

# Life and Health Actuarial Task Force

## Amendment Proposal Form\*

1. Identify yourself, your affiliation and a very brief description (title) of the issue.

Tony Dardis, Chair Modeling Efficiency Work Group – Modeling Efficiency issues related to the VM-20 exposure draft.

2. Identify the document, including the date if the document is “released for comment,” and the location in the document where the amendment is proposed:

VM-20: Requirements for Principle-based Reserves for Life Products, Working Draft Dated 6-2-11. Sections: Definitions, 2.H, 7.A, 7.B, 7.G, and 7.H.

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted or changed by providing a red-line (turn on “track changes” in Word®) version of the verbiage. (You may do this through an attachment.)

See attached.

4. State the reason for the proposed amendment? (You may do this through an attachment.)

Revision of requirements and guidance regarding modeling efficiency techniques.

---

\* This form is not intended for minor corrections, such as formatting, grammar, cross-references or spelling. Those types of changes do not require action by the entire group and may be submitted via letter or email to the NAIC staff support person for the NAIC group where the document originated.

NAIC Staff Comments:

Dates: Received	Reviewed by Staff	Distributed	Considered
<b>Notes:</b>			

## Definitions

G. The term “model segment” means a group of policies and associated assets that are modeled together to determine the path of net asset earned rates.

H. The term “modeling efficiency technique” shall refer to any technique designed to reduce the size or run time of an actuarial model without compromising the usefulness of the results calculated by the model. Examples include, but are not limited to:

1. Choosing a reduced set of scenarios from a larger set or an alternative set consistent with prescribed models and parameters.
2. Generating a smaller liability or asset model to represent the full seriatim model using grouping compression techniques, or other similar simplifications.

I. The term “mortality experience cell” means a subset of policies from a mortality segment that are grouped together when determining credibility adjusted experience rates.

J. The term “mortality segment” means a subset of policies from a credibility segment for which a separate mortality table representing the prudent estimate assumption will be determined.

K. The term “net asset earned rates” means the path of earned rates reflecting the net general account portfolio rate in each projection interval (net of appropriate default costs and investment expenses).

L. The term “net premium reserve” means the amount determined in Section 3.

M. The term “non-guaranteed element (NGE)” means either: (a) dividends under participating policies or contracts; or (b) other elements affecting life insurance or annuity policyholder/contract holder costs or values that are both established and subject to change at the discretion of the insurer.

N. The term “per policy reserve” means an amount determined for each policy that equals the greater of the cash surrender value and the seriatim reserve.

O. The term “policy” means an individual life insurance policy included in the scope of these requirements.

P. The term “policyholder efficiency” means the phenomenon that policy holders will act in their best interest with regard to the value of their policy. A policyholder acting with high policyholder efficiency would take actions permitted in their contract which would provide the greatest relative value. Such actions include but are not limited to not lapsing a low value or no value contract, persisting, surrendering, applying additional premium, exercising loan and partial surrender provisions.

Q. The term “pretax interest maintenance reserve” or “PIMR” means the statutory interest maintenance reserve liability adjusted to a pre-tax basis for each model segment at the projection start date and at the end of each projection interval.

R. The term “Principle-Based Reserve Actuarial Report” or “PBR Actuarial Report” means the document containing supporting information prepared by the company as required by VM-31.

S. The term “prudent estimate assumption” means a risk factor assumption developed by applying a margin to the anticipated experience assumption for that risk factor.

T. The term “reinsurance cash flows” means the amount paid under a reinsurance agreement between a ceding company and an assuming company. Positive reinsurance cash flows shall represent amounts payable from the assuming company to the ceding company; negative reinsurance cash flows shall represent amounts payable from the ceding company to the assuming company.

U. The term “reinsurance aggregate cash flows” means the difference between reinsurance cash flows and reinsurance discrete cash flows, as defined below. An example of reinsurance aggregate cash flows includes experience refunds.

**Guidance Note:** If a reinsurance agreement gives rise to reinsurance aggregate cash flows, the company should take care to examine and apply the guidance in Sections 8.A.3 through 8.A.5 with regard to the treatment of such cash flows.

VU. The term “reinsurance discrete cash flows” means reinsurance cash flows determined by applying reinsurance terms to an individual covered policy, without reference to the circumstances and events of other policies. Examples of reinsurance discrete cash flows would be proportional sharing of one or more items of revenue or expense associated with an underlying reinsured policy.

WV. The term “scenario” means a projected sequence of events used in the cash flow model, such as future interest rates, equity performance, or mortality.

XW. The term “scenario reserve” means the amount determined on an aggregated basis for a given scenario that is used as a step in the calculation of the stochastic reserve.

YX. A “secondary guarantee” is a guarantee that a policy will remain in force for some period of time (the secondary guarantee period) even if its fund value is exhausted, subject to one or more conditions.

ZY. The term “seriatim reserve” means the amount determined for a given policy that is used as a step in the calculation of the deterministic reserve.

AAZ. The term “stochastic reserve” means the amount determined in Section 5.

BBAA. The term “stochastic exclusion test” means a test of reserves under specified economic scenarios to determine whether a group of policies is required to comply with stochastic modeling requirements.

CCBB. The term “universal life insurance policy” means a life insurance policy where separately identified interest credits (other than in connection with dividend accumulations, premium deposit funds, or other supplementary accounts) and mortality and expense charges are made to the policy. A universal life insurance policy may provide for other credits and charges, such as charges for cost of benefits provided by rider.

DDCC. The term “variable life insurance policy” means a policy that provides for life insurance the amount or duration of which varies according to the investment experience of any separate account or accounts established and maintained by the insurer as to the policy.

---

## Section 2. Minimum Reserve

H. A company may use simplifications, ~~and~~ approximations and modeling efficiency techniques to calculate the net premium reserve, the deterministic reserve and/or the stochastic reserve required by this section if the company can demonstrate that the impact of such ~~techniques simplifications and approximations~~ does not ~~materially understate the resulting minimum reserve~~ understate the reserve by a material amount.

### Rationale:

We are not aware of any reason for the standard for suitability of an approximation to vary between Section 2.H and Section 7.A.2.

---

## Section 7. Cash Flow Models

A. Model Structure

1. The company shall design and use a cash flow model that

- a. Complies with applicable Actuarial Standards of Practice in develop cash flow models and projecting cash flows.
  - b. Uses model segments consistent with the company’s asset segmentation plan, investment strategies, or approach used to allocate investment income for statutory purposes.
  - c. Assigns each policy subject to these requirements to only one model segment and shall use a separate cash flow model for each model segment.
  - d. Projects cash flows for a period that extends far enough into the future so that no obligations remain.
2. The company may use ~~a simplified approach to~~simplifications or modeling efficiency techniques to develop cash flows, if the ~~company shows that the~~approach produces reserves that are no less than those produced by a more robust cash flow model is consistent with Section 2.H.

**Guidance Note:** For example, it may be reasonable to assume 100% deaths or 100% surrenders after some appropriate period of time.

**Rationale:**

We are not aware of any reason for the standard for suitability of an approximation to vary between Section 2.H and Section 7.A.2.

**Section 7. Cash Flow Models**

B. General Description of Cash Flow Projections

- 2. In determining the deterministic reserve and stochastic reserve the company may perform the cash flow projections for each policy in force on the date of valuation or by grouping ~~policies into representative cells of model plans using all characteristics and criteria having a material impact on the size of the reserve~~using modeling efficiency techniques. If ~~the company groups policies in representative cells~~such techniques are used, the company shall develop the groups ~~such that the resulting reserve is not materially different than the reserve that would result with no grouping in a manner consistent with 2.H.~~

~~**Guidance Note:** The actuary shall rely on guidance from applicable ASOPs to show compliance with this requirement.~~

**Drafting Note:** The Actuarial Standards Board is in the process of developing a new ASOP for principle-based reserves for life products. It is anticipated that this ASOP will provide guidance on how to group policies into representative modeling cells, as well as providing guidance on model granularity versus model accuracy

**Rationale:**

We are not aware of any reason for the standard for suitability of an approximation to vary between Section 2.H and Section 7.B.2.

The Guidance Note on ASOPs has been dropped since the actuary should rely on guidance from applicable ASOPs for all aspects of VM-20, not just this section.

**Section 7. Cash Flow Models**

G. Economic Scenarios

2. Stochastic Economic Scenarios

- a. For purposes of calculating the stochastic reserve under Section 4, the company shall use
- i. U.S. Treasury interest rate curves following a prescribed economic scenario generator with prescribed parameters; and
  - ii. Total investment return paths for general account equity assets and separate account fund performance generated from a prescribed economic scenario generator with prescribed parameters.

**Guidance Note:** It is expected that the prescribed generator will produce prescribed returns for several different investment categories (similar to the 19 categories provided by the American Academy of Actuaries for C3P2: Treasuries at different tenors, money market/short term investments, U.S. Intermediate Term Government Bonds, U.S. Long Term Corporate Bonds, Diversified Fixed Income, Diversified Balanced Allocation, Diversified Large Capitalized U.S. Equity, Diversified International Equity, Intermediate Risk Equity, and Aggressive or Specialized Equity).

- b. The company shall map each of the proxy funds defined in Sections 7J and 7K to the prescribed fund returns defined in Section 7.G.2.a. This mapping process may involve blending the accumulation factors from two or more of the prescribed fixed income and/or equity returns to create the projected returns for each proxy fund. If a proxy fund cannot be appropriately mapped to some combination of the prescribed returns, the company shall determine an appropriate return and disclose the rationale for determining such return.

**Guidance Note:** Mapping of the returns on the proxy funds to the prescribed funds returns is left to the judgment of the actuary, but the returns so generated must be consistent with the prescribed returns. This does not imply a strict functional relationship between the model parameters for various markets/funds, but it would generally be inappropriate to assume that a market or fund consistently “outperforms” (lower risk, higher expected return relative to the efficient frontier) over the long term.

When parameters are fit to historic data without consideration of the economic setting in which the historic data emerged, the market price of risk may not be consistent with a reasonable long-term model of market equilibrium. One possibility for establishing ‘consistent’ parameters (or scenarios) across all funds would be to assume that the market price of risk is constant (or nearly constant) and governed by some functional (e.g., linear) relationship. That is, higher expected returns can only be garnered by assuming greater risk (For example, the standard deviation of log returns is often used as a measure of risk).

Specifically, two return distributions  $X$  and  $Y$  would satisfy the following relationship:

Market Price of Risk  $E[R_X] - r = E[R_Y] - r$

where  $E[R]$  and  $\sigma$  are respectively the (unconditional) expected returns and volatilities and  $r$  is the expected risk-free rate over a suitably long holding period commensurate with the projection horizon. One approach to establish consistent scenarios would set the model parameters to maintain a near-constant market price of risk.

A closely related method would assume some form of ‘mean-variance’ efficiency to establish consistent model parameters. Using the historic data, the mean-variance (alternatively, ‘drift-volatility’) frontier could be constructed from a plot of (mean, variance) pairs from a collection of world market indices. The frontier could be assumed to follow some functional form (quadratic polynomials and logarithmic functions tend to work well) with the coefficients determined by standard curve fitting or regression techniques. Recognizing the uncertainty in the data, a ‘corridor’ could be established for the frontier. Model parameters would then be adjusted to move the proxy market (fund) inside the corridor.

Clearly, there are many other techniques that could be used to establishing consistency between the return on the proxy funds and the prescribed returns. While appealing, the above approaches do have drawbacks and the actuary should not be overly optimistic in determining the fund returns.

- c. ~~Use of fewer scenarios than the full set prescribed by the NAIC is permissible as a model efficiency technique provided that: A scenario reduction technique is a methodology that derives a reduced set of economic scenarios from a larger set while maintaining the characteristics and robustness of the larger set.~~

~~Scenario reduction techniques may be considered acceptable as long as:~~

- i. ~~the larger smaller set of scenarios is randomly selected from or generated using a scenario reduction technique applied to the larger set prescribed by the NAIC, and;~~
- ii. ~~the use of the techniques is consistent with Section 2.H the scenario reserves of a representative subset of policies, run using the reduced scenario set, are consistent with the scenario reserves of the same subset of policies, run using the larger scenario set; and~~
- iii. ~~use of the full set of scenarios would not result in a materially greater reserve~~

~~The number of scenarios required to comply with Section 2.H will depend on the specific nature of the company's assets and liabilities and may change from time to time. Compliance with Section 2.H would ordinarily be tested by comparing scenario reserves of a small model or a representative subset of policies, run using the reduced scenario set, with the scenario reserves of the same subset or small model, run using the larger scenario set. Companies should also perform a periodic analysis of the impact of using a different number of scenarios on the stochastic reserve, noting the difference in results as the number of scenarios is increased. Again, an appropriate subset of the entire inforce block can be used for this analysis.~~

~~A well designed technique of scenario reduction will generally have less impact on the results than random selection of the reduced scenario set.~~

~~Drafting Note: Other necessary additions include: added documentation and a definition of the calibration criteria~~

~~Drafting Note: More guidance is needed on how many scenarios a company should generate.~~

#### **Rationale:**

- a. We are not aware of any reason for the standard for suitability of an approximation to vary between Section 2.H and Section 7.G.2.c.
- b. Companies may find it more feasible to generate a test model that is reasonably representative of the sensitivity of the business under different scenarios by developing a small cell model, rather than by taking a subset of policies.
- c. One technique discussed in the literature (e.g. Manistre and Hancock 2005, <http://www.soa.org/library/journals/north-american-actuarial-journal/2005/april/naaj0502-7.pdf>) involves calculating a CTE measure by taking (a) the CTE as calculated using a relatively large model over a subset of scenarios and (b) an estimate of the bias imparted by the subset of scenarios (which estimate would be determined through the use of a relatively small cell model over the larger set of scenarios). The current wording may be construed to disallow use of this technique (which may be intentional, or may not be).

---

## **Section 7. Cash Flow Models**

### **H. Determination of Net Asset Earned Rates and Discount Rates**

3. The company may use a grouped liability model to calculate the path of net asset earned rates for the deterministic reserve and then perform the seriatim reserve calculation for each policy based on those net asset earned rates.

**Guidance Note:** Section 7.A.2 permits the use of ~~simplified approaches~~ modeling efficiency techniques to calculate the deterministic reserve and stochastic reserve. This availability for simplification includes ways to determine appropriate net asset earned rates. Small to intermediate size companies, or any size company with smaller blocks of business, have options to create net asset earned rates ~~under simplified approaches if they continue to meet the requirement that the approach produces reserves that are no less than those produced by a more robust cash flow model~~ with modeling efficiency techniques if the results are consistent with Section 2.H.