AMERICAN ACADEMY of ACTUARIES

**ARWG Report to LATF's VM-22 Subgroup**
**Concerning Potential VM-22 Reserve Methodology**

**Indianapolis, IN – August 22, 2013**

The Annuity Reserve Work Group (ARWG) of the American Academy of Actuaries[1] is pleased to provide you this report on its progress towards fulfilling the request made by the Life Actuarial Task Force at the NAIC Spring 2012 National Meeting to develop a draft of VM-22 covering all non-variable annuities and deposit funds. There has been considerable thought and work expended towards this goal. This report provides the VM-22 Subgroup with an update on the progress made. Equally important, it provides the Subgroup with a description of the direction we are currently taking for recommendations on VM-22 and also identifies the major differences between these recommendations and the requirements of VM-20 and VM-21.

***Please note the following:***

- *Some of the proposals we've made are tentative and we anticipate further review of the structure described in this report.*
- *In particular, the approach outlined in this report anticipates the introduction of lapse rates into the Floor Reserve. This should not be regarded as a final recommendation by the ARWG, as this will require additional discussion and study.*
- *The concepts behind many aspects of the "Modeled Reserve" discussed in this report are relatively new and there are many details to be considered in the future as we continue to explore the methodology.*
- *Finally, the ARWG anticipates that the Kansas Insurance Department will conduct a field test involving a small number of products and companies' actual business in force for which sample calculations of the reserves described in this report will be made. The field test is expected to be completed by the end of the year and will be based on the approach outlined in this report. The ARWG anticipates that the results of this field test will be shared with it and this will further inform us and may help further develop the methodologies described in this report. However, the ARWG will not directly participate in the test; it is our understanding that the design and requirements of the field test are being developed solely by the Kansas Insurance Department.*

At this time we are focusing our attention on deferred annuities with cash values but will consider other annuities in scope at a later date.

[1] The American Academy of Actuaries is a 17,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

Our goal for the methodology underlying VM-22 requirements is to propose a sound principle-based reserve standard for annuities other than variable annuities, incorporating:

1. an appropriate formulaic floor reserve that extends the current CARVM methodology to reflect its use as a minimum reserve instead of as the primary reserve;

2. an auditable modeled reserve that properly reflects the key risks of today's complex annuity product designs; and

3. assurance of an adequate reserve standard by exploring possible expansion of asset adequacy analysis requirements, if necessary.

**Minimum Reserve Standard.** Under the VM-22 requirements currently under consideration, the reserve for a given block of business would equal (i) the sum, for all policies in the block, of the larger of the Floor Reserve and the policy cash value, plus (ii) the excess, if any, of the Modeled Reserve over (i).

**Floor Reserve**. The Floor Reserve being considered by the ARWG provides substantial contractholder protection; the "Modeled Reserve" (described later in the report) may require an increase over this floor when analysis of the risks undertaken by the issuer indicates that one is needed.

A significant aspect of the proposed Floor Reserve is that it should result in values that are reasonably comparable to the reserves currently required under CARVM and Actuarial Guideline XXXIII (AG 33) / Actuarial Guideline XXXV (AG 35),[2] while at the same time reflecting the greater variety and complexity of current non-variable deferred annuity products. To provide greater flexibility in the formulaic Floor Reserve calculation, a designation of three types of benefits was created as a first step: (i) certain contract benefits referred to as Listed Benefits,[3] (ii) "rich" non-listed benefits (such as Guaranteed Minimum Death Benefits (GMDBs) with death benefits significantly higher than the contract account value, and (iii) all other benefits. Then, the Floor Reserve was defined as the greater of α and β, where:

[2] References within this document to AG 33 should generally be interpreted to also include AG 35 inasmuch as AG 35 must currently be followed regarding CARVM valuation of Equity Indexed Annuities (EIAs); most of the products for which GLIBs are currently offered are EIAs.

[3] Examples of Listed Benefits are GLIBs, annuitizations other than GLIB elections, and annuitization within the annuitization tier of a two-tiered annuity. LTC benefits provided under a deferred annuity may also be considered a Listed Benefit if the contractholder may elect whether or not to receive benefits once the LTC disabling event has occurred.

Because many Listed Benefits may include charges or fees to pay for the benefit, they will have the effect of reducing the amount of cash value that is available and may also serve to increase the ultimate death benefit beyond that provided by a traditional waiver of surrender charge by adding a benefit equal to a refund of fees that have been deducted from the accumulation value.

- $\alpha$ represents the scenario in which the Listed Benefits are not elected by the contractholder – therefore no future charges are deducted for these benefits after the valuation date and no cost for them is reflected. The reserve is computed as currently required by CARVM, except that prescribed lapse rates are utilized in every Integrated Benefit Stream (IBS) and it is assumed that any Listed Benefits are terminated on the valuation date (and reflecting termination of any charges for the Listed Benefit).

- $\beta$, on the other hand, represents the scenarios in which the contractholder continues to pay for the Listed Benefits after the valuation date and intends to use them at some future point (unless death or an immediate need for cash intervenes, as represented in the valuation formulas as specified lapse rates). The reserve is the largest present value of IBSs, one for each Listed Benefit and is defined by prescribed assumptions for all elective contractholder behavior, with the assumptions incorporating a test for Listed Benefits that are "in the money." As such, there would need to be prescribed assumptions for election of those Listed Benefits and prescribed incidence rate assumptions for other elective behavior such as lapse rates.

A measure of in-the-money-ness (ITM) of the "rich" non-listed benefits would be used to adjust the prescribed lapses for both $\alpha$ and $\beta$.

Like current CARVM, the calculation of $\alpha$ considers all future Integrated Benefit Streams (except that prescribed lapse rates are incorporated) - while assuming that Listed Benefits have been terminated, while the calculation of $\beta$ considers the group of Integrated Benefit Streams (one IBS for each Listed Benefit) in which the Listed Benefits are elected with $\beta$ being the largest present value of these IBS's. $\alpha$ is a Greatest Present Value calculation considering a potentially infinite set of IBSs, while $\beta$ is the largest of a small number of Present Value calculations. For both $\alpha$ and $\beta$, prescribed dynamic lapse rates are utilized, which are modified for adjustment by an in-the-money-ness (ITM) function of the respective benefits. Prescribed incidence rates for the Listed Benefits are included in the calculation of $\beta$. When no Listed Benefits are present in a contract, only $\alpha$ is needed for reserve calculation. When a Listed Benefit has already been elected as of the valuation date (and no other Listed Benefits are available), then the calculation of $\alpha$ would be unnecessary and the lapse rates, if any, following election are considered in the $\beta$ calculation.

Please note that for the field testing of these calculations, the results with and without the use of lapse rates in the calculations of $\alpha$ and $\beta$ will be considered. Following review of those results, the use of prescribed lapse rates in the calculation we are considering for $\alpha$ may be revisited by the ARWG with possible subsequent modification in our direction.

Thus, for contracts not involving a Listed Benefit, we expect that the Floor Reserve under consideration would be less than the currently required reserve to the extent that the prescribed lapse rates produce a GPV smaller than that which requires consideration of lapse rates from 0% to 100%. In addition, for contracts that contain a Listed Benefit, we expect there may also be a further reduction from current CARVM to the extent (a) the greatest present value under CARVM is determined from an IBS involving utilization of the Listed Benefit and (b) the present value of the single, identified IBS for the Floor Reserve is lower.

However, the Floor Reserve includes a cash value minimum, so the Floor Reserve per policy will never be less than the contract cash value. Thus, the decreases discussed above will effectively never come into being once the cash value is reached.

- It is worth noting that cash values for deferred non-variable annuities are very significant as a percentage of premium, thus establishing a material minimum reserve amount. This can be contrasted with that for some forms of life insurance, which are either exempt from cash values or provide very minimal values.

- The current annuity nonforfeiture law requires the cash value to be a very high percentage of the accumulation value at all times (generally 90% or more) and causes surrender charges to grade off over time, even if new surrender charges are created through payment of additional premiums or crediting of excess interest.[4]

It is important to note that the Floor Reserve has been designed so that adding a GLIB benefit to an existing contract will not lower the Floor Reserve below what would result without it. The formulas specified for the Floor Reserve in Appendix B may help to explain why this is so. It should also be noted that the formulas for $\beta$ assume continuation past the valuation date of all Listed Benefits while the formulas for $\alpha$ assume all Listed Benefits are terminated on the valuation date.

Further, it is worthwhile noting that under the VM-22 requirements currently under consideration by the ARWG, all business, including contracts with a GLIB, will not have a reserve less than the Modeled Reserve described in the report.

We understand that LATF may want any potential modifications to reserve requirements prior to adoption of VM-22 (e.g., to address reserves for GLIB business currently resulting from AG 33) to be consistent with the $\beta$ portion of the Floor Reserve described in this report. Thus, providing the Subgroup with the information in this report may prove valuable in its consideration of changes to existing GLIB reserve requirements.

Refer to Appendix B for formulas specifying how $\alpha$ and $\beta$ are to be calculated.

**Modeled Reserve.** The counterpart to the Stochastic Reserve under VM-20 or the Conditional Tail Expectation Amount under VM-21 (AG 43) is the Modeled Reserve. However, there are key differences between them under our current proposal:

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[4] A recent possible exception to this rule is introduced by the current trend in deferred annuity product development to incorporate benefits not recognized by the current annuity nonforfeiture law, such as with Guaranteed Lifetime Income Benefits (GLIBs). Products with these benefits may still have significant cash values, but there is typically no component of the cash value that recognizes these benefits despite the reduction in the accumulation value (and cash value) where charges are deducted for the extra benefit.

- Instead of a large number (perhaps a thousand or more) scenarios focusing solely on the interest rate and/or market risks, we anticipate proposing that a small number of scenarios for each of the critical risks for each product group will be used to develop the reserve.

- The proposed scenario projections will be performed using the company's anticipated experience assumptions for those assumptions within the company's control and use prescribed methods for setting all other assumptions.

- The result derived from the scenarios will be an amount called the Current Estimate Reserve.

- An aggregate margin (a.k.a. Margin over Current Estimate) will be added to the Current Estimate Reserve to produce the Modeled Reserve. This result will be compared to the Floor Reserve.

- It has been suggested that some type of additional scenario testing may need to be performed on the larger of the Floor Reserve and the Modeled Reserve to produce the final reserve but we have not considered this in any depth.

**Comparison of Reserve Features.** To facilitate a comparison between the tentative requirements described in this report with (i) those currently required for statutory reporting and (ii) those contained within VM-20 & VM-21, we have prepared the following two charts:

| Annuity Reserve Change Comparison | | |
|---|---|---|
| **Aspect** | **Current Requirement** | **Currently Envisioned for VM-22** |
| Defined Reserve | CARVM with AG 33 and other Actuarial Guidelines. Subject to aggregate asset adequacy analysis at the company level. | Greater of Floor Reserve and Modeled Reserve.[5] Subject to asset adequacy analysis at either the company level or perhaps at a block-of-business or line of business level. |
| Magnitude of Current Reserve and Floor Reserve | CARVM Reserve under AG-33 is Greatest Present Value of all possible Integrated Benefit Streams, subject to the Cash Value Floor | α is similar to existing CARVM, but with prescribed lapse rates adjusted for ITM of rich non-listed benefits. For α, no future charges or benefits related to Listed Benefits are included in the calculations. α is a GPV calculation. For β, prescribed lapse rates, adjusted for ITM of the Listed Benefits and "rich" non-listed benefits, and prescribed Listed Benefit incidence rates are included in the calculations. β is a PV calculation of a single Integrated Benefit Stream for each Listed Benefit. The Floor Reserve for each contract is the larger of α and β, subject to the Cash Value Floor. |
| Reserve Assumptions | Those required under the current Standard Valuation Law | For the Floor Reserve, assumptions are those currently required for CARVM statutory valuation except for the prescribed lapse assumptions, adjusted for ITM (α and β) and the prescribed incidence rates for the Listed Benefit Integrated Benefit Stream (β). For the Modeled Reserve, assumptions are the actuary's anticipated experience assumptions plus prescribed variations[6] in the critical assumptions for the calculation of the Current Estimate Reserve with margins provided by the Margin over Current Estimate (aggregate margin). |

[5] Note that we expect to propose that this be expressed in VM-22 as the Floor Reserve, plus the excess, if any, of the Modeled Reserve over the Floor Reserve.
[6] See Appendix C

| **Reserve Features Comparison<br>VM-20 & VM-21 vs. Currently Envisioned for VM-22** | | |
|---|---|---|
| **Aspect** | **VM-20 & VM-21** | **Currently Envisioned for VM-22** |
| **Current Assumption Reserve** | Deterministic Reserve (VM-20), Stochastic Reserve (VM-20 and VM-21) | Modeled Reserve |
| **Number of Scenarios** | Generally considered to be a large number (>= 1,000 ?) for Stochastic, 1 for Deterministic | Small number per risk with multiple risks |
| **Risks Tested Using Scenarios** | Generally limited to interest rate and market risk. Other risks are tested by adding margins to anticipated experience assumptions. | All critical risks |
| **General Conservatism Requirement** | CTE 70 + individual assumption margins | Evaluation of Critical Risks with reflection of possible outcomes in Current Estimate Reserve plus explicit statutory conservatism built into the Margin over Current Estimate (aka Aggregate Margin) |
| **Theoretical Goal of Principle-based Reserve** | CTE measure applied to model results where each critical assumption incorporating randomness is stochastically modeled. However, current practice under VM-20 and VM-21 generally only stochastically model interest and market risks. | Modeled Reserve may take a large, practical step towards this theoretical goal. |
| **Assumption Margins** | Current practice generally results in margins added to each assumption | Margin over Current Estimate added to Current Estimate Reserve |
| **Guardrails** | Many required margins or assumptions | Requirements around assumed probability distribution of current estimate reserve assumptions, including specified methods for determining assumed experience for risks outside the control of the company |
| **Auditability of Current Assumption Reserve** | Time consuming; difficult to manage | The methodology being considered is intended to make the audit process more manageable |

| | | |
|---|---|---|
| **Minimum Reserve** | **VM-20:** Largest of Net Premium Reserve (with Cash Value Floor), Deterministic Reserve, and Stochastic Reserve **VM-21**: Larger of Standard Scenario Reserve (with Cash Value Floor) and CTE Reserve | Larger of the Floor Reserve and the Modeled Reserve, where the Floor Reserve is based on the greatest of the Cash Value, α and β, as discussed above. |
| **Guaranteed Minimum Death Benefits** | Reflected in both reserve components with special requirements in the calculation of the Accumulated Net Revenue, especially to avoid assuming lapses when other more valuable benefits exist. | GMDBs are not Listed Benefits but are reflected in α and in β (to the extent the GMDB still exists if the Listed Benefit is terminated) components. An "in the money-ness" test for "rich" non-listed benefits will be included in the lapse rate assumptions to avoid the assumption of surrendering a policy when a significantly larger death benefit is available. |
| **Tax Reserve** | **VM-20:** Net Premium Reserve (with Cash Value Floor) **VM-21**: Standard Scenario Reserve (with Cash Value Floor) | Expected to be Floor Reserve (with Cash Value Floor) |
| **Reserve Assumptions** | **VM-20**: Experience Based Assumptions with margins for Deterministic Reserve and Stochastic Reserve (with many margins that are prescribed) and prescribed assumptions for Net Premium Reserve. **VM-21**: Prescribed assumptions (including lapse and election rates for Accumulated Net Revenue portion) for the Standard Scenario Reserve. Prudent estimate for the CTE Reserve. | α is similar to existing CARVM, but with prescribed lapse rates along the GPV path. The lapse rates would be adjusted for ITM if there are rich non-listed benefits. For α, no future charges or benefits related to Listed Benefits are in the calculations. For β, prescribed lapse rates (adjusted for ITM of the listed benefits and rich non-listed benefits) and Listed Benefit incidence rates are included in the calculations. β is the largest of a PV calculation of a single Integrated Benefit Stream for each Listed Benefit. Reserve is larger of α and β, subject to the Cash Value Floor. |

| | | |
|---|---|---|
| **Coordination with Asset Adequacy Analysis** | The resulting reserves are required to be included in the company-wide asset adequacy analysis. Some actuaries believe either the Stochastic Reserve constitutes a Cash Flow Testing exercise or that modifications of the stochastic testing can be used for CFT. | Similar coordination is expected, but in addition, the need for additional scenario testing is under consideration. |

## Appendix A

## Important Issues Being Considered

A. Decrease complexity from that in AG-43 and VM-20

1. Make the methodology easier to implement

2. Make the methodology less dependent on large amounts of computer power

3. Increase the opportunity to explain volatility of results between valuation dates

B. Increase auditability

C. Develop a method (Modeled Reserve) that considers the products' key risks in the reserve calculation (i.e., not just interest and equity risks)

D. Develop a method that is flexible enough to encompass combination products and other product innovation

E. Develop a method that produces reserves and analysis that provides value to Company Management

F. Potentially allow a company that passes an exclusion test to hold reserves greater than the Floor Reserve in lieu of calculating a Modeled Reserve

G. Ensure that any changes made to AG-33 before VM-22 is finalized are considered in drafting VM-22, and that discussions regarding VM-22 are considered in any changes made to AG-33.

## Appendix B

## Documentation of Floor Reserve Formulas

$_nV_x = \max\left\{\alpha, \beta\right\}$

$\alpha =$ CARVM Reserve computed assuming all Listed Benefits have been terminated with no further charges assessed *

$= \max\limits_{i=1}^{i=\infty}\left\{{}^iPVIBS_x^n\right\}$

* further charges not to be deducted following the valuation date for all Listed Benefits

where:

$i$ represents an index of the (generally) infinitely large number of Integrated Benefit Streams to be considered under CARVM,

$$ {}^iPVIBS_x^n = \sum_{NE}\sum_{t=1}^{\Omega-x-n} v^t \cdot {}_{t-1}^{\;\;i}p_{x+n} \cdot {}^iq_{x+n+t-1}^{NE} \cdot {}^iNEB_{n+t}^{NE} + \sum_{t=1}^{\Omega-x-n} v^t \cdot {}_t^ip_{x+n} \cdot {}^iq_{x+n+t}^{w} \cdot {}^iCV_{n+t} + \sum_{t=1}^{\Omega-x-n} v^t \cdot {}_t^ip_{x+n} \cdot {}^iq_{x+n+t}^{f} \cdot {}^iFPW_{n+t} $$

${}^iq_{x+n+t-1}^{NE}$ and ${}^iq_{x+n+t}^{f}$ are elements of the $i^{th}$ set of assumed incidence rate vectors, $\left\{{}_V^iq_{x+n}^{NE}, {}_V^iq_{n+n}^{f}\right\}$ corresponding to ${}^iIBS_x^n$, the $i^{th}$ Integrated Benefit Stream, with the "V" left-subscript indicating "vector" and ${}_V^iq_{x+n}^{NE}$ representing a collection of vectors, one for each Non-Elective Benefit (such as ${}_V^iq_{x+n}^{d}$ for mortality rates), and for valuation at the $n^{th}$ duration, with ${}_V^iq_{x+n}^{d} = \left\{{}^iq_{x+n}^{d}, {}^iq_{x+n+1}^{d}, {}^iq_{x+n+2}^{d}, ..., {}^iq_{\Omega-1}^{d}\right\}$ and the other ${}_V^iq_{x+n}^{NE}$ vectors, ${}_V^iq_{n+n}^{f}$, of Elective Benefits defined similarly

${}^iq_{x+n+t}^{w}$ are elements of ${}_V^iq_{x+n}^{w}$, a prescribed vector of lapse (surrender) rates

${}_0^ip_{x+n} = 1$, with successive values defined recursively, where

$$ {}_t^ip_{x+n} = {}_{t-1}^{\;\;i}p_{x+n} \cdot \left(1 - {}^iq_{x+n+t-1}^{w} - {}^iq_{x+n+t-1}^{f}\right) \cdot \prod_{NE}\left(1 - {}^iq_{x+n+t-1}^{NE}\right) $$

${}^iNEB_{n+t}^{NE}$ is the Non-Elective Benefit amount at time n+t for the $NE^{th}$ Non-Elective Benefit. For example, for the contract death benefit, this would be ${}^iDB_{n+t}$

and would include the death benefits provided by any Guaranteed Minimum Death Benefits

${}^iCV_{n+t}$ is the contract cash value at the end of year n+t. The contract cash value as of the valuation date will reflect all past premiums, charges and benefits.

${}^{i}FPW_{n+t}$ is the assumed amount of free withdrawal taken at the end of year n+t. Note that this is not necessarily the maximum free withdrawal amount, but rather the amount assumed as the free withdrawal. In practice, of course, this is typically set equal to the maximum free withdrawal amount.

$$\beta = \max_{L}\left\{ {}_{L}PVIBS_{x}^{n} \right\},$$

where

$${}_{L}PVIBS_{x}^{n} = \sum_{NE}\sum_{t=1}^{\Omega-x-n} v^{t}\cdot {}_{t-1}^{\ L}p_{x+n}\cdot {}^{L}q_{x+n+t-1}^{NE}\cdot {}^{L}NEB_{x+n+t}^{NE} + \sum_{t=1}^{\Omega-x-n} v^{t}\cdot {}_{t}^{L}p_{x+n}\cdot {}^{L}q_{x+n+t}^{wb}\cdot {}^{L}CV_{n+t} +$$
$$\sum_{t=1}^{\Omega-x-n} v^{t}\cdot {}_{t}^{L}p_{x+n}\cdot {}^{L}q_{x+n+t}^{f}\cdot {}^{L}FPW_{n+t} +$$
$$\sum_{t=1}^{\Omega-x-n} v^{t}\cdot {}_{t}^{L}p_{x+n}\cdot q_{x+n+t}^{L}\cdot$$
$$\sum_{k=1}^{\Omega-(x+t)}\left[ v^{k-1}\cdot {}_{k-1}^{\ L}p_{x+n+t}^{a}\cdot\left(\left(\sum_{NE} v\cdot {}^{L}q_{x+n+t+k-1}^{NEa}\cdot {}_{L}NEB_{n+t+k}^{a}\right) + {}_{L}AP_{n+t} + v\cdot {}^{L}q_{x+n+t+k}^{wa}\cdot {}^{L}CV_{n+t+k}^{a}\right)\right]$$

where

$L$ is among the set of Listed Benefits (GLIB, regular annuitization, upper tier annuitization of a two-tiered annuity, etc.) and indicates a particular such benefit, with the maximum over all values of L providing the contributions to the present value of all such Listed Benefits taken together.

All vectors of incidence rates (except those specifically noted below) are as defined as for the calculation of ${}^{i}PVIBS_{x}^{n}$ except that they are specific prescribed values for the $L^{th}$ Listed Benefit instead of being elements of the assumption vectors for the $i^{th}$ Integrated Benefit Stream

***Drafting Note: Benefits and incidence rates below are annotated with L to indicate that that their value may be dependent on or different after utilization of the listed benefit.***

${}^{L}NEB_{n+t}^{NE}$ is the Non-Elective Benefit amount at time n+t for the $NE^{th}$ Non-Elective Benefit. For example, for the contract death benefit, this would be ${}^{L}DB_{n+t}$

and would include any death benefits provided by the Listed Benefit and any Guaranteed Minimum Death Benefit

${}^{L}CV_{n+t+k}^{a}$ is the contract cash value at the end of year n+t+k and reflects any changes from ${}^{L}CV_{n+t}$ (the cash value derived assuming Listed Benefit L is in force but prior to election of the Listed Benefit) that result from election of Listed Benefit L. For example, if Benefit L is a GLIB, then withdrawals made under the GLIB will typically also be deducted from the contract accumulation value and a consequent reduction in ${}^{L}CV_{n+t}$ will result. Note that both these values are distinct from ${}^{i}CV_{n+t}$ for the $i^{th}$ Integrated Benefit Stream in the calculation of $\alpha$ where it is assumed that the Listed Benefits are terminated on the valuation date.

${}^{L}FPW_{n+t}$ is the assumed amount of free withdrawal taken at the end of year n+t on a basis consistent with the calculation of ${}^{i}PVIBS_{x}^{n}$ and thus also reflects election of Listed Benefit L.

${}^{L}q_{x+n+t}^{wb}$ is the prescribed lapse rate applicable *before* utilization or election of a listed benefit

${}^{L}q_{x+n+t+k}^{wa}$ is the prescribed lapse rate, if any, applicable *after* utilization or election of a listed benefit

***DRAFTING NOTE:***
***An example of prescribed lapse rates might be that the lapse rate is a constant percentage that does not vary except by In-The-Moneyness Percentage (ITM%) category. ITM% = 100 * ((Max PV (Benefit) / CV) – 1):***

| ***ITM% Category*** | ***Lapse%*** |
|---|---|
| ***ITM% < 10%*** | ***1.00 * Lapse%*** |
| ***10% <= ITM% < 20%*** | ***0.50 * Lapse%*** |
| ***20% <= ITM% < 50%*** | ***0.25 * Lapse%*** |
| ***50% <= ITM%*** | ***0.00%*** |

***When the policy cash value is depleted, Lapse% = 0%.***

${}_{L}NEB_{n+t+k}^{NEa}$ is the Non-Elective Benefit amount at time n+t for the $NE^{th}$ Non-Elective Benefit *after* election of benefit L.

${}_{L}AP_{n+t}$ is the "annuity payment" (or GLIB withdrawal amount) under benefit L.

$q_{x+n+t}^{L}$ is the prescribed incidence rate for benefit L

${}_{k-1}^{\;L}p_{x+n+t}^{a}$ survivorship values reflect the mortality and lapse rates *after* election of benefit L, so that ${}_{0}^{L}p_{x+n+t}^{a} = {}_{t}^{L}p_{x+n}$ and ${}_{k}^{L}p_{x+n+t}^{a} = {}_{k-1}^{\;L}p_{x+n+t}^{a} \cdot (1 - {}^{L}q_{x+n+t+k-1}^{wa}) \cdot \prod_{NE} (1 - {}^{L}q_{x+n+t+k-1}^{NEa})$

${}_{0}^{L}p_{x+n} = 1$, with successive values defined recursively, where

$${}_{t}^{L}p_{x+n} = {}_{t-1}^{\;L}p_{x+n} \cdot \left(1 - {}^{L}q_{x+n+t-1}^{w} - {}^{L}q_{x+n+t-1}^{f}\right) \cdot \prod_{NE} \left(1 - {}^{L}q_{x+n+t-1}^{NE}\right)$$

## Appendix C

## Detailed Description of the Modeled Reserve Methodology Being Examined by ARWG

The intent of the methodology for the Modeled Reserve is to approximate the reserve that would be determined using the approach specified for the stochastic reserve under VM-20 or VM-21 but stochastically modeling all assumptions whose values could be considered to vary randomly (or have a random component). However, the desire is to approximate that kind of reserve using a process that is less calculation-intensive and more auditable.

In short, the idea is to use a small number of specially constructed scenarios in place of the full complement of scenarios generally required under stochastic scenario simulations. A set of such scenarios would be required for each of the major risks affecting a given product group and not restricted to just investment risks. The results from the small number of scenarios are to be used in a very mechanical and specified way. We are hopeful this will make the process more transparent and less burdensome. From an audit point of view, it could thus become more practical to audit both the construction of the scenarios across all major risks and the process by which scenario results are used to calculate both the Current Estimate Reserve (i.e., the reserve calculated without margins) and the aggregate "margin over current estimate" in the Modeled Reserve.

In order to apply the methodology, one must identify a block of business for which the spectrum of critical risks is the same and the supporting assets to be valued for reserve purposes. These assets and liabilities will be used in an asset / liability model to calculate the "scenario reserves" (defined below) that will be used to determine the Modeled Reserve for a given block of business sharing the same primary risk drivers. The unit of account for the Modeled Reserve is therefore the block of business.

The methodology can be outlined as follows:

1. <u>Determine a small number of primary risk drivers for this business.</u> This may include the investment environment, mortality, persistency, and one or more types of contractholder behavior (e.g., option election rates) depending on the product.

2. <u>For each primary risk driver, determine the anticipated experience assumption.</u> Ideally this determination would be determined using the principles articulated in the Valuation Manual, but LATF may wish to put some limits on the range of experience that can be assumed.

3. <u>For each primary risk driver, develop a probability distribution around the anticipated experience at each future period.</u> These distributions need to be specific enough that the experience at a specified percentile level ("prescribed variation" to be specified in VM-22) in the distribution can be calculated. For example the mean, standard deviation, and skewness may be specified.

4. <u>For each primary risk driver, use the anticipated experience and the distribution around that experience to develop a small number of scenarios.</u> These scenarios will be defined formulaically based on the anticipated experience and the distributions. The result will be a small set of scenarios that represents a sample of the actual distribution of results for that risk driver. One of these scenarios must be the anticipated experience, and one must be the worst

realistic experience that the sum of reserves and capital is expected to cover – something at perhaps the 99th percentile level. For every “bad” scenario, an equally “good” scenario must be included in the group of scenarios. A probability will be assigned to each scenario, with the sum of the probabilities adding to 100% within a risk driver. However, the exact number of such probabilities and their values have yet to be determined.

5. Calculate a “scenario reserve” for each scenario for each risk driver. The scenario reserve is the present value of the future product cash flows and expenses in that scenario, discounted using the monthly investment returns in that scenario.

6. Calculate the “current estimate” reserve. This is the probability-weighted average of all the scenarios across all risks. This represents a “mean” rather than a “median,” and may be higher than the anticipated experience scenario reserve due to the optionality of the assets and liabilities and the skewness of the distribution of scenario results.

7. Calculate the “component risk amount” for each primary risk driver. This is the excess of the greatest scenario reserve for that risk driver over the Current Estimate reserve.

8. Calculate a “composite risk amount.” This is intended to be the sum of the component risk amounts, adjusted for correlations between risks. The general concept for calculating this combined sum have not yet been specified but might resemble the formula used to combine C-1, C-2, C-3, and C-4 risks in RBC, which takes account of independent and dependent risk factors.

9. Use the “composite risk amount” to calculate an aggregate reserve margin. Two methods are under consideration for the aggregate reserve margin – the confidence level method and the cost of capital method. The “composite risk amount” can be used within either method to calculate a reserve margin. Details of the way the “composite risk amount” would be used in each method are beyond the scope of this report.

Actuarial judgment must be applied in several steps in this process. LATF may wish to put limits on the exercise of professional actuarial judgment in the following areas:

1. Determination of the anticipated experience. For assumptions that are largely outside the control of the company, such as the investment environment and some elements of contractholder behavior, regulators may specify the methodology for developing the anticipated experience. For assumptions for which experience is relevant and emerging but not fully credible, regulators may wish to put limits on the range of what can be anticipated experience.

2. Determination of the probability distribution around anticipated experience. LATF may wish to specify the methodology for developing assumptions that are largely outside the control of the company. For other assumptions, regulators may wish to specify the width and/or skewness of the distribution that must be used. Since we would anticipate that a great deal of judgment may be required in this area, regulators may take the approach of specifying the range and skewness that must be used for most common risk drivers, allowing exceptions only with the approval of the commissioner. Alternatively, a qualified, independent organization could be assigned to make these estimates and update them periodically.

3. Assigning probabilities to each scenario. This needs to be done at two levels. First there is a set of probabilities for each scenario within a risk driver, and second there is a relative weight to be given to each risk driver. The relative probabilities for scenarios within a risk driver will be specified because they must be consistent with the means by which the scenarios themselves are formulaically constructed. However, our recommendations for the relative weight given to each risk driver (i.e., the total weight for all its scenarios) are still an open issue. Consideration should be given to the sensitivity of the modeled reserve to the risk factor in developing the weights. LATF may wish to consider whether more guidance is needed in this area.

**Modeled Reserve Exclusion Test**

It is uncertain at this time whether we will recommend that an exclusion test be provided under which companies may exclude blocks of business from the calculation of the Modeled Reserve. However, in the event this is deemed necessary and appropriate, a test could be developed that would allow the reserve for blocks of business passing the test to be equal to the current CARVM reserve or other amount.