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## **2011 Capital and Solvency Return**

### **STRESS/SCENARIO ANALYSIS – CLASS 4, CLASS 3B AND INSURANCE GROUPS**

The Bermuda Monetary Authority (the Authority) is conducting stress/scenario testing and analysis with all Class 4 and Class 3B insurers<sup>1</sup> (insurers), and Bermuda insurance groups (groups) (i.e. groups for which the Authority is the Group Supervisor). All insurers and groups are required to complete this exercise. The results are to be submitted to the Authority with the 2011 year-end Capital and Solvency Return.

The objective of stress testing as part of the 2011 year-end Capital and Solvency Return is to assess the capital adequacy of the insurers and groups under adverse economic and underwriting conditions. More specifically, the purpose of the tests is to assess the impact of the events on a insurer's (legal entity's) / group's statutory balance sheet (statutory admitted assets, admitted liabilities, and capital and surplus) as determined by the insurers' / groups' internal model and/or vendor model(s). Thus, these tests help determine the capacity of insurers / groups to absorb the manifestation of key financial risks, such as shocks to investment performance and the loss profile associated with specific underwriting risks.

#### **General instructions**

*Measurement of impact.* As noted above, the insurer / group is to provide the post stress/scenario positions of the expected impact and effects on both statutory assets and liabilities.

*Accounting treatment.* The insurer / group is to use the accounting standard ordinarily used for statutory reporting so that the pre-stress/scenario statutory capital and surplus can be reconciled to the insurer's / group's 2011 year-end statutory balance sheet.

*Timing of impact.* The stress/scenario impact and effects to be reported are those that would be observed immediately upon the occurrence of the event (stress/scenario) as determined by the insurer's / group's internal or vendor model(s) (both with and without the effect of reinsurance and/or other loss mitigation instruments).

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<sup>1</sup> In this document, the terms “insurer” and “insurers” include “reinsurer” and “reinsurers”, respectively.

*Balance sheet date.* The insurer / group is to run the stress/scenario tests based on its balance sheet position and aggregate in-force exposures as at 1<sup>st</sup> January 2012<sup>2</sup>.

*Vendor and/or internal model descriptions.* To assist the Authority with comparability, the insurer / group is to provide a description of the vendor model(s) used to perform the stress/scenario tests, identifying what model and version was used for each stress/scenario. The acquisition of a vendor package is not an obligation. If the insurer / group does not lease or otherwise use one of the three vendor packages mentioned below, the Authority should be contacted for further direction. Where an internal model is utilised, the description should also include information on the internal model's key assumptions and parameters.

### **A. Economic Scenarios**

The economic stress scenarios comprise capital market-related single factor shocks (equity returns and credit spreads). The calibration of these shocks is informed by an adverse global macroeconomic scenario. In light of continued sovereign risk concerns and its implications for the investment performance of insurers / groups in anticipation of changes in regulatory standards internationally, this round of economic scenarios also includes foreign currency shocks as well as haircuts on sovereign and financial sector debt that exceed the general adversity of widening credit spreads and are specific to particular exposures.

The insurer / group is to quantify the implications of the following separate and distinct impacts upon its statutory balance sheet:

<u>Stress Event</u>	<u>Interpretation</u>
<b>R1.</b> Severe decline in equity prices	Equity prices decline by 40% across the board, i.e. there is no allowance for diversification across the markets (it is assumed that all markets are correlated and the impact is on assets only).
<b>R2.</b> General widening of spreads	Rating class-specific widening of credit spreads based on historical calibration (see Table 1). These shocks assume an increase in default risk consistent with market expectations but not a general shift in the yield curve impacting the valuation of fixed income investments.

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<sup>2</sup> Note: Where the fiscal year does not correspond to the calendar year, in-force exposures on the day following the fiscal year-end should be used rather than 1 January 2012.

**Table 1. Credit spread widening***In basis points (as of end-Oct. 2011, estimated as "through the cycle" adverse scenario)*

Statistical confidence	Rating category					Below BB
	AAA	AA	A	BBB	BB	
95 <sup>th</sup> percentile	81	127	137	199	642	1,152
99 <sup>th</sup> percentile	142	215	224	329	1,030	1,884

Sources: Bloomberg, staff calculations. Note: The adverse scenario ("through-the-cycle") was calibrated to historical price changes of rating-specific baskets of credit default swaps (CDS) with maturity terms of three years. The estimation period covered 1,520 observations between 1 January 2006 and 28 October 2011.

**R3. Combined R1 and R2.****R4. Foreign currency shocks**

Broad-based depreciation of the U.S. dollar according to Table 2.

**Table 2. FX shock parameters***In percent*

USD/EUR	-20	Exchange rates quoted as units of the other currency per one unit of U.S. dollar (USD). An decrease means a depreciation of the U.S. dollar.
USD/JPY	-10	
USD/GBP	-20	
USD/Other non-EM currencies	-15	

**R5. Escalation of European sovereign risk**

Large valuation losses on government and financial sector debt (debt securities and loans) issued by creditors in Belgium, France, Greece, Ireland, Italy, Portugal, and Spain according to Table 3.

**Table 3. Sovereign Debt Haircut (relative to Dec. 31, 2010)***In percent (as of end-Oct., 2011)*

	Time to Maturity				
	<1 year	<2 years	<3 years	<4 years	>4 years
Belgium	14.05	14.22	14.04	13.73	13.35
France	6.51	6.84	7.13	7.18	6.91
Greece	63.54	60.61	59.39	60.07	61.06
Ireland	41.72	39.63	37.55	37.37	36.97
Italy	20.74	20.90	20.68	20.42	19.95
Portugal	43.71	41.77	40.12	39.83	39.92
Spain	23.57	23.55	23.34	23.17	22.81

Sources: Bloomberg, staff calculations. Note: Based on 90th percentile of past price changes of forward contracts on credit default swaps (CDS) with maturity terms between one and five years respectively (since end-2008).

**B. Underwriting Loss Scenarios**

The insurer / group is to run the Lloyd’s developed realistic disaster scenarios (‘RDS’) as specified in Lloyd’s Handbook on “Realistic Disaster Scenarios – Guidance and Instructions” (January 2011) using aggregates in-force at 1<sup>st</sup> January 2012<sup>3</sup>.

Commercially available models do not currently exist for two (2) of the selected RDS. As such, this document provides details on ultimate industry-wide settlement values and insurers / groups are expected to utilise their knowledge of market shares and other pertinent details to arrive at their expected losses. Details of all assumptions and calculations utilised to arrive at final results must be presented.

Certain non-peak perils which do not currently exist in vendor models are included in this document, along with the details of key assumptions.

**1) Vendor Modelled RDS**

Provided the insurer / group has the package(s), it is to use one or more of the three vendor models (RMS, AIR, and/or EQE) to evaluate its expected losses emanating from the specified vendor events identified via the vendor IDs shown below. Due to the upgrades to vendor modelled RDS each year, updated events IDs (if applicable) will be published in February 2012.

All models are to run under the guidelines prescribed in the Lloyd’s 2011 instructions. All lines of business and exposures should be included in the final estimates; any deviations from this requirement should be noted.

The insurer / group is to run all the events from each of the scenario groupings (US Windstorm, US Earthquake, Non-US Windstorm, Non-US Earthquake) below. It should use the underlying loss distribution from its aggregate Net Probable Maximum Loss (submitted in the Bermuda Solvency Capital Requirement (BSCR)) to calculate and submit the corresponding return period (e.g.: 1-in-50 year event, 1-in-100 year event, etc.) of each event. The return period should be submitted with each event from each scenario grouping.

The insurer / group is to include demand surge and storm surge for storm events, and demand surge and fire following for earthquakes.

**a) *US Windstorm***

<u>Event</u>	<u>AIR ID</u>	<u>EQE ID</u>	<u>RMS ID</u>
<b>UW1. Northeast Hurricane</b>	270061930	45257	441305
<b>UW2. Carolinas Hurricane</b>	270215886	38353	440744
<b>UW3. Miami-Dade Hurricane</b>	270205454	29950	443334
<b>UW4. Pinellas Hurricane</b>	270255149	38151	450475
<b>UW5. Gulf Windstorm (onshore)</b>	270159943	7797	444103

<sup>3</sup> Note: Where the fiscal year does not correspond to the calendar year, in-force exposures on the day following the fiscal year-end should be used rather than 1 January 2012.

**b) US Earthquake**

<u>Event</u>	<u>AIR ID</u>	<u>EQE ID</u>	<u>RMS ID</u>
<b>UE1. Los Angeles Earthquake</b>	110018063	5879	2007934
<b>UE2. San Francisco Earthquake</b>	110036355	607	2006214
<b>UE3. New Madrid (NM) RDS</b>	110005938	2832	2081051
<b>UE4. NM Extreme Stress Scenario</b>	110013130	2833	n/a

**c) Non-US Windstorm**

<u>Event</u>	<u>AIR ID</u>	<u>EQE ID</u>	<u>RMS ID</u>
<b>IW1. European Windstorm</b>	410013756	8674	865781
<b>IW2. Japanese Typhoon</b>	620021377	10327 <sup>4</sup>	157359

**d) Non-US Earthquake**

<u>Event</u>	<u>AIR ID</u>	<u>EQE ID</u>	<u>RMS ID</u>
<b>IE1. Japanese Earthquake</b>	520567766	75967	803094

**2) Unmodelled RDS**

**a) AI. Aerospace/Aviation Event**

The insurer / group should assume a collision between two aircrafts over a major city, anywhere in the world, using the insurer's or group's two largest airline exposures.

The insurer / group should assume a total industry loss of up to US\$4 billion, comprising up to US\$2 billion per airline and any balance up to US\$1 billion from a major product manufacturer's product liability policy(ies) and/or traffic control liability policy(ies), where applicable.

Consideration should be given to other exposures on the ground and all assumptions should be stated clearly.

The information should include:

- i.) The city over which the collision occurs;
- ii.) The airlines involved in the collision;
- iii.) Each airline's policy limits and attachment points for each impacted (re)insurance contract (policy);
- iv.) The maximum hull value per aircraft involved;
- v.) The maximum liability value per aircraft involved;
- vi.) The name of each applicable product manufacturer and the applicable contract (policy) limits and attachment points (deductibles); and

<sup>4</sup> Scenario event description: "Vera (1959)"

- vii.) The name of each applicable traffic control authority and the applicable contract (policy) limits and attachment points (deductibles).

In addition, the insurer / group is to use the underlying loss distribution for its aggregate Net Probable Maximum Loss (submitted in the BSCR) to calculate and submit the corresponding return period (e.g. 1-in-50 year event, 1-in-100 year event, etc.) of the loss.

***b) Marine Event***

The insurer / group is to select one scenario from below which would represent its largest expected loss. In addition, the insurer / group is to use the underlying loss distribution from its aggregate Net Probable Maximum Loss (submitted in the BSCR) to calculate and submit the corresponding return period (e.g. 1-in-50 year event, 1-in-100 year event, etc.) of the largest expected loss.

***i) M1. Marine Collision in Prince William Sound***

A fully-laden tanker calling at Prince William Sound is involved in a collision with a cruise vessel carrying 500 passengers and 200 staff and crew. The incident involves the tanker spilling its cargo and loss of lives aboard both vessels.

Assume 70% tanker owner and 30% cruise vessel apportionment of negligence and that the collision occurs in US waters.

Assume that the cost to the tanker and cruise vessel owners of the oil pollution is US\$2 billion. This would lead to oil pollution recoveries on the International Group of P&I Associates' General Excess of Loss Reinsurance Programme of US\$1 billion from the tanker owner and US\$0.55 billion from the cruise owner.

Assume: 1) 125 fatalities with an average compensation of US\$1.5 million for each fatality, 2) 125 persons with serious injuries with an average compensation of US\$2.5 million for each person, and 3) 250 persons with minor injuries with an average compensation of US\$0.5 million for each person.

***ii) M2. Major Cruise Vessel Incident***

A US-owned cruise vessel is sunk or severely damaged with attendant loss of life, bodily injury, trauma and loss of possessions. The claims were to be heard in a Florida court.

Assume: 1) 500 passenger fatalities with an average compensation of US\$2 million, 2) 1,500 injured persons with an average compensation of US\$1 million, and 3) assume an additional Protection and Indemnity loss of US\$500 million to cover costs such as removal of wreck and loss of life and injury to crew.

**3) Unmodelled Non-Peak Perils**

**a) *N1. US Oil Spill***

The insurer / group is to assume an oil spill releasing at least five million barrels of crude oil into the sea. In addition to property, the insurer / group is also to consider in its assumptions the following coverage: business interruption, workers compensation, directors and officers, comprehensive general liability, environmental / pollution liability and other relevant exposures. Assume 1) 15 fatalities, 2) 20 persons with serious injuries, and 3) an estimated insured industry loss of US\$2.1 billion.

All assumptions, including demand surge, should be stated clearly and submitted to the Authority.

**b) *N2. US Tornadoes***

The insurer / group is to assume an EF5 multiple-vortex tornado touching down in several heavily populated cities and towns in the South and Mid West regions of the US. Assume 1) 125 fatalities, 2) 600 persons with mild-to-serious injuries, 3) 20,000 people are displaced and left homeless, 4) 50% to 75% of the 10,000 buildings (commercial, residential and other outbuildings included) have been damaged by the tornado's wind field, and 5) an estimated insured industry loss of US\$5.0 billion. Consideration should be given to the cumulative effect of such a large number of total losses.

All assumptions, including demand surge, should be stated clearly and submitted to the Authority.

**c) *N3. Australian Flooding***

The insurer / group is to assume heavy rainfalls across major cities in Australia causing severe flooding and/or repeated flash flooding. Assume 1) 40 fatalities, 2) 200,000 people are affected and displaced, 3) 190 persons with mild-to-serious injuries, 3) 70% of the 8,500 homes and businesses that are flooded could not be recovered, 4) suspension of all agricultural and mining operations, and 5) an estimated insured industry loss of US\$2.2 billion. The insurer / group is to include landslides following flood.

All assumptions, including demand surge, should be stated clearly and submitted to the Authority.

**d) *N4. Australian Wildfires***

The insurer / group is to assume a series of bushfires during extreme bushfire-weather conditions across Australian states affecting populated areas. Assume 1) 180 fatalities, 2) 500 people with mild-to-serious injuries, 3) displacement of 7,600 people, and 4) destruction of over 5,000 buildings (commercial, residential and other outbuildings included). Assume an estimated insured industry loss of US\$1.3 billion.

All assumptions, including demand surge, should be submitted and stated clearly to the Authority.

### **C. Insurer / Group-Specific Scenario**

The insurer / group is to submit detailed qualitative disclosure of the impact upon both its statutory statement of income and liquidity positions of a ratings downgrade of its Bermuda legal entity or group by two notches or below A-, whichever is lower. The disclosure should cover and provide an indication of the relative impact/severity of collateral requirements, loss payment triggers on in-force policy contracts, claw-backs, and/or other adverse financial and liquidity implications of the downgrade.

Upon reviewing the disclosure, the Authority may request additional information relating to the liquidity impact and potential losses.

### **D. Worst-Case Annual Aggregate Catastrophe Loss Scenario**

The insurer / group is to submit the following:

#### ***1. R3 above and three largest underwriting scenarios***

The aggregate impact of:

- a) An economic scenario which would result simultaneously in the occurrence of R1. and R2. above; and
- b) An aggregation of the three largest net underwriting losses from the above series of UW (US Windstorm), UE (US Earthquake), IW (International Windstorm), IE (International Earthquake), A (Aviation), and M (Marine) loss events.

The underwriting loss events follow in quick succession and there is the inability to engage in capital or other fundraising activities. In addition, an assumption should be made that there is no geographic correlation between these non-economic events. The insurer / group is to disclose its assumptions, including any magnified demand surge, if applicable, from the multiple events.

The insurer / group should use the underlying loss distribution from its aggregate Net Probable Maximum Loss (submitted in the BSCR) to calculate and submit the return period (e.g. 1-in-50 year event, 1-in-100 year event, etc.).

#### **and**

#### ***2. Either series of loss simulations or results of other analysis it performs related to extreme tail events that it would consider a worst case scenario***

##### ***a). Series of loss simulations or results of other analysis performed related to extreme tail events***

The insurer / group is to run a series of loss simulations or other analysis performed related to extreme tail events that include all in-force policies for 1<sup>st</sup> January 2012<sup>5</sup>. The insurer / group is also to submit its underlying assumptions, inter alia, risk measure, return period, and time horizon.

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<sup>5</sup> Note: Where the fiscal year does not correspond to the calendar year, in-force exposures on the day following the fiscal year-end should be used.

The underlying assumptions are to include, but are not limited to, assumptions relating to reinstatement premiums and/or vendor model(s). Where vendor model(s) are used for, and serve as inputs to, the simulation, the insurer / group must disclose the model(s) specifications (e.g. AIR, RMS, EQECAT, proprietary, etc.), model version and assumptions (such as the inclusion or exclusion of demand surge, standard versus near-term, etc.).

***b). Insurer / group specific worst-case scenario***

The insurer / group is to submit a description of its own worst-case annual aggregate loss scenario and the underlying assumptions. Although the scenario could, it does not have to exceed a 1-in-250 year event but rather should be at a level considered extreme but plausible by the insurer / group.

The insurer / group should use the underlying loss distribution from its aggregate Net Probable Maximum Loss (submitted in the BSCR) to calculate and submit the return period (e.g. 1-in-50 year event, 1-in-100 year event, etc.).

**E. Catastrophe Loss Event Analysis**

The insurer / group is to submit the following arising from Hurricanes Gustav and Ike (both gross and net):

- Total statutory property catastrophe premium exposed to Atlantic Basin hurricane
- Total of all other premium exposed to Atlantic Basin hurricane
- Initial estimate of ultimate loss
- Latest estimate of ultimate loss
- Estimate from the insurer’s or group’s catastrophe model of loss should this event reoccur with exposures as at 1<sup>st</sup> January 2012
- Estimate from the insurer’s or group’s catastrophe model of industry loss should the event reoccur as at 1<sup>st</sup> January 2012

<u>Event</u>	<u>AIR ID</u>	<u>EQE ID</u>	<u>RMS ID</u>
<b>Gustav</b>	270177143	128026	2848401
<b>Ike</b>	270208840	128025	2848403

Details of all assumptions and calculations utilised to arrive at final results in relation to recurrence of the event must be presented. Insurers / groups are encouraged to consult the Authority’s Catastrophe Return Guidance Note for additional guidance.

**F. Terrorism**

The insurer / group is to submit the estimated top ten losses in descending order arising from explosion of a two tonne bomb based upon policies in-force at 1<sup>st</sup> January 2012, including the vendor or internal model description, and vendor model version, if applicable. For each of the projections, provide the following:

- State/province

- Country
- Total gross loss estimate
- TRIP or other recoverable if any
- Reinsurance recoveries if any
- Total net loss estimate
- Target location if known

Details of all assumptions and calculations utilised to arrive at final results must be presented. The insurer / group is encouraged to consult the Authority's Catastrophe Return Guidance Note for additional guiding principles in relation to terrorism.

#### **G. Other Scenarios**

Where the underwriting scenarios under B above either do not apply or partially apply to the insurer / group resulting in de minimis loss projections, the insurer / group should submit to the Authority three of its own underwriting scenarios and also use these in the calculation for D1. The insurer / group is to submit the following for each of the three scenarios:

- a) Description of the scenarios and related key assumptions;
- b) The post stress/scenario positions on aggregate statutory assets and statutory liabilities that would be observed immediately upon the occurrence of the event (stress/scenario) (both with and without the effect of reinsurance and/or other loss mitigation instruments); and
- c) The return period (e.g. 1-in-50 year event, 1-in-100 year event, etc.) calculated using the underlying loss distribution from its aggregate Net Probable Maximum Loss (submitted in the BSCR).

**NOTE: The Authority may advise whether it deems the scenarios to be appropriate (e.g. extreme enough based upon the characteristics of the insurer's or group's business) and either request amendments to assumptions or that alternative scenarios are to be submitted.**