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ACTUARIAL GUIDANCE NOTE

AGN 7 DYNAMIC SOLVENCY TESTING

Introduction

This Actuarial Guidance Note comprises two parts – Requirements (Part I) and Explanatory guidelines (Part II).

With effect from 31 December 2011, the previous AGN 7 on Dynamic Solvency Testing (effective from 2005) shall be cancelled, and this Actuarial Guidance Note shall come into force.

Part I –Requirements

1. Scope

This guidance note applies to the Appointed Actuary (the "Actuary") of an Insurer (the "Insurer") when preparing a Dynamic Solvency Testing Report on the Insurer's financial condition for the Board of Directors. This Actuarial Guidance Note applies to the Long Term business written in or from Hong Kong.

2. Investigation

2.1 Subject to the explanatory guidelines provided in Part II, the Actuary must make an annual investigation of the Insurer's projected financial position and condition of the Long Term business.

2.2 The Actuary must make a report of each investigation in writing to the Insurer's Board of Directors. The report must identify any threats to satisfactory financial condition that the investigation reveals and possible actions for dealing with these threats.

2.3 The Actuary should also conduct an interim investigation if there is a material adverse change in the Insurer's circumstances.

2.4 The Actuary must specifically highlight any area where the Actuary gives advice which is not consistent with this guidance note. Adequate records must be kept to justify any departure from the guidance note.

3. Method

3.1 Current Financial Position

The report must include an outline of the current financial position and underlying valuation basis, including special reserves.

There must be a discussion of the difference between the current position and the position projected in the base scenario in the previous year's report.

3.2 Dynamic Solvency Testing

3.2.1 Dynamic Solvency Testing ("Solvency Testing") examines the effect of various plausible adverse scenarios on the Insurer's projected capital adequacy. It is one of the Actuary's primary tools for investigating an Insurer's financial condition.

3.2.2 The purpose of Solvency Testing is to identify:

- the capital adequacy position of an Insurer on an ongoing concern basis;
- plausible threats to the Insurer's future financial position;
- actions which lessen the likelihood of those threats; and
- actions which would mitigate the impact of a threat if it materialized.

3.2.3 Solvency Testing is defensive, i.e. it addresses threats to financial condition rather than the exploitation of opportunity.

3.3 Satisfactory Financial Condition

The Insurer's financial condition is satisfactory if:

- under the base scenario, it meets the minimum regulatory capital requirement throughout the forecast period, i.e. being solvent; and
- under all the tested prescribed and plausible adverse scenarios, the Insurer's assets exceed liabilities throughout the forecast period, i.e. being capital adequate.

3.4 Forecast Period

Solvency Testing results must be reported for every year-end throughout the forecast period, with the forecast period beginning at the most recent financial year-end balance sheet date. The forecast period for a typical life Insurer would be three financial years. The forecast period should be extended to five financial years if there is reasonable indication that a capital adequacy problem is likely to occur after three financial years. In addition, actual capital positions for the two years immediately preceding the forecast period must be presented.

3.5 Scenarios

The scenarios consist of a base scenario, 6 prescribed simple scenarios and at least three compound scenarios. Each scenario takes into account:

- not only inforce policies but also the policies assumed to be sold during the forecast period; and
- the events and/or business operations that may adversely impact the financial condition of the long term business.

3.6 Base Scenario

The base scenario is a realistic set of assumptions used to forecast the Insurer's financial position over the forecast period. Normally, the base scenario is consistent with the Insurer's business plan.

If the business plan is completed before the reporting date, the Actuary should allow for any material differences between the actual position of the Insurer at the reporting date, and the position projected in the business plan. The Actuary would normally accept the business plan's assumptions for use in the base scenario, unless these assumptions are inconsistent or unrealistic enough to potentially result in misleading figures being reported. However, if there is any new information available at the time the Solvency Testing is conducted, the information may be included in the base scenario. The Actuary should report any material inconsistency between the base scenario and the business plan.

The Actuary should ensure that:

1. the projections are comprehensive in scope, covering all key products and lines of business, and all assets that are material to the solvency of the Insurer;
2. separate projections are made for each insurance fund established and maintained by the Insurer;
3. in circumstances where the assets or liabilities of an insurance fund (that are material to solvency) have different inherent characteristics, there are separate projections by major product line and asset class within the insurance fund; and
4. adequate checks are conducted on the appropriateness of any data or projections that form the basis for the Solvency Testing report.

3.7 Prescribed Scenarios

3.7.1 Simple Scenarios

The Actuary must test the following six simple scenarios.

A. Throughout the forecast period, allow for:
   - 15% deterioration in mortality rates for life business / endowment business;
   - 15% deterioration in morbidity rates;
   - 15% increase in incidence rates for disability, accident and sickness; and
   - 15% improvement in mortality for annuity business.

B. Throughout the forecast period, allow for an increase or decrease in lapse rates of 5%, depending on which alternative produces the most adverse results, by product.

C. Throughout the forecast period, (and commencing immediately after the valuation date) allow for:
   - interest rates to be set to 85% of the rates projected in the base scenario; and
   - equity and real estate market values fall by 25% in the first year, and thereafter grow at the same rate as the base scenario.

   Any fixed-income assets, such as bond and mortgage, must be re-valued to reflect consequent changes in values as appropriate under the Insurer's accounting policy. If the liabilities' valuation interest rates are changed then this needs to be stated.

D. Throughout the forecast period, (and commencing immediately after the valuation date) allow for:
   - interest rates to be set to 130% of the rates projected in the base scenario, or at the base scenario rates plus 2% if greater; and
   - equity and real estate market values fall by 25% in the first year, and thereafter grow at the same rate as the base scenario.

   Any fixed-income assets, such as bond and mortgage, must be re-valued to reflect consequent changes in values as appropriate under the Insurer's accounting policy. If the liabilities' valuation interest rates are changed then this needs to be stated.

E. High growth throughout the forecast period, with growth rate being 30%, or 150% of plan growth rate if higher, and with a reasonable increase in expenses, consistent with the higher growth.

F. Low growth throughout the forecast period, with year 1 sales being 80% of current year, followed by 20% drop for years 2 and 3, without any saving in expenses other than commission and commission-related expenses that are directly related to the new sales volume.

3.8 Plausible Adverse Scenarios

3.8.1 Compound Scenarios

In addition to the six prescribed scenarios above, the Actuary must test at least three short-term or medium-term compound scenarios.

There are three example scenarios listed in Explanatory Guidelines (Item G, H and I). The Actuary may substitute alternative compound scenarios that are more relevant to the Insurer.

3.8.2 Additional plausible adverse scenarios

The Actuary should consider testing additional plausible adverse scenarios where

each additional scenario contains a number of plausible adverse assumptions about matters to which the Insurer's financial condition is sensitive. Plausible adverse scenarios vary among Insurers and may vary over time for a particular Insurer. In many cases, plausible adverse scenarios are associated with a low probability of occurrence, but the potential financial impact could be severe.

3.9 Ripple Effects

The Actuary must consider "ripple" effects. Although most of the other assumptions used in the base scenario may remain appropriate in the prescribed and plausible adverse scenarios, some may need adjustments to reflect the interdependence of assumptions in the plausible adverse scenarios , for a more internal consistent set of assumptions. The possible actions to be initiated by the external bodies have been provided in the relevant section in Part II, while a list of items to be considered for assumptions adjustment has also been provided in Appendix 2 of Part II.

3.10 Scope of the Investigation and Report

3.10.1. The report must contain the key assumptions of the base scenario, the six simple scenarios, and the three or more other adverse scenarios posing the greatest risks to the satisfactory financial condition of the Insurer. The report must also include comments on major risks faced by the Insurer. The meaning of satisfactory financial condition is defined in paragraph 3.3 of this guidance note.

3.10.2. The report must also state which of the plausible adverse scenarios examined would cause the Insurer to fall below the minimum regulatory capital requirement. Even though the Actuary may have signed a satisfactory financial condition opinion, the report must make it clear that under these scenarios the regulators may impose restrictions on the operations of the Insurer, including its ability to write new business.

3.10.3. For each of the plausible adverse scenarios reported upon, the Actuary must also report the results without the effect of any extraordinary management action and without the effect of any regulatory action.

3.10.4. The Actuary should consider the effects of the Insurer's valuation and accounting bases, including any taxation impacts, and these should be included in the testing and reporting.

3.10.5. If the investigation identifies any plausible threat to satisfactory financial condition, then the Actuary must identify potential management action which would lessen the likelihood of that threat, or which would mitigate that threat, if it materialized.

3.11 Revaluation of the Assets

Invested assets whose value depends on interest rates must be revalued throughout the forecast period, in accordance with changing interest rates in each scenario.

3.12 Revaluation of the Policy Liabilities

Ideally, for each adverse scenario, the policy liabilities and the minimum regulatory capital requirement should be revalued throughout the forecast period in order to be consistent with the projected assumptions at each point of time in each scenario. Revaluation only at the end of the forecast period may be a suitable compromise, provided the Actuary is confident, given the projected position at the end of the forecast period in that scenario, that the Insurer's assets would exceed its liabilities throughout the forecast period if revaluation were performed every year. Existing revaluation practice of the Insurer should be considered.

3.13 Interim Investigation

In rare cases, a material adverse change in the Insurer's circumstances since the last annual investigation may be so far reaching that to delay reporting Solvency Testing results to the time of the next annual investigation would be imprudent. For example, failure to meet the minimum applicable regulatory capital requirement, or adoption of a radically different business plan, may trigger the need for an immediate report . In such a case, the Actuary should undertake and report an interim investigation.

4. Reporting

4.1 The Actuary must submit the report to the Board of Directors.

4.2 In order to give the Insurer's management an opportunity to react to the results of the investigation, the Actuary would normally discuss the report with the Insurer's senior management in advance of its submission.

4.3 An interpretative report is more useful than a statistical report.

4.4 The timing of the report depends on the urgency of the matters reported, and on the desirability of integrating Solvency Testing into the Insurer's annual financial planning cycle. The annual report in writing must be completed and available to the Board within 6 months of each financial year-end. The report should take into account post-valuation date events, if significant.

5. Opinion

5.1 The report must contain an opinion signed by the Actuary. The purpose of the opinion is to report on the financial condition of the Insurer.

5.2 The wording of the opinion follows: (insert appropriate wording where indicated by [square brackets])

"I have completed my annual investigation of the financial condition of [company name]

as at [date] in accordance with accepted actuarial practice.

I have analyzed the projected financial positions of the company during the [number] year projection period under a series of scenarios. A description of these scenarios and their impact on the company is included within this report.

The analysis incorporates assumptions relating to business growth, investments, [mortality, morbidity, claims frequency, capital injections, other policy-related experience] and other internal and external conditions during the forecast period, as well as potential management responses to various plausible adverse scenarios. The most significant assumptions are described within this report.

In my opinion, the financial condition of the company [is satisfactory under these assumptions or is not satisfactory for the following reasons...]. The term "satisfactory financial condition" in this report means that throughout the forecast period, the company's assets exceed the liabilities under all tested prescribed and plausible adverse scenarios, and meets the minimum regulatory capital requirement under the base scenario.

"I have complied with Actuarial Guidance Note 7 on Dynamic Solvency Testing issued by the Actuarial Society of Hong Kong in carrying out this investigation for the company."

OR

"I have complied with Actuarial Guidance Note 7 on Dynamic Solvency Testing issued by the Actuarial Society of Hong Kong in carrying out this investigation for the company except with the deviations as set out below: [.....]"

[signature of Actuary]

[typed name of Actuary]

[report date]"

5.3 If the Insurer's financial condition is deemed unsatisfactory, the Actuary must report an unsatisfactory opinion.

The Actuary must also report any plausible adverse scenarios that cause the Insurer to fall below the minimum regulatory capital requirement. Even though the Actuary may have signed a satisfactory financial condition opinion, the report must make it clear to the board that the Insurer might be prevented from writing new business by the regulators under these scenarios in the absence of capital enhancements.

***** END OF ACTUARIAL GUIDANCE NOTE – Part I *****

Part II – Explanatory Guidelines

1. General

Scope

For avoidance of doubt, this Actuarial Guidance Note will apply to the Long Term business of an Insurer if it is incorporated in Hong Kong. For an Insurer incorporated outside Hong Kong, this Actuarial Guidance Note will apply to the Long Term business written through its establishment in Hong Kong.

Although this Actuarial Guidance Note does not apply to the General business of an Insurer, the net assets of General business could be used to help meeting the capital adequacy requirements. All assets would be subject to the effects of the asset shocks in each scenario.

In some cases, business lines of an Insurer may be excluded from Dynamic Solvency Testing:

1. business lines that the Actuary considers to be immaterial;
2. business lines with capital levels so high that there is no plausible threat to capital adequacy.

In such cases, the Actuary must describe the standard of materiality in the report, and discuss it with the Insurer's management

Actuary

Actuary refers to the Actuary appointed under "INSURANCE COMPANIES ORDINANCE - CHAPTER 41 SECTION 15 Appointment of auditor and actuary PART III (1) (b)" or any subsequent amendment or replacement legislation.

"if the insurer carries on long term business, an actuary possessing the prescribed qualifications or who is acceptable to the Insurance Authority, as actuary to the insurer, and whenever any such appointment comes to an end the insurer shall as soon as practicable make a fresh appointment."

2. Base Scenario

In the construction of a base scenario, the following specifications or definitions must be provided:

- Dividend: any management action taken on dividend such as policyholders' dividend must be specified in the report
- Yield curve: if the interest rate in the base scenario is inconsistent with both the current level of the yield curve and the forward rates implied by the current yield curve, this should be stated by the Actuary
- Investment return for a bond portfolio: yield for a bond portfolio should be expressed consistently with the accounting basis of the Insurer and be after investment expenses
- Equity and real estate value: the value must be consistent with the accounting basis of the Insurer for assets, such as reported on marked-to-market basis or as amortized book value.

3. Prescribed Scenarios

In addition to the descriptions of the six scenarios in Part I, the Actuary should take note of the application and timing of shocks, as well as potential ripple effects to be considered, as described below:

A. Scenario with mortality and morbidity risks

Statement:

"*Throughout the forecast period, allow for:*

- *15% deterioration in mortality rates for life business / endowment business;*
- *15% deterioration in morbidity rates;*
- *15% increase in incidence rates for disability, accident and sickness; and*
- *15% improvement in mortality for annuity business.*

Description:

For life business, the adjusted mortality rate is calculated as:

$$q'_{x+t} = q_{x+t} * (1 + 15\%) \text{ for all } t>=0, \; 0 \leq q'_{x+t} \leq 1$$

where q'_{x+t} is the adjusted mortality rate, q_{x+t} is the original mortality rate, with x denoting the issue age and t denoting the policy year. For example, a mortality rate of 0.1 may become (0.1*1.15) for all the years in the forecast period.

For endowment business,

if it is pure endowment, the adjusted mortality rate is calculated by:

$$q'_{x+t} = q_{x+t} * (1 - 15\%) \text{ for all } t>=0, \; 0 \leq q'_{x+t} \leq 1$$

if it is a combination of life / endowment, the adjusted mortality rate is calculated by:

$$q'_{x+t} = q_{x+t} * (1 + 15\%) \text{ for all } t>=0; \text{ or}$$

$$q'_{x+t} = q_{x+t} * (1 - 15\%) \text{ for all } t>=0; \; 0 \leq q'_{x+t} \leq 1$$

depends on whether increase or decrease of 15% produces deteriorating results at the end of the forecast period.

where q'_{x+t} is the new adjusted mortality rate, q_{x+t} is the original mortality rate, with x denoting the issue age and t denoting the policy year.

For disability, accident and sickness, the adjusted morbidity rate or adverse incidence rate is calculated by:
$d'_{x+t} = d_{x+t} * (1 + 15\%)$ for all t>=0, $0 \leq d'_{x+t} \leq 1$where d'_{x+t} is the new adjusted morbidity rate or adverse incidence rate, d_{x+t} is the original morbidity rate or incidence rate, with x denoting the issue age and t denoting the policy year. Please note that this would be the minimum level by assuming no further deterioration in the recovery or termination rate, but if the impact is significant from those deteriorations, the Actuary should also reflect those into the scenarios appropriately.

For annuity business, the adjusted mortality rate is calculated by:
$q'_{x+t} = q_{x+t} * (1 - 15\%)$ for all t>=0, $0 \leq q'_{x+t} \leq 1$where q'_{x+t} is the new adjusted mortality rate, q_{x+t} is the original mortality rate, with x denoting the issue age and t denoting the policy year.

B. Scenario with persistency risks

Statement:
"Throughout the forecast period, allow for an increase or decrease in lapse rates of 5%, depending on which alternative produces the most adverse results, by product.

Description:
For each specific product, the Actuary should first determine whether addition or subtraction of 5% lapse rate produces deteriorating results at the end of the forecast period. This addition or subtraction is subject to the normal limit of 0% or 100%. For example, a 3% lapse rate may become 8% or 0%."

If addition produced deteriorating results, adverse lapse rate is calculated by:

$$w'_{x+t} = w_{x+t} + 5\% \text{ for all } t>=0, \text{ subject to } [0\% , 100\%]$$

where w'_{x+t} is the new adverse lapse rate in percentage, w_{x+t} is the original lapse rate in percentage, with x denoting the issue age and t denoting the projection year. For example, a 3% lapse rate may become 8% for all the years in the forecast period.

Else if subtraction produced deteriorating results, adverse lapse rate is calculated by:

$$w'_{x+t} = w_{x+t} - 5\% \text{ for all } t>=0, \text{ subject to } [0\% , 100\%]$$

where w'_{x+t} is the new adverse lapse rate in percentage, w_{x+t} is the original lapse rate in percentage, with x denoting the issue age and t denoting the projection year.

C. Scenario with drop in interest rates

Statement:
" Throughout the forecast period, (and commencing immediately after the valuation

date) allow for:

- *interest rates to be set to 85% of the rates projected in the base scenario; and*
- *equity and real estate market values fall by 25% in the first year, and thereafter grow at the same rate as the base scenario.*

Any fixed-income assets, such as bond and mortgage, must be re-valued to reflect consequent changes in values, as appropriate under the Insurer's accounting policy. If the liabilities' valuation interest rates are changed then this needs to be stated. "

Description:

The interest rates refer to the prevailing yields of the fixed-income assets, if market values are being reported as the assets value under the Insurer's accounting policy. If amortized book values are being reported, then the prevailing yields should only be applied for the new money, while the existing assets portfolio should have their yields remain unchanged.

The adjusted interest rate should be consistent with:

$i'_t = i_t * 85\%$ for all $t>0$

where i'_t is the adjusted interest rate, i_t is the interest rate in the base scenario, with t denoting the projection year. For example, a 5% interest rate may become (5%*85%) for all the years in the forecast period. The adjusted interest rates are to be applied to the base scenario assumptions at or immediately after the start of the forecast period, and persist throughout the forecast period.

The adverse equity and real estate value should be consistent with:

$V'_1 = V_0 * 75\%$

$V'_t = V'_{t-1} * (V_t / V_{t-1})$ for all $t>1$

where V'_t is the new equity and real estate value, with t denoting projection year. The deterioration of equity and real estate value is thus assumed to occur sometime during the first projection year, and the assets are subject to growth consistent with the base scenario after the end of the first year. For example, if the original equity and real estate value is 100 units, and the base scenario growth rate is 10% throughout the forecast projection period, then the adverse equity and real estate value is (100*75%), (100*75%*110%), (100*75%*110%*110%) in year 1, 2 and 3 respectively of the forecast period.

The equity and real estate value should be consistent with the accounting basis of the Insurer for assets, such as reported on marked-to-market basis or amortized book value. This is to test the matching between assets and liabilities under different interest sensitivities.

Dividend yields should be determined according to the best estimate of the Actuary in light of the emerging investment return.

Given that resilience reserves and reserve provisions for Class G Long Term Business determined under GN7 are also established to protect against adverse investment scenarios, the Actuary should consider adjusting projected resilience reserves and GN7 reserves in this scenario, to ensure a proper provision for the same risk.

The Actuary should disclose in a statement whether such reserves adjustments have been

made in this scenario. Please note that such adjustments should only be considered for the investment scenarios in this AGN.

D. Scenario with rise of interest rates

Statement:
"Throughout the forecast period, (and commencing immediately after the valuation date) allow for:

- *interest rates to be set to 130% of the rates projected in the base scenario, or at the base scenario rates plus 2% if greater; and*
- *equity and real estate market values fall by 25% in the first year, and thereafter grow at the same rate as the base scenario.*

Any fixed-income assets, such as bond and mortgage, should be re-valued to reflect consequent changes in values, as appropriate under the Insurer's accounting policy. *If the liabilities' valuation interest rates are changed then this needs to be stated."*

Description:
The interest rates refer to the prevailing yields of the fixed income assets, if market values are being reported as the assets value under the Insurer's accounting policy. If amortized book values are being reported, then the prevailing yields should only be applied for the new money, while the existing assets portfolio should have their yields remain unchanged.

The adjusted interest rate should be consistent with:

$$i'_t = \max(i_t + 2\% , i_t * (1 + 30\%)) \text{ for all } t>0$$

where i'_t is the adjusted interest rate, i_t is the interest rate in the base scenario, with t denoting the projection year. The adjusted interest rates are to be applied to the base scenario assumptions at or immediately after the start of the forecast period, and persist throughout the forecast period. For example, a 5% interest rate may become max[5%+2%, (5%*130%)] (i.e. 7%) for all the years in the forecast period.

The adverse equity and real estate value is calculated in the same way as for the scenario with a fall in interest rates, described above in (c).

The equity and real estate value must be consistent with the accounting basis of the Insurer for assets, such as reported on marked-to-market basis or amortized book value. This is to test the matching between assets and liabilities under different interest sensitivities.

Dividend yields should be determined according to the best estimate of the Actuary in light of the emerging investment return.

Given that resilience reserves and reserve provisions for Class G Long Term Business determined under GN7 are also established to protect against adverse investment scenarios, the Actuary should consider adjusting projected resilience reserves and GN7 reserves in this scenario, to ensure a proper provision for the same risk.

The Actuary should disclose in a statement whether such reserves adjustments have been made in this scenario. Please note that such adjustments should only be considered for the investment scenarios in this AGN.

E. Scenario with high growth

Statement:
"High growth throughout the forecast period, with growth rate being 30%, or 150% of plan growth rate if higher, and with a reasonable increase in expenses, consistent with the higher growth."

Description:
The adjusted growth rate per year is calculated by:

max (30%, 150% of plan growth rate)

where adjusted growth rate should be defined at the company level.

This adjusted growth rate is then applied to sales:

$Sales_{t+1} = Sales_t * (1 + \text{adjusted growth rate per year})$ for t = 0, 1, 2, 3

where t denotes current year or forecast year.

The adjusted growth is to be applied on a yearly basis. First apply to the base scenario assumptions at the start of the projection year and persist throughout the year, then for the remaining years, apply similarly to the adjusted sales. Here is an example:

	Actual	Forecast period		
	Current year	Year 1	Year 2	Year 3
Plan sales (in units)	100	110	140	170
Plan growth rate		10.00%	27.27%	21.43%
150% plan growth rate		15.00%	40.91%	32.14%
Adjusted growth rate		30.00%	40.91%	32.14%
Adjusted sales (in units)		130	155	185

F. Scenario with low growth

Statement:
"Low growth throughout the forecast period, with year 1 sales being 80% of current year, followed by 20% drop for years 2 and 3, without any saving in expenses other than commission and commission-related expenses that are directly related to the new sales volume."

Description:
Adjusted growth rate per year = - 20%

where adjusted growth rate should be defined at the company level.

This adjusted growth rate is then applied to sales:

$Sales_{t+1} = Sales_t * (1 + \text{adjusted growth rate per year})$ for t = 0, 1, 2, 3

where t denotes current year or forecast year.

The adjusted growth is to be applied on a yearly basis. First apply to the base scenario assumptions at the start of the projection year and persist throughout the year, then for the remaining years, apply similarly to the adjusted sales. For example, if the actual sales of current year is in 100 units, then the adjusted sales are (100*80%), (100*80%*80%), (100*80%*80%*80%) for year 1, 2 and 3 respectively in the forecast period.

4. Plausible Adverse Scenarios

The Actuary should take note of the application and timing of shocks, as well as potential ripple effects to be considered.

Given that resilience reserves and reserve provisions for Class G Long Term Business determined under GN7 are also established to protect against adverse investment scenarios, the Actuary should consider adjusting projected resilience reserves and GN7 reserves in this scenario, to ensure a proper provision for the same risk.

The Actuary should disclose in a statement whether such reserves adjustments have been made in this scenario. Please note that such adjustments should only be considered for the investment scenarios in this AGN.

Example compound scenarios

The following scenarios are examples only, and may be substituted by alternative compound scenarios that are more relevant to the Insurer.

G. One year short-term shock scenario associated with epidemic outbreak:

(a) 15% deterioration in mortality rates in year 1, but with the same mortality rates as the base scenario in later years;
(b) 25% drop in equity and real estate in year 1, but with the same growth rates as the base scenario in later years;
(c) low growth, with year 1 sales being 80% of current year or 80% of projected plan sales, if lower, but with the same growth rates as the base scenario in later years;
(d) 5% addition or reduction of lapse rates over the forecast period, with the alternative producing the most adverse impact to be used; but with the same lapse rates as the base scenario in later years;

Description:

- "15% deterioration in mortality rates in year 1";
  The adjusted mortality rate is calculated by:

$$q'_{x+t} = q_{x+t} * (1 + 15\%) \text{ for all } t>=0$$

  where q'_{x+t} is the adjusted mortality rate, q_{x+t} is the original mortality rate, with x denoting the issue age and t denoting the policy year. For example, a mortality

rate of 0.1 may become (0.1*1.15) for all the years in the forecast period.

- "25% drop in equity and real estate in year 1";
  Projected equity and real estate values are calculated in the same was as described in the simple "Scenario with rise of interest rates".

- "low growth, with year 1 sales being 80% of current year or 80% of projected plan sales, if lower";
  In year 1, adjusted growth rate of -20% is applied to sales:
  $$\text{Year 1 sales} = \text{current sales} * (1 - 20\%)$$
  Sales in later years of the forecast period would follow the plan growth rate.

- "5% addition or reduction of lapse rates over the forecast period, with the alternative producing the most adverse impact to be used."
  Calculation of the adverse lapse rates are calculated in the same way as described in the simple "Scenario with persistency risks".

H. Medium-term inflationary scenario:

(a) Interest rates (new money yield) 4% p.a. higher than base assumptions throughout the forecast period, commencing immediately after the valuation date;
(b) Inflation 4% p.a. higher than base assumptions throughout the forecast period, commencing immediately after the valuation date;
(c) Dividend rates may be forced up in the light of the emerging investment return;
(d) Switch of new sales to products that reflect the increased new money rates better than the traditional products, or alternatively, if no new products being assumed, a reduced level of new sales should be assumed instead;
(e) 25% drop in equity and real estate market values in the first two years, with base scenario growth rate on these asset values in the remaining forecast period.

Description:

- "Interest rates (new money yield) 4% p.a. higher than base assumptions throughout the forecast period, commencing immediately after the valuation date";

  The adjusted interest rate is calculated by:
  $$i'_t = i_t + 4\% \text{ for all } t>=0$$
  where i'_t is the adjusted interest rate, i_t is the original interest rate, with t denoting projection year. The adjusted interest rates are to be applied to the base scenario assumptions immediately after the start of the forecast period, and continue to apply on a yearly basis throughout the forecast period. For example, a 5% interest rate may become (5%+4%=9%).

- "Inflation 4% p.a. higher than base assumptions throughout the forecast period, commencing immediately after the valuation date";
  The adjusted inflation rate is calculated by:
  $$r'_t = r_t + 4\% \text{ for all } t>=0$$

where r'_t is the adjusted inflation rate, r_t is the original inflation rate, with t denoting projection year. The adjusted inflation rates are to be applied to the base scenario assumptions immediately after the start of the forecast period, and continue to apply on a yearly basis throughout the forecast period. For example, a 3% inflation rate may become (3%+4%=7%) throughout the forecast period.

- "25% drop in equity and real estate market values in the first two years, with base scenario growth rate on these asset values in the remaining forecast period".

  The deterioration of equity and real estate value may be assumed to occur sometime during the first 2 projection years, and subject to growth (if any) for the remaining forecast period. For example, if the original equity and real estate value is in 100 units, and the growth rate in the base scenario is 10% throughout the forecast projection period, then the adverse equity and real estate value is (100*75%) by the end of year 2, and recover to (100*75%*110%) in year 3 and similarly in remaining years of the forecast period.

  The equity and real estate value must be consistent with the accounting basis of the Insurer for assets, such as reported on marked-to-market basis or amortized book value. This is to test the matching between assets and liabilities under different interest sensitivities.

I. Medium-term deflationary scenario:

(a) Short-term interest rates of new money yield drop by 50% in total over the course of the first 3 years in the forecast period;
(b) Inflation rate decreases to base scenario rate less 4% for every year in the forecast period;
(c) Dividend rates may go down consistently in the light of the emerging investment return;
(d) 25% drop in equity and real estate in total over the first 2 years, then remain stable in year 3 and thereafter;
(e) Bond default rates to double (over those assumed in the base scenario);
(f) Prepayments of mortgages are doubled.
(g) 10% deterioration in foreign exchange rates in year 1, on the currencies unmatched portion of assets or liabilities, and then the foreign exchange rates remain unchanged in the later years.

Description:

- "Short-term interest rates of new money yield drop by 50% in total over the course of the first 3 years in the forecast period";

  The change in short-term interest rates may be assumed to occur sometime during the first 2 projection yeas. For example, if the original short-term interest rate is 5%, it may drop to (5% * 50%) by the end of year 2, then remain stable in year 3 and thereafter.

- "Inflation rate decreases to base scenario rate less 4% for every year in the forecast period";

The adjusted inflation rate is calculated by:

$$r'_t = r_t - 4\% \text{ for all } t>=0$$

where r'_t is the adjusted inflation rate, r_t is the original inflation rate, with t denoting projection year. The adjusted inflation rate is to be applied to the base scenario assumptions immediately after the start of the forecast period, and continue to apply on a yearly basis throughout the forecast period. For example, a 3% inflation rate may become (3% – 4% = -1%).

- "25% drop in equity and real estate in total over the first 2 years, then remain stable in year 3 and thereafter";
  For example, if the original equity and real estate value is in 100, it may drop to (100 * 25%) by the end of year 2, then remain stable in year 3 and thereafter;

- For the unmatched currencies portion of assets and liabilities, a 10% deterioration would be either a 10% depreciation in the unmatched portion of assets or a 10% appreciation in the unmatched portion of liabilities, including the unmatched portion on pegged currencies. Any impact from the derivatives on currency and any possible future depreciation on the unpegged currencies should also been taken into account.

Other notes on the Scenarios

The Actuary must consider the six prescribed simple scenarios and at least three compound scenarios such as those shown above or others more relevant to the Insurer. The Actuary must determine the sensitivity of the Insurer's capital adequacy to each risk. As a minimum, in addition to the base scenario, the nine scenarios described above must be tested independently and reported annually.

To help the Actuary determine if a risk is material and plausible, it may be useful to stress test the capital adequacy of the Insurer. The Actuary might determine how much a base scenario assumption needs to be changed before an adverse scenario gives rise to an unsatisfactory financial condition. The Actuary can then judge whether a plausible risk or event exists for the Insurer over the forecast period.

In many cases, plausible adverse scenarios are associated with a low probability of occurrence but the potential financial impact could be severe. In such cases, it is usually not necessary for the Actuary to construct integrated scenarios by combining two or more low probability adverse scenarios.

In some cases, however, the probability associated with a plausible adverse scenario may be close to the probability associated with the base scenario. For example, a significant asset on the balance sheet may be showing early signs of distress. In such cases, an integrated scenario would be constructed by combining each more probable adverse scenario, with a low probability adverse scenario. The low probability adverse scenario selected would be the one that has the greatest effect on the Insurer's financial condition

and is plausible when combined with the more probable adverse scenario.

The resulting plausible scenarios would be expected to have a financial outcome more adverse than the worst prescribed scenarios. Where the actuary has chosen plausible scenarios which have a financial result less adverse than the prescribed scenarios the actuary should explicitly state that, in the Actuary's opinion, no plausible scenario has an outcome which is more financially adverse than the worst prescribed scenario. In this case the actuary should also present the results of the capital adequacy "stress testing" described above.

5. Ripple Effects

Ripple effects include both regulatory action and policyholder action especially under any plausible adverse scenario where the Insurer fails to meet the minimum regulatory capital requirement. In considering plausible risks and ripple effects, the Actuary needs to determine the best estimate assumptions. Below are some guidelines for some of the possible assumptions to take note of:

5.1 Assumed capital enhancements

There will be some situations where capital enhancements are a basic part of a Insurer's business plan. This should not be a cause for the Actuary to not be able to sign the satisfactory opinion. However, the Actuary should be satisfied with the intent of the entity making the injection, and that such injections are within the means of that entity. The Actuary must clearly report the projected future capital injections in the base scenario.

For testing adverse scenarios essentially out of the control of management, it is appropriate then not to assume any additional capital from outside, beyond that called for in the business plan and base scenario. If the satisfactory financial position in a test relies on additional capital being available to the company over and above what is assumed in the business plan, this must be stated and has it communicated explicitly in the report to the Board of Directors.

5.2 Assumed management action

As part of projecting future financial positions, the Insurer's expected response to adversity can be taken into account. Selection of the assumptions for each response should at least take into consideration the following items:

- the effectiveness of the Insurer's management information systems;
- the Insurer's historical record of promptness and willingness to make difficult decisions, when faced with adversity; and
- the external environment assumed in the scenario.

In accordance with the standard of practice and in order not to present a misleading picture, clear reporting of assumed management action is essential. The Actuary must

report the assumed response, so that users of the report may consider its practicality and adequacy. Also, for each of the plausible adverse scenarios posing the greatest risk, the Actuary must also report the results without the effect of extraordinary management action.

In this context, *extraordinary management action* refers to those actions which would occur relatively rarely, such as

- raising additional capital above what is assumed in the business plan,
- placing a limit on the volume of policies issued, or
- reducing dividends for products which have never had dividend cuts in the past.

5.3 Assumed regulatory action

There may be some situations where regulatory response to adverse scenarios should be assumed to occur. The Actuary should consider the impact of regulator in restricting new business or even taking control. In cases where the regulator takes control, the Actuary should assume that all assets and liabilities would be re-evaluated on a liquidation basis.

For such situations the Actuary must report results with and without the assumed regulatory action.

The Actuary should not assume a change in Actuarial standards or regulations, unless it is more prudent to do so.

5.4 Assumed rating agency action

Many plausible adverse scenarios will result in a significant reduction of capital and surplus. In cases where a downgrade by a rating agency is likely, the Actuary should incorporate the consequences of the downgrade into the scenario.

It may be helpful under adverse scenarios to report results with and without assumed rating agency action.

6. Revaluation of the Assets

In case where asset modeling is not available for projecting individual assets, the Actuary can choose to apply the adjustment factors to each invested assets whose value depends on interest rates. Each adjustment factor should have its determination approach / rationale fully described and its reasonableness tested by the Actuary.

7. Sample Report Outline

The Actuary must deliver a clear and complete report on the results and implications of the work. A sample report outline is given in Appendix 1.

APPENDIX 1: Sample Report Outline

(a) Executive Summary
- Summarization of scenario results
- Highlight the most significant capital adequacy risks

(b) The Actuary's Opinion Statement

(c) Introduction to Dynamic Solvency Testing Report
- Purpose of the report
- Scope, process, limitations and reliance
- Methodology – projection software used, description of projection model used
- Revaluation of the Assets / Policy Liabilities – in case of any limitation on assets / policy liabilities modeling, description of any approximation being adopted, with the approach / rationale and reasonableness.

(d) Capital Adequacy Measurement
- Description and current position

(e) Base Scenario
- Description of scenario, assumptions, results
- Discuss consistency of the capital position with the situation projected in the previous year's base scenario.

(f) Six Prescribed Scenarios
- Description of scenarios, assumptions, results
- Disclosure as to whether any adjustments have been applied to resilience reserves or GN7 reserves under the investment scenarios of this AGN

(g) Three Plausible Adverse Scenarios
- Description of the three scenarios, assumptions, results
- Disclosure as to whether any adjustments have been applied to resilience reserves or GN7 reserves under the investment scenarios of this AGN

(h) Analysis of Risks by Line of Business
- Discussion of risks and scenario results

(i) Conclusions and Recommendations
- Summary of results
- Actuary's assessment and recommendations, including the ability of the Insurer to meet the satisfactory financial condition
- Risks that threaten the financial strength of the Insurer

(j) Appendices
- Capital enhancement activities
- Key assumptions, reference should be made to experience reports or investigations produced and utilized in preparing projections. These normally include: economic assumptions; mortality / morbidity; lapse rates; expenses; reinsurance; other material assumption(s), if any.
- Other considerations (e.g. rating agencies, taxation, valuation/accounting issues)

APPENDIX 2– List of Considerations

The list below outlines a number of items that can be considered when constructing a scenario or determining ripple effects. This list is by no means exhaustive, and should not be relied upon by the Actuary as being the only items that need to be considered when constructing a scenario.

- Mortality rates (allowing for changes in underwriting practices)
- Morbidity and other claim incidence/recovery rates (allowing for changes in underwriting and claims management practices)
- Initial expenses
- Renewal expenses
- Investment expenses
- Expense inflation
- Commission overrides / commission related expenses
- Lapse rates
- Surrender/redemption rates
- Partial surrender/fund withdrawal rates
- Unit linked growth rates / Universal Life crediting rates
- Premium holiday rates
- Non-forfeiture option take-up rates (e.g. policy loans)
- Other non-forfeiture option assumptions (e.g. Policy loan interest rates)
- Reinsurance premiums, recoveries, commissions, profit shares etc., and the potential impact of reinsurance reviews to them in the future
- Possibility and severity of potential reinsurer defaults
- New business product mix
- New business sales
- Changes in premium mode
- Changes to non-guaranteed premium rates
- Changes to other non-guaranteed product features
- Changes to investment management fees charges
- Bonus/Dividend scales, and changes to them in the future
- Take-up and surrender rates for dividend left on deposit
- Crediting rates for dividends left on deposit
- Take-up rates for dividends settled as paid-up additions
- Take-up of other options granted to P/H (e.g. annuity settlement options etc.)
- Capital inflows / S/H dividends paid from/to parent company (allowing for changes in target surplus requirements for each scenario)
- Capital injections into subsidiary Life Co
- Tax rates and tax losses carried forward
- Asset purchases / sales in the future, allowing for liquidity requirements
- Accounting basis that is adopted for asset valuation on the balance sheet
- Investment policy and implications of any shocks to it
- Changes in corporate bond credit spreads and default rates in each scenario
- Options and guarantees embedded in assets (e.g. callable bonds)
- Re-pricing of new business after a shock
- Methods and assumptions used in determining liabilities in each scenario

- Changes in the severity of the currency mismatch and resilience reserve tests assumed to apply in the scenarios
- Changes in the foreign exchange rates
- Credit rating for the Company (e.g. a down-grade could affect sales and surrenders)
- Differences in policyholder behaviour by issue year cohorts or by other policyholder segments

***** END OF ACTUARIAL GUIDANCE NOTE *****