

## **Life Actuarial (A) Task Force Amendment Proposal Form\***

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

Dave Neve, chairperson of the American Academy of Actuaries Life Reserves Work Group.

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, Draft dated 12/2/12, Section 4

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 Appendix A

4. State the reason for the proposed amendment:

### Summary of Proposal

Under this amendment, a company would have the option to calculate the Deterministic Reserve (“DR”) using an alternative method to the one already specified in VM-20. The alternative method theoretically results in equivalent reserves as those produced under the current VM-20 approach.

The alternative method (“Direct Iteration Option”) permits the calculation of the DR by finding directly the starting assets that fully liquidate the liabilities for a block of business over the DR projection horizon using the same cash flow model and assumptions required currently in VM-20. The statutory carrying value of those starting assets is held as the DR. This alternative mitigates certain issues associated with the current VM-20 approach while simplifying the calculation of the DR (including eliminating the need to calculate Net Asset Earned Rates (“NAERs”)).

### Discussion of Direct Iteration Option

Under VM-20, the DR is an aggregate reserve for a group of policies calculated as the actuarial present value of benefits, expenses and related amounts less the actuarial present value of premiums and related amounts. A single economic scenario is prescribed. In determining the actuarial present values, a path of discount rates must be derived from the cash flow model’s projection of NAERs. Because this is an asset/liability modeling exercise, the NAERs depend upon:

- Projected net investment earnings from the portfolio of starting assets;
- The pattern of projected asset cash flows from the starting assets and subsequent reinvestment assets;
- The pattern of net liability and expense cash flows; and
- The projected net investment earnings from reinvestment assets.

VM-20 requires finding a starting asset portfolio that, when included in the cash flow model, results in a deterministic reserve amount that is within 2% of the statutory valuation of those starting assets. Iterative techniques are often used to find such a starting asset portfolio.

### Equivalence

This proposal for permitting the Direct Iteration Option rests on the observation that the current VM-20 method and the proposed method should result in equivalent reserves. Table 1 portrays a simple example illustrating this. The example demonstrates that the calculation of the DR at issue (\$76.06, in row E below) can be shown to just cover the periodic cash flows over the coverage period (10 years), resolving to \$0.00 at the end of the coverage period (Asset roll forward row). *Although not specifically stated in VM-20, this equivalency is key to the definition of the DR.* The parameters that make the example simple are a level NAER, and annual cash flows assumed to occur precisely at the end of each period.

Table 1

Period	0	1	2	3	4	5	6	7	8	9	10
A) Net cash flows		-40	-20	-10	-5	-1	-1	-2	-1	-2	-1
B) NAER		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
C) Path of Discount Rates		0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756
D) -A * C		38.4615	18.4911	8.8900	4.2740	0.8219	0.7903	1.5198	0.7307	1.4052	0.6756
E) Sum (D) from (t) to 10	76.06	37.60	19.11	10.22	5.94	5.12	4.33	2.81	2.08	0.68	-
Asset roll forward	\$ 76.06	\$ 39.10	\$ 20.67	\$ 11.49	\$ 6.95	\$ 6.23	\$ 5.48	\$ 3.70	\$ 2.85	\$ 0.96	\$ (0.00)

The Direct Iteration Option has strong similarities to the Canadian Asset-Liability Method (“CALM”) for determining reserves. Under CALM, the reserve is the reported value of the starting assets whose cash flows, when considered with other modeled asset and liability cash flows, completely liquidate all modeled liabilities by the end of the projection horizon under conservative economic scenarios.

### Reasons for Permitting the Direct Iteration Option

1. Equivalence – Both methods are theoretically equivalent and satisfy the goal of finding those starting assets that should run off the liabilities under the conservative assumptions desired for a DR. However, field testing found that the current VM-20 method may result in starting asset levels that are insufficient in maturing modeled liabilities or result in excess assets at the end of the projection period.

As part of an ACLI study on the impact of VM-20,<sup>1</sup> companies evaluating the DR were asked to determine whether the VM-20 methodology provided sufficient modeled assets to satisfy model segment liabilities. Participants were asked to report evidence of the “ending book value of assets” from their Phase 1 DR calculation. Few, if any of these companies reported a near-zero ending asset value. Deviations tended to be greater for products with longer projection horizons and significant modeled cash flows in later durations. While companies did not analyze why this happened, it suggested that care be exercised when using the path of NAER-based discount rates to discount net cash flows.

2. Simplicity – From the perspective of setting up and running models, this direct approach may be considerably simpler for a company as there is no need to calculate NAERs, consider non-cash accounting items, discount the liability cash flows, and meet a 2% collar test.
3. Reduced Chance of Error - The determination of the NAER is particularly subject to errors, and *errors in the NAER can compound* as all liability cash flows are discounted by the product of all NAERs determined prior to the point of the liability cash flow. These intermediate steps typically

<sup>1</sup> <http://publications.milliman.com/research/life-rr/pdfs/vm-20-impact-study.pdf>, page 34.

add to the potential for error, and will likely be a source of concern in practice. (See Appendix B for a further discussion of the nature of NAER errors)

4. Cash Flows Only Considered – For the current VM-20 approach to work, the non-cash amortization/accretion of bond premiums/discounts must be included in the projection model (as well as PIMR recognition and amortization). This is not necessary in a direct approach where only real cash flows need to be considered. (Note that the Direct Iteration Method does include the unamortized bond premiums/discounts in the DR as it is the statutory carrying value of the assets that liquidate the obligations that is held as the DR.)
5. Proof of Reserve Adequacy – The direct calculation alternative method provides proof that the liabilities have been run off and that there is either a zero or slightly positive asset balance remaining at the end of the projection.
6. No Collar Test needed – Under the current VM-20 method, the statutory valuation of the final starting assets must be within 2% of the modeled deterministic reserve. The 2% collar allowance may itself introduce some error in the DR calculation. Under the alternative method, this collar test is unnecessary as the appropriate level of assets is directly iterated for.

## Appendix A

### Section 4. Deterministic Reserve

For a group of one or more policies for which a deterministic reserve must be calculated pursuant to Sections 2.A or 2.B, the company shall calculate the deterministic reserve for the group using [the method described in either subsection A or subsection B of this section.](#)

A. Calculate the deterministic reserve equal to the actuarial present value of benefits, expenses, and related amounts less the actuarial present value of premiums and related amounts where:

1. Cash flows are projected in compliance with the applicable requirements in Sections 7, 8 and 9 over the single economic scenario described in Section 7.G.1.
2. Present values are calculated using the path of discount rates for the corresponding model segment determined in compliance with Section 7.H.4.

3. The actuarial present value of benefits, expenses and related amount equals the sum of:

- a. Present value of future benefits, but before netting the repayment of any policy loans;

**Guidance Note:** Future benefits include but are not limited to death and cash surrender benefits.

- b. Present value of future expenses excluding federal income taxes and expenses paid to provide fraternal benefits in lieu of federal income taxes;

- b. Policy account value invested in the separate account at the valuation date; and

**Guidance Note:** when paragraph c. is taken in conjunction with 4.b. below, the net result produces the correct cash flows as well as NAER,

- c. Policy loan balance at the valuation date with appropriate reflection of any relevant due, accrued or unearned loan interest, if policy loans are explicitly modeled under Section 7.E.

- d. Policy loan balance at the valuation date with appropriate reflection of any relevant due, accrued or unearned loan interest, if policy loans are explicitly modeled under Section 7.E.

**Guidance Note:** when paragraph d. is taken in conjunction with 4.c. below, the net result produces the correct cash flows as well as NAER,

4. The actuarial present value of premiums and related amounts equals the sum of the present values of

- a. Future gross premium payments and/or other applicable revenue;

- b. Future net cash flows to or from the general account, or from or to the separate account;
  - c. Future net policy loan cash flows, if policy loans are explicitly modeled under Section 7.E;  
**Guidance Note:** Future net policy loan cash flows include: loan interest paid in cash; additional loan principal; and repayments of principal, including repayments occurring at death or surrender (note that the future benefits in Section 4.A.3.a are before consideration of policy loans).
  - d. Future net reinsurance discrete cash flows determined in compliance with Section 8;
  - e. The future net reinsurance aggregate cash flows allocated to this group of policies as described in Subsection C of this section; and
  - f. The future derivative liability program net cash flows (i.e., cash received minus cash paid) that are allocated to this group of policies.
5. If a group of policies is excluded from the stochastic reserve requirements, the company may not include future transactions associated with non-hedging derivative programs in determining the deterministic reserve for those policies.

**B. Calculate the deterministic reserve as a - b, where**

a = the aggregate annual statement value of those starting assets which, when projected along with all premium and investment income, result in the liquidation of all projected future benefits and expenses by the end of the projection horizon. Under this alternative, the following considerations apply:

- 1. Cash flows are projected in compliance with the applicable requirements in Section 7, 8 and 9 over the single scenario described in Section 7.G.1.
- 2. The requirements for future benefits and premiums in Section 4.A apply as well to the calculation of the deterministic reserve under this subsection.

b = that portion of the PIMR amount allocated under Section 7.

- C. Future net reinsurance aggregate cash flows shall be allocated as follows:
- 1. Future net reinsurance aggregate cash flows shall be allocated to each policy reinsured under a given reinsurance agreement in the same proportion as the ratio of each policy's present value of future net reinsurance discrete cash flows to total present value of future net reinsurance discrete cash flows under the reinsurance agreement.
  - 2. Future net reinsurance aggregate cash flows allocated to a group of policies is equal to the sum of future net reinsurance aggregate cash flows allocated to each policy in the group.

## Appendix B

### Errors and approximations in calculation of the Net Asset Earned Rate (NAER)

The calculation of the NAER is complex. Approximations must be made, and errors due to simple misunderstanding have been common during field tests. Some of the common approximations and errors fall in these two categories:

1. **Assumed timing of cash flows during the month.** Many models provide only the total cash flow for the month, even while internally assuming different parts of the cash flow such as premiums, benefits and expenses occur at different times during the month. In order to calculate a monthly NAER, one must make an assumption regarding the timing of cash flows during the month if complete information is not available. The table below illustrates the different results that can be calculated simply due to different assumptions regarding the timing of cash flows during the month, or due to rounding the monthly NAER to a single basis point.

Assets at beginning of month	A	1000	
Cash flow	C	-10	
Investment income	I	5	
Assets at end of month	B	995	
<hr/>			
Computed yield rate:		Monthly	Annualized
BOM cash flow	$I/(A+C)$	0.5051%	6.23%
MOM cash flow	$I/(A+0.5C)$	0.5025%	6.20%
EOM cash flow	$I/A$	0.5000%	6.17%
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<b>Rounding monthly yield to single basis point:</b>		Monthly	Annualized
BOM cash flow	$I/(A+C)$	0.51%	6.29%
MOM cash flow	$I/(A+0.5C)$	0.50%	6.17%
EOM cash flow	$I/A$	0.50%	6.17%

The timing of large “chunky” cash flows (e.g., reinsurance transactions) may further exacerbate the drift when such transactions are significant.

2. **Miscalculation of NAER within a model.** The calculation of investment income for purposes of calculating the NAER includes many items that are typically calculated separately within a model. Since commercial software has not yet been adapted to provide verified calculation of the NAER, modelers have had to implement the calculation on their own. In some cases, an ad hoc implementation can accidentally leave out some items that should be included in investment income for purposes of calculating the NAER. Items that might be overlooked include the following:

- Defaults

- Realized capital gains on sale of investments
- Unrealized capital gains included in ending asset values
- PIMR amortization
- Investment expenses
- Amortization of bond premium and discounts