no large exposures because they are homogeneous and so taking the largest 5 portfolios could underestimate the risk of a single event impacting a number of policies.?

Commented [AS3]: **Question 2 for CAT WS** – Is additional criteria needed here to ensure a single 200m area is not used to represent more than 1 of the top 5 exposures? For example, if there are multiple policies relating to the same industrial site

$SCR_{firec} = \max(E_{1c}, E_{2c}, E_{3c}, E_{4c}, E_{5c})$

$SCR_{firer} = \max(\mathbf{Z \cdot MRE}, E_{1r}, E_{2r}, E_{3r}, E_{4r}, E_{5r})$

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E_{xi} = Total exposure (building, content and business interruption) within 200m radius of xth largest industrial exposure.

E_{xc} = Total exposure (building, content and business interruption) within 200m radius of xth largest commercial exposure.

E_{xr} = Total exposure (building, content and business interruption) within 200m radius of xth largest residential exposure.

Z = Underpin factor (to be calibrated)
MRE = Mean residential exposure value

4.5.2. Discussion

The advantages of this approach include

- Significantly reduced calculation burden for insurers who are manually geocoding risks.
- Current level of risk sensitivity will be maintained in majority of cases, especially for insurers with large (eg industrial) exposures.
- Theoretical integrity of calculation is maintained.
- It provides a consistent and transparent approach for simplification.

The disadvantages of this approach include

- Portfolios can be envisaged where there is a reduced capital requirement

5. Calculation of exposure on a gross or net basis

The current volume measure for fire risk is calculated on a gross of reinsurance basis whereas the actual capital requirement is determined net of reinsurance. This can lead to a loss in risk sensitivity if there is a discrepancy between the largest exposure on gross and net basis.

The advantage provided by the simplification of screening a selected number of top exposures allows to implement a more risk sensitive approach by providing fire risk accumulation on a net of Reinsurance basis.

An example which explains the issue can be found in section 8.3 of the discussion paper on the Solvency II review.

As noted in the discussion paper, this issue also affects the marine risk and aviation risk submodules. It is assumed consistency of approach is required across all of these submodules.

6. Conclusions and recommendations

We recommend proceeding with the simplification described in 4.5 - Determine exposure based on 200m radius around at minimum top 5 exposures per risk type (Industrial, commercial, residential).

Commented [AS4]: Question 3 for CAT WS - Is there an agreement on this recommendation?

Appendix – recalibration information

Conflagration events such as the Enschede and the AZF explosions can serve as a proxy for accumulation events (conflagration) the Fire risk submodule aims at capturing.

Both events articulate that the choice of a 100% damage ratio on sums insured within a 200m radius does not constitute a conservative calibration for the fire risk submodule.

Explosion of a fireworks warehouse

Enschede, the Netherlands (2000)

The houses and other structures were razed within a 250-m radius around the site. Over the zone extending out to 750 m, buildings were heavily damaged. In all, 500 homes or businesses were destroyed or sustained considerable damage; the accident had rendered this zone unsafe for any human residence or activity.
The municipality of Enschede decided to evacuate and demolish whatever was still standing. For the time being, the district was considered to no longer exist.

The above description of the disaster consequences conclude to total losses within a 250 meter radius.

Disaster Area

Source: French Sustainable Development Ministry - DGPR / SRT / BARPI

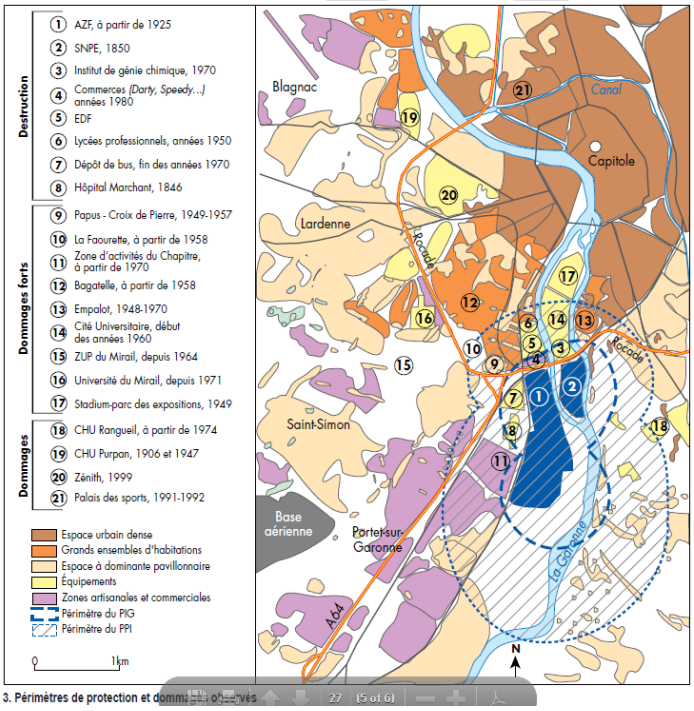
Explosion of the AZF chemical plant

Toulouse, France (2001)

Translated version of French language study: the explosion caused significant damages in the south west part of Toulouse. The AZF industrial site has been obliterated. Only the guard post and the AZF tower remained standing. The guard post was destroyed the following day for security reasons. Nearby, the retail areas of Darty and Brossette were totally destroyed. 150 SEMVAT buses (the Toulouse public transport company) have also been destroyed within the warehouse located in front of the AZF site.

Numerous houses/multi-storey housing, a number of companies and some public equipment (swimming pool, sport hall, concert hall, and a high school) have been damaged. Damages such as cracked walls, blown out doors and windows, ripped out roofs, broken windows, etc. were observed up to downtown Toulouse (a few km away).

This description in addition to the below map shows that exposures numbered 1 to 8 have been totally destroyed by the explosion over a radius going beyond 200 meters. Significant or partial damage area extend well beyond a kilometer.



3. Périmètres de protection et dommages observés

Source: L'explosion de l'usine AZF à Toulouse: une catastrophe inscrite dans la ville. Centre interdisciplinaire d'études urbaines (2002)

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