



BERMUDA MONETARY AUTHORITY

CATASTROPHE RISK RETURN (“Cat Return”) GUIDELINES

FOR CONSULTATION

JULY 2010

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0. INTRODUCTION

This consultation paper outlines the Bermuda Monetary Authority's ("the Authority") proposed approach to the Catastrophe Risk Return ("Cat Return"), providing draft guidance on this topic.

The views of the insurance industry and other interested persons on the proposals set out in this paper are invited. Comments should be sent to the Authority addressed to policy@bma.bm no later than 31st August 2010.

1. FOREWORD

1. The Bermuda Monetary Authority (“the Authority”) is continuing its programme of regulatory development for the Bermuda market place. The objective is a regulatory regime appropriate for the Bermuda market and recognized as meeting or exceeding international standards.

1.1 SCOPE OF APPLICATION

2. It is proposed that all Class 4 and Class 3B¹ insurers will be required to complete and submit to the Authority the Cat Return with an annual filing from the 2010 year-end, except where granted a waiver. All Class 3A insurers writing property catastrophe business, and insurance groups, will also be required to complete and submit the Cat Return from the 2011 year-end.

1.2 WAIVERS

3. Insurers with no catastrophe exposure may apply to the Authority for an exemption from filing or submit a “Nil Return”.

2. CATATROPHE RISK ASSESSMENT

4. The global insurance market and the Bermuda market in particular, significantly rely upon vendor models to assess catastrophe exposures. If the vendor models underestimate potential losses arising from events, the industry as a whole may have capital levels impacted to a greater extent than expected². Not only is this a strategic and risk management issue for a company, it also impacts its regulatory capital requirement. It is a policyholder protection matter since the Catastrophe Risk Charge is generally a significant contributor to this requirement.

¹ In the guidance insurers includes reinsurers.

² The Authority published the “Survey of Economic Capital Modelling Practices in the Bermuda Insurance Market” in December 2008, which discussed vendor models in more depth.

5. The Cat Return should set out the extent of such reliance and highlight the actions insurers³ take to mitigate model risk, including a description of procedures and analytics in place to monitor and quantify exposure to vendor models. It also serves as a tool to assist the Authority to assess the reasonableness of inputs into the catastrophe component of the regulatory capital requirement, and whether regulatory standards are being applied evenly.

6. The Authority expects insurers to have in place procedures and analytics for monitoring model risk. This may include suitable capital leverage guidelines, based on aggregate information such as exposure, rather than modelled statistics like probable maximum losses (“PMLs”). All material input assumptions, including the testing of zonal, peril and other risk categorization dimensions both within and between classes of business, should be challenged.

7. The Authority has worked with industry, to review standard metrics for assessing capital requirements. These will focus both on an absolute basis, independently of modeling, and on probabilistic scenarios from catastrophe models.

8. Examples of the types of measures and relationships that the Authority will review to assess catastrophe risk include:

- Examining the rank of PML and Realistic Disaster Scenarios (“RDS”) against the relative rank of various other cat exposure metrics (such as Limits/Total Insured Value (“TIV”), catastrophe premium). Discrepancies may exist in relative ranking which may highlight factors such as:
 - Construction of a superior portfolio of risks.
 - Relatively higher or lower attachment point, relative to other markets, and the possibility of exposure to greater model risk.

³ In this guidance, henceforth insurer includes an insurance or reinsurance group.

- o The application of different model mixes by region-peril⁴ and different levels of loss modification applied to gross results.
- Assessing the amount that exposure to catastrophes extends beyond the statutory property catastrophe line. The Authority will also look to assess potential for non-accumulated exposure to correlated catastrophe losses.
- Considering a company's reinsurance or retrocessional protection against catastrophes, to assess the impact of reinsurance default.
- Examining relative changes of exposure from one year to the next, for consistency and reasonableness.

9. The Authority will attempt to review responses in an unbiased manner, examining practice across industry and within peer groups, that seeks to address certain differences between modeling practices (such as the mixing of various vendor catastrophe model severity distributions), while preserving the effects of other factors (such as treatments for data quality, and unmodelled contractual obligations etc.).

10. In determining regulatory capital requirements, the Authority may require insurers to run catastrophe accumulations with various minimum multiplicative loss modification factors applied to ground up losses, to more fully account for the non-linear way losses to excess of loss programmes may cause such losses to be magnified (see the Appendix). This is may only be envisaged if a company appears to be deviating substantially from market practice with respect to the level of loss modification factors applied.

⁴ Region-peril represents the concept that catastrophe models are built specifically to define catastrophes for a geographical region rather than for a specific country or on the basis that all perils for a region are constructed in one model. Examples of region-perils would include: Atlantic basin hurricane, North American earthquake and European windstorm. Vendor catastrophe models do not currently consistently model the entire region-peril. An example would be Pacific basin typhoon, which is currently not modelled in its entirety for any of the major vendor catastrophe models. While certain countries/regions are modelled, the correlated losses associated with a typhoon hitting successively the Philippines, Taiwan and Japan are not currently calculated.

11. This Cat Return, in conjunction with other risk exposure information submitted in the Capital and Solvency Return, will also be used to assess liquidity. Liquidity risk is not always mitigated simply by holding additional capital. Claims paying ability is obviously an important factor that is perhaps more pronounced with catastrophe risk where large amounts of capital may have to be liquidated to pay claims at very short notice. Additionally complexity arises with the currency mismatch that may exist between company capital and a subset of its potential catastrophe liabilities. An insurer should be able to demonstrate that it has considered potential challenges to liquidity, including the methodology and principles used to measure liquidity, contingency plans, access to new funding sources, and projected liquidity requirements.

12. Examples of the types of measures that the Authority may use to assess liquidity risk include:

- Examining Gross and Net PML and RDS returns as a function of quoted government investments adjusted for any encumbrances.
- The ratio of effective asset duration to effective liability duration.

3. STRESS AND SCENARIO TESTING

13. Insurers should be capitalized at a level to withstand the impact of a combination of extreme but not inconceivable adverse events. A well run insurer will have comprehensive stress and scenario testing procedures to monitor capital adequacy in adverse scenarios as part of its risk management framework. These include procedures to undertake, review and, where appropriate, react to the results of rigorous, forward-looking stress and scenario tests that identify possible events or cyclical changes in market conditions that could adversely impact an insurer's earnings, liability or asset values.

14. The Authority's current regulatory reporting includes a number of standardized stress tests, and the Bermuda Solvency Capital Requirement ("BSCR") model implicitly incorporates stress testing as well. These stress tests currently focus on economic and natural catastrophes. It was decided during the BSCR design phase in 2007 that man-made catastrophes (e.g. terrorist acts) would be assessed outside the model. The Authority will use the Cat Return as an instrument to augment its existing regime by introducing an assessment of terrorism exposure.

4. PUBLICATION

15. In addition to assessing the reasonableness of PML components generating the Catastrophe Risk Charge contribution to the regulatory capital requirement and liquidity risk arising from catastrophe risks, the Authority proposes to use the Cat Return as a source for the publication of aggregated catastrophe modelling practices within the Bermuda market.

16. The Authority believes that this would not only enhance its reputation as a leader in the regulation of catastrophe markets, but the increased transparency should benefit the Bermuda market generally as stakeholders are educated with respect to the quality of modelling on the island.

5. COMPLETION OF THE CAT RETURN

17. The Cat Return will be embedded in the BSCR model to eliminate duplication in the submission of information, and to simplify the annual regulatory reporting process by allowing companies to complete a single file template to satisfy their obligations for risk reporting.

6. GUIDELINES FOR COMPLETING THE CAT RETURN

18. The Cat Return contains the following sheets:

- Company information
- Exceedance probability curve sheets:
 - o EP Curve Total⁵
 - o EP Curve Insurance
 - o EP Curve Reinsurance
 - o EP Curve Atlantic Hurricane
 - o EP Curve North American Earthquake
 - o EP Curve European Windstorm
 - o EP Curve Japanese Earthquake
 - o EP Curve Japanese Typhoon
 - o EP Curve All Other Perils
- Accumulations Overview
- Data Analysis
- Reinsurance Disclosures
- Insurance Terrorism Exposure – 150M Defined Geographical Radius
- Reinsurance Terrorism Exposure – 150M Defined Geographical Radius
- Reinsurance Terrorism Limits
- Assumed Exchange Rates

19. Specific guidance notes in respect of each sheet are provided in the remainder of this document. Should an insurer have any questions on these guidance notes or any other aspect of the Cat Return, it may contact the Authority for further instruction. In addition to the guidance notes provided in this document there are comments inserted within the excel spreadsheet to aid companies in completing the return.

⁵ It is anticipated that the EP Curve Total would represent the combined business as reported separately for the EP Curve Insurance and EP Curve Reinsurance segments.

20. The following definitions relate to various sections of the Cat Return:

“Modelable” - exposure that can be run through a vendor catastrophe model

"Not-modelable" – exposure that cannot be run through a vendor catastrophe model or where there are no catastrophe models that assess the region-peril under consideration.

"Data deficient" - data limitations that prevent the exposure from being run through a vendor catastrophe model. This may be due to the resolution of the data or the completeness of the data, which for other reasons is not good enough to produce credible modeling results.

"Model deficient" - vendor models cannot process the vast majority of the exposures.

“Modelled” - risks that the insurer was able to model, and so appear in its PML. Non-modelled would be the opposite and so does not appear in the PML.

“Property catastrophe” means the "property catastrophe" statutory line of business.

"Other" statutory lines of business refers to all statutory lines other than property catastrophe.

“Proportional” – throughout the Capital and Solvency Return means business written by an insurer (primary writer) and its reinsurer where the reinsurer’s exposure attaches at the same layer as the insurer and losses are shared in a proportional manner, such as quota or surplus share contracts.

6.1 EXCEEDANCE PROBABILITY CURVE SHEETS

21. The Authority is requesting an Exceedance Probability (“EP”) curve for the insurer covering exposure to loss from all insurance and reinsurance operations including the impact of any insurance linked securities (“ILS”) investments for the following region-perils:

- a. Total all perils combined
- b. Atlantic basin hurricane
- c. North American earthquake
- d. European windstorm
- e. Japanese earthquake
- f. Japanese typhoon
- g. All other perils⁶

22. The responses from the “Total all perils combined” sheet are carried through to the subsequent worksheets where appropriate. Where differences in response are appropriate for an insurer, it may modify the response on the other worksheets.

23. Additionally the Authority requests an EP curve for each of the following major business segments for all perils combined:

- h. Total insurance
- i. Total reinsurance

24. Insurers are exempted from h and i, where the percentage of premium in either insurance or reinsurance is less than 5% of the total net premium provided for a. above.

⁶ All Other Perils – This is the residual natural catastrophe exposure retained by the company for all other region-perils except Atlantic basin hurricane, North American earthquake, European windstorm, Japanese earthquake, Japanese typhoon.

25. Where the Authority has questions or concerns it may ask for additional information including permutations of the various perils, vendor models, business segment or gross/net perspective. The Authority may also request additional returns should comparability with other market participants be difficult.

6.1.1 Exceedance probability information

26. Atlantic basin hurricane losses should include the total losses for each event considering the correlation of losses from hurricanes from exposures within the Caribbean, Mexico, the USA and Canada (but not necessarily be limited to losses from these territories).

27. North American earthquake losses would include accumulated losses in an event from exposures within the US, Mexico and Canada (but not necessarily be limited to losses from these territories).

28. The following definitions and illustrations are associated with the EP curves:

“Gross per occurrence loss (USD \$M)” - this should be gross of reinstatement premiums due on inwards reinsurance business written and gross of any reinsurance recoveries.

“Gross TVaR (USD \$M)” - this represents the Tail Value at Risk⁷ (“TVaR”) calculated for the region-peril under consideration for this return.

⁷ TVaR is the conditional expectation of values at and beyond the stated return period requested. Gross TVaR should be gross of reinstatement premiums if any are due on inwards reinsurance business written and gross of any reinsurance recoveries. Net TVaR should be net of reinstatement premiums if any are due on inwards reinsurance business written and net of any reinsurance recoveries due (themselves net of any reinstatement premiums payable). In addition to including the impact of traditional reinsurance and retrocessional protection, net TVaR responses should include the benefits from catastrophe bonds, catastrophe swaps, industry loss warranties and other non-traditional risk mitigation transactions.

For example for Atlantic hurricane the 50 year Gross TVaR (USD \$M) would be the expected gross loss in millions of US dollars gross of reinstatement premiums for all losses from Atlantic hurricane only, considered on an annual basis for all years equal to and less frequent than 50 years (i.e. 50 year return periods to 1,000,000 year return period).

“Net per occurrence loss (USD \$M)” - This should be net of reinstatement premiums due on inwards business, if any, and net of any reinsurance recoveries due (themselves net of any reinstatement premiums payable). In addition to including the impact of traditional reinsurance and retrocessional protection, responses should include the benefits from catastrophe bonds, catastrophe swaps, industry loss warranties and other non-traditional risk mitigation transactions.

“Net TVaR (USD \$M)” - This represents the Tail Value at Risk (TVaR) calculated for the region-peril under consideration for this return in millions of US dollars.

For example for Atlantic hurricane the 50 year Net TVaR (USD \$M) would be the expected net loss (net of reinstatement premiums and net of any reinsurance recoveries (themselves net of any reinstatement premiums due)) for all losses from Atlantic hurricane only considered on an annual basis for all years equal to and less frequent than 50 years (i.e. 50 year return periods to 1,000,000 year return period).

“Annual average aggregate gross loss (USD \$M)” and “Annual average aggregate net loss (USD \$M)” would be the annual average aggregate losses over the entire year from all contracts taking into consideration participation shares and reinstatement terms for the region-peril under consideration.

“Standard deviation of annual aggregate gross loss (USD \$M)” and “Standard deviation of annual aggregate net loss (USD \$M)” would be the standard deviation of annual aggregate losses over the entire year from all contracts taking into consideration participation shares and reinstatement terms for the region-peril under consideration on a gross and net basis respectively.

“Total statutory gross property catastrophe premium modelled (USD \$M)” and “Total gross all other premium modelled (USD \$M)” should be gross of upfront reinsurance premiums paid and correspond to the statutory lines of business specified in the Capital and Solvency Return.

“Total statutory net property catastrophe premium modelled (USD \$M)” and “Total net all other premium modelled (USD \$M)” should be net of upfront reinsurance premiums paid only and correspond to the statutory lines of business specified in the Capital and Solvency Return.

For the following fields:

“Total net statutory property catastrophe limits exposed (USD \$M) – modelled”

“Total net statutory property catastrophe limits exposed (USD \$M) - not modelled”

“Total net all other lines limits exposed (USD \$M) – modelled”

“Total net all other lines limits exposed (USD \$M) - not modelled”

Net exposure limits should only differ from gross limits for any proportional reinsurance placed. No consideration should be taken for any excess of loss reinsurance protecting an insurer's gross exposure.

6.1.2 Significant sources of catastrophe risk and associated loss

29. The Authority would expect that all significant sources of catastrophe risk and associated loss are included in the loss estimation techniques employed by the insurer. The following factors can have significant impact on varying loss potential and as such it is important that the Authority clearly understands what is reflected within the insurer's loss estimates and the variation in practice across industry.

- Allocated loss adjustment expense
- Property – buildings
- Property – contents
- Additional living expenses
- Business interruption
- Auto physical damage
- Workers' compensation
- Personal accident
- Life insurance
- Onshore Energy
- Offshore Energy
- Ocean marine
- Inland marine
- Flood
- Crop
- Other primary insurance

30. These factors all include drop down menus with appropriate choices. The Authority asks insurers to select the appropriate choice from the drop down menu that best describes the situation for the insurer. Depending on the factor, the following responses are felt as reasonable choices:

- Yes
- Yes - supplementing vendor models where required⁸
- Yes - only where vendor models incorporate
- No - not material or applicable
- No

31. The Authority would expect insurers to have a reasonable and objective method of determining whether items are not material or not applicable though may seek to understand this process from time to time.

32. For answers of “No” an additional question appears which seeks an explanation for why the factor has not been included.

6.1.3 Assumed reinsurance

33. In general, with few exceptions, open market reinsurance (as distinct from intra-company transactions) includes contractual features which limits catastrophe exposure regardless of the form it is assumed⁹.

8 Vendor catastrophe models may not be able to model all exposures or all possible supplemental perils to a primary peril. For example, catastrophe exposure to per risk exposures can be difficult to model due to either insufficient detail on the individual exposures or because the region-peril is not supported in a catastrophe model. Similarly, ‘fire following earthquake’ may not be modelled in a country though there may be potential for this loss, or a peril may have the potential to cause correlated loss in countries that are not modelled as the modeller has only modelled those countries deemed to present the most significant risk.

9 The main exceptions include some Japanese proportional property business (largely EQ need to put in full exposed) and some continental proportional property business (generally wind exposure).

34. The Authority has observed that much of the intra-company reinsurance is structured around optimizing capital structure. Often quota share transactions with parent or group-affiliate companies are written with terms that are usually not available in the open reinsurance market. Examples include the lack of occurrence caps for catastrophe exposures.

35. Ideally each return provided by a company will include all catastrophe exposures as appropriate for the various perils and lines of business required. This includes all the different products which may vary in their concentration to catastrophe exposure but nevertheless are exposed to these losses. Given the potential for capital threatening events to involve many contracts it is thus important that the Authority understands the comprehensiveness of the return in this respect.

6.1.4 Pools and assessments

36. For many reinsurance contracts, pools and assessments¹⁰ are an explicit contractually covered exposure. However the modelling of these exposures is slightly more complicated and requires diligent attention to detail by insurers and reinsurers and indeed may require approximations given the lack of detailed information available on the actual exposures of the pool. The Authority wishes to understand the comprehensiveness of the return in this respect.

10 Voluntary/involuntary pools and assessments feature in many coastal states as a solution for homeowners who cannot get insurance for some reason. The specifics vary from state to state, but broadly insurers will receive an assessment every year for losses associated with this pool based upon their market share. These pools have a tendency to be populated with the above average risks from either a construction or hazard perspective.

6.1.5 Supplemental perils and model options

37. The Authority considers that, under best practices, loss estimates provided and considered by an insurer would ideally include as comprehensive an attempt as possible of correctly assessing the true impact of correlated losses associated with a given peril. These include considerations for model features such as supplemental perils and model options as well as considerations to overcome the limitations of catastrophe models.

38. The Authority recognizes that catastrophe models have limitations in the ability to model supplemental perils but that some companies have considered and constructed methodologies for addressing these limitations¹¹. For example, when Hurricane Katrina produced losses associated with the flooding of Lake Pontchartrain, none of the major vendor models modelled this at the time.

39. Given the potential magnitude of supplemental perils and the non-uniform treatment of these perils across industry, it is important for the Authority to understand the specific practice of each insurer for each region-peril. As a result the Authority requests information on the detail of how insurers are handling supplemental losses.

40. On account of the “Atlantic Multi-decadal oscillation selection”, the Authority to enquires whether an insurer has used near-term event sets or long-term event sets. Near-term event sets reflect the perception of a prolonged period of higher than average temperature for the Atlantic Ocean, associated with the heightened phase of the Atlantic Multi-decadal Oscillation (AMO). Long-term event sets average over several cycles of the AMO and have a lower frequency of hurricanes than near-term event sets.

11 The Authority published the “Survey of Economic Capital Modelling Practices in the Bermuda Insurance Market” in December 2008. Appendix 3 “Modelling for Property Catastrophe Business” discusses methods to overcome these and other vendor models limitations.

6.1.6 Other adjustments information

41. The Authority recognizes that companies make a variety of adjustments to catastrophe model exposures to address several factors such as non-modelled contractual obligations, perceived model deficiencies and perceived data deficiencies.

42. Adjustments for “insurance to value” might be made where a company feels the submission it has received is exposed to underinsurance for whatever reason.

43. The following definitions /examples are associated with other adjustments:

“Adjustments for exposure growth” - for a risk or portfolio where no prospective change is expected, this might just be an adjustment in insured values for the impact of inflation. For risks or portfolios proposing significant growth or contraction this would contemplate the growth/contraction and any impact of inflation.

“Supplemental losses for non-modelled line of business” - certain vendor models do not incorporate the ability to run all types of exposure through the model or data is not received in a format that allows the models to be run. In these cases, companies may use various methods to incorporate this exposure within the vendor model framework, allowing consistent consideration and treatment to other exposures. Examples might include aviation and marine exposure to earthquake, hurricane or fire following, or property per risk exposures where individual location information is not available or where a vendor model does not have a detailed model.

“Adjustments for model deficiencies – severity” - certain vendor models do not incorporate the ability to model all possible sources of loss associated with an event. In these cases companies may use various methods to incorporate this potential for loss within the vendor model framework, allowing consistent consideration and treatment of exposures. Examples might include fire following earthquake in most of Europe, losses

associated with auto exposures or other supplemental perils where not modelled by a vendor model.

Additionally, in situations where a significant change of risk is perceived, such as the recognition of the true potential exposure to terrorism after 9/11, the change in the view of hurricane risk after 2005, and the recent changes in US earthquake risk by the US Geological Survey (“USGS”), this section may be used to reflect any changes insurers may make in advance of the release of new vendor models versions which incorporate this new view of risk.

“Average loading factor applied to ground up loss for all adjustments applied” - This ideally would be calculated as the ratio of:

$$\frac{\text{Ground up loss including all company adjustments applied to company's share of losses}}{\text{Ground up loss excluding all company adjustments applied to company's share of losses}} - 1$$

Assessment of these adjustments is aimed at capturing the aggregate impact on a ground up basis of:

- Allocated Loss Adjustment Expense
- Adjustments for exposure data quality deficiencies
- Insurance to value adjustments
- Adjustments for exposure growth
- Adjustments for model deficiencies - severity
- Adjustments for model deficiencies - frequency
- Additional demand surge loadings
- Other factors for prudence

44. It is also recognized that certain factors may be handled in a variety of ways¹². For example, adjustments for exposure data quality deficiencies may be carried out on the underlying exposure data or on results.

45. The Authority recognizes that this item may be difficult to assess for some companies on an exact basis due to the different systems and data captured across industry. To the extent this is not answerable for certain permutations (such as for the insurer as a whole - all perils, reinsurance and insurance) or is not able to be determined strictly on an exact basis, the Authority would like insurers to estimate this quantity and note the method accordingly in “Is this average loading factor determined analytically or estimated?”.

6.2 ACCUMULATIONS OVERVIEW

46. This worksheet is aimed at getting an overview of the accumulation methodologies main features, including which catastrophe models are used, how frequently accumulations are conducted, etc. In most cases, the Authority feels the questions are relatively straight- forward. However some clarification is appropriate for some questions, e.g. “Are your pricing and accumulations fully consistent?” is asking whether the annual expected loss that is implied in the accumulations is identical and equal to the annual expected loss pick made at the time of underwriting.

12 In this regard, insurer adjustments would not include supplemental perils modelled by a vendor model, but would include modifications for supplemental perils which are contractually covered but not modelled by a vendor model. Similarly demand surge, as modelled by a vendor model, or secondary uncertainty, as modelled by a vendor model without adjustments would not be included in this consideration. For the Atlantic basin hurricane peril this would not include the change in loss implied in moving from a long-term frequency assessment to a near-term frequency assessment.

47. Blended portfolios refer to the creation of a portfolio view of risk by combining multiple catastrophe model results. Blending will typically also occur at the time of underwriting and may include the creation of a blended model expected loss to each contract¹³.

48. The Authority recognizes the possibility that various regions, lines of business or even insurance and reinsurance operation practices may have different approaches within an insurer's company.

6.3 DATA ANALYSIS

49. Objective data quality assessment methodologies or tools may not be in place for all region-peril models provided by a vendor model provider. As such, while the Authority recognizes that assessing data quality has been considered in a number of ways, it feels it is more important at this point to understand the comprehensiveness of data capture by insurers and their corresponding ability to consider the data in their accumulations and pricing. For the purposes of this worksheet, insurers should answer on a basis consistent with their accumulation practice queried and presented elsewhere in this return.

50. This section of the Cat Return aims broadly to capture how much risk is modelled by insurers versus not modelled. For both modelled and non-modelled exposures, an understanding of how the exposures are considered in the accumulations is sought. The quality of modelled exposure data is also queried, examining factors on a contract count basis and on a limits basis.

13 Blending might involve having individual specific catastrophe model choices for each region-peril (e.g. AIR for US hurricane, RMS for European windstorm and EQECAT for worldwide earthquake etc.) or having specific proportions defined by region-peril or for each specific contract (e.g. 50%:50% AIR:EQECAT for US hurricane, 100% RMS for European windstorm, 25%:75% AIR:EQECAT for worldwide earthquake, etc.).

51. The Authority feels that the appropriate splits on which to examine data capture are as follows:

- US-specific contracts - all exposures – this would consider all exposures included in a company’s returns under statutory zones 1, 3, 4, 5, 6, 7 and 11.
- All other contracts - all exposures - this would consider all exposures included in a company’s returns under statutory zones 2, 8, 9, 10, 12 and 13.

52. The Authority recognizes that this may be a difficult worksheet for companies with internal systems that have not been designed to record and handle the type of information requested. The Authority supports the recent emphasis on data quality and capture, and believes that monitoring this information is important.

53. Given the desire to examine this information, but acknowledging the difficulty for some insurers currently to analyze and report on their data in this way, the Authority will allow insurers to complete this worksheet to the best of their ability.

54. Where an insurer is unable to answer a data return point¹⁴, the Authority requests that the insurer input a statement of explanation. The Authority anticipates that it may not be able to foresee all potential issues insurers may have and is thus open to discussion on insurer approaches if this outlined solution is difficult.

55. The Authority will tend to look more favorably on insurers that are able to provide either answers to this worksheet or similar management assessment reports.

14 For example, insurers may not be able to provide the modelable contract count for US-specific contracts, or perhaps can only respond on a total basis without the ability to separate responses into what are effectively US all exposures and all other exposures.

56. For business that does not include an occurrence cap, the Authority suggests that insurers should include the total insured value if known. If the total insured value is unknown or the insurer feels that a more appropriate method of including this exposure exists than including the total insured value, it is asked to explain how these exposures are included in the return information provided.

6.4 REINSURANCE OR RETRO DISCLOSURES

57. The Authority seeks to understand for reinsurance or retro purchased the types of purchases that are made. In particular, the Authority seeks information on whether protection against natural catastrophe loss is obtained by:

- Insurance-linked securities (“ILS”) protection
- Industry loss warranties (“ILW”) contracts
- Other contracts
- Property catastrophe contracts
- Property per risk contracts
- Property retro contracts
- Quota share contracts
- Surplus share contracts

58. The Authority feels that the appropriate splits on which to examine data capture are as follows:

- US-specific contracts - this would consider all reinsurance or retrocession where the contracts are exposed to statutory zones 1, 3, 4, 5, 6, 7 and 11 only.
- Worldwide contracts - this would consider all reinsurance or retrocession where the contracts are exposed to statutory zone 12 only.

- All other contracts - this would consider all reinsurance or retrocession where the contracts are exposed to statutory zones 2, 8, 9, 10 and 13 only.

59. For business that is uncapped, the Authority proposes that companies should include the total insured value if known. If there are reinsurance or retro contracts that are purchased without occurrence limits, the insurer is asked to provide details of these contracts.

60. To the extent a contract will not fit into the aforementioned categorization, insurers should assign the contract to the most appropriate category, and describe the nature of the contract and where it has been assigned.

6.5 TERRORISM

61. The Authority believes it is appropriate to consider terrorism exposure, in both absolute terms and for realistic scenarios of loss. When examining absolute exposure to terrorism event from insurance and reinsurance in what might constitute worst case scenarios, conventional attacks are useful measures in understanding solvency threats. Additionally, the Authority is expanding regulatory reporting to include terrorism scenarios.

6.5.1 Reinsurance and Insurance 150m terror exposure

62. For insurance business that has terrorism exposure, the Authority requests information on the ten largest 150m accumulations of exposure to conventional terrorism losses. The exposure calculation should include all exposures within the 150m radius and assume a total loss to insurance commitments within the 150m radius.

63. Information should be provided on a gross basis. Possible recoveries from TRIP¹⁵ and other reinsurance are requested as separate information in order to consider both gross and net exposures. For the purposes of this worksheet, insurers should assume that any reinsurance is in force as if no terror events had occurred in the previous year.

64. Where insurers are unsure whether there is exposure within a given 150m radius, perhaps due to issues with poor data, for conservative purposes these exposures should be included within the accumulations.

Information is requested on:

- Latitude of accumulation centroid
- Longitude of accumulation centroid
- Zipcode/Postcode
- State/Province
- Country
- Total gross exposure
- TRIP or other terror pool recoverables if any
- Reinsurance recoveries if any
- Total net exposure
- Target location

¹⁵ TRIP is the Terrorism Risk Insurance Programme enacted on December 26, 2007 when the Terrorism Risk Insurance Programme Reauthorization Act of 2007 was signed into law. This extends the Terrorism Risk Insurance Act through December 31, 2014.

65. Target location information is requested to allow the Authority to easily identify the approximate location of concern. While there is considerable debate as to which targets might or might not be at heightened risk of terrorism, the Authority thinks it is useful to think in this way and that it is likely that insurers will agree. If there are no perceived targets, insurers should note accordingly in this field.

66. Where information is requested, if multiple values may be appropriate (such as zip code/postcode), insurers should include all possible data if possible.

67. It is intended that the “TRIP or other terror pool recoverables if any” column should be completed for other terror pools where there is sovereign government backing which would ensure the recoverability of this form of reinsurance.

6.5.2 Reinsurance terrorism limits

68. For reinsurance business that has terrorism exposure, the Authority is requesting information on the ten US States or countries outside of the US with the most reinsurance limit at risk to terrorism when considered across all lines of business exposed.

69. Details on the ten largest exposed US States or countries is requested separately for conventional and Nuclear, Chemical, Biological or Radiological (“NBCR”) acts of terrorism and the Authority requests details on:

- The US State or country
- Total gross reinsurance limits exposed to terrorism
- TRIP or other terror pool recoverables if any
- Reinsurance or retro recoveries if any

70. Information on limits exposed should be provided on a gross basis with reinsurance and other protections to be accounted for separately in order to consider both gross and net exposures. For the purposes of this worksheet, insurers should assume that any reinsurance is in force as if no terror events had occurred in the previous year.

71. It is intended that the “TRIP or other terror pool recoverables if any” column should be completed for other terror pools where there is sovereign government backing which would ensure the recoverability of this form of reinsurance.

6.6 ASSUMED EXCHANGE RATES RETURN

72. The Authority is aware that significant changes in exchange rates may occur throughout the course of a year. In order to avoid distortions associated with exchange effects, the Authority requests information on all exchange rates assumed in compiling the information in the return.

Exchange rates should be input for:

\$:EUR

\$:GBP

\$:Yen

\$:CHF

For any other currency please use \$:Other (specifying Other in column B) as appropriate.

Please input rates in the form such that the \$:GBP rate on December 31, 2008, was \$1:GBP1.447.

6.7 CATASTROPHE LOSS EVENT ANALYSIS

73. The Authority sees value in assessing insurers' modeling veracity by examining the performance of the modeling and risk management process in the context of actual events. The Authority believes that there should be some meaningful relationships established between insurers' estimated losses from catastrophe models and their actual losses particularly when viewed across various lines of business and across industry.

74. Accordingly, the Authority will work with the three primary model vendors to obtain Event IDs for large losses that occur on a going forward basis when a new version of the relevant region-peril model is constructed. Ideally this is done by including the actual best estimate footprint¹⁶ for the event within the stochastic event sets used by insurers in every day pricing and accumulations¹⁷.

75. The Authority will request, along with its standard stress and scenarios, information on the statutory property catastrophe line of business and for information from all other statutory lines of business exposed to Atlantic basin hurricane and other region-perils. This would include but not necessarily be limited to:

- Property
- Property Non-proportional

16 Catastrophe models include events that are stochastically similar but are inherently an approximation to the actual event. For example, stochastically similar events may preserve coarse aggregate features such as loss by line of business but produce a poor geographical representation of the actual losses from an event. Cat modelling companies thus produce actual best estimate footprint for the event.

17 Shortly after an actual event EQECAT will provide a patch which allows users to include the actual best estimate footprint event within their stochastic event with zero probability. When a new version of the model is issued the actual best estimate footprint event is included within the stochastic event set with a non-zero probability. After a large event occurs, RMS has committed to providing a best estimate footprint of the new event within their stochastic event set. These "historical" event footprints will be assigned a very low probability of occurrence, allowing insurers to monitor their potential losses to a repeat event within their portfolio monitoring tools without significantly disturbing the integrity of the stochastic catalogues used for pricing. AIR currently produces an actual historical event catalogue as an option for the running of its models in addition to the stochastic event set. This may require companies with external tools to consider the storage methodology for exposure to losses to historical events.

- Energy Offshore / Marine
- Energy Offshore / Marine Non-proportional
- Retro Property

76. Such information would include the initial estimate of gross and net ultimate losses, and the latest estimate of gross and net ultimate losses. The initial estimate could be any estimate, made up to the end of the quarter for which the loss event occurred. Gross ultimate loss should be gross of reinstatement premiums, due on inwards business (if any) and gross of any reinsurance recoveries.

77. Net ultimate loss should be net of reinstatement premiums due on inwards business if any and net of any reinsurance recoveries due on outwards reinsurance or retro contracts (themselves net of any reinstatement premiums payable). Responses should include the benefits from catastrophe bonds, catastrophe swaps, industry loss warranties and other non-traditional risk mitigation transfers.

APPENDIX A- ILLUSTRATION

Losses as calculated by catastrophe models are considered from a number of financial perspectives. The first financial perspective that is calculated is the gross loss. An example of this is the total financial loss to a building, ignoring any terms of an insurance policy. The first financial perspective to consider insurance policy terms is the "ground up loss". This will consider the impact of any deductible, limit and co-insurance that are contractually part of the insurance for an individual insurance policy. Catastrophe models will aggregate the ground up losses from multiple buildings and associated insurance policies that are covered in a portfolio (for example the entirety of an insurance company's book of business) in order to calculate the total losses associated with an event. This is the loss before catastrophe reinsurance.

Reinsurance companies apply various loading factors to address components of loss they anticipate either for contractual reasons (e.g. allocated loss adjustment expense is contractually payable but not modelled by the catastrophe models) or to address their perceived deficiencies in the catastrophe models (e.g. fire following earthquake where this is not modelled). These factors have a non-linear impact on reinsurance losses - so a 10% increase in ground up losses will not necessarily cause a 10% increase in losses to a reinsurance treaty.

Numerical example:

An earthquake causes a gross loss of \$100,000 on a \$1,000,000 building. Given an insurance policy with a 2% deductible this equates to a \$20,000 deductible with \$80,000 being subject to the insurance policy.

Looking at all the policies in the insurer's book of business, the catastrophe model calculates a total loss of \$100M from the earthquake. No losses are calculated for fire following, though these losses are anticipated. A reinsurer might include a 7% load for allocated loss adjustment expense and a 10% load for anticipated fire following losses

(increasing ground up losses by 17.7% in total) resulting in a total ground up estimated loss of \$117.7M.

To illustrate non-linearity, a reinsurer providing cover of \$50M XS \$90M, this cumulative loading of 17.7% may increase its obligation from \$10M to 27.7M or a 177% increase in losses.