Draft Pending Adoption

Draft: 12/3/25

Aggregation Method Implementation (G) Working Group
Virtual Meeting
November 19, 2025

The Aggregation Method Implementation (G) Working Group of the International Insurance Relations (G) Committee met on Nov. 19, 2025. The following Working Group members participated: Andrew N. Mais, Chair (CT); Rebecca Easland, Vice Chair (WI); Kevin Clark (IA); Christopher Joyce (MA); John Rehagen (MO); Anthony Quandt (NE); Puran Bheamsain (NY); Diana Sherman (PA); Elizabeth Kelleher Dwyer and Patrick Smock (RI); and Scott A. White and Dan Bumpus (VA).

1. Received an Update on the Technical Drafting Group

Ned Tyrrell (NAIC) gave an update on the Working Group's ongoing work (Attachment 1). His presentation included updates on the creation and purpose of the group and the timeline of upcoming deliverables.

2. Heard an Update on the Draft Scalar Paper

Quandt gave a summary of a paper discussing the impact of changes in interest rates on excess relative ratio (ERR) scalars (Attachment 2).

3. Heard an Update on the Draft Valuation Paper

Bruce Friedland (Friedland Actuarial) gave a summary of a paper discussing the impact of changes in interest rates on statutory reserves calculated under principle-based reserving. He discussed how a decrease in interest rates would impact a sample portfolio of policies valued under VM-20, VM-21 and VM-22. Commissioner Mais asked how the paper discussed would compare to the sensitivity of the insurance capital standard (ICS). Friedland said that the focus had been on principle-based reserving. Commissioner Mais suggested that the paper be modified to include this topic. Friedland and Tyrrell agreed to discuss further and update the paper for the Fall National Meeting.

4. Heard an Update on the Draft Other Tools Document

Commissioner Mais asked Tyrrell to give an update on the work in the "Other Tools" area. Tyrrell said that while Prudential and Tom Finnell provided useful summaries, the work area was not at the same level as the valuation or scalar work areas. He noted that there may be a lack of clarity regarding the role of tools, such as Own Risk and Solvency Assessment (ORSA), as they were developed prior to the adoption of the group capital calculation (GCC). He said there was a survey on the *ORSA Guidance Manual* that the Working Group can respond to. Commissioner Mais said that he should respond to the survey on behalf of the Working Group with a request for more clarity on this subject.

Commissioner Mais then asked Ian Adamczyk (Prudential) and Caitlin Zanoni (Prudential) to give an overview of the document that they had provided (Attachment 4). Prudential provided a summary of group regulatory tools with a focus on ORSA. The document included examples of market shocks that insurers may assess including

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interest rate shifts, credit spread widening/tightening, and changes in foreign exchange rates. Commissioner Mais encouraged others to provide information that would help produce a paper in this area.

Having no further business, the Aggregation Method Implementation (G) Working Group adjourned.

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Draft Pending Adoption

Draft: 11/21/25

Aggregation Method Implementation (G) Working Group
E-Vote
October 9, 2025

The Aggregation Method Implementation (G) Working Group of the International Insurance Relations (G) Committee conducted an e-vote that concluded Oct. 9, 2025. The following Working Group members participated: Andrew N. Mais, Chair (CT); Rebecca Easland, Vice Chair (WI); Kevin Clark (IA); Susan Berry (IL); Anthony Quandt (NE); Bob Kasinow (NY); Elizabeth Kelleher Dwyer (RI); and Scott A. White and Dan Bumpus (VA).

1. Adopted its 2026 Proposed Charges

The Working Group conducted an e-vote to consider adoption of its 2026 proposed charges. The charges remain unmodified from its 2025 charges.

Clark made a motion, seconded by Easland, to adopt the Working Group's 2026 proposed charges (Attachment XX). The motion passed unanimously.

Having no further business, the Aggregation Method Implementation (G) Working Group adjourned.

SharePoint/NAIC Support Staff Hub/Committees/G Committee/National Meetings/AMIWG/E-vote Minutes_AMIWG Oct 9 2025.docs

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Draft: 8/20/25

Aggregation Method Implementation (G) Working Group
Minneapolis, Minnesota
August 11, 2025

The Aggregation Method Implementation (G) Working Group of the International Insurance Relations (G) Committee met in Minneapolis, MN, March 25, 2025. The following Working Group members participated: Andrew N. Mais, Chair (CT); Rebecca Easland, Vice Chair (WI); Kevin Clark (IA); Susan Berry (IL); Christopher Joyce (MA); John Rehagen (MO); Anthony Quandt (NE); David Wolf (NJ); Bob Kasinow (NY); Elizabeth Kelleher Dwyer and Patrick Smock (RI); and Scott A. White and Dan Bumpus (VA).

1. Adopted its June 9 Minutes

The Working Group met June 9 (Attachment A). During this meeting, it took the following action: 1) adopted its Spring National Meeting minutes; 2) received an update on its ongoing activities; and 3) heard comments from interested parties.

Wolf made a motion, seconded by Berry, to adopt the Working Group's June 9 minutes.

2. Discussed its Activities

Commissioner Mais introduced a presentation by Ned Tyrrell (NAIC) with an update on ongoing work in scalars, the Aggregation Method (AM) review, the creation of a group for providing technical input, and the Working Group's work plan. Commissioner Mais thanked the volunteers who have joined the technical group.

3. Adopted a Recommendation on the Use of the ERR Scalar Approach in the AM

Commissioner Mais provided background on a discussion on scalars and "meaningful from a prudential point of view, relevant for the monitoring of financial soundness and that provides for comparable outcomes to the ICS." He asked Tyrrell to go over a recommendation (Attachment B) to change the AM scalar approach from unscaled (as used in the provisional AM) to the excess relative ratio (ERR) approach for purposes of planning the final AM and for the ERR approach to use scalars with a calibration of 200% of the authorized control level (ACL). Tyrrell described the ERR and the choice of calibration level. Commissioner Mais invited interested state insurance regulators and parties to comment on the proposal.

Shannon Jones (American Council of Life Insurers—ACLI) said the ACLI is supportive of the recommendation and offered to provide help, such as assistance in updating scalars for individual jurisdictions. Tom Finnell (AHIP) asked whether the comparability assessment would have turned out differently if ERR scalars had been used instead of the (unscaled) provisional AM. Tyrrell responded that while he could not speak for the decisions made by the International Association of Insurance Supervisors (IAIS), the AM data collected for the comparability assessment did include a range of alternative scaling options. This range, which included the ERR, was determined to represent every potentially reasonable method of achieving comparable outcomes. The plan had always been to make a selection from this range after the IAIS made its decision about comparability. Finnell asked whether the AM would have been found to be more comparable if the ERR had been used. Ryan Workman (NAIC) clarified that the

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results of the comparability assessment are final and that state insurance regulators will decide how to best address the issues raised during the implementation of the AM.

Quandt made a motion, seconded by Joyce, to adopt the recommendation. The motion passed.

4. Discussed Other Matters

Commissioner Mais thanked the Working Group for their support and reminded attendees that the International Insurance Relations (G) Committee will meet later that day. Having no further business, the Aggregation Method Implementation (G) Working Group adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/G CMTE/National Meetings/AMIWG/2025 Summer NM/Final Minutes AMIWG_Minneapolis 20250811.docx

Aggregation Method Implementation (G) Working Group (AMIWG)

December 9, 2025

DECEMBER 8–11

NAIC®

2025 FALL NATIONAL MEETING
HOLLYWOOD, FL

Background

AM as the US implementation of the ICS

At the end of 2024, the International Association of Insurance Supervisors (IAIS) concluded that the AM provides a basis of implementation of the ICS for Internationally Active Insurance Groups (IAIGs)

- Reporting/disclosure requirements in ComFrame will also apply to the AM
- IAIS comparability assessment highlighted two areas where work will help ensure convergence:
  - treatment of interest rate risk, and
  - appropriate timing of supervisory intervention

US Implementation of the ICS

Highlights of AMIWG deliverables

Review of US Group Solvency Regulation

- Recommendations on any potential refinements to the AM for comparable implementation of the ICS
- Will use technical documents on valuation, scalars and ‘other tools’ as reference

Finalization of the Aggregation Method

Recommendations to other working groups, as applicable

Monitor any further development of ICS and impact to the AM

AMIWG deliverables timeline

1st Q 2026

Undertake review identifying any potential gaps in US system and develop recommendations

2nd Q 2026

Finalize review/ recommendations and Aggregation Method document

3rd Q 2026

Approval by G Committee and recommendations to other working groups, as applicable

Ongoing

Monitor any changes to ICS and impact to AM

US Implementation of the ICS

Highlights of IAIS deliverables

Self-Assessment Questionnaire on ICS implementation

- Developing instructions for AM specificities

ComFrame in ICP 9 (supervisory reporting) and ICP 20 (public disclosure), and a new paragraph 47 of ComFrame Assessment Methodology

- IAIS public consultation launched Nov 21 (comments due by Feb 5)
- A public background session on Dec 11 at 15:00 – 16:30 CET

IAIS Assessment of ICS implementation for AM

- Developing methodology; assessments to begin 2027, at earliest

IAIS deliverables timeline

1st Q 2026

SAQ instructions for AM specificities

2026

Jurisdictional self-assessment of ICS implementation

4th Q 2026

Adoption of ComFrame requirements in ICPs 9 and 20

2027 (or later)

IAIS assessment of ICS implementation

Thank you

Impact of Scalars on the Sensitivity of the Aggregation Method to Changes in Interest Rates

In August 2025, the Aggregation Method Implementation Working Group (AMIWG) recommended using the Excess Relative Ratio (ERR) approach for purposes of planning the Final AM.[1] This proposal noted that scalars could address issues highlighted including sensitivity due to changes in interest rates. The purpose of this paper is to examine how the ERR scalars impact the AM's sensitivity to interest rates.

Excess Relative Ratio Approach

The ERR scalar approach was developed to address concerns with volatility and cross-jurisdictional comparability. The method adjusts both available and required capital, with three main advantages: it is designed to adapt to changes in solvency regimes without introducing uneconomic volatility; it recognizes cross-jurisdictional differences in required reserves; and it produces results that are directionally consistent with the conversion of overseas capital into RBC terms.

The AM considers the Available Capital (AC) and Calculated Capital (CC) of each entity in an insurance group to determine the aggregated capital score. AC represents the entity's Capital & Surplus, or jurisdictional equivalent (Total Adjusted Capital (TAC) for U.S. insurers). Calculated Capital, also known as Required Capital in the US, represents the jurisdictional capital requirements (200% of the Authorized Control Level (ACL) for U.S. insurers). The ERR approach adjusts the CC for International insurers to align with RBC, then also adjusts AC to account for differences in reserve conservatism, recognizing that some jurisdictions have a regulatory approach that emphasizes reserves while others require greater capital. Because both AC and CC are sensitive to financial market conditions, particularly interest rates, the ERR scalar approach inherits sensitivity to changes in rate environments and constitutes a viable standard metric by which the U.S. will implement the ICS.

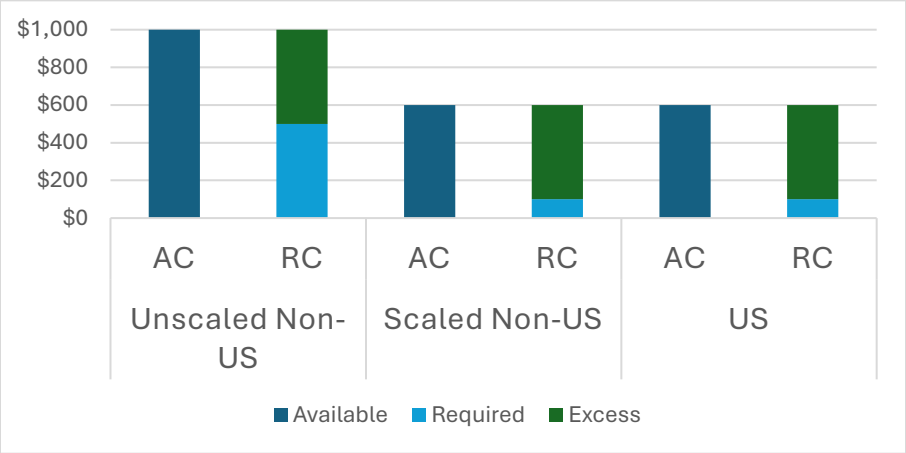
Sample Calculation

What follows is an example of how scaling impacts a group that has one US entity and one non-US entity in a "Regime A" that is typical of the non-US regimes that are material to the AM. Note that this is a hypothetical example but the underlying following stylized facts are

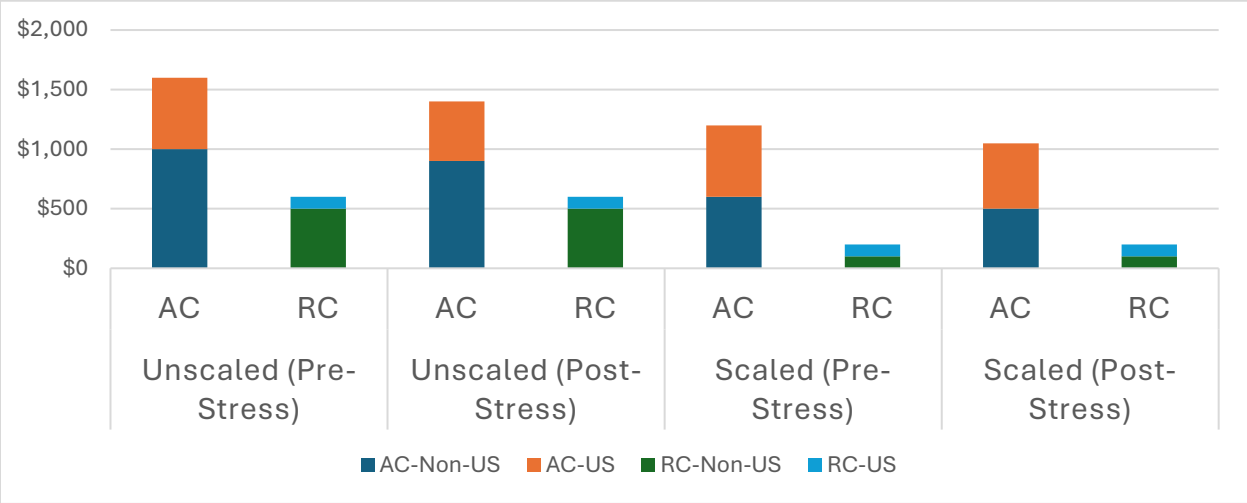
[1] https://content.naic.org/sites/default/files/national_meeting/Materials%20-%20AMIWG%20Summer%20National%20Meeting%20081125.pdf

based on empirical results from regimes where a less conservative approach to reserves (along with a correspondingly large capital requirement).

Assume that the two entities have the same excess capital of $500 but the starting capital ratio is 200% for the non-US entity, 600% for the US entity and, for simplicity, that these are the same as the industry averages for the two regimes. The relatively large available and required capital in the non-US entity are brought down to the same level as in the US entity using a scalar of 0.20 (=[200% - 100%]/[600% - 100%]) and an adjustment to the available capital to keep the excess unchanged.



Further, by scaling the available and required capital to similar levels, the ERR makes the sensitivity of group results to changes in individual entities more equal. For instance, assume there is an interest rate stress that results in a decrease in available capital of 100 for the non-US entity and 50 for the US entity. Before scaling, this would lead to a smaller percentage point decrease in the capital ratio for the non-US entity than for the US entity which may seem counterintuitive when analyzing group results. But after scaling this would lead to decreases that are proportional to the change in excess capital (i.e. from 600% to 500% for the non-US entity and from 600% to 550% for the US entity).



Conclusion

A scalar adjusts for differences in the level of calibration between different types of capital requirements and differences in valuation between the entities. The ERR approach adjusts available and required capital to produce the same average solvency ratio in each jurisdiction while keeping the excess capital (i.e. the amount by which available exceeds required capital) unchanged for each individual entity. The inputs to this calculation are sensitive to changes in interest rates and the resulting scalar helps adjust for any resulting differences.

Interest Rate Sensitivity in US Statutory Reserving

December 2, 2025

Table of Contents

Executive Summary

This paper will discuss how US statutory reserving requirements respond to changes in interest rates. Specifically, this paper will briefly discuss formulaic reserves and will provide a more detailed discussion of principle-based Reserve (PBR) methods and assumptions, asset adequacy testing (AAT), asset/liability matching (ALM) as it relates to PBR and AAT, and interest rate risk under risk-based capital (RBC).

Regarding PBR, this paper will focus on the 2026 version of the Valuation Manual (VM)[1] section 20 (VM-20) covering life insurance products, VM-21 (variable and registered index-linked annuities), and VM-22 (fixed deferred and payout annuities). The reserves calculated under each VM chapter are discussed, focusing on the components that are interest rate sensitive. AAT, covered under VM-30, acts as an umbrella over statutory reserving with interest rate sensitivity a key risk to assess.

Under the three PBR VM chapters, a stochastic reserve (SR) is calculated for interest sensitive contracts and may be calculated in other circumstances. The SR is made up of the conditional tail expectation at the 70th percent level (CTE 70) of scenario reserves as determined in each VM chapter. The CTE 70 is the highest 30% of the scenario reserves. A scenario reserve is determined for each interest rate scenario where a large number of interest rate scenarios covering a wide range of interest rates are run. A deterministic reserve (DR) may be calculated over a single interest rate scenario. A formulaic net premium reserve (NPR) is calculated under VM-20. Most of the focus of this paper is on the SR as the SR is most reflective of changes in interest rates. The DR may also exhibit interest rate sensitivity, albeit for only one interest rate scenario.

There are exclusion tests that may exempt non-interest sensitive or less interest sensitive contracts from calculating the SR, and sometimes the DR. The objective is to avoid running many interest rate scenarios if the contracts are not particularly interest sensitive, meaning the scenario reserves generated from those scenarios are not materially different.

Reserves for products under VM-20 and VM-22 were run under 9/30/2025 interest rate scenarios at policy inception using the new National Association of Insurance Commissioners (NAIC) Generator of Economic Scenarios (GOES). A universal life with a secondary guarantee (ULSG)[2] product was run under VM-20 and a fixed deferred annuity with a guaranteed living withdrawal benefit (GLWB)[3] was run under VM-22. 1,000 scenarios as of 9/30/2025 were used for each of the baseline runs as well as two shock scenario sets, 100 bps up and 100 bps down[4].

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[1] The VM can be found at https://content.naic.org/pbr_data.htm

[2] A secondary guarantee is a guarantee to keep the contract in force even if there is insufficient account value to pay contract charges. There are several forms of secondary guarantees such as a shadow (parallel) account value must stay positive or a fixed annual premium obligation must be met.

[3] A GLWB has many different designs, however general features include guaranteed payouts for the contract holder's lifetime even if there is insufficient account value to cover the withdrawal. Fees are charged against the account value to pay for the benefit, and a benefit base is used along with guaranteed payout factors are used to determine the guaranteed benefit amount.

[4] The shock scenarios were simplified from what would occur under PBR. The shocks parallel shifted the 9/30/2025 scenarios up or down by 100 bps. If treasuries moved by 100 bps, that new initial curve would be

It should also be noted that under PBR, the various reserve floors may appear to reduce or eliminate interest rate sensitivity because the floors happen to determine the reserve rather than the detailed reserve calculations. The examples use unfloored SR's to show the interest rate sensitivity inherent in the PBR reserve calculation.

An example is not provided under VM-21. In general, interest rate sensitivity in VM-21 is captured through impacts on contract guarantees on withdrawals, annuitizations, and death benefit, as well as yields on general account assets and contract crediting rates.

The ULSG product was designed with a lifetime secondary guarantee using a shadow account with target premiums that will maintain the secondary guarantee through attained age 121. The product was run under VM-20 at issue ages 55, 65, and 75, each with a $500,000 face amount. Each run was separate. An attribution analysis of the change in reserve was performed on the age 65 cell. In addition, age 65 was run with a shorter reinvestment duration, demonstrating the impact of duration mismatch on reserves.

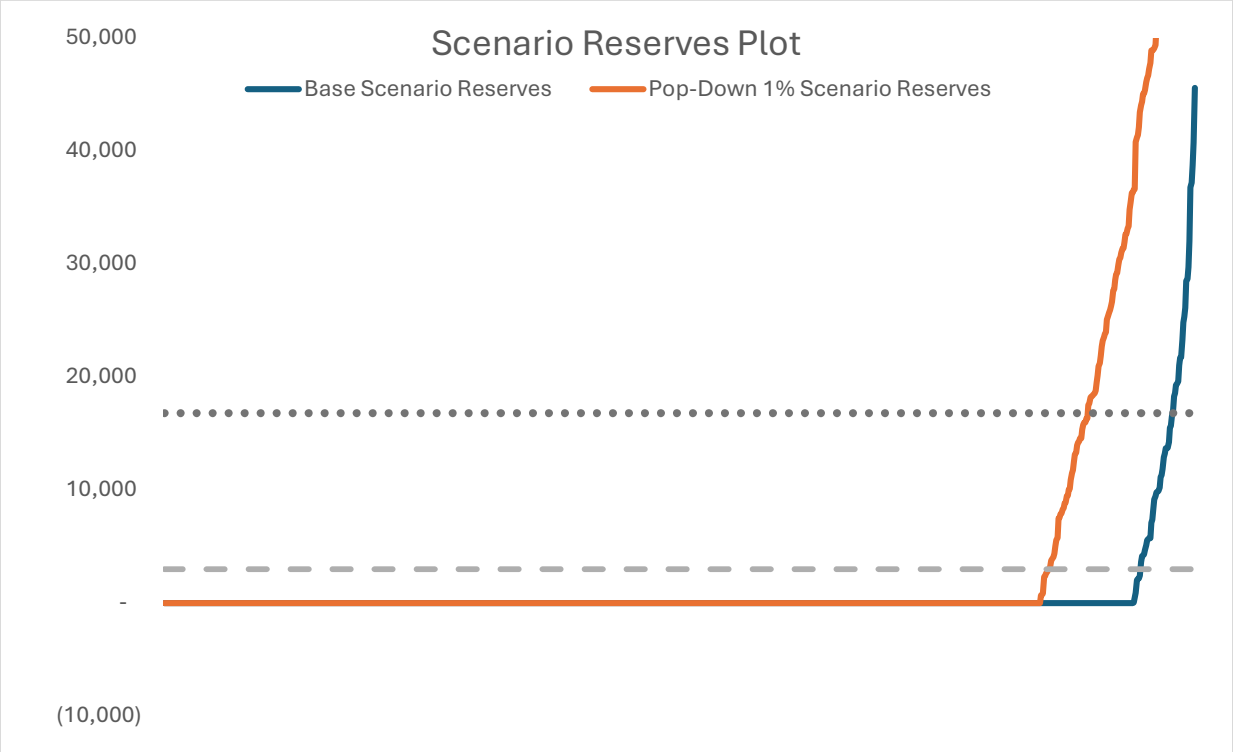
The results are as follows:

	Stochastic Reserves CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff ($)** **Pop-Down vs Base / Pop-Up vs Base**
55-Year-Old Cell	21,701	43,908	2,451	22,207 / -21,701
65-Year-Old Cell	2,991	16,808	0	13,816 / -2,991
7 5-Year-Old Cell	-	70	0	70 / 0
65 YO Cell; Shorter Reinvs[5]	6,575	21,892	89	15,317 / -6,486

The scenario reserves for the age 65 cell for both the baseline and 100 bps shock down are shown below:

used to generate new interest rate scenarios under PBR. The simplification used may overstate the change in reserve because the parallel shift in the interest rate scenarios does not reflect the mean reversion that would occur in a regeneration of interest rate scenarios from a lower or higher initial treasury curve. Another factor impacting results is if the mean reversion parameters are changed as rates change. This is a lesser concern in that the parameters will undergo routine review periodically, likely every few years. It is also difficult to predict the impact on results.

[5] Shorter reinvestment assumption is 50% 5-year; 35% 10-year; 15% 20-year



Additionally, an attribution analysis was performed on the age 65 cell, showing the major components impacting the reserve change. As expected, lower interest rates increased the reserve from $2,991 to $16,808.

	Stochastic Reserves	Attribution Impact	Attribution Step
Baseline	**2,991**		
		9,880 | +72%	Investment Income
		2,107 | +15%	Discount Vector
		1,829 | +13%	Residual
1% Pop-Down	**16,808**		

Lower investment income due to lower reinvestment yields resulted in higher asset shortfalls and starting assets that need to be accounted for in the reserves, making up more than 2/3 of the change in reserve. The discount rates decreased by close to 100 bps in the shock down run, impacting the present values of asset shortfalls.

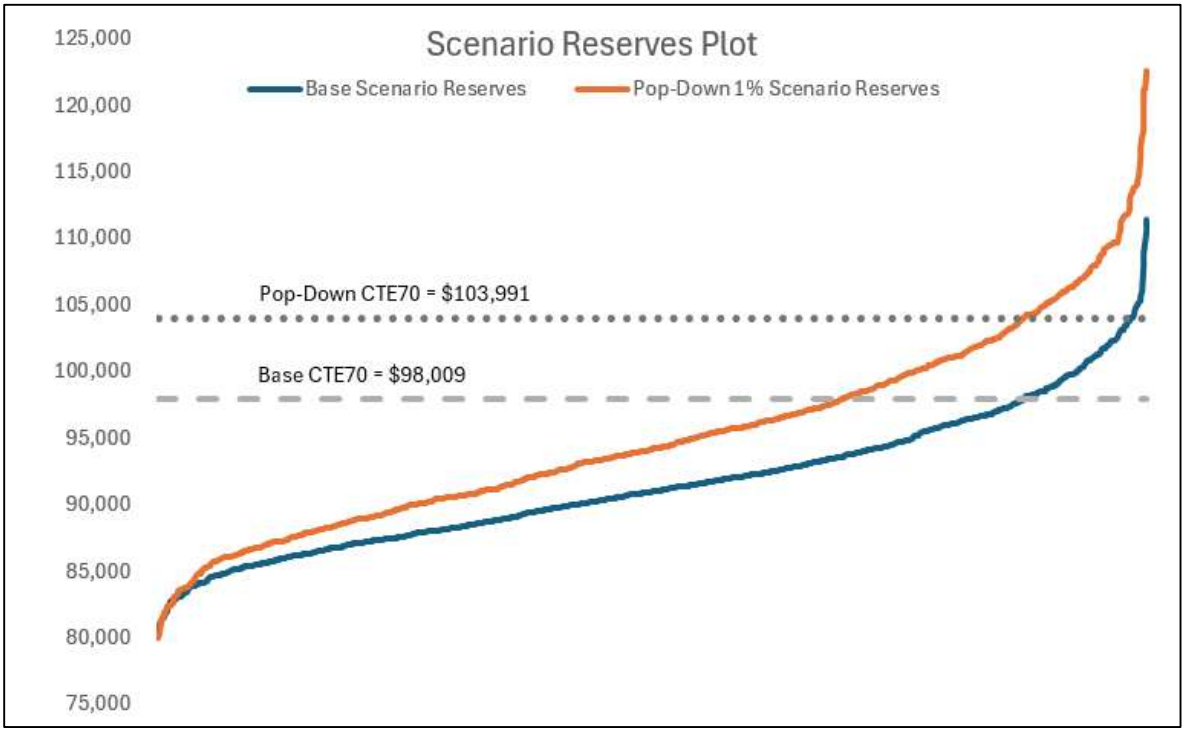
The fixed deferred annuity was designed with a 7-year surrender charge, a one-year interest rate guarantee and a guaranteed minimum interest rate of 3.0%, along with a GLWB. Issue age cells of 55, 65, and 75 were run under VM-22 at, each with a $100,000 single premium. An attribution analysis of the change in reserve was performed on the age 65 cell. In addition, age 65 was run with a shorter reinvestment duration, which demonstrated the impact of duration mismatch on reserves.

The results are as follows:

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff** Pop-Down vs Base / Pop-Up vs Base
55-Year-Old Cell	93,476	101,398	89,173	+8.5% / -4.6%
65-Year-Old Cell	98,009	103,991	93,859	+6.1% / -4.2%
75-Year-Old Cell	90,728	91,251	90,499	+0.6% / -0.3%
65 YO Cell; Shorter Reinvs[6]	99,481	105,900	94,794	+6.5% / -4.7%

The scenario reserves for the age 65 cell for both the baseline and 100 bps shock down are shown below:

[6] Shorter reinvestment duration assumption is 50% 5-year; 35% 10-year; 15% 20-year



In addi7tion an attribution analysis was performed on the age 65 cell, showing the major components impacting the reserve change. As expected, lower interest rates increased the reserve from $98,009 to $103,991.

	Stochastic Reserves UNFLOORED CTE70	Attribution Impact	Attribution Step
Baseline	**98,009**		
		3,331 | +56%	Discount Rates
		1,963 | +33%	Investment Income
		691 | +12%	Withdrawals
		(4) | 0%	Residual
1% Pop-Down	**103,991**		

The discount rates decreased by close to 100 bps in the shock down run, making up more than ½ of the change in reserve. Lower investment income due to lower reinvestment yields resulted in higher asset shortfalls that need to be accounted for in the reserves. Lower interest rates means that lapses will tend to decrease. Lower lapses mean the level of withdrawals under the GLWB will increase (more people to use the benefit), increasing the required reserves.

As the examples demonstrate, PBR recognizes changes in both asset and liability cash flows. As rates decline, so do investment yields and discount rates, reflected in increasing reserves. As rates

decline, policyholder behavior changes, such as fewer people lapsing, impacting cash flows, and increasing reserves.

In addition to a dynamic and responsive reserve framework, actuaries are required to perform AAT each year. AAT acts as an umbrella over reserve frameworks to help ensure adequate reserves over a wide range of interest rates, with appropriate conservatism to model moderately adverse conditions (loosely defined as CTE70 or the 85th percentile of results as the intent is to test reserves at a similarly conservative level at which reserves are set).

Cash flow testing (CFT) is the most appropriate AAT method for interest sensitive products. CFT generally allows for aggregation within legal entity, allowing sufficiencies to offset deficiencies between blocks. To the extent that the actuary or regulator believes that standalone testing of a particular block is required, additional testing may be performed. CFT sets assets equal to reserves at time 0 of the valuation. Both the assets and liability cash flows are valued over a wide range of stochastic and/or deterministic interest rate scenarios. There must be sufficient cash inflows to cover cash outflows over time in those scenarios in moderately adverse conditions. If cash flows are not adequate in enough scenarios, reserves may need to be strengthened.

ALM is recognized both in PBR and CFT. In general, the greater the mismatch between asset and liability durations, and in some cases convexity, the larger the reserve under PBR will be. Under the wide range of interest rate scenarios run under both PBR and CFT, mismatches that exist at the start of the model run and those that either are created or exacerbated during the model run will be recognized. In the case of PBR, the reserve will be higher. For CFT, there will either be smaller surpluses or larger deficiencies and an increased likelihood of requiring asset adequacy reserves.

For the ULSG issue age 65 example, the liability duration is 22.5 years driven by the long-term nature of the product. The initial asset portfolio duration is 9.2 years. The baseline reinvestment asset duration is 8.4 years. Under the sensitivity, the shorter reinvestment asset duration is 7.0 years, 1.4 years shorter than the baseline, increasing the asset/liability mismatch. As can be seen below, the increase in mismatch between asset and liability duration and the resulting increase in mismatch of asset and liability cash flows increases the reserve[7].

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff ($) Pop-Down vs Base / Pop-Up vs Base**
65-Year-Old Cell Baseline Reinvestment Duration (33% 5yr; 33% 10yr; 33% 20yr)	2,991	16,808	2,451	13,816 / -2,991
65-Year-Old Cell Shorter Reinvestment Duration (50% 5yr; 35% 10yr; 15% 20yr)	6,575	21,892	89	15,317 / -6,486

[7] While the duration mismatch is large even in the baseline, the purpose of this example is to show relative change. It is highly unlikely that a company would construct a portfolio with such a large mismatch.

For the deferred annuity issue age 65 example, the liability duration is 13.5 years driven by the GLWB. The initial asset portfolio duration is 9.2 years. The baseline reinvestment asset duration is 8.4 years. Under the sensitivity, the shorter reinvestment asset duration is 7.0 years, 1.4 years shorter than the baseline, increasing the asset/liability mismatch. As can be seen below, the increase in mismatch between asset and liability duration and the resulting increase in mismatch between asset and liability cash flows increases the reserve[8].

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff** Pop-Down vs Base / Pop-Up vs Base
65-Year-Old Cell Baseline Reinvestment Duration (33% 5yr; 33% 10yr; 33% 20yr)	98,009	103,991	93,859	+6.1% / -4.2%
65-Year-Old Cell Shorter Reinvestment Duration (50% 5yr; 35% 10yr; 15% 20yr)	99,481	105,900	94,794	+6.5% / -4.7%

Under RBC, interest rate risk is accounted for by factors applied to low, medium, and high-risk products. The higher the risk, the higher the factor and required capital. In addition, there are model based methods that either add or subtract from the required capital. Fixed deferred annuities, immediate annuities, structured settlements, guaranteed investment contracts, and single premium life insurance use the CFT models and conservative prescribed scenarios. The methodology used for these contracts, described later in the paper, is designed to approximate the 95th percentile. Interest rate risk is taken into account through running multiple interest rate scenarios, valuing both assets and liabilities in each scenario as in CFT.

Variable annuities calculate CTE98 (average of the 2% worst scenario reserves) following the VM-21 SR methodology and a separate calculation for contracts following the Alternative Methodology. By using PBR models, interest rate risk will be accounted for in the same manner, by determining asset and liability values over a wide range of interest rate scenarios and accounting for scenario short falls in the scenario reserve calculations. The methodology also takes the SPA into account. The capital calculations use much deeper in the tail results.

As noted above, interest rate risk is accounted for in several ways, through both reserves and capital. Adverse projected cash flows due to interest rates will tend to increase model-based reserve and capital requirements.

Introduction

The purpose of this paper is to describe and demonstrate interest rate sensitivity under PBR. Descriptions of PBR are based on the 2026 VM. The examples shown are based on September 30, 2025, GOES interest rate scenarios and shocks of those scenarios. The examples are hypothetical and to the best of my knowledge are reasonable representations of products available in the US.

The intended users of this paper are US and international regulators, specifically those regulators working on standards for the Aggregation Method (AM) of group capital in the US and international regulators working on Insurance Core Standards (ICS) for group capital under the auspices of the International Association of Insurance Commissioners (IAIS).

I, Bruce A. Friedland, am an Actuarial Strategist with Friedland Actuarial. I am a member of the American Academy of Actuaries. I meet the Academy qualification standards to render the opinions expressed in this paper. I have prepared this paper along with the conclusions contained herein. Thomas Wurfel, FSA, MAAA, President of Allen Bailey and Associates, has developed the models, analysis, and results. I have reviewed the analysis and results and have had discussions with Mr. Wurfel, so that we agree on the analysis and conclusions contained herein. I am able to provide any supplementary information and explanation. Neither I nor my firm have any conflicts of interest in providing the information and opinions in this report.

Actuarial methods, considerations, and analyses used in the preparation of this paper conform to the appropriate standards of practice as promulgated by the Actuarial Standards Board, which standards form the basis for this paper.

This paper was peer reviewed by the following individuals:

John Brady, FSA, MAAA
Steven Chang, FSA, CERA
Qamar Islam, FSA, MAAA
Michael Watanabe, FSA, MAAA, CERA
Kyle Walster, FSA, MAAA

Background

Reserves are set under statutory principles to provide protection to policyholders and promote company solvency against adverse fluctuations.[8]

Until relatively recently, life insurance reserves were formulaic. Reserves per unit could be derived for all future periods and could be found through table look ups. Reserves often followed approaches like the Net Level Premium Method (NLP) and later the Commissioner's Reserve Valuation Method (CRVM) for life insurance, and the Commissioner's Annuity Reserve Valuation Method (CARVM) for annuities. Prescribed mortality and discount assumptions were set

[8] 2026 Valuation Manual -redline p.5. All VM references throughout this document is to the 2026 Valuation Manual.

conservatively, and additional conservatism was added by flooring the calculated reserve at the contract's cash surrender value.

In the early 1990's, it was recognized that assets backing reserves also needed to be evaluated, and reserves needed to be evaluated under a wide range of interest rates, which led to the creation of asset adequacy testing (AAT). For products that are interest rate sensitive, CFT is generally the appropriate asset adequacy method. CFT models use moderately adverse assumptions and test whether the assets backing the tested blocks of business are sufficient, along with future premiums, to pay liabilities as they come due over the lifetime of the policies tested. CFT is performed over a wide range of interest rate (and equity, if applicable) scenarios. The tested scenarios may be deterministic, stochastic or both deterministic and stochastic. To the extent that ending negative surplus (ending deficiencies) or material negative interim surplus (interim deficiencies) amounts occur in enough scenarios involving moderately adverse conditions, the company's appointed actuary may conclude that additional reserves need to be held. The additional reserve amount and accompanying assets should result in projections using the same moderately adverse assumptions and conditions where there is no longer negative ending or material interim deficiencies. Since the starting assets are set equal to the initial reserve (including any additional asset adequacy reserve), CFT identifies an appropriate total reserve amount reflecting moderately adverse conditions for the blocks of business tested.

As products became more complex, especially with the advent of ULSG, a reserve regime, PBR, was contemplated in the early 2000's where an economic based reserve would be calculated and held as the liability for policyholder benefits. The economic reserve would use best estimate assumptions along with appropriate conservatism through provision for adverse deviation (PAD or margin).

The reserve calculation would use modeled projections of cash flows rather than formulaic methods. As a result, the reserve would be more responsive to product liability, related asset, and economic risks. The reserve framework would be a flexible chassis used to respond to product innovation and changes in risk profile of those products, without having to change the reserving structure. As a result, PBR would account for asset and product complexity, creating reserves reflective of both asset and product related risks. To the extent that the appointed actuary believes that the methods, assumptions, and models do not produce adequate reserves, additional reserves may be held. PBR has flexibility built into the reserving framework because the actuary can choose to set non-prescribed assumptions and margins (called a prudent estimate assumption) at an appropriate level to reflect product risks and data credibility.

Under PBR and AAT, sensitivity tests of key assumptions are expected. For the most part the tests are meant to represent a reasonable deviation from the baseline assumptions used in the model. Sensitivity tests help identify material risks and they also demonstrate how the reserving framework responds to assumption deviations. For example, under CFT for a fixed annuity, lapses can be increased in a rising interest rate scenario as rising rates lead to better competitor crediting rates. Contract holders hold products with lower fixed rates and will be more likely to lapse their policy to obtain a higher rate elsewhere. Higher lapses reduce spread and profitability. In a declining rate scenario, lapses can be stressed down as better deals are not available elsewhere and guaranteed minimum crediting rates may reduce profitability through spread compression.

In both the case of PBR and AAT, detailed reports are required. An actuarial memorandum is required under VM-30 to support the appointed actuary's Statement of Actuarial Opinion (SAO) for the year. Detailed PBR reporting requirements are included in VM-31. Both documents help regulators understand key product risks as well as company actions taken to mitigate those risks. The reports provide a great deal of transparency for the regulators.

Additionally, VM-G established PBR governance requirements for company board of directors, senior management, and qualified actuaries (those actuaries responsible for PBR calculations).

Companies are also required to calculate and hold RBC. Required capital charges use factors assigned to asset, pricing, interest rate, and business risks. There are also model based methods to evaluate interest rate risk on certain products, in addition to factor charges. Levels of capital are defined where the company is expected to either add surplus or reduce risk, or where regulator intervention is indicated. Competitive pressure and company prudence result in companies holding multiples of these levels.

As a broad generalization, reserves are held to cover risk at around the 85th percentile of potential outcomes and capital is held for risks around the 95th percentile or deeper in the tail, depending on block.

As will be noted in the sections below, PBR and CFT reflect interest rate risk and respond to changes in interest rates. This occurs through regular updates in economic scenarios, their corresponding impacts on discount rates, and considering changes in policy holder behavior tied to changes in interest rates. Assumptions are also routinely updated and must be supported by data, credibility analysis, sound actuarial judgment, and prescription in some cases.

VM-20

VM-20 was effective on a prospective basis for issues beginning 1/1/2017 or later, with a 3-year transition period for new issues. As a result, unless a company satisfied a size based or a product-based exemption, new life insurance contracts needed to be valued on a PBR basis beginning 1/1/2020.

Reserve Methodology

VM-20 utilizes a three-pronged approach to reserving: a stochastic reserve (SR), a deterministic reserve (DR), and a net premium reserve (NPR). There is also a cash surrender value floor and a cost of insurance floor. The SR utilizes a wide range of interest rate scenarios. The DR uses a specified interest rate scenario, and the NPR is a formulaic reserve.

The main element of the SR is the CTE70 of the scenario reserves, where CTE70 is the average of the highest 30% of the scenario reserves. The scenario reserve reflects starting assets as well as asset shortfalls that occur over the projection period. Interest rate sensitivity occurs through changes in asset and liability cash flows due to changes in interest rates, affecting items such as discount

rates, reinvestment yields, investment income, liability cash flows through dynamic lapse and changes in crediting rates (e.g., if there is a reduction in spread due to guaranteed minimum crediting rates), as applicable to a particular product.

The SR and DR calculations are aggregated, model-based reserves while the NPR is seriatim and formula based. For a given group of policies calculating all three reserves the sum of the seriatim NPR's are determined first, subject to the seriatim cash surrender value floor and seriatim cost of insurance to the next processing date (½ c_x) floors, less any due and deferred premium for those policies. Next the DR and SR for those same policies is determined along with the pre-tax interest maintenance reserve (PIMR) for each of the DR and SR blocks. The DR and SR are reduced by the applicable PIMR and the larger of those two results are used in the final reserve. Finally add the excess in the prior step over the NPR minus the due and deferred premium to the NPR less due and deferred premium in the first step. Effectively, the PBR is set at the highest of the three values.

As an example, assume, after application of the cash surrender floor and ½ c_x to the NPR:

NPR for all policies = $10,000
Due and Deferred Premium for all policies = $1,000
SR = $13,500
DR = 11,000
$PIMR_{SR} = PIMR_{DR} = 0$

PBR = NPR – Due and Deferred Premium + [Max (0, Max ((SR- $PIMR_{SR}$, DR- $PIMR_{DR}$))) – (NPR - Due and Deferred Premium)]
= 10,000 – 1,000 + [Max (0, (Max (13,500, 11,000))) – (10,000 – 1,000)]
= 9,000+ [13,500 – 9.000] = $13,500

Additionally, VM-20 defines different reserving categories. They are the term reserving category, ULSG reserving category and all other VM-20 product reserving category. As a general rule, final VM-20 reserves are determined based on aggregated results at the reserving category level.

Exclusion Tests

There is a stochastic exclusion test (SET) and a deterministic exclusion test (DET) that can exempt companies from calculating the SR, DR, or both. Certain products are not eligible for the SET and DET such as ULSG with anything other than a non-material secondary guarantee (defined in the VM). It should be noted that term is not eligible for the DET.

If the company passes the SET, then the DR and NPR are calculated. If the company passes both the SET and the DET then only the NPR is calculated. Interest sensitive products will tend to fail the SET, which means all three reserves must be calculated

Exclusion tests are used to identify policy groups that should be or may not electively be subject to the SR, based on the sensitivity of reserves over a range of interest rate (and equity, if applicable) scenarios, or the DR. The exclusion tests help to right size the effort in calculating reserves while

ensuring the appropriate reserve(s) is calculated based on the inherent risks in the product. If products are not sensitive to interest rates, then reserves will tend to not vary significantly over a broad range of interest rate scenarios. As a result, it is extraneous work to calculate reserves over many scenarios in that circumstance. Instead, an appropriate reserve can be determined with one interest rate scenario. Policies that are interest sensitive will tend to fail the SET or may not even be eligible for exclusion. As a result, all three reserves need to be calculated for interest sensitive policies. There is also no SET available for any group of policies that utilizes a future hedging strategy, unless the hedge is for a low utilization, immaterial benefit. Alternatively, companies always have the option to calculate all three reserves and not perform the SET.

There are three different stochastic exclusion tests, only one of which needs to be passed (there are also rules about failing one test then trying another, which is outside the scope of this paper). The first one is the Stochastic Exclusion Ratio Test (SERT). This test is calculated annually and within 12 months of the PBR valuation date. The SERT entails calculating an adjusted DR individually for each of 16 defined interest rate scenarios in VM-20. The baseline scenario uses the prescribed economic scenario generator and no interest rate shock. The baseline is subtracted from the largest DR from the other 15 DR's. This difference is divided by the present value of future net (of reinsurance) benefits from the baseline scenario in order to normalize the results between the two scenarios. The SET is satisfied if this result is less than 6%. The inference is that if the SERT is less than 6%, then the product group is less interest sensitive and conversely more interest sensitive if the ratio is over 6%. Since the 16 scenarios test various interest rate (and equity) shocks, a wider range of results suggests more interest rate sensitivity and the need to calculate stochastic reserves. VM-20 permits using a gross premium reserve from the company's asset adequacy models (with a couple of modifications for added conservatism) instead of the DR, calculating the SERT in the same manner.

As an example of the SERT, consider a baseline result of $120 million, the largest adjusted DR of $130 million and a present value of future net benefits of $240 million. The SERT is 4.2%, and an SR is not necessary. Instead let the largest adjusted DR = $135 million. The SERT is 6.25% and the SR must be calculated.

The second test is the Stochastic Exclusion Demonstration Test (SEDT). This test is conducted at the time of PBR implementation and at least once every three years thereafter. The SEDT entails periodically calculating the SR for the group of exempted policies. The DR for those policies is compared with the NPR less due and deferred premium. The larger of those two reserves are compared to the SR and as long as that reserve is larger than the SR, the SEDT is passed.

If Max [DR, NPR – due and deferred premium] > SR, then the SEDT is passed.

The SEDT also permits other variations using some of the scenario reserves that make up the SR or risk-based demonstrations, however the objective is the same. This is to show that the reserves that will be calculated if the SEDT is passed are at least as large as the SR. The SEDT captures interest rate risk, or the lack of it, by requiring an SR or similar calculation and comparing it to a single scenario and a formulaic reserve.

The final test is the SET Certification Method. This is a certification that one of the other two methods has been passed within the past 3 years and that there have not been material changes in

interest rate or asset return volatility risk for the policies and their supporting assets subject to the certification.

The next step is to determine if the group of contracts passes the Deterministic Exclusion Test (DET). If the group of contracts pass the DET, the reserve is the NPR – due and deferred premium. There are certain products that are not eligible for the DET. This includes ULSG, unless the secondary guarantee is "non-material," as well as term insurance policies and term riders. Additionally, any group of policies that fail the SET must also calculate the DR. The DET Net Premium Test is a demonstration that the sum of gross premiums exceeds the sum of valuation net premiums, indicating an adequate premium is being charged to the policyholder compared to premiums based on reserve assumptions of interest and mortality. There is also a certification method available. As a broad generalization, the DET is structured to compare premiums because interest sensitive contracts would have failed the SET and would not be eligible for the DET.

SR Calculations and Scenarios

The SR requires calculating a series of scenario reserves, one for each interest rate scenario. Technically there can be multiple model segments due to different products or product series, all with their own cash flows and assumptions, including discount rates; this paper will ignore multiple model segments for brevity. The scenario reserve is the sum of the starting value of assets used in the model plus the greatest discounted value of the negative of projected assets. The discount rate will be described below. Scenario reserves are ranked and the average of the CTE70 of reserves becomes the SR. The qualified actuary can add additional amounts if any material risk cannot be explicitly modeled.

For a given scenario reserve, asset and liability cash flows are projected to the point where no obligations remain. This avoids ignoring material potential losses past a certain projection point and inconsistency of practice from company to company, should more subjective criteria be used. The cash flows reflect margin in each material assumption, some prescribed and some based on judgment. In general, the less credible the data and/or the more volatile the assumption, the larger the margin should be.

Interest rate scenarios are determined from a prescribed interest rate generator, GOES. Alternatively, companies can use their own interest rate scenario generator if they can demonstrate that reserves will not be materially less than those calculated with GOES scenarios. The company must run a sufficient number of scenarios to cover a wide range of interest rates. They must demonstrate that enough scenarios have been run and that the SR would not materially increase if a larger number of scenarios were run. The DR utilizes a prescribed scenario, SERT scenario 12.[9] The impact of using the GOES scenarios may be phased in over a three-year period beginning on January 1, 2026.

[9] For the DR, the prescribed interest rate scenario, Scenario 12 of the SERT scenarios, is described for interest rates in VM-20 as *uniform downward shocks each month for 20 years such that interest rate levels are approximately at the one standard deviation down level(16%) from the stochastic distribution of interest rates. After year 20, very small positive uniform shocks are applied to allow interest rates to approximately revert to their long-term median levels.*

While the GOES model governance is still in draft form, it is scheduled to be discussed at the NAIC's fall meeting in early December. The current draft calls for monthly updates to the Treasury model to reflect starting conditions. At the beginning of each year an annual review will take place. Back testing will be used to compare the projected results to the actual previous year data. Recommendations will be made and considered as to whether model parameters need to be updated. A review will be conducted every five years to recalibrate the GOES model. Finally, the current draft addresses off cycle updates. Updates may be indicated and will be taken if there is a significant change in economic conditions, a change in Federal Reserve policy, model findings, failure to meet acceptance criteria, insurance product changes that indicate a need for new GOES functionality or an emphasis on certain risks.

Discount Rates

Discount rates are determined differently for the DR and the SR. For the SR, the discount rate is 105% of the path of one-year treasury rates for each projection year for each scenario reserve. The SR discounts excess or insufficient asset amounts in this manner, as the discount rate reflects the *marginal* assets required to eliminate any small asset overage or shortfall over the projection period. These amounts tend to be small, and the discount rate is not as critical because the starting asset amount requirements result in a starting asset amount between 98% and 102% of the modeled reserve. However, there is discussion about adopting an NAER approach for consistency with other VM chapters.

For the DR, the discount rate is based on the net asset earned rate (NAER) along scenario 12. The DR methodology uses an actuarial present value of premiums, benefits, and expenses methodology. As a result, the NAER represents the approximate earned rates on assets for each year in the projection period for scenario 12. Loosely speaking, the NAER path is net investment income/invested assets at each projection point. There is an alternative method to calculate the DR which is that starting assets are iterated until all benefits and expenses are covered by the end of the projection horizon. There is no NAER needed here for discounting as there are no excess or shortfalls of assets to discount.

Projected Cash Flows and Assumption Considerations

Cash flows include any material income or benefit item such as mortality, lapse/surrender, expenses, commissions, net investment income (net of default costs and investment expenses, realized capital gains/losses, and hedges) and reinsurance. Any non-guaranteed elements (NGE) projected should reflect any guarantees as well as past NGE practices and policies. Further, the projection of NGE's must be consistent with experience assumptions in each scenario. For example, if interest rates increase, dividends are also expected to go up. Inconsistent treatment could be maintaining the current dividend scale. Similarly, a reasonable expectation is that non-guaranteed crediting rates must increase as interest rates increase. Policyholder behavior assumptions must also be consistent with the projected NGE's and the economic scenario. For example, it would not be reasonable for the company to assume that policyholders would continue to accept lower rates, and the company would reap higher spreads when competitors offer higher rates.

Starting asset amount cash flows are projected using appropriate techniques and those projected asset amounts must be consistent with the value of the starting assets at the beginning of the projection.

The company chooses its own reinvestment assumption consistent with its current reinvestment practice or its anticipated and supportable future practice, if different. The company also must calculate a guardrail assumption using high quality public non-callable corporate bonds and must use the more conservative of the two assumptions. Spreads over treasuries are prescribed and are updated each year. Current spreads are used in projection year 1 (subject to adjustments detailed in VM-20), grading to long term spreads beginning in projection year 4 and later. The projection year is always counted from the model start date, so this process occurs at each valuation. There are also current and long-term swap spreads. The spreads vary based on credit rating and the weighted average life of the projected asset. Spreads are updated monthly.

Assumptions such as interest rates or equities are required to be modeled stochastically in calculating the SR. Other assumptions can also be modeled stochastically. Any material assumption that is not modeled stochastically is required to have appropriate margin; the less credible or supportable the assumption based on available data, the larger the margin should be. In addition, margins should vary as appropriate based on interest rate or equity scenario.

Policyholder behavior assumptions are also important for certain products. For example, if lapse behavior is expected to, or data shows, increases in lapses as rates rise because contract holder rates are locked in and competitor rates are higher (disintermediation risk), an appropriate scenario by scenario or dynamic formula assumption should be used.

Appropriate sensitivity tests are also performed. This helps identify key risks based on the product(s) being valued. In general, this includes any assumption not stochastically modeled.

As noted above there are numerous places where interest rates come into play in VM-20, impacting the reserve amount. Starting assets reflect actual gross yields. These yields are then reduced by prescribed, conservative default costs and appropriate investment expenses. As those assets throw off coupons or other cash flows through the projection period, the conservative reinvestment strategy (the more conservative of the company's reinvestment strategy or the reinvestment guardrail) ensures continued conservatism throughout the projection period based on information that is known at the time.

Under US statutory reporting, reserves are required to be reported quarterly. At that point, assumptions are updated, as appropriate. For example, mortality experience rarely moves in such a way that a quarter's worth of experience changes results materially; annual updating is usually sufficient. Interest rate scenarios, in force listings and starting assets are updated quarterly. To the extent interest rates have moved over the quarter those changes are reflected in all impacted areas of the calculations such as reinvestment yields, discount rates, and dynamic lapse assumptions.

These changes will be discussed further in the example below.

VM-20 Example

This is an example of a day 1[10] reserve calculation for a ULSG product.

Reserves were run under the 9/30/2025 GOES scenario set, along with a 1% parallel shift up (1% pop-up), and a 1% parallel shift down (1% pop-down) of the 9/30/2025 GOES scenario set.

Product Design/Details, Assumptions and Margins

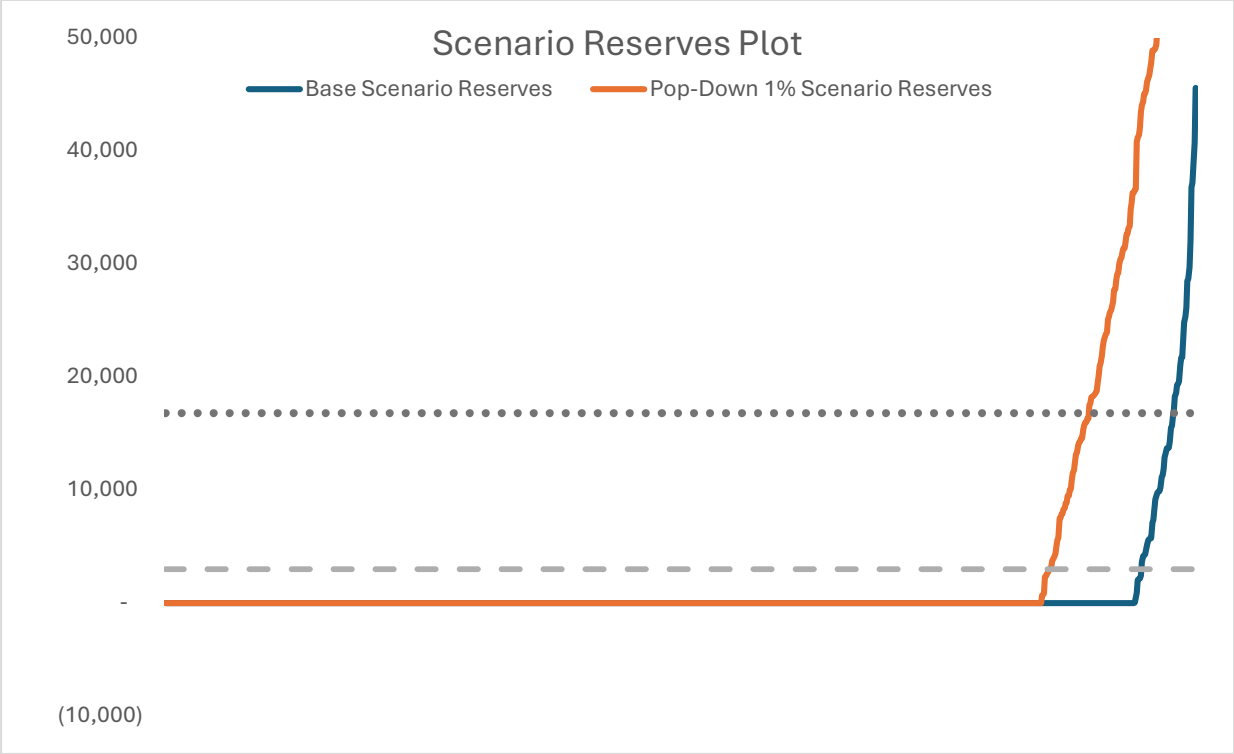
The ULSG product is designed so that target premiums will maintain the secondary guarantee through attained age 121. The product will offer minimal opportunity for cash value accumulation at current crediting rates levels and expense charges. Product design and assumption details are provided in Appendix 1.

Results

The results for modeled ages 55, 65, and 75 are shown below along with a shorter duration reinvestment assumption using the modeled age 65.

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff ($)** Pop-Down vs Base / Pop-Up vs Base
55-Year-Old Cell	21,701	43,908	2,451	22,207 / -19,250
65-Year-Old Cell	2,991	16,808	0	13,816 / -2,991
75-Year-Old Cell	-	70	0	70 / 0
65 YO Cell; Shorter Reinvs[11]	6,575	21,892	89	15,317 / -6,486

[10] Assets are purchased at time zero and the reserves are calculated the next day.
[11] Shorter reinvestment assumption is 50% 5-year; 35% 10-year; 15% 20-year



Attribution Analysis

An attribution analysis was performed for the age 65 cell between the baseline and the 1% pop-down scenario to determine the interest rate sensitivity in the stochastic reserve. The key interest rate sensitive drivers identified are (1) investment income and (2) discount rates.

	Stochastic Reserves	Attribution Impact	Attribution Step
Baseline	**2,991**		
		9,880 | +72%	Investment Income
		2,107 | +15%	Discount Rates
		1,829 | +13%	Residual
1% Pop-Down	**16,808**		

(1) Investment income: The investment income early in the projection period is largely based on the assumed starting asset portfolio. After Year 5, when proceeds from the starting asset portfolio 5-year bond maturities are reinvested at lower rates under the 1% pop-down scenario set, the investment income diverges based on the projected yields. This divergence grows after Year 10 and after Year 20 when all assets from the starting asset portfolio have matured. Lower investment income will result in greater asset shortfalls and a higher reserve.

(2) Discount rates: The discount rates under the 1% pop-down scenario set for the CTE70 scenarios are on average 106 basis points lower than the baseline scenario set over the course of the projection period. As a result of the lower discount rates, the asset shortfalls are higher, increasing the reserve.

VM-21

VM-21 was effective 1/1/2020 with a 3-year transition period, incorporating much of the PBR approach of Actuarial Guideline 43. It was retroactively applied to variable annuities with and without GMDBs and with and without Variable Annuity Guaranteed Living Benefits (VAGLBs). VAGLBs contemplated by VM-21 include Guaranteed Minimum Accumulation Benefits (GMABs), hybrid and traditional Guaranteed Minimum Income Benefits (GMIBs), lifetime and non-lifetime Guaranteed Minimum Withdrawal Benefits (GMWBs), and Guaranteed Payout Annuity Floors (GPAF). Contracts not covered by VM-21 include modified guaranteed annuities covered explicitly under another NAIC regulation and contracts that guarantee an index and do not contain GMDBs or VAGLB.

Variable annuity reserves are generally more sensitive to changes in equities than interest rates because policyholders tend to allocate more of their separate account investments to equity funds than bond or money market funds. The VM-21 PBR approach reflects sensitivity to interest rate risks related to product features including GMIBs, GPAF, guaranteed minimum credited rates on general account investments, and the PV of GMDB and GMWBs.

Under VM-21, the SR[12] plus any Additional Standard Projection Amount (SPA) is the reserve for many contracts. The SR is the CTE70 of scenario reserves. Each scenario reserve reflects starting assets as well as asset shortfalls over the projection period and is subject to an aggregate cash surrender floor. The SPA uses prescribed assumptions and other adjustments and, if positive, is added to the SR.

An Alternative Methodology is available for VM-21 contracts that contain only Guaranteed Minimum Death Benefits (GMDBs) or no guaranteed benefits at all. This reserve is the cash surrender value plus a factor applied to each product.

The SR may be determined for a single model segment incorporating all VM-21 contracts (other than those using the Alternative Methodology) or using multiple model segments. The SR uses a greatest present value of accumulated deficiencies (GPVAD) approach where there is a floor of zero so scenarios with surpluses cannot offset scenarios with deficiencies. All appropriate cash flows, net of reinsurance ceded, are included in the calculation reflecting the product features of the group of contracts. This includes but is not limited to contract guarantees, benefit payments, general expenses, fund expenses, fees, reinsurance, revenue sharing, and any spread earned on the general account. It also includes all cash flows related to hedges used to mitigate the risks of

[12] Terms used throughout this paper are as defined in the various VM chapters. For example, the SR in VM-20 is not the same as the SR in VM-21, yet SR is used to describe both.

the guarantees, with the requirement that any future hedging strategy be reflected in the projections.

Once cash flows are projected for each scenario, the GPVAD as of the valuation date is determined. The scenario reserve is then the starting assets used in the projection plus the GPVAD (essentially the greatest present value of asset shortfall to cover the liability cash flows in the projection) minus the PIMR allocated to the contracts valued in the scenario reserve. This scenario reserve is then subject to an aggregate cash surrender floor for the policies in the grouping used to calculate the scenario reserve. In formula form:

> Scenario reserve = max [(starting asset amount + GPVAD – allocated PIMR), aggregate cash surrender value]

Starting assets should be equal to the approximate statutory reserve and consist of all separate account assets, hedge instruments, and enough general account assets plus allocated PIMR to cover the balance of the estimated statutory reserve.

Alternatively, the scenario reserve can be calculated by the direct iteration method, where starting assets are iterated until all projected benefits and expenses are covered, i.e., there are no accumulated deficiencies. The reserve is equal to the starting assets, subject to the cash surrender value floor.

Asset cash flow projections for both the general account and the separate account should be appropriately modeled reflecting expected cash flows for each asset as well as projecting gross investment returns and realized/ unrealized capital gains/losses consistent with the scenario being modeled.

The projection period must be long enough that the resulting reserve would not be materially larger due to the inclusion of a longer time period. Generally, this means that liability cash flows are run to a point where they are no longer material.

The SR is subject to an SPA floor. The SPA, as noted above, is not calculated for policies following the Alternative Methodology. It is a reserve adjustment with prescribed assumptions replacing company assumptions along with a couple of other adjustments recalculating the reserves without future hedges except for index credits. Its main purpose is to establish a reserve level for comparison with company calculated reserves. If the SPA is greater than 0, then that amount is added to the SR to determine the SPA “reserve.” It does not create a safe harbor (if company reserves are larger, they must be held).

Contracts eligible for the Alternative Methodology have either no guaranteed benefits or, at most, GMDBs. If the company uses the SR/SPA approach to value policies that otherwise qualify for the Alternative Methodology, they can only switch to the Alternative Methodology with domiciliary commissioner permission.

The reserve under the Alternative Methodology for contracts with GMDBs is the seriatim cash surrender value plus a factor applied to each contract. The reserve before application of floors can be less than the cash surrender value due to a negative factor. The reserve is then floored at the

larger of the cash surrender value and the CARVM reserve. If there are no GMDBs then the reserve is the CARVM reserve.

VM-21 also describes considerations in setting policyholder behavior assumptions and setting a prudent estimate mortality assumption, including reflection of efficiency in policyholder behavior (similar to the discussion in the VM-22 section). Details are beyond the scope of this paper.

Appropriate sensitivity tests also must be performed and documented. The sensitivity tests should cover key assumptions, including policyholder behavior assumptions. The results of the tests should be used by the actuary to determine if calculated reserves are set at an appropriate level.

VM-22

Reserves

VM-22 is the latest addition to model-based reserving for US life and annuity products. VM-22 is effective for 1/1/2026 and later issues with a three-year transition period. All prospective business must be valued under PBR beginning with 1/1/2029 issues unless an exemption applies. During the transition period, companies can choose to value contracts on a PBR basis block by block. Once the company values the business under VM-22, it must continue to do so. The basic framework for VM-22 is VM-21, with appropriate modifications for fixed annuities and there are also some VM-20 elements in VM-22.

An issue still under discussion is whether VM-22 is to be retroactive, retroactive to what date and whether and how retroactive adoption will be optional at the company's discretion or whether adoption is mandatory. Any retroactive application will be effective with the 2027 VM. Retroactivity is beyond the scope of this paper.

VM-22 covers fixed annuity products such as fixed deferred annuities (FA's), fixed indexed annuities (FIA's), payout annuities (PA's), group annuities such as under pension risk transfer (PRT), and longevity reinsurance.

There are three reserving categories: Payout Annuities, Longevity Reinsurance and Accumulation. Payout contains contracts like PA and PRT. Longevity Reinsurance includes contracts transferring longevity (mortality) risk from one company to another and Accumulation covers all other contracts, such as FIA and FA. Reserves are calculated within each reserving category. However, currently aggregation is permitted between the Payout and Accumulation category if both groups manage risks together and are backed by the same asset portfolio or portfolios following the same ALM strategy. Some details on this cross-category aggregation are under consideration for refinement at the time of this writing, currently under exposure and discussion.

Reserve Methodology

VM-22 has many similarities with VM-21. The SR is calculated in a similar manner, the CTE70 of scenario reserves, where each scenario reserve is subject to an aggregate cash surrender value floor. VM-22 also has an SPA, which is currently a disclosure item. However, when the SPA is greater than 0 the actuary should strengthen SR assumptions and/or margins to reduce the SPA to 0, unless the reason for differences between the SR and SPA are due to company assumptions that are backed by credible and appropriate experience data. There is also a DR method for certain eligible blocks of business. Blocks of business will either calculate the SR and SPA or the DR.

The main reserve under VM-22 is the SR. There are exclusion tests, which will be described below. There is also a DR, subject to a single scenario test. So VM-22 starts with the requirement to calculate the SR, unless an exclusion test is met. If the exclusion test is met, then reserve calculations follow the old formulaic methods unless the block of business qualifies for the DR. As noted above, VM-20 requires calculating the SR, DR, and NPR unless the relevant exclusion tests are met.

Scenario reserve calculations are structured similarly to the other VM sections. The scenario reserve is the starting asset amount plus the GPVAD.

The direct iteration method may also be used, where starting assets are iterated until all projected benefits and expenses are covered, i.e., there are no accumulated deficiencies.

In determining a final SR amount, the CTE70 reserve calculated using PBR assumptions is increased by a hedging error factor multiplied by the difference between CTE70 reserves calculated without future hedges except interest credits, and the CTE70 reserve using PBR assumptions, if positive. The error factor varies between 5% and 100% and will vary based on the sophistication of the hedge modeling and formal back testing of the model. In other words, there is some level of modeled hedge ineffectiveness that must be accounted for in the final SR.

For any block of policies required to calculate the DR or SR, the SPA must be calculated. The SPA is currently a disclosure only item. It is a reserve adjustment (either an SR or DR structure consistent with how the block is valued) with prescribed assumptions replacing company assumptions along with a couple of other adjustments including recalculating the reserves without future hedges except for index credits. Its main purpose is to establish a reserve level for comparison with company calculated reserves. If the SPA is greater than 0, then that amount is added to the SR or DR to determine the SPA "reserve." It does not create a safe harbor (if company reserves are larger, they must be held).

If the SPA is greater than 0, then disclosures in the PBR report under VM-31 are required. While there are details to work out during the transition period, an attribution analysis between the company reserve and the SPA is required. In addition, the VM-31 report must justify the reason reserves are not strengthened when an SPA is greater than 0, and that justification must be based on company assumptions that "can be supported based on reliable, relevant and credible company data." In other words, if credible company assumptions result in a lower reserve than the SPA implies, there is no need for reserve strengthening.

Exclusion Tests

The SR exclusion tests, like VM-20, consist of a SERT, a Demonstration test and a Certification Method. The SERT also uses 6% as the pass/fail point, however 47 scenario reserves instead of 15 are compared to the baseline. That is because the 16 scenarios (same as VM-20 scenarios) have two additional sets of results, one set assuming +1% (per year from the valuation date to the projection year) future mortality improvement and the other assuming -1% future mortality improvement.

The Demonstration test, like VM-20 requires the same periodic determination; the test is passed if the formulaic CARVM reserve is larger than the SR calculated for the block subject to the Demonstration test.

The Certification method indicates passage of one of the other tests within the last three years, with no material changes in interest rate risk, mortality/longevity risk, and asset return volatility risk. VM-22 also allows a direct certification in year 1 of implementation and every three years thereafter, for contracts without guaranteed living benefits (GLB), future hedging strategies and is not PRT business, based on not being materially subject to the risks described above. This alternative certification does require having documentation available backing up the certification.

As noted above, the DR is a required comparative calculation in VM-20. In VM-22, it is an *alternative* calculation. The DR is intended for products where the tail (CTE70) scenario reserves calculated do not vary materially across a range of interest rate scenarios due to a lack of interest rate sensitivity or for any other reason, because cash flows are not influenced by these factors. As a result, an appropriate reserve can be calculated using a single scenario rather than going through the process of running many scenarios to get a very similar value.

In order to calculate the DR, the block of policies must pass the Single Scenario Test (SST). The SST requires that the block of policies have predictable, stable cash flows, limited policyholder behavior tied to economic conditions or changes in interest rates and also pass a version of an exclusion test. It is expected that contracts with surrender benefits, recurring premium payment and GLB's are unlikely to pass the SST.

The SST exclusion tests are very similar to the regular exclusion tests. The SST SERT uses only the 16 scenarios with no mortality improvement with the same test structure and 6% pass level. The Demonstration test requires comparing the SR with the DR rather than the formulaic CARVM reserve. The Certification method requires a quantitative demonstration as part of the certification.

Projected Cash Flows and Assumption Considerations

Projected cash flow items include premium, other fees and charges, revenue sharing income, death claims, surrender and withdrawal benefits, other guarantees, NGE, expenses, reinsurance, and hedges. Invested asset cash flows consist of investment income as well as realized gains/losses and reflect default costs, investment expenses, prepayments, and any asset sales. Like VM-20 and VM-21, VM-22 has a reinvestment guardrail. The reinvestment assumption will be the company's assumption or guardrail, whichever results in the higher reserve.

Projected market value adjustment (MVA) is also included in the cash flows if this is a feature of the contract. The MVA adjusts the cash surrender value of the contract based on the change in interest rates from policy issue to the valuation date. This feature helps protect the company as rates change, with the contract holder sharing in investment risk with the company, in a sense. As interest rates go up, bond prices go down. The MVA reduces the contract's cash surrender value, subject to the non-forfeiture floor. Similarly, as interest rates go down bond prices go up. The MVA increases the contract's cash surrender value.

Other cash flows that may be relevant for VM-22 products include projected annuitization benefits from settlement options or election of GMIB or GMWB). Under the SPA, once a product with a GMIB or GMWB no longer has any account value, the contract is assumed to stay in force, i.e., there is no assumed lapse at that point.

In general PBR requires assuming efficient (although not necessarily perfect) policyholder behavior. For example, in the moneyness (ITM) of benefits need to be addressed. The more in the money the guaranteed benefit, the lower lapses are expected to be. For example, VM-22 considers ITM in the SPA for GMWB's and similar living benefits by comparing the guaranteed actuarial present value (GAPV) of the benefit stream to the contract's account value. To the extent the GAPV is increasingly larger than the account value, the expectation is that the contract holder will place more value on the GLWB benefits and will be reluctant to lapse their policy. While SPA prescribed assumptions are not required for the SR, they should be considered as deemed appropriate. For example, should there be an expectation of lapse when there is a guaranteed living benefit and no account value?

As the cash surrender value floor is applied to the NPR in VM-20 and there is no NPR in VM-22, the aggregate cash surrender floor is applied to each scenario reserve (or the scenario reserve for the DR) for that group of contracts. Additionally, if a contract has a market value adjustment (MVA) feature and all assets supporting the block are held at market value, then MVA on the valuation date is applied to the aggregate cash surrender value.

Discount Rates

Similarly to the DR under VM-20, there is no NAER needed for the direct iteration method. For the GPVAD method, the discount rate will be the NAER on the additional invested asset portfolio. This additional asset portfolio represents general account assets over and above starting assets that are needed in a scenario reserve to cover any accumulated deficiencies. Assets should be selected in such a way that the scenario would not have accumulated deficiencies. The additional assets can be a pro-rata slice of the starting assets, cash or additional general account assets assigned to the PBR calculation. If PBR is calculated for other products, such as under VM-21, the same assets cannot be used in both places. For example, if a particular CUSIP is used in its entirety under VM-21, it cannot also be used for VM-22.

The additional invested asset portfolio is projected out, where investment cash flows are reinvested using the applicable reinvestment assumption or guardrail, defaults, and investment expenses. No liabilities are projected. The NAER is the vector of annual earned rates for each scenario reserve that replicates the growth of the additional invested asset portfolio from period to period over the projection.

VM-22 Example

This is an example of a day 1[13] reserve calculation for a fixed deferred annuity with a GLWB. The product design is, like the ULSG example above, typical of products available in the market.

Reserves were run under the 9/30/2025 GOES scenario set, along with a 1% parallel shift up (1% pop-up), and a 1% parallel shift down (1% pop-down) of the 9/30/2025 GOES scenario set.

Product Design/Details, Assumptions and Margins

The fixed rate deferred annuity was designed with a 7-year surrender charge schedule. The GLWB rider was designed with a 10-year rollup with 12% compound interest and a 110 basis points fee. Product design and assumption details are described in Appendix 2.

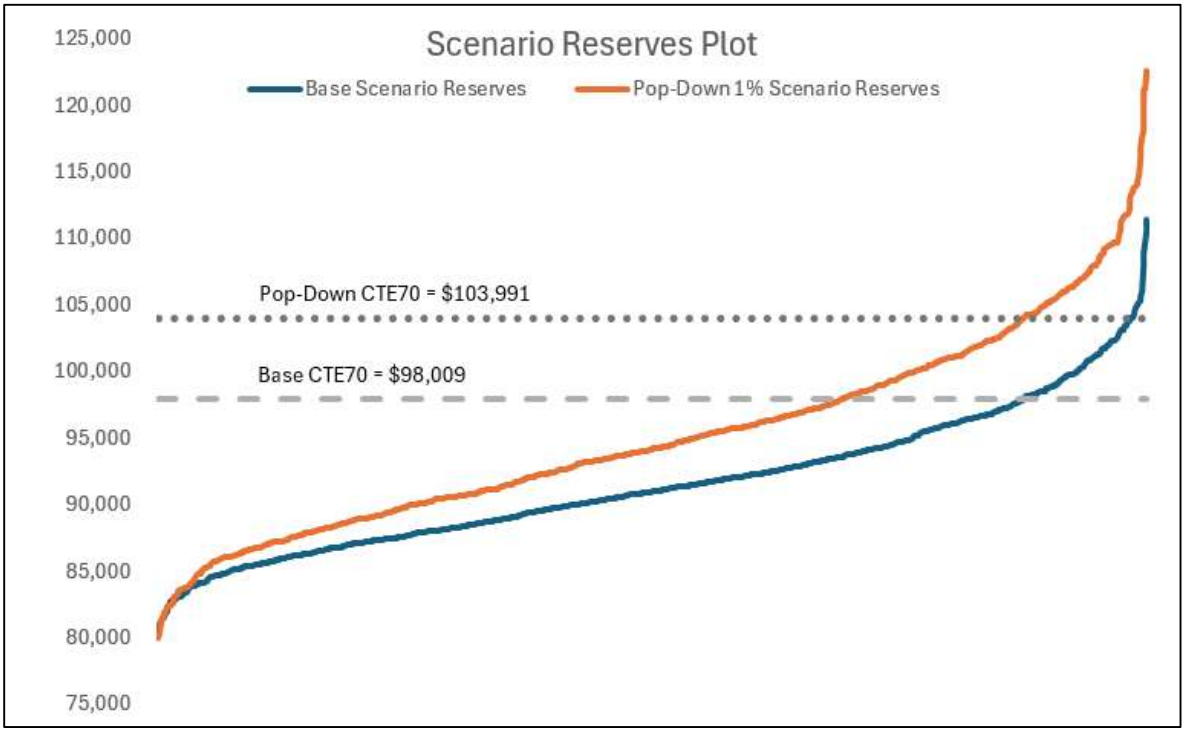
Results

The results for modeled issue ages 55, 65, and 75 are shown below along with a shorter duration reinvestment assumption using the modeled age 65.

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff** Pop-Down vs Base / Pop-Up vs Base
55-Year-Old Cell	93,476	101,398	89,173	+8.5% / -4.6%
65-Year-Old Cell	98,009	103,991	93,859	+6.1% / -4.2%
75-Year-Old Cell	90,728	91,251	90,499	+0.6% / -0.3%
65 YO Cell; Shorter Reinvs[14]	99,481	105,900	94,794	+6.5% / -4.7%

The 65 year old baseline and pop-down scenarios reserves are depicted below.

[13] Assets are purchased at time zero and the reserves are calculated the next day.
[14] Shorter reinvestment assumption is 50% 5-year; 35% 10-year; 15% 20-year



Attribution Analysis

An attribution analysis was performed for the age 65 cell between the baseline and the 1% pop-down scenario to determine the interest rate sensitivity in the stochastic reserve, ignoring any cash surrender value floor. The key interest rate sensitive drivers identified are (1) the discount vector, (2) investment income, and (3) withdrawals.

	Stochastic Reserves UNFLOORED CTE70	Attribution Impact	Attribution Step
Baseline	**98,009**		
		3,331 | +56%	Discount Rates
		1,963 | +33%	Investment Income
		691 | +12%	Withdrawals
		(4) | 0%	Residual
1% Pop-Down	**103,991**		

(1) Discount rates: In these model runs; the additional invested asset portfolio is assumed to be cash immediately invested as of the valuation date using the assumed reinvestment strategy. The vector of annual earned rates that replicates the growth in this additional asset portfolio, which is the basis for discounting the accumulated deficiencies, is interest sensitive and directly impacted by projected yields. The NAER vector under the 1% pop-down scenario set for the CTE70 scenarios is on average 96 basis points lower than the baseline scenario set over the course of the projection period. As a result of the lower discount rates, the GPVADs are higher.

(2) Investment income: The investment income early in the projection period is largely based on the assumed starting asset portfolio. After Year 5, when proceeds from the starting asset portfolio 5-year bond maturities are reinvested at lower rates under the 1% pop-down scenario set, the investment income diverges based on the projected yields. This divergence grows after Year 10 and after Year 20 when all assets from the starting asset portfolio have matured. Lower investment income will result in greater accumulated deficiencies and a higher reserve.

(3) Withdrawals: Projected interest rates will impact policyholder behavior. Competitor rates in the 1% pop-down scenario set are lower, which results in reduced lapses in the dynamic lapse formula. This in turn results in increased exposure to living benefit withdrawals leading to greater accumulated deficiencies and a higher reserve.

Asset Adequacy Testing

At the end of each year, the appointed actuary must provide a SAO. While reserves are calculated every month or quarter, AAT is an additional step to ensure the overall level of reserves are adequate. So, one way to think about US statutory reserving is that PBR's model based and transparent approach results in a conservative reserve covering the material risks, including interest rate risk, of the blocks covered. CFT serves to cover PBR and non-PBR blocks, tested in aggregate at a legal entity level, with an additional layer of testing to determine appropriately conservative reserving levels reflecting interest rate risk as well as any other material risks.

As noted above and to be discussed further, this paper focuses on interest sensitive blocks and CFT, as opposed to other asset adequacy testing methods, which are generally not appropriate for interest sensitive blocks. The description of the products, the assets and reserves tested, the analysis, results and conclusions are documented in an actuarial memorandum that is submitted with the SAO.

CFT is designed to cover interest rate risk (equity risk if applicable) as well as all other material risks related to the products tested. From an interest rate risk perspective, the appointed actuary is expected to consider a wide range of interest rate scenarios. The testing must be conducted in Moderately Adverse Conditions. Actuarial Standard of Practice 22 (ASOP 22) defines Moderately Adverse Conditions" as *"Conditions that include one or more unfavorable, but not extreme, events that have a reasonable probability of occurring during the testing period."* This is generally considered to be, roughly speaking, a CTE70 or 85th percentile evaluation of reserves. Required

capital (actually multiples of that amount) are held by companies to cover risks that are "deeper in the tail" and will be discussed below.

Interest Rate Scenarios

Many companies use scenarios described in New York regulations (NY 7) for AAT[15]. They are:

1. level with no deviation;
2. uniformly increasing over ten years at a half percent (0.5%) per year and then level;
3. uniformly increasing at one percent per year over five years and then uniformly decreasing at one percent per year to the original level at the end of the ten years and then level;
4. an immediate increase of three percent and then level;
5. uniformly decreasing over ten years at a half percent (0.5%) per year and then level;
6. uniformly decreasing at one percent per year over five years and then uniformly increasing at one percent per year to the original level at the end of ten years and then level; and
7. an immediate decrease of three percent and then level.

In scenarios 5, 6 and 7 the rates are floored at either half their initial level or their initial level minus ½ the initial 5 year treasury rate.

Some actuaries will supplement these scenarios with other deterministic scenarios, test stochastic scenarios, test both deterministic and stochastic scenarios or test scenarios other than the NY 7. The overarching consideration is that the distribution of interest rates in moderately adverse conditions is used to test the blocks covered by CFT for asset adequacy. Under a wide range of interest rates there must be sufficient cash flows (from premiums, investment income, fees, reinsurance allowances, etc.) to cover benefit payments and expenses as they come due, over the projection period. For example, interest rate scenarios should reflect treasury rates at today's levels as well as above and below those levels.

Assumptions and Margins

Reinvestment assumptions should use appropriately conservative spreads to treasuries, relevant default charges as well as investment expenses that reflect expenses charged on the pool of assets over the projection period. In the case of investment expenses, an overall cost (in bps) may not be appropriate over the projection period if, say, higher yielding, more complex assets with higher investment expense charges come to dominate a scenario over time. Developing expenses that vary by asset class would avoid this problem to a large extent.

While there is not a specific requirement to apply an explicit margin to all assumptions, key assumptions should have added on conservatism. Conservatism should be reflected in the CFT baseline runs and not through sensitivity tests, with an overall objective of modeling moderately adverse scenarios.

[15] 11 CRR-NY §95.10(d)(1)

The scenarios tested must use an appropriate allocated amount of Interest Maintenance Reserve (IMR). Any admitted negative IMR must be fully allocated and used to reduce the amount of starting assets used in the projections.

Considerations

The actuary will also establish criteria for determining whether asset adequacy reserves are or are not required. For example, the criteria might be to pass (meaning there are no ending surplus deficiencies and there are at most small, temporary interim deficiencies) 5 out of the 7 NY7. Both book and market value of assets are considered in the criteria.

Assets and liabilities are projected out to a point where there is no or an immaterial amount of liabilities remaining. This is to ensure there are no material deficiencies being ignored. For example, if the projection period was 20 years, however 60% of the block was still in force at that time, this would raise the question of whether the projection period was long enough. The projection period clearly would not be long enough if there were material deficiencies in projection years 25 – 35.

Another important consideration is sensitivity testing. Key assumptions should be tested, and the appointed actuary should discuss in the actuarial memorandum how those sensitivity tests were used or not used to influence their determination on whether an asset adequacy reserve is required or not. Sensitivity tests related to interest rate risk may include adjustments to asset yields through reduced reinvestment spreads, higher default rates and higher lapse rates due to higher interest rates and the resulting disintermediation risk.

New AAT Regulations

In recent years two new actuarial guidelines (actuarial guidelines are used to interpret and provide details on regulations as practice evolves and new information becomes available) impacting AAT have been introduced. The first one is Actuarial Guideline LIII – Application of the Valuation Manual for Testing the Adequacy of Life Insurance Reserves (AG53). AG53 requires identification of asset groups used in cash flow testing that have a spread over US Treasuries that is larger than AG53 defined spreads (called Guideline Excess Spreads or GES). AG53 also requires attribution of GES into appropriate risk components including the portion of excess spread due to interest rate risk. AG53 further requires sensitivity tests that reduced the GES on reinvested assets to zero, meaning modeled spreads over Treasury are not larger than the AG53 spreads. AG53 does not mandate holding additional reserves; however, the tests do create additional data points for the appointed actuary to consider in forming their opinion on the need for any additional asset adequacy reserve.

Actuarial Guideline LV – Application of the Valuation Manual for Testing the Adequacy of Reserves Related to Certain Life Reinsurance Treaties (AG55), is effective for year-end 2025. Generally speaking, actuaries have traditionally evaluated reinsurers' collectability risk. If there were indications of strong claims paying ability (solid ratings, history of paying the cedant on time and in full, etc.), many actuaries would make that assumption in CFT. If by assuming there was a sound reinsurance asset, no asset adequacy reserves were required, then the appointed actuary could conclude that reserves were adequate on all direct written business. AG55 requires more direct

cash flow testing of assets backing reinsured business in certain situations as well as recognizing any material differences between statutory reserve credits and reserves held by the reinsurer to back the business. AG55 testing applies to Asset Intensive Reinsurance Transactions which is defined as *"Coinsurance arrangements involving life insurance products that transfer significant, inherent investment risk including credit quality, reinvestment, or disintermediation risk as determined by Appendix A-791 of the Life and Health Reinsurance Agreements Model Regulation."*[16]

Similar to AG53, AG55 tests that must be run result in new data points for the appointed actuary to consider in forming their opinion. Officially both AG53 and AG55 are disclosure only; as noted previously, the appointed actuary should consider all available and relevant information in forming their opinion.

Asset/Liability Management

Making sure that expected asset cash flows line up well with expected payments of benefits and expenses is an important component of sound insurance company management. While assets and liabilities do not have to be perfectly matched, they should be reasonably so. ALM is typically thought of in terms of matching duration. For more sophisticated approaches, convexity is also considered. Tight asset/liability matching tends to lower PBR reserve requirements and makes reserves less sensitive to interest rate fluctuations, while greater mismatches tend to lead to higher reserves and increased sensitivity to interest rate changes.

Because PBR includes both asset and liability cash flows, asset/liability mismatches will increase reserves. As a result, companies reduce risk and reserve levels by maintaining strong ALM programs and managing tight asset and liability duration and convexity.

A key component of AAT is ALM. Some of the origins of AAT trace back to company insolvencies at least partially related to ALM mismatches. Mismatches in CFT are reflected in either reduced surpluses or perhaps larger deficiencies. Take the example of performing CFT on a multi-year guaranteed fixed deferred annuity block. Both low and high interest rate environments would be part of the testing. In rising rate environments, lapse rates will tend to rise as policyholders turn in their lower credited rate products to purchase a higher credited rate competitor product. Overall profitability will be lower as assets earning a spread for the company must be sold (asset adequacy testing does not allow recognizing new business, so there would be no new cash that can cover surrenders). Assets, like bonds, will incur market value losses compounding the negative impact of the higher rate environment. From an ALM perspective, the liability duration decreased relative to the asset duration. The impacts are reduced if assets and liabilities are well matched prior to the increase in interest rates. If there was already a significant mismatch, such as asset durations are much longer than liability durations, results are magnified. Product features also come into play as the presence of the MVA can reduce company interest rate risk, as long as the MVA formula moves in reasonable lock step with asset market value changes.

The opposite impact can occur when interest rates decline. People tend to hold onto their contracts longer as better credited rates are not available elsewhere. Liability durations will extend. With

[16] AG55 3.B

shorter asset durations, companies will need to reinvest in a lower rate environment, also either reducing surpluses or increases in deficiencies.

Examples

For the ULSG issue age 65 example, the liability duration is 22.5 years driven by the long-term nature of the product. The initial asset portfolio duration is 9.2 years. The baseline reinvestment asset duration is 8.4 years. Under the sensitivity, the shorter reinvestment asset duration is 7.0 years, 1.4 years shorter than the baseline and increasing the asset/liability mismatch. As can be seen below, the increase in mismatch between asset and liability duration increases the reserve.

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff ($) Pop-Down vs Base / Pop-Up vs Base**
65-Year-Old Cell Baseline Reinvestment Duration (33% 5yr; 33% 10yr; 33% 20yr)	2,991	16,808	0	13,816 / -2,991
65-Year-Old Cell Shorter Reinvestment Duration (50% 5yr; 35% 10yr; 15% 20yr)	6,575	21,892	89	15,317 / -6,486

For the deferred annuity issue age 65 example, the liability duration is 13.5 years driven by the GLWB. The initial asset portfolio duration is 9.2 years. The baseline reinvestment asset duration is 8.4 years. Under the sensitivity, the shorter reinvestment asset duration is 7.0 years, 1.4 years shorter than the baseline and increasing the asset/liability mismatch. As can be seen below, the increase in mismatch between asset and liability duration increases the reserve.

	Stochastic Reserves UNFLOORED CTE70			
	9/30/25 GOES	**1% Pop-Down**	**1% Pop-Up**	**Diff Pop-Down vs Base / Pop-Up vs Base**
65-Year-Old Cell Baseline Reinvestment Duration (33% 5yr; 33% 10yr; 33% 20yr)	98,009	103,991	93,859	+6.1% / -4.2%
65-Year-Old Cell Shorter Reinvestment Duration (50% 5yr; 35% 10yr; 15% 20yr)	99,481	105,900	94,794	+6.5% / -4.7%

Interest Rate Risk Under RBC, including C3P1 and C3P2

Required capital for interest rate risk (C-3) is calculated on page LR027 of the RBC life report. LR027 includes both a factor method as well as cash flow modeling for certain products. RBC must be calculated and reported annually, although best practice is to project RBC throughout the year to better manage capital positions.

Factor-Based RBC Components

For the factor-based portion of C-3, products are split up into low, medium and high risk categories. As risk increases so do the factors and the resulting required capital charges. For example, a fixed deferred annuity with MVA is classified as low risk due to the MVA (sharing of investment risk with the contract holder). Similarly, single premium whole life is also considered to be low risk as the product is heavily funded and consequently has a low net amount at risk.

On the other hand, a deferred annuity contract without an MVA and with surrender charges less than 5% has a lower barrier to exit, making the policyholder surrender option more valuable and more likely to work against the insurer's interest in keeping the contract in force. As a result, those contracts are considered high risk and have a higher required capital charge.

Model-Based RBC Components

Additionally, certain products undergo cash flow modeling to reflect interest rate risk. There is C-3 phase 1 modeling (C3P1) and C-3 phase 2 modeling (C3P2). The results of C3P1 or C3P2 can either increase or decrease required C-3 capital.

C3P1 covers fixed deferred annuities and single premium life insurance as well as immediate annuities, structured settlements, and guaranteed investment contracts. It is meant to approximate the 95th percentile C-3 risk. The company's CFT models should be used with all the same assets (except the asset valuation reserve, AVR) and assumptions, however a different scenario set must be used, and the results are measured differently. There is a 50 scenario set that can be used, which is a subset of the most extreme scenarios from a larger 200 scenario set. Alternatively, companies can use a smaller 12 scenario set, however it is more conservative. For each scenario, statutory surplus for each calendar year is present valued to the valuation date using 105% of the after tax one year treasury rates for that scenario. The most negative of the present value of surplus for each scenario is that scenario's C-3 measure. The scenario specific C-3 measures are ranked in descending order, from the largest capital need to the smallest. For the 50 scenario set the 5th through 17th largest scenarios are each weighted by prescribed weights. The weighted average of these scenarios grossed up to a pre-tax basis is the C3P1 amount. For the 12 scenario set, The C3P1 amount is max[1/2 x the largest capital requirement; average of the 2nd and 3rd largest capital requirement] grossed up to a pretax amount.

C3P2 covers variable annuities. C3P2 is calculated differently for contracts that calculate reserves under the VM-21 Alternative Methodology and those that calculate the SR/SPA. After calculating CTE98 for the SR/SPA contracts, Federal income tax must also be reflected in the calculations and there are two methods that can be used. Depending on the tax method chosen, C3P2 is either:

1) 25% x ((CTE98 + SPA – Statutory Reserve) x (1 – Federal Income Tax Rate) – (Statutory Reserve – Tax Reserve) x Federal Income Tax Rate; or
2) 25% x (CTE98 + SPA – Statutory Reserve) - this method embeds tax into the projections used to calculate CTE98.

The total asset requirement (TAR) is the VM-21 reserve plus the amount above.

For Alternative Methodology contracts with GMDB, the TAR is the cash surrender value plus the Additional Asset Requirement (AAR). The AAR includes provision for amortization of outstanding surrender charges + provision for fixed dollar expenses net of fixed dollar revenue and provision for claims in excess of account value less spread based revenue. Once TAR is determined, the C3P2 component is TAR minus the Alternative Methodology reserve under VM-21.

For variable annuities without guarantees, the C3P2 component is 11% of (fund balance less cash surrender value if the surrender charge is based on the fund balance); if the surrender charge is based on fund contributions, the C3P2 component is 2.4% of (fund balance less cash surrender value if the fund balance exceeds the sum of premiums less withdrawals) and 11% of (fund balance less cash surrender value if the fund balance does not exceed the sum of premiums less withdrawals). All results are multiplied by 79% to account for Federal Income Tax.

The C3P2 component for contracts with no cash surrender value and no performance guarantees is zero. C3P2 is the sum of the various C3P2 components described above.

As can be seen from the calculations above, interest sensitive contracts account for interest rate risk in determining required capital both from applications of factors as well as following either a PBR methodology using deep in the tail scenarios (C3P2) or using conservative scenarios (approximating the 95% percentile) in a CFT setting (C3P1).

Conclusion

As this paper describes and demonstrates, within the US reserving and capital framework, interest rate risk is accounted for in a number of ways. The methodologies are responsive to changes in rates as well as changes in other key assumptions through appropriately frequent updates. Adverse impacts to asset and liability cash flows are captured through higher reserves and capital charges. There are governance frameworks in place, involving the board of directors, senior management, and actuaries. The actuary has responsibility to ensure the appropriateness of the calculations and must transparently document assumptions, margins, analysis, results and conclusions, allowing management and regulators to clearly understand the work performed.

Bruce A. Friedland, FSA, MAAA
Friedland Actuarial

Appendix 1

ULSG Product Design and Assumptions

PRODUCT FEATURES	
Product Definition	Universal life product with lifetime secondary guarantee (attained age 121)
Product Parameters	Product is designed so that target premiums will maintain the secondary guarantee through attained age 121. Product is designed to offer minimal opportunity for cash value accumulation at current crediting rates levels.
Surrender Charges	15% policy year 1, 14% policy year 2, 13% policy year 3 grading 1%/year to 1% at year 15, 0% thereafter. % of face amount
Modeled Cells	Male Age 55 Non-Smoker; Male Age 65 Non-Smoker; Male Age 75 Non-Smoker
Policy Size	$500,000 face amount
Current Account Parameters	$15 per $1,000 expense charge 8% premium load Cost of insurance charges - 100% 2001 CSO Ultimate M NS 2% guaranteed interest crediting rate 2% target spread for setting interest crediting rate
Shadow Account Parameters	Cost of insurance charges - 100% 2015 VBT M NS S&U 8.5% interest crediting rate, compounded
Target Premium	Solved premium to carry shadow account to attained age 121
Premium Paying Pattern	Target premium funding annually
Commission Rate	Up to target: Year 1, 120%; Years 2–10, 3%; Years 11+, 2% Above target: Years 1–10, 3%; Years 11+, 2%

ASSUMPTIONS	
Acquisition Expense	$0.55 per $1,000 and $200 per policy
Maintenance Expense	2% of premium and $50 per policy with annual inflation
Inflation	One-half of 5-year treasury rate linked to each scenario
Base Lapse Assumption	3/3/2.5/2.5/2.0/2.0/2.0/2.0/2.0/2.0/2.0/2.0/3.5+
Dynamic Lapse Adjustment	50% of base lapse when account value > $0 0% total lapse when account value < $0
Base Mortality Rate Assumption	80% of 2015 VBT S&U ANB from issue to age 100 100% of 2015 VBT ANB from age 100 Assuming fully credible company experience data No future mortality improvement assumed

MARGINS FOR SCENARIO RESERVES	
Lapse Margin	10% lower lapse
Expense Margin	5% higher expenses
Mortality Margins	See Mortality Margins Detail

Margin Assumptions from VM-20 Section 9.C.6: Prescribed Mortality Margins
Separate prescribed margins will be added to company experience mortality rates and to the applicable industry basic tables

Margins applied from Issue Age 65 to age 100
Limited Fluctuation Margins
Assumed credibility level 93-100%

Attained Age	Factor	Attained Age	Factor
<46	4.0%	76-77	2.9%
46-47	4.0%	78-79	2.8%
48-49	3.9%	80-81	2.6%
50-51	3.9%	82-83	2.5%
52-53	3.8%	84-85	2.4%
54-55	3.8%	86-87	2.3%
56-57	3.7%	88-89	2.2%
58-59	3.6%	90-91	2.1%
60-61	3.5%	92-93	2.0%
62-63	3.5%	94-95	1.8%
64-65	3.4%	96-97	1.7%
66-67	3.3%	98-99	1.6%
68-69	3.2%		
70-71	3.1%		
72-73	3.0%		
74-75	2.9%		

Margins applied from age 100
Industry Table Margins

Attained Age	Factor
100-101	7.4%
102-103	6.7%
104-105	6.0%
106 and over	5.3%

INVESTMENT MIX AND ASSUMPTIONS
Initial Asset Portfolio Net Yield = Yields detailed below minus VM-20 Defaults minus Investment Expenses
Reinvestment Assets Net Yield = GOES Scenario Set Treasury Yields plus VM-20 Spreads minus VM-20 Defaults minus Investment Expenses

*See VM-20 Spread Details Tab and VM-20 Default Details

Assumed Investment Expense = 25bps

INITIAL ASSET PORTFOLIO

	Maturity		
Type/Rating	**5**	**10**	**20**
BBB	20%	40%	40%

Yields		
5	**10**	**20**
5.50%	5.75%	6.00%

REINVESTMENT ASSETS ALLOCATIONS

	Maturity			
Type/Rating	**5**	**10**	**20**	**Totals**
Aa2	16.67%	16.67%	16.67%	50%
A2	16.67%	16.67%	16.67%	50%
Totals	33.33%	33.33%	33.33%	100%

**Quality mix aligns with guardrail (VM-20 Section 7.E.1.g)*

WAL (Weighted Average Life)	Spreads for Reinvested Assets			
	Current (Table F)		Long-Term (Table H)	
	Aa2	A2	Aa2	A2
5	38.30	60.91	66.08	96.29
10	49.94	75.94	88.68	119.93
20	57.86	77.10	109.37	134.17

Table A. Baseline Annual Default Costs (in bps) using Moody's Data as of December 2024 *
Calendar Years 1970 - 2024 Raw Data

PBR Credit Rating	Moody's Credit Rating	Weighted Average Life									
		1	2	3	4	5	6	7	8	9	10
3	Aa2	0.22	0.58	1.09	1.40	1.58	1.74	1.85	1.97	2.12	2.31
6	A2	1.67	5.04	9.28	10.31	10.87	11.43	11.91	12.17	12.81	14.00
9	Baa2	26.99	35.10	36.02	37.34	38.36	40.41	42.45	44.06	44.62	44.41

* This table is effective on 6/30/2025

PBR Credit Rating 9 is used for the starting assets and Credit Ratings 3 and 6 are used for the reinvestment assets.

Appendix 2

Deferred Annuity Product Design and Assumptions

PRODUCT FEATURES	
Product Definition	Fixed rate non-qualified deferred annuity with a GLWB rider
Surrender Charges	7-year schedule linearly grading from 9% to 3%, and then zero
Modeled Cells	Male Age 55 Non-Smoker; Male Age 65 Non-Smoker; Male Age 75 Non-Smoker
Policy Size	$100,000 single premium
Commission Rate	7% of premium
Crediting Rate	Portfolio net earned rate minus 1.00% spread subject to guarantee rate of 3.0%
Free Partial Withdrawals	10% of fund value
GLWB Rider	10-year rollup with 12% compound interest
GLWB Rider Fees	110bps rider fee as a percent of guaranteed benefit base
GLWB Utilization	Each "Modeled Cell" assumes below utilization mix (before margins)
Wait Period	
5	30%
10	65%
Never	5%
Lifetime Withdrawal Percentage Upon GLWB Activation	Activate at Age 60: 4.0% of guaranteed benefit base Activate at Age 65: 4.5% of guaranteed benefit base Activate at Age 70: 5.0% of guaranteed benefit base Activate at Age 75: 5.5% of guaranteed benefit base Activate at Age 80: 6.0% of guaranteed benefit base Activate at Age 85: 6.5% of guaranteed benefit base

ASSUMPTIONS	SCENARIO RESERVES	SPA
Acquisition Expense	$300 per policy	-
Maintenance Expense	$150 per policy	$100 per policy; 7bps fund value
Inflation	One-half of 5-year treasury rate linked to each scenario	SPA prescribed inflation of 2.5% (from 2015) applied to per policy expense
Withdrawals Before GLWB Activation	Attained age 69 and less: 1.15% Attained age 70 and over: 1.65%	
Withdrawals After GLWB Activation	100% of guaranteed maximum lifetime withdrawal amount	
Base Surrender Assumption	See Surrender Assumption Detail Tab (SPA assumption)	
Dynamic Surrender Adjustment	See Surrender Assumption Detail Tab (SPA assumption)	
Base Mortality Rate Assumption	80% of 2012 IAM Basic Table with Projection Scale G2	2012 IAM Basic Table with Projection Scale G2; Multiplied by factors on SPA Mortality Assumption Detail Tab

MARGINS FOR SCENARIO RESERVES	
Surrender Margin	10% lower surrenders
Expense Margin	5% higher expenses
Mortality Margin	10% lower mortality
GLWB Utilization Margin	Margin consists of moving the 5% from the never-utilize bucket to 10-year wait bucket

Surrender Assumptions from VM-22 Section 6.C.5: SPA Prescribed Assumptions — Full Surrenders

Base Surrender Rates

Table 6.6: Base Lapse Rates for Indexed Annuities and Fixed Annuities with Guaranteed Living Benefits

Years Before or After Surrender Charge Expiration	Attained Age			
	Before 60	60 to 69	70 to 79	80 and above
5 yrs or more after expiry	11.5%	6.5%	4.5%	4.0%
4 yrs after expiry	11.5%	6.5%	4.5%	4.0%
3 yrs after expiry	11.5%	6.5%	4.5%	4.0%
2 yrs after expiry	11.5%	6.5%	4.5%	4.0%
1 yr after expiry	11.5%	6.5%	4.5%	4.0%
Upon expiry	18.5%	14.0%	11.0%	8.5%
1 yr to expiry	7.0%	4.5%	4.5%	3.5%
2 yrs to expiry	3.0%	2.5%	2.0%	2.5%
3 yrs to expiry	2.5%	1.5%	2.0%	2.5%
4 yrs to expiry	2.0%	1.5%	1.5%	2.0%
5 yrs or more to expiry	2.0%	1.5%	1.5%	1.5%

Dynamic Surrender Adjustment

Total Lapse = (Base Lapse x GMIR Factor + Rate Factor) x ITM Factor

where:

ITM Factor

$ITM\ Factor = (0.75 \div \text{ITM})^2$	if ITM < 0.75 and AV ≠ 0
$ITM\ Factor = 1$	if 0.75 ≤ ITM ≤ 1.25 and AV ≠ 0
$ITM\ Factor = (1.25 \div ITM)^2$	if ITM > 1.25 and AV ≠ 0
$ITM\ Factor = 0$	if AV = 0

$ITM = GAPV \div Account\ Value$

Rate Factor

$$Rate\ Factor = Market\ Factor \times Max(0,\ 1 - 5 \times (1\text{-}CSV/AV))$$

GMIR Factor

For indexed annuities:

$GMIR\ Factor = 1.00$

For fixed annuities:

$GMIR\ Factor = 1.25$	if GMIR ≤ 1.0%
$GMIR\ Factor = 1.00$	if 1.0% < GMIR ≤ 2.5%
$GMIR\ Factor = 0.70$	if GMIR > 2.5%

Market Factor

$Market\ Factor = -1.25 \times (CR - MR)^X$	if CR ≥ MR
$Market\ Factor = 0$	if MR > CR ≥ (MR − BF)
$Market\ Factor = 1.25 \times (MR - BF - CR)^X$	if CR < (MR − BF)

X = 2.0 during Surrender Charge Period, 2.5 at Shock, and 2.5 thereafter

Minimum and Maximum Lapse (not applicable if AV = 0)

$Minimum\ Lapse = 0.5\%$

$Maximum\ Lapse = 90\%$

Crediting Rate (CR)

For indexed annuities:

CR = the options budget (or value of the options supporting the index crediting strategy, as appropriate), at the time of the projection

For fixed annuities:

CR = the crediting rate, at the time of the projection

Market Rate (MR)

MR = the market competitor rate at the time of the projection

For indexed annuities and fixed annuities with Interest Guarantee Period < 2 Years:

MR = Max (3-month Treasury rate, 5-year Treasury rate plus 50% A / 50% AA spread) minus Pricing Spread

For fixed annuities with Interest Guarantee Period ≥ 2 Years:

MR = N-year Treasury rate plus 50% A / 50% AA spread minus Pricing Spread

N = 5-year Treasury rate for 2 years ≤ Interest Guarantee Period < 5 years
N = 7-year Treasury rate for 5 years ≤ Interest Guarantee Period < 7 years
N = 10-year Treasury rate for Interest Guarantee Period ≥ 7 years

Pricing Spread = 0% (since already reflected in selection of credit spread)

Buffer Factor (BF)

BF = a buffer factor where dynamic lapses do not occur, 50bps

GAPV for the ITM calculation details:

3. Guarantee Actuarial Present Value

The Guarantee Actuarial Present Value (GAPV) is used in the determination of the full surrender rates (Section 6.C.5) and other voluntary contract terminations (Section 6.C.10). The GAPV represents the integrated actuarial present value of the lump sum or income payments associated with all guaranteed living benefits, including account value, within the contract, as well as death benefits associated with GMDBs. For the purpose of calculating the GAPV, such payments shall include the portion that is paid out of the contract holder's Account Value. Regarding contracts for which there is no account value or surrender benefit, such as some contracts within the Payout Annuity Reserving Category and Longevity Reinsurance Reserving Category, the GAPV requirements are not applicable.

The calculation of an integrated benefit, for a future projection period can be expressed as:

${}_{t}p_{x+t}$ * Living Benefit (survival to receive benefit at time t and associated amount) + ${}_{t}p_{x+t}$ * ${}_{t}q_{x+t}$ * Death Benefit (then current probability of death multiplied by any death benefit)

The GAPV shall be calculated in the following manner:

a. The GAPV shall be determined by setting the guaranteed benefit exercise timing in a prudent matter, such that the policyholder realizes the value and broader efficiency of the product (i.e., elect immediate, defer until a significant deferral credit or attained age band break, etc.). Note that it is generally prudent to assume immediate election, unless there are other product feature considerations that make immediate election unavailable or significantly less valuable than waiting for a preset period of time

b. Once a GMWB is exercised, the contract holder shall be assumed to withdraw in each subsequent contract year an amount equal to no less than the initial percentage taken of the GMWB's guaranteed maximum annual withdrawal amount in that contract year (and 100% when the account value is depleted).

c. If account value growth is required to determine projected benefits or product features, then the account value growth shall either be assumed to be the current fixed index credited interest rate or the current option budget, by strategy, reduced by fees chargeable to the account value.

d. For a GMDB that terminates at a certain age or in a certain contract year, the GAPV shall be calculated as if the GMDB does not terminate. Benefit features such as guaranteed growth in the GMDB benefit basis may be calculated so that no additional benefit basis growth occurs after the GMDB termination age or date defined in the contract.

e. The mortality assumption shall follow the mortality assumption in Section 6.C.8. The discount rate used shall be the 10-year Treasury Department bond rate on the valuation date of the financial report that is being developed, unless otherwise specified in a subsequent subsection of Section 6.C.3.

Mortality Assumptions from VM-22 Section 6.C.8: Prescribed Assumptions — Mortality

For Individual Annuity contracts within the Accumulation Reserving Category, the mortality rate for a contract holder with age x in year (2012 + n) shall be calculated using the following formula, where q_x denotes mortality from the 2012 IAM Basic Mortality Table, as defined in VM-M Section 2.C, multiplied by the appropriate factor (F_x) from Table 6.7 and $G2_x$ denotes mortality improvement from Projection Scale G2, as defined in VM-M Section 1.J.1.c:

$$q_x^{2012+n} = q_x^{2012}(1 - G2_x)^n * F_x$$

SPA Multiplicative Factors (Fx) for Individual Annuities - Male

Attained Age	Factor	Attained Age	Factor
50	105.0%	81	103.0%
51	105.0%	82	104.4%
52	105.0%	83	105.8%
53	101.6%	84	107.2%
54	98.2%	85	108.6%
55	94.8%	86	110.0%
56	91.4%	87	110.0%
57	88.0%	88	110.0%
58	86.0%	89	110.0%
59	84.0%	90	110.0%
60	82.0%	91	110.0%
61	80.0%	92	110.0%
62	78.0%	93	110.0%
63	80.0%	94	110.0%
64	82.0%	95	110.0%
65	84.0%	96	110.0%
66	86.0%	97	110.0%
67	88.0%	98	109.0%
68	89.0%	99	108.0%
69	90.0%	100	107.0%
70	91.0%	101	106.0%
71	92.0%	102	105.0%
72	93.0%	103	104.0%
73	94.0%	104	103.0%
74	95.0%	>=105	102.0%
75	96.0%		
76	97.0%		
77	98.0%		
78	99.0%		
79	100.0%		
80	101.0%		

INVESTMENT MIX AND ASSUMPTIONS

Initial Asset Portfolio Net Yield = Yields detailed below minus VM-20 Defaults minus Investment Expenses
Reinvestment Assets Net Yield = GOES Scenario Set Treasury Yields plus VM-20 Spreads minus VM-20 Defaults minus Investment Expenses
See VM-20 Spread Details and VM-20 Default Details

Investment Expense – 25 bps

INITIAL ASSET PURCHASES

	Maturity		
Type/Rating	**5**	**10**	**20**
BBB	20%	40%	40%

Yields		
5	**10**	**20**
5.50%	5.75%	6.00%

REINVESTMENT

	Maturity			
Type/Rating	**5**	**10**	**20**	**Totals**
Treasuries	1.67%	1.67%	1.67%	5%
Aa2	5.00%	5.00%	5.00%	15%
A2	26.66%	26.66%	26.66%	80%
Totals	33.33%	33.33%	33.33%	100%

**Quality mix aligns with guardrail (VM-22 Section 4.D.3.b)*

WAL (Weighted Average Life)	Spreads for Reinvested Assets			
	Current (Table F)		Long-Term (Table H)	
	Aa2	A2	Aa2	A2
5	38.30	60.91	66.08	96.29
10	49.94	75.94	88.68	119.93
20	57.86	77.10	109.37	134.17

Table A. Baseline Annual Default Costs (in bps) using Moody's Data as of December 2024 *
Calendar Years 1970 - 2024 Raw Data

PBR Credit Rating	Moody's Credit Rating	Weighted Average Life									
		1	2	3	4	5	6	7	8	9	10
3	Aa2	0.22	0.58	1.09	1.40	1.58	1.74	1.85	1.97	2.12	2.31
6	A2	1.67	5.04	9.28	10.31	10.87	11.43	11.91	12.17	12.81	14.00
9	Baa2	26.99	35.10	36.02	37.34	38.36	40.41	42.45	44.06	44.62	44.41

* This table is effective on 6/30/2025

PBR Credit Rating 9 is used for the starting assets and Credit Ratings 3 and 6 for the reinvestment assets.

Attachment G

During its November 19 call, the Chair of the Aggregation Method (G) Implementation Working Group asked if there was a way to understand how the analysis in the valuation work area's paper ("Interest Rate Sensitivity in US Statutory Reserving") would apply to a comparison between the Aggregation Method and the Insurance Capital Standard (ICS). What follows is a discussion of how liabilities for US life insurance entities (as calculated using Principles Based Reserving) compare and contrast to ICS liabilities (which are calculated using current estimates).[1]

Comparison to Current Estimates—

Current estimates are the expected present value of policyholder cashflows. Like the stochastic reserve under PBR, which takes into account future cash flows, the current estimate is based on a statistical measure of the present value of future cashflows over the full lifetime of an insurance policy.

Both CE and PBR are calculated using current assumptions. Both are sensitive to the impact that changes in interest rates have on policyholder cashflows and the time value of money. However, differences in the way cashflows are statistically measured (including guardrails/floors and margins) and how asset returns are reflected can lead to differences in the magnitude of this impact.

Policyholder Cash Flows: The stochastic reserve is calculated as the average of the most extreme scenarios while the current estimate is the average across all scenarios. The resulting statutory reserve is generally more conservative than the current estimate as:

- The amount by which the average across the extreme scenarios exceeds the current estimate is a prudential margin. This difference is not reported separately in statutory reserving so is sometimes referred to as an implicit margin. But it can be calculated explicitly from the underlying model. For example, the stochastic reserve for the Deferred Annuity in the working group's paper is calculated, before floors, as the average across all scenarios above the 70th percentile. This is the CTE70 of 98,009. The current estimate is the average across scenarios. This is the CTE0 of 91,622. The prudential margin is 6,386 which is the difference between the two.
- The Principle Based Reserve also contains further safeguards and floors that ensure a greater level of conservatism than the stochastic reserve or the current estimate. For life insurance these include the deterministic reserve, net premium reserve, cash

[1] The ICS liability also includes a margin for prudence but as it assumes this margins does not change in response to interest rate shocks, the focus of this discussion is on PBR versus current estimates. https://www.iais.org/uploads/2024/12/ICS-Level-1-and-Level-2-texts.pdf

surrender value floor, and the use of prudent estimate assumptions. This means that the CTE0 of a PBR model will always be above the true central estimate. For example, these floors mean that the reserve for Universal Life with Secondary Guaranty is zero in most scenarios (both before and after the change in interest rates)

If a change in interest rates affects policyholder cashflows, it will impact both the current estimate and the stochastic reserve. For instance, if a decrease in interest rates results in greater in-the-moneyness of income benefits and more lifetime income withdrawals, this will impact both the mean and CTE70 of the distribution. However, an increase in the stochastic reserve will only impact the statutory reserve if it is above the other floors. This will mute the impact of smaller interest rate fluctuations on the statutory reserve relative to changes in the current estimate but, for sufficiently large impacts on future cash flows, the CE and statutory reserve will both be impacted.

Time Value of Money: The present value of expected future cashflows is calculated by applying a discount rate to determine what a future cashflow is worth today. A current estimate is a general term that allows for a range of discounting methodologies.

- In the Insurance Capital Standard (ICS) developed by the International Association of Insurance Supervisors (IAIS), the discount rate depends on which "bucket" a policy is in. There is a General, Middle and Top bucket with criteria, based on a policy's characteristics, which determine how well asset and liability cashflows can be matched. Policies in higher buckets are discounted at rates that better match the (usually higher) rate of return that an insurer would earn on its own investment portfolio. The ICS discount rate does not depend on whether or not there is a reserve deficiency.
- Under PBR, this is done by modeling the interaction with asset cashflows. For life insurance, the present value of the surplus or deficiency of the asset cashflows for each scenario and at each point in time is discounted at 1.05 times the future one year risk free rate. As PBR is calculated based on the upper percentiles, the discount rate is disproportionately impacted by scenarios with a deficiency. For annuities, discounting is done using the Net Asset Earned Rate (NAER) method which takes asset cashflows into account.

Changes in interest rates change the time value of money. A decrease in rates will decrease the discount rate that is applied to policyholder cashflows of both the CE and PBR. An increase (or decrease) in the interest rate will lead to decrease (or increase) in the present value. However, the impact on PBR is more complex than for the CE as the change in reserve represents discounted impact on both asset and policyholder cashflows.

- A decrease in interest rates will make both surpluses and deficiencies larger. These impacts will somewhat offset when viewed across all scenarios but, for upper percentiles, scenarios mostly have deficiencies and so a decrease in interest rates causes the size of the deficiencies (and therefore the reserve) to increase. For instance, 42% of the scenarios used to calculate the Deferred Annuity have a deficiency. They are almost exactly offset by the scenarios with a surplus when calculating the impact of a change in interest rates on the discount vector for the CTE0. (Attribution of $2 of the total $3,531 change observed). However, all of the top 30% of scenarios have a deficiency and so a change in interest rates leads to almost half of the change in the CTE70 being due to the change in discounting (Attribution of $3,331 out of the total $5,591 change observed).

Attachment H – Initial Summary of 'Other Tools' for Discussion by Work Area

Note to Work Area 4 members: what follows is the result of a cursory review of NAIC models and guidance to list the various supervisory powers and tools that may be germane to assessing or addressing interest rate risk of life insurers, and which may impact the timing of any appropriate supervisory intervention. The list is likely to be incomplete, and descriptions and references could use improvement. First impressions may be most important, and to that end, a call will be held in the next few weeks to discuss members' views about the proposed chart, as well as the proposed steps outlined below and how to best proceed.

It is proposed that members of Work Area 4 collaborate regarding the following steps:

1. Assess the approach taken with the chart; does the content and structure at this juncture appear adequate to inform AMIWG's discussions as it deliberates implementation of the AM and the issues raised by the IAIS relative to interest rate risk and supervisory intervention? If not, what improvements to the overall content/ structure should be considered?
2. Are there other relevant powers/tools that should also be listed and considered? Are there any listed here that are not considered sufficiently relevant and should be excluded? Which of the items listed are most directly relevant (and possibly, most effective) in specifically assessing and addressing interest rate risk of life insurers?
3. Are the descriptions adequate? Note that most of the current text was taken from sections of the Financial Analysis Handbook, with the desire to keep descriptions high-level and brief.
4. In the case of some tools, such as ORSA, the applicable NAIC guidance is intentionally non-prescriptive. In such instances, what type of information would generally be expected to be included in the case of an ORSA of a large life insurance group relative to interest rate risk? E.g., description of scenario approach used; of scenarios applied including level of stress; etc.

Supervisory Power/Tool	Description
Enterprise risk report (Form F) (see also beginning at	Filed by the ultimate controlling person; identifies the material risks withing the insurance holding company system that could pose enterprise risk to the insurer.

page 641 of the FAH)	
Group capital calculation (see also page 655 of the FAH)	Filed by the ultimate controlling person; the report to be completed in accordance with the NAIC Group Capital Calculation instructions. Some exemptions may apply.
ORSA (see also beginning at page 630 of the FAH)	Larger scale insurers and insurance groups are subject to the requirements of the Risk Management and Own Risk and Solvency Assessment Model Act (#505). This model requires among other things, the maintenance of a risk management framework to assist with identifying, assessing, monitoring, managing, and reporting on its material and relevant risks. It also requires the completion of an Own Risk and Solvency Assessment (ORSA) no less than annually, but also at any time when there are significant changes to the risk profile of the insurer or the insurance group. The ORSA is the insurer/group's internal assessment appropriate to its nature, scale and complexity addressing the material and relevant risks associated with an insurer's current business plan and the sufficiency of capital resources to support those risks. Any follow-up associated with this risk assessment should be coordinated through the lead state to improve regulatory effectiveness and reduce the level of regulatory duplication. If a U.S. state insurance commissioner is the global group-wide supervisor of an IAIG, the U.S. state insurance commissioner should receive the ORSA Summary Report covering all material group-wide insurance operations.
Liquidity stress test	Applies to insurers that meet at least one threshold of the Scope Criteria. The filing of stress test result shall comply with the NAIC Liquidity Stress Test Framework's instructions and reporting templates.
Supervisory colleges	A supervisory college as a regulatory tool that is incorporated into the existing risk-focused surveillance approach when a holding company system contains internationally active legal entities with material levels of activity and is designed to work in conjunction with a regulatory agency's analytical, examination and legal efforts. The supervisory college creates a more unified approach to addressing global financial supervision issues. Effective and efficient regulatory scrutiny of group-wide issues should occur in the context of an organized global approach and involve all significant regulatory parties, including regulatory agencies from countries outside of the U.S., and other state and federal agencies within the states. In rare cases (e.g., certain large health insurance groups), the use of a supervisory college for U.S.-only insurance groups (no insurance

	business outside the U.S.) may be beneficial to increasing the efficiency and effectiveness of group regulation. This type of supervisory college is referred to as a regional supervisory college
Group-wide supervision of IAIGs	If the commissioner is the group-wide supervisor for an internationally active insurance group, the commissioner is authorized to engage in any of the following group-wide supervision activities: (1) Assess the enterprise risks within the internationally active insurance group to ensure that: (a) The material financial condition and liquidity risks to the members of the internationally active insurance group that are engaged in the business of insurance are identified by management, and (b) Reasonable and effective mitigation measures are in place; Request, from any member of an internationally active insurance group subject to the commissioner's supervision, information necessary and appropriate to assess enterprise risk; Coordinate and, through the authority of the regulatory officials of the jurisdictions where members of the internationally active insurance group are domiciled, compel development and implementation of reasonable measures designed to ensure that the internationally active insurance group is able to timely recognize and mitigate enterprise risks to members of such internationally active insurance group that are engaged in the business of insurance;
NAIC's Financial Analysis (E) Working Group	The Working Group's primary role is to identify insurance companies and groups of national significance that are, or may be, financially troubled, and determine whether appropriate regulatory action is being taken, and if not, what action should be taken. This group of state regulators meets and holds conference calls throughout the year. This peer review process is an essential part of the state-based system of insurance regulation in that it reinforces the communication and cooperation that is necessary to regulate insurers and insurance groups.
Financial Analysis – Holding company and group level	Provides continuous off-site monitoring of a group's financial condition, monitor internal/external changes relating to all aspects of the insurer and work with examination staff to review specific risks through an on-site examination. The holding company analysis procedures are designed to determine what risks exist at the holding company. Every holding company system is reviewed in order to derive an overall assessment that highlights areas where a more detailed analysis may be necessary. The procedures are intended to be used at the discretion of analysts depending upon the sophistication, complexity and overall financial position of the holding company system, as well as the degree of interdependence and interconnectivity within the holding company system. Also,

	consistent with the risk-focused surveillance approach, analysts should have a firm understanding of the branded risk categories for each group, including but not limited to market risks (which includes interest rate risk).

Note to Work Area 4 members. The chart continues, below, but with some powers /tools that may be considered too general or not directly relevant to interest rate risk of life insurers or the timing of supervisory intervention. However, it is noted that within the IAIS' ICPs and ComFrame, there is recognition of a range of actions that may be taken, from communicating with the group to obtain and verify information so as to assess the scope and severity of the problem, to restricting new business and even to exit the market. Even in a situation where interest rate risk may be the only apparent issue, the supervisor may nonetheless be compelled to take other actions to preserve the financial strength of the group in the meantime – such as restricting dividends, other distributions, or transactions with affilates. In that regard, the state-based system is somewhat unique in that pre-approval of extraordinary dividends is required, whereas in other key jurisdictions, dividends may be declared, paid, and simply disclosed or reported after-the-fact to supervisors; no pre-approval is necessary, unless that is part of the supervisory response to problems noted at the company. The same is true for transactions among affiliates within an insurance holding company system, for which pre-approval (or non-disapproval within a stated time frame) is the norm in the state-based system in the U.S. The pre-approval requirements of the state-based regime thus seems to enhance the timing of certain supervisory actions taken in the U.S. as compared to some other key jurisdictions. ***That said, a discussion point with Work Area #4 is the extent to which the items below, or other items like them, should be included in the chart for AMIWG's attention.***

Supervisory Power/Tool	Description
Financial Analysis – legal entity level	Procedures aimed at assessing market risks, including interest rate risk, e.g., review of statements of actuarial opinion and other actuarial filings and findings on asset adequacy analysis and liquidity issues including scenarios tested (also including interest rate scenarios); information on asset-liability matching; derivative use plans.

Group Profile Summary	All results of holding company analysis are to be documented in the GPS for purposes of presenting a comprehensive view of the current and prospective risks facing the holding company group as well as the ongoing regulatory plan (or supervisory plan) to ensure effective supervision. A separate supervisory plan document may also be utilized to outline more detailed steps to ensure effective supervision for high priority or potentially troubled insurers within the group, as necessary. The purpose of the GPS also is to serve as the primary communication tool between the lead state and other regulators that provides consistency between the states. The GPS is intended to serve as a "living document" to "house" summaries of information from legal entity IPSs that are material to the group, such as coordinated risk-focused examinations, financial analysis, internal and external changes, supervisory plans, and other group information. Completing and distributing the GPS to other regulators on a timely basis is the sole responsibility of the lead state
Insurance Holding Company System Analysis	See starting at p. 587 of FAH
Annual registration requirements (Form B)	Agreements and transactions between in insurer and its affiliates; financial statements of the parent filed with the SEC; all dividends and other distributions; consolidated filings
Prior notice requirements for transactions within an Insurance Holding Company System (Form D)	Such transactions must adhere to stated standards, e.g., that the terms be fair and reasonable. For specified transactions, notice must be given to the Commissioner at least 30 days in advance for approval or non-disapproval within that period of time.
Dividends and other distributions	"Extraordinary" dividends or distributions, as defined, are subject to pre-approval requirements.
Examination authority – full scope and targeted examinations	The NAIC's Insurance Holding Company System Model Act provides that the commissioner shall have the power to examine any registered insurer and its affiliates to ascertain the financial condition of the insurer, including the enterprise risk to the insurer by the ultimate controlling party, or by any entity or combination of entities within the insurance holding company system, or by the insurance holding company system on a consolidated basis. Also, NAIC Model Act on Examinations (#390) provides that the commissioner or any of the commissioner's examiners may conduct an examination under this Act of any company as often as the commissioner in his or her sole discretion deems appropriate…

Model Audit Rule	(brief description to be added; audited financial statements, other reports by the CPA (e.g., report on internal controls) and their review by regulatory analysts can shed light on risks, as well as on material internal control weaknesses (which could relate to ALM)
The Corporate Governance Annual Disclosure Model Act (#305) and the Corporate Governance Annual Disclosure Model Regulation (#306)	(brief description to be added – could address governance over risk management)

Attachment I – Example Provided to Other Tools Work Area

In addition to insight gained through the Aggregation Method, state regulators employ a range of additional tools to obtain insight into risks the insurance groups they supervise are exposed to and ensure that reasonable and effective mitigation measures are in place. Most notable among these is Own Risk and Solvency Assessment (ORSA), which is the insurance group's internal assessment of the sufficiency of capital resources to support relevant risks. The ORSA is required to be completed no less than annually, with more frequent updates if there are significant changes to the risk profile of the insurance group.

While the content of the ORSA is unique to each insurance group, the NAIC maintains an ORSA Guidance Manual that establishes minimum requirements for what must be included. Section 3 of the ORSA requires insurance groups to provide an assessment of group capital (current year with a comparison to the prior year) and prospective assessment of solvency under normal and stressed environments that demonstrates the group has the financial resources necessary to execute its multi-year business plan in accordance with its stated risk appetite. Stress testing scenarios are intended to be coherent and comprehensive, assessing all the underlying insurance companies' and group's key risk exposures. Stress scenarios will be informed by the risks that are relevant to the insurance group and cover a range of severities (e.g., cyclical, worst in history, acute vs prolonged shocks, etc.). For global life insurers market risk – and interest rate risk in particular – is key among the exposures assessed and discussed with their groupwide supervisor. Examples of potential shocks include:

- Interest rates decreasing or increasing with the severity being informed by the currency of the exposure and varying by tenor (e.g., impact at 10-year point vs 30-year) and target severity (e.g., cyclical, worst in history, etc.).
- Credit spread widening or tightening
- Equity market declines
- Currency appreciation or depreciation

While a statutory lens is foundational, others may also be relevant to the insurance group for executing its multi-year business plan (e.g., result through an internal economic model lens, U.S. GAAP lens, liquidity lens, etc.) and shared with state regulators as part of their oversight of the insurance group to ensure they have a fulsome understanding of risk exposures and how the insurer is managing them.

More broadly, state regulators have the authority to examine any insurer and its affiliates to ascertain the financial condition of the insurer, including the enterprise risk to the insurer by the ultimate controlling party, or by any entity or combination of entities within the insurance holding company system, or by the insurance holding company system on a consolidated basis in order to determine its financial condition and if supervisory action or intervention is warranted. State regulators employ this authority proactively and meet on a regular basis with group management to receive updates on a range of topics that enable them to maintain a robust understanding of the financial strength of the insurance group and entities within it. Areas of regular focus and discussion include:

- Enterprise risk management – e.g., updates on risk exposures and risk appetite; how exposures are emerging and managed
- Capital and liquidity management – e.g., updates capital and liquidity position; impacts of market developments; forecasted results; rating agency views and developments; capital markets activities
- Investment portfolio management – e.g., update on investment holdings (asset classes, credit quality, etc.), performance, and strategy
- Financial reporting – e.g., updates on financial performance; discussions with internal and external auditors regarding their work

In addition to the examples noted above, state regulators also request and receive information on an adhoc basis when market conditions or developments warrant. Examples of situations include receiving updates on implications of volatility in financial markets on capital and liquidity (e.g., a spike in interest rates), investment portfolio developments (e.g., exposure to sectors / counterparties experiencing stress), etc.

Outline of Review of US Group Capital Regulation

For Discussion by Aggregation Method (G) Implementation Working Group (AMIWG)

AMIWG's charges include a review of the group capital of US groups and their potential for comparable implementation of the Insurance Capital Standard (ICS) including:

a. Sensitivity to changes in interest rates and their impact on the solvency of the US life groups
b. Supervisory intervention of US groups on group capital grounds
c. Use of scalars and choice of regulatory intervention points
d. Reporting and disclosure requirements

This review will include identification of gaps/refinements and recommendations for implementation of the ICS via the Aggregation Method.

Outline

I. Purpose of Review
II. Sensitivity to Changes in Interest Rates
    a. Technical papers
    b. Review of Existing Tools
    c. Identification of Gaps / Refinements
III. Supervisory Intervention of US groups on group capital grounds
    a. Review of Existing Tools
    b. Intervention at Entity vs Group Level
    c. Scalars & Choice of Regulatory Intervention Points
    d. Identification of Gaps / Refinements
IV. Consideration of Final Version of Aggregation Method
    a. Potential Changes to Provisional AM
    b. Scaling Methodology
    c. Reporting / Disclosure
V. Recommendations
    a. Final Version of Aggregation Method for Implementation of ICS
        i. Use of Excess Relative Ratio Scalars
        ii. Comparison to Group Capital Calculation
    b. Recommendation of Refinements / Clarifications for other working groups