Valuation Manual

Jan. 1, 2024 Edition

Table of Contents

VM-20: Requirements for Principle-Based Reserves for Life Products

Table of Contents

Section 1: Purpose

A.   These requirements establish the minimum reserve valuation standard for individual life insurance policies issued on or after the operative date of the *Valuation Manual* and subject to a principle-based valuation with an NPR floor under Model #820. These requirements constitute the Commissioners Reserve Valuation Method (CRVM) for policies of individual life insurance.

B.   Individual life certificates under a group life contract shall be subject to the requirements of VM-20 if all of the following are met. These requirements constitute the CRVM for such certificates.

1.   An individual risk selection process, defined as follows, is used to obtain group life insurance coverage;

        An individual risk selection process is one that is based on characteristics of the insured(s) beyond sex, gender, age, tobacco usage, and membership in a particular group. This may include, but is not limited to: completion of an application (beyond acknowledgement of membership to the group, sex, gender, and age); questionnaire(s); online health history or tele-interview to obtain non-medical and medical or health history information; prescription history information; avocations; usage of tobacco; family history; or submission of fluids such as blood, Home Office Specimens (HOS), or oral fluid. The resulting risk classification is determined based on the characteristics of the individual insured(s) rather than the group, if any, of which it is a member (e.g., employer, affinity, etc.). The individual certificate holder is charged a premium rate based solely on the individual risk selection process and not on membership in a specific group.

> **Guidance Note:**
>
> The use of evidence of insurability does not by itself constitute an individual risk selection process. Use of information obtained from a census or question(s) regarding gender, occupation, age, income, and/or tobacco usage solely for purposes of determining a rate classification does not by itself qualify a group as having used an individual risk selection process. Group insurance where the underwriting based on the characteristics of the group and census data but where some individuals are subjected to individual risk selection as a result of compensation level, age, an existing medical condition or impairment, late entry into the group, failure of the group to meet minimum participation requirements, or voluntary buy-up of increased coverage does not meet the definition of an individual risk selection process.

2.   The individual certificates utilize premiums or cost of insurance schedules and charges based on the individual applicant's issue age, duration from underwriting, coverage amount, and risk classification, and there is a stated or implied schedule of maximum gross premiums or net cash surrender value required in order to continue coverage in force for a period in excess of one year;

> **Guidance Note:**
>
> Coverage amount does not imply a requirement for banding of premiums or charges but rather rates or charges that are multiplied by number of units of coverage of face amount (or net amount at risk) per $1,000 to obtain the actual premium or charge.

3.   The group master contract is designed, priced, solicited, and managed similar to individual ordinary life insurance policies rather than specific to the group as a whole;

4.   The individual certificates have similar acquisition approaches, provisions, certificate-holder rights, pricing, and risk classification to individual ordinary life insurance contracts.

5.   The individual certificates are issued on or after the operative date of the *Valuation Manual* except election of the transition period in Section II, Subsection 1.F.1.

Section 2: Minimum Reserve

A.   All policies subject to these requirements shall be included in one of the VM-20 reserving categories, as specified in Section 2.A.1, Section 2.A.2 and Section 2.A.3 below.

> **Guidance Note:**
>
> Since group insurance subject to an individual risk selection process and meeting all the requirements in Section 1.B is subject to VM-20 requirements, Section 2.A shall apply—meaning that any such contracts will be included in one of the VM-20 reserving categories defined by Section 2.A.1, Section 2.A.2, and Section 2.A.3. All requirements in VM-31 that apply to a VM-20 reserving category shall apply to any group insurance subject to individual risk selection that has been included in that VM-20 reserving category.

The company may elect to exclude one or more groups of policies from the SR calculation and/or the DR calculation. When excluding a group of policies from a reserve calculation, the company must document that the applicable exclusion test defined in Section 6 is passed for that group of policies. The minimum reserve for each VM-20 reserving category is defined by Section 2.A.1, Section 2.A.2 and Section 2.A.3, and the total minimum reserve equals the sum of the Section 2.A.1, Section 2.A.2 and Section 2.A.3 results below, defined as:

1.   Term reserving category — All policies and riders belonging in the Term reserving category are to be included in Section 2.A.1.b unless the company has elected to exclude a group of them from the SR calculation and has applied the stochastic exclusion test (SET) defined in Section 6, passed the test and documented the results.

    a.   For the group of policies and riders for which the company did not compute the SR: the sum of the policy minimum NPRs for those policies plus the excess, if any, of the DR for those policies determined pursuant to Section 4 over the quantity (A–B), where A = the sum of the policy minimum NPRs for those policies, and B = any due and deferred premium asset held on account of those policies.

    b.   For the group of policies and riders for which the company computes all three

reserve calculations: the sum of the policy minimum NPRs for those policies plus the excess, if any, of the greater of the DR for those policies determined pursuant to Section 4 and the SR for those policies determined pursuant to Section 5 over the quantity (A–B), where A = the sum of the policy minimum NPR's for those policies, and B = any due and deferred premium asset held on account of those policies.

    c.   The due and deferred premium asset, if any, shall be based on the valuation net premiums computed in accordance with Section 3.B.4.a, for the base policy, determined without regard to any NPR floor amount from Section 3.D.1. The valuation net premium is zero in the first policy year for policies in the Term product group. Since the due and deferred premium asset and unearned premium reserve are based on the valuation net premium, it follows that these are also zero in the first policy year.

> **Guidance Note:** This may not be the case for riders that use a different reserving method.

2.   ULSG reserving category — All policies and riders belonging to the ULSG reserving category are to be included in Section 2.A.2.c unless the company has elected to exclude a group of them from the SR calculation or both the DR and SR calculations and has applied the applicable exclusion test(s) defined in Section 6, passed the test(s) and documented the results.

    a.   For the group of policies and riders for which the company did not compute the DR nor the SR: the sum of the policy minimum NPRs for those policies.

> Guidance Note: This may be applicable for a group of ULSG policies that meet the definition of a "non-material secondary guarantee" and passes both the DET and the SET.

    b.   For the group of policies and riders for which the company did not compute the SR: the sum of the policy minimum NPRs for those policies plus the excess, if any, of the DR for those policies determined pursuant to Section 4 over the quantity (A–B), where A = the sum of the policy minimum NPRs for those policies, and B = any due and deferred premium asset held on account of those policies.

    c.   For the group of policies and riders for which the company computes all three reserve calculations: the sum of the policy minimum NPRs for those policies plus the excess, if any, of the greater of the DR for those policies determined pursuant to Section 4 and the SR for those policies determined pursuant to Section 5 over the quantity (A–B), where A = the sum of the policy minimum NPRs for those policies, and B = any due and deferred premium asset held on account of those policies.

    d.   The due and deferred premium asset, if any, shall be based on the valuation net premiums computed in accordance with Section 3.B.5.d, for the base policy, determined without regard to any NPR floor amount from Section 3.D.2.

3.   All Other VM-20 reserving category– All policies and riders belonging to the All Other VM-20 reserving category are to be included in Section 2.A.3.c unless the company has elected to exclude a group of them from the SR calculation or both the deterministic and SR calculations and has applied the applicable exclusion test defined in Section 6, passed the test and documented the results.

    a.   For the group of policies and riders for which the company did not compute the

DR nor the SR: the sum of the policy minimum NPRs for those policies.

b. For the group of policies and riders for which the company did not compute the SR but did compute the DR: the sum of the policy minimum NPRs for those policies plus the excess, if any, of the DR for those policies determined pursuant to Section 4 over the quantity (A–B), where A = the sum of the policy minimum NPRs for those policies, and B = any due and deferred premium asset held on account of those policies.

c. For the group of policies and riders for which the company computes all three reserve calculations: the sum of the policy minimum NPRs for those policies plus the excess, if any, of the greater of the DR for those policies determined pursuant to Section 4 and the SR for those policies determined pursuant to Section 5 over the quantity (A–B), where A = the sum of the policy minimum NPRs for those policies, and B = any due and deferred premium asset held on account of those policies.

B. Section 3 defines the requirements for the policy NPR. Section 4 defines the requirements for the DR, and Section 4.C defines how that reserve is attributed to a VM-20 reserving category. Section 5 defines the requirements for the SR, and Section 5.G defines how that reserve is determined for each VM-20 reserving category.

C. The reserve for each VM-20 reserving category as determined in Section 2.A.1, Section 2.A.2 or Section 2.A.3 shall be allocated to each policy within that VM-20 reserving category in the same proportion as the minimum NPR for that policy to the minimum NPR for the VM-20 reserving category with the exception to make best efforts to minimize allocating the deterministic or SR in excess of the net premium reserve, with any adjustment for due and deferred premiums, to policies which did not produce this excess. A clear example is to use the NPR per policy in Section 2.A.3.a as the allocated reserve per policy, given that no deterministic or SR is used in Section 2.A.3.a.

D. The reserves for supplemental benefits and riders shall be calculated consistent with the requirements for "Riders and Supplemental Benefits" in Section II, Reserve Requirements.

E. The company may calculate the DR and the SR as of a date no earlier than three months before the valuation date, using relevant company data, provided an appropriate method is used to adjust those reserves to the valuation date. Company data used for experience studies to determine prudent estimate assumptions are not subject to this three-month limitation.

F. If a company has separate account business, the company shall allocate the minimum reserve between the general and separate accounts subject to the following:

1. The amount allocated to the general account shall not be less than zero and shall include any liability related to contractual guarantees provided by the general account.

2. The amount allocated to the separate account shall not be less than the sum of the cash surrender values and not be greater than the sum of the account values attributable to the separate account portion of all such contracts.

G. A company may use simplifications, approximations and modeling efficiency techniques to calculate the NPR, the DR and/or the SR required by this section if the company can demonstrate that the use of such techniques does not understate the reserve by a material amount, and the expected value of the reserve calculated using simplifications, approximations and modeling efficiency techniques is not less than the expected value of the reserve calculated that does not use them. The preceding demonstration requirements of Section 2.G do not apply to the use of model segmentation for purposes of determining the net asset earned rates.

> **Guidance Note:**
>
> Examples of modeling efficiency techniques include, but are not limited to:
>
> 1. Choosing a reduced set of scenarios from a larger set consistent with prescribed models and parameters.
>
> 2. Generating a smaller liability or asset model to represent the full seriatim model using grouping compression techniques or other similar simplifications.
>
> There are multiple ways of providing the demonstration required by Section 2.G. The complexity of the demonstration depends upon the simplifications, approximations or modeling efficiency techniques used. Examples include, but are not limited to:
>
> 1. Rounding at a transactional level in a direction that is clearly and consistently conservative or is clearly and consistently unbiased with an obviously immaterial impact on the resulting reserve (e.g., rounding to the nearest dollar) would satisfy 2.G without needing a demonstration. However, rounding to too few significant digits relative to the quantity being rounded, even in an unbiased way, may be material and in that event, the company may need to provide a demonstration that the rounding would not produce a material understatement in the reserve.
>
> 2. A brute force demonstration involves calculating the minimum reserve both with and without the simplification, approximation or modeling efficiency technique, and making a direct comparison between the resulting reserves. Regardless of the specific simplification, approximation or modeling efficiency technique used, brute force demonstrations always satisfy the requirements of Section 2.G.
>
> 3. Choosing a reduced set of scenarios from a larger set consistent with prescribed models and parameters and providing a detailed demonstration of why it did not understate the reserve by a material amount and the expected value of the reserve would not be less than the expected value of the reserve that would otherwise be calculated. This demonstration may be a theoretical, statistical or mathematical argument establishing, to the satisfaction of the insurance commissioner, general bounds on the potential deviation in the reserve estimate rather than a brute force demonstration.
>
> 4. Selecting a margin for lapse rates where the directionality of the margin changes at a certain duration may require a detailed, calculation-based demonstration. Rather than a brute force demonstration, a company may be able to use representative cells to establish a materiality range supporting the use of a simplified lapse margin using, for example, the average duration that the directionality of the margin changes.

H.   The company shall establish, for the DR and SR, a standard containing the criteria for determining whether an assumption, risk factor or other element of the principle-based valuation has a material impact on the size of the reserve. This standard shall be applied when identifying material risks under VM-20 Section 9.B.1. Such a standard shall also apply to the NPR with respect to VM-20 Section 2.G.

> **Guidance Note:**
>
> For example, the standard may be expressed as an impact of more than X dollars or Y% of the reserve, whichever is greater, where X and Y are chosen in a manner that is meant to stand the test of time and not need periodic revision.
>
> The standard is based on the impact relative to the size of the NPR, DR and SR as opposed to the

impact relative to the overall financial statement (e.g., total company reserves or surplus). Reviewing items that may lead to a material misstatement of the financial statement in the current year is appropriate in its own context, but it is not appropriate for identifying material risks for PBR, which itself is an emerging risk.

Note that the criteria apply to the NPR, DR and SR, and not just the final reported reserve. For example, if the DR is less than the NPR, the criteria still apply to the DR.

The standard also applies to exclusion tests, as they are an element of the principle-based valuation.

I. Section 2.G and Section 2.H provide companies some flexibility in assumption setting and modeling methodologies, but they do not allow for skipping mandated steps without providing a valid approximation, simplification, or modeling technique under Section 2.G that neither materially understates nor downwardly biases the reserve.

Examples of omissions that would not satisfy VM-20 Section 2.G include: not computing even a simplified NPR; not computing even a simplified DR or SR without having passed the relevant exclusion test(s); omitting prescribed mortality margins; not establishing any lapse margins; not building even a simplified asset model for the DR; using the alternative investment strategy without first determining that it produces a higher reserve than the company investment strategy; and ignoring post-level term losses.

> **Guidance Note:**
>
> The issue here is not the use of approximations; it is about skipping mandated VM-20 requirements. Thus, for example, this does not rule out the use of a relatively simple asset model that is acceptable pursuant to VM-20 Section 7.E.1.a, nor the judicious use of the previous year's assumption development work to save time and effort.

Section 3: Net Premium Reserve

A. Applicability

 1. The NPR for each policy must be determined on a seriatim basis pursuant to Section 3.

 2. When valuing term riders pursuant to Paragraph E in "Riders and Supplemental Benefits Requirements" in Section II, the reserve requirements for term policies are applicable.

B. NPR Calculation

 1. For the purposes of Section 3, the following terms apply:

  a. A policy with "multiple secondary guarantees" is one that: i) simultaneously has more than one shadow account; ii) simultaneously has more than one cumulative premium type of guarantee; or iii) simultaneously has at least one of each. A single shadow account with a variety of possible end dates to the secondary guarantee, depending on the policyholder's choice of funding level, constitutes a single—not multiple—secondary guarantee.

> **Guidance Note:**

Policy designs that are created simply to disguise guarantees or exploit a perceived loophole must be treated in a manner similar to more typical product designs with similar guarantees. If a policy contains multiple secondary guarantees, such that a subset of those secondary guarantees in combination represent an implicit guarantee that would produce a higher NPR if that implicit guarantee were treated as an explicit secondary guarantee of the policy, then the policy should be treated as if that implicit guarantee were an explicit guarantee. For example, if there were a policy with a "sequential secondary guarantee" where only one secondary guarantee applied at any given point in time but with a series of secondary guarantees strung together with one period ending when the next one began, the combined terms of the secondary guarantees would be regarded as a single secondary guarantee.

  b. The "fully funded secondary guarantee" at any time is:

    i. For a shadow account secondary guarantee, the minimum shadow account fund value necessary to fully fund the secondary guarantee for the policy at that time. For any policy for which the secondary guarantee contractually cannot be fully funded in advance, this shall be the present value of the contractually permitted premium stream that would fully fund the guarantee at the earliest possible date (using the valuation interest rate and mortality standard specified in Section 3.C).

    ii. For a cumulative premium secondary guarantee, the amount of cumulative premiums required to have been paid to that time that would result in no future premium requirements to fully fund the guarantee, accumulated with any interest or accumulation factors per the contract provisions for the secondary guarantee. For any policy for which the secondary guarantee contractually cannot be fully funded in advance, this shall be the present value of the contractually permitted premium stream that would fully fund the guarantee at the earliest possible date (using the valuation interest rate and mortality standard specified in Section 3.C).

  c. The "actual secondary guarantee" at any time is:

    i. For a shadow account secondary guarantee, the actual shadow account fund value at that time.

    ii. For a cumulative premium secondary guarantee, the actual premiums paid to that point in time, accumulated with any interest or accumulation factors per the contract provisions for the secondary guarantee.

  d. The "level secondary guarantee" at any time is:

    i. For a shadow account secondary guarantee, the shadow account fund value that would have existed at that time assuming payment of the level gross premium determined according to Section 3.B.5.c.i.1.

    ii. For a cumulative premium secondary guarantee, the amount of cumulative level gross premiums determined according to Section 3.B.5.c.i.1, accumulated with any interest or accumulation factors per the contract provisions for the secondary guarantee.

2. Section 3.B.4 and Section 3.B.5 provide the calculation of a terminal NPR under the assumption of an annual mode gross premium. In Section 3.B.4 and Section 3.B.5, the gross premium referenced is the gross premium for the policy assuming an annual premium mode.

3. Since terminal NPRs are computed as of the end of a policy year and not the reporting date, the terminal NPR as of policy anniversaries immediately prior and subsequent to the reporting date are adjusted to reflect that portion of the net premium that is unearned at the reporting date. This is generally accomplished using either the mean reserve method or the mid-terminal method as discussed in *SSAP No. 51R—Life Contracts*. Other appropriate methods, including an exact reserve valuation, may also be used.

4. For all policies and riders within the Term reserving category, other than those addressed in Section 3.B.8 below, the NPR on any valuation date shall be equal to the actuarial present value of future benefits less the actuarial present value of future annual valuation net premiums as follows:

   a. The annual valuation net premiums shall be a uniform percent of the respective adjusted gross premiums, described in Section 3.B.4.b, such that at issue the actuarial present value of future valuation net premiums shall equal the actuarial present value of future benefits plus an amount equal to $2.50 per $1,000 of insurance for the first policy year only.

   > **Guidance Note:** When calculating the present values under Section 3.B.4.a.i and Section 3.B.4.a.ii, benefits and premiums during the years following the end of the level term period should be projected assuming that the policies subject to the shock lapse in each year do not pay the higher premium in that year.

   A shock lapse is deemed to have occurred in any year for which the prescribed lapse rate is greater than or equal to 25%. Valuation net premiums for policy years after a shock lapse shall be limited and may result in two uniform percentages, one applicable to policy years prior to that shock lapse and one applicable to policy years following that shock lapse. However, for policies with more than one shock lapse, only one shock lapse shall be subject to such treatment, namely the one that would produce the largest ratio ii/i as computed below before any such percentages are applied. For these policies, these percentages shall be determined as follows:

   i. Compute the actuarial present value of benefits for policy years following the shock lapse.

   ii. Compute the actuarial present value of valuation net premiums for policy years following the shock lapse.

   iii. If ii/i is greater than 135%, reduce the net valuation premiums in ii uniformly to produce a ratio of ii/i of 135%.

   iv. If the application of iii produces an adjustment to the net valuation premiums following the shock lapse, increase the net valuation premiums for policy years prior to the shock lapse by a uniform percentage such that at issue the actuarial present value of future valuation net premiums equals the actuarial present value of future benefits plus $2.50 per $1,000 of insurance for the first policy year only.

   b. Adjusted gross premiums shall be determined as follows:

   i. The adjusted gross premium for the first policy year shall be set at zero.

   ii. The adjusted gross premium for any year from the second through fifth policy year shall be set at 90% of the corresponding gross premium for that policy year.

    iii.   The adjusted gross premium for any year after the fifth policy year shall be set equal to the corresponding gross premium for that policy year.

    c.   The gross premium in any policy year is the maximum guaranteed gross premium for that policy year, inclusive of any applicable policy fee.

    d.   Actuarial present values are calculated using the interest, mortality and lapse assumptions prescribed in Section 3.C.

5.   For all policies and riders within the ULSG reserving category, other than indexed universal life policies for which the company did not compute the DR nor the SR, the NPR shall be determined as follows:

    a.   If the policy duration on the valuation date is prior to the point when all secondary guarantee periods have expired, the NPR shall be the greater of the reserve amount determined in Section 3.B.5.c and the reserve amount determined in Section 3.B.5.d, subject to the floors specified in Section 3.D.2.

    b.   If the policy duration on the valuation date is after the expiration of all secondary guarantee periods, the NPR shall be the reserve amount determined according to Section 3.B.5.d only, subject to the floors specified in 3.D.2.

    c.   A reserve amount for the policy shall be calculated assuming the secondary guarantee is in effect as described below. If the policy has multiple secondary guarantees, the NPR shall be calculated as below for the secondary guarantee that provides the greatest NPR as of the valuation date. For the purposes of this subsection, let n be the longest number of years the policy can remain in force under the provisions of the secondary guarantee. However, if a shorter period produces a materially greater NPR, then n shall be that shorter number of years.

        i.   As of the policy issue date:

            1)   Determine the level gross premium at issue, assuming payments are made each year for which premiums are permitted to be paid, such period defined as v years in this subsection, that would keep the policy in force to the end of year n, based on policy provisions, including the secondary guarantee provisions, such as mortality, interest and expenses. In no event shall v be greater than n for purposes of the NPR calculated in this subsection.

            2)   Determine the annual valuation net premiums at issue as that uniform percentage (the valuation net premium ratio) of the respective gross premiums such that at issue the actuarial present value of future valuation net premiums over the n-year period shall equal the actuarial present value of future benefits over the n-year period. The valuation net premium ratio determined shall not change for the policy.

            3)   Using the level gross premium from Section 3.B.5c.i.1 above, determine the value of the expense allowance components for the policy at issue as x_1, y_{2-5} and z_1 defined below.

                x_1 = a first-year expense equal to the level gross premium at issue

                y_{2-5} = an expense equal to 10% of the level gross premium and applied in each year from the second through fifth policy year

z_1= a first-year expense of \$2.50 per \$1,000 of insurance issued

The expense allowance shall be amortized over the span of years in the secondary guarantee period during which premiums are permitted to be paid. E_{x+t}, the expense allowance balance as of the end of the policy year t, shall be computed as follows:

$$E_{x+t} = VNPR \cdot \ddot{a}_{x+t:\overline{v-t|}} \left[\frac{x_1+z_1}{\ddot{a}_{x:\overline{v|}}} + y_{2-5} \cdot C_{x+t} \right] \qquad \text{for } t < v$$

$$= 0 \qquad\qquad \text{for } t \geq v$$

Where:

t = 1,2,.. (number of completed years since issue)

VNPR = Valuation Net Premium Ratio from 3.B.5.c.i.2 above

$C_{x+t} = 0$ when t = 1

$$= \sum_{w=1}^{t-1} (1/\ddot{a}_{x+w:\overline{v-w|}}) \qquad\qquad \text{when } 2 \leq t \leq 5$$

$$= C_{x+5} \qquad\qquad\qquad\qquad \text{when } t > 5$$

ii.   After the policy issue date, on each future valuation date, the NPR shall be determined as follows:

        1)   As of the valuation date for the policy being valued, determine the actual secondary guarantee, denoted ASG_{x+t}, as outlined in Section 3.B.1.c and the fully funded secondary guarantee, denoted $FFSG_{x+t}$, as outlined in Section 3.B.1.b.

        2)   Divide ASG_{x+t} by $FFSG_{x+t}$, with the resulting ratio capped at 1. The ratio is intended to measure the level of prefunding for a secondary guarantee, which is used to establish reserves. Assumptions within the numerator and denominator of the ratio, therefore, must be consistent in order to appropriately reflect the level of prefunding. As used here, "assumptions" include any factor or value, whether assumed or known, which is used to calculate the numerator or denominator of the ratio.

        3)   Compute the net single premium (NSP_{x+t}) on the valuation date for the coverage provided by the secondary guarantee for the period of time ending at attained age x+n, using the interest, lapse and mortality assumptions prescribed in Section 3.C below. The net single premium (NSP) shall include consideration for death benefits only.

        4)   The NPR for an insured age x at issue at time t shall be according to the formula below:

$$Min \left[\frac{ASG_{x+t}}{FFSG_{x+t}} , 1 \right] \cdot NSP_{x+t} - E_{x+t}$$

Guidance Note: For a non-integer value of t, E_{x+t} is obtained by taking the present value at duration t of E_{x+T}, where T is the next higher integer; i.e., entails discounting by valuation interest,

mortality, and lapse for the fractional year between the valuation date and next anniversary (T – t).

    iii.   Actuarial present values referenced in this Section 3.B.5.c are calculated using the interest, mortality and lapse assumptions prescribed in Section 3.C below.

  d.   A reserve amount for the policy shall be calculated assuming the secondary guarantee is not in effect. The reserve amount shall be determined by the policy features and guarantees of the policy without considering any secondary guarantee provisions as follows:

    i.   Determine the level gross premium at issue, assuming payments are made each year for which premiums are permitted to be paid, such period defined as "s" in this subsection, that would keep the policy in force for the entire period coverage is to be provided based on the policy guarantees of mortality, interest and expenses.

    ii.   Determine the annual valuation net premiums as that uniform percentage (the valuation net premium ratio) of the respective gross premiums, such that at issue the actuarial present value of future valuation net premiums shall equal the actuarial present value of future benefits.

    iii.   Using the level gross premium from Section 3.B.5.d.i, determine the value of the expense allowance components for the policy at issue as x_1, y_{2-5} and z_1 defined below.

x_1 = a first-year expense equal to the level gross premium at issue

y_{2-5} = an expense equal to 10% of the level gross premium and applied in each year from the second through fifth policy year

z_1 = a first-year expense of $2.50 per $1,000 of insurance issued

The expense allowance shall be amortized over the period during which premiums are permitted to be paid. E_{x+t}, the expense allowance balance, as of the end of policy year t, shall be calculated as follows:

$$E_{x+t} = VNPR \bullet \ddot{a}_{x+t:\overline{s-t|}}\left[(x_1 + z_1)/\ddot{a}_{x:\overline{s|}} + y_{2-5}\bullet C_{x+t}\right] \qquad \text{for t < s}$$

$$= 0 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{for t} \geq \text{s}$$

Where:

        t = 1,2,.. (number of completed years since issue)

$VNPR = Valuation\ Net\ Premium\ Ratio\ from\ 3.B.5.d.ii$

$C_{x+t} = 0$ when t = 1

$= \sum_{w=1}^{t-1}(1/\ddot{a}_{x+w:\overline{s-w|}})$ when $2 \leq t \leq 5$

$= C_{x+5}$ when t > 5

iv. For a policy issued at age *x,* at any duration *t*, the net premium reserve shall equal:

$$m_{x+t} \bullet r_{x+t} \qquad \text{Where:}$$

1) m_{x+t} = the actuarial present value of future benefits less the actuarial present value of future valuation net premiums and less the unamortized expense allowance for the policy, E_{x+t} ,

> **Guidance Note:** For a non-integer value of t, E_{x+t} is obtained by taking the present value at duration t of $E_{x+\text{T}}$, where T is the next higher integer; i.e., entails discounting by valuation interest and survivorship for the fractional year between the valuation date and the next anniversary (T – t).

2) Let:

e_{x+t} = max (the actual policy fund value on the valuation date, 0)

f_{x+t} = the policy fund value on the valuation date is that amount which, together with the payment of the future level gross premiums determined in Section 3.B.5.d.i above, keeps the policy in force for the entire period coverage is to be provided, based on the policy guarantees of mortality, interest and expenses.

Then set r$_{x+t}$ equal to:

1, if $f_{x+t} \leq 0$

min($[e_{x+t}/ f_{x+t}]$, 1), otherwise

v. The future benefits used in determining the value of m_{x+t} shall be based on the greater of e_{x+t} and f_{x+t} together with the future payment of the level gross premiums determined in Section 3.B.5.d.i above, and assuming the policy guarantees of mortality, interest and expenses.

vi. The values of *ä* are determined using the NPR interest, mortality and lapse assumptions applicable on the valuation date.

vii. Actuarial present values referenced in this Section 3.B.5.d are calculated using the interest, mortality and lapse assumptions prescribed in Section 3.C.

6. For all policies and riders within the All Other VM-20 reserving category, as well as indexed universal life policies for which the company did not compute the DR nor the SR , the NPR shall be determined pursuant to applicable methods in VM-A and VM-C for the basic reserve. The mortality tables to be used are those defined in Section 3.C.1 and in VM-M Section 1.H.

7. The actuarial present value of future benefits equals the present value of future benefits including, but not limited to, death, endowment (including endowments intermediate to the term of coverage) and cash surrender benefits. Future benefits are before reinsurance and before netting the repayment of any policy loans.

8. For life insurance coverage that the company has assumed on a YRT basis, the reinsurer's

net premium reserve shall be one half year's cost of insurance for the reinsured net amount at risk.

C.   Net Premium Reserve Assumptions

    1.   Mortality Rates

        a.   Except as indicated in Section 3.C.1.b, and subject to the conditions outlined for reserves in VM-A-814 and A-815 in Appendix A of this manual, the mortality standard used in determining the present values described in Section B of this section shall be the 2001 CSO Mortality Table as defined in VM-M Section 1.G of this manual.

        b.   Subject to the conditions defined in Section 3.C.1.c, the 2017 CSO Mortality Tables as defined in VM-M Section 1.H are required as the valuation standard for ordinary life policies issued on or after Jan. 1, 2020, and subject to this section. A company may elect to apply this table to determine minimum reserve standards to one or more plans of insurance for policies issued on or after Jan. 1, 2017. The 2017 CSO Mortality Tables shall be used for the Actuarial Method, as defined in the *Term and Universal Life Insurance Reserve Financing Model Regulation* (#787), for all policy issue dates.

        c.   Conditions for application of the 2017 CSO:

            i.   For each plan of insurance with separate rates for smokers and nonsmokers, an insurer may use:

                C.   Composite mortality tables to determine minimum reserve liabilities; or

                D.   Smoker and nonsmoker mortality to determine minimum reserve liabilities if nonforfeiture values are also determined using smoker and nonsmoker mortality.

            ii. For plans of insurance without separate rates for smokers and nonsmokers, the composite mortality tables shall be used.

            iii. For the purpose of determining minimum reserve values and amounts of paid-up nonforfeiture benefits, the 2017 CSO Mortality Table may, at the option of the company for each plan of insurance, be used in its ultimate or select and ultimate form.

        d.   At the election of the company, for any one or more specified plans of insurance and subject to satisfying the conditions stated in Section 3.C.1.e, the 2017 CSO Preferred Class Structure Mortality Table may be substituted in place of the 2017 CSO Smoker or Nonsmoker Mortality Table as the minimum valuation standard for policies issued on or after Jan. 1, 2017, or for any policies valued using the Actuarial Method, as defined in Model #787.

        e.   Conditions for preferred structure tables:

            i.   For each plan of insurance with separate rates for preferred and standard nonsmoker lives, an insurer may use the super preferred nonsmoker, preferred nonsmoker and residual standard nonsmoker tables to substitute for the nonsmoker mortality table found in the 2017 CSO Mortality Table

to determine minimum reserves. At the time of election and annually thereafter, except for business valued under the residual standard nonsmoker table, the appointed actuary shall certify that:

    a)   The present value of death benefits over the next 10 years after the valuation date, using the anticipated mortality experience without recognition of mortality improvement beyond the valuation date for each class, is less than the present value of death benefits using the VBT corresponding to the valuation table being used for that class.

    b)   The present value of death benefits over the future life of the contracts, using anticipated mortality experience without recognition of mortality improvement beyond the valuation date for each class, is less than the present value of death benefits using the VBT corresponding to the valuation table being used for that class.

ii.   For each plan of insurance with separate rates for preferred and standard smoker lives, an insurer may use the preferred smoker and residual standard smoker tables to substitute for the smoker mortality table found in the 2017 CSO Mortality Table to determine minimum reserves. At the time of election and annually thereafter, for business valued under the preferred smoker table, the appointed actuary shall certify that:

    a)   The present value of death benefits over the next 10 years after the valuation date, using the anticipated mortality experience without recognition of mortality improvement beyond the valuation date for each class, is less than the present value of death benefits using the preferred smoker VBT corresponding to the valuation table being used for that class.

    b)   The present value of death benefits over the future life of the contracts, using anticipated mortality experience without recognition of mortality improvement beyond the valuation date for each class, is less than the present value of death benefits using the preferred smoker VBT.

iii.   Selection of the proper set of mortality rates when a company chooses to use a permitted preferred class structure mortality table shall be subject to *Actuarial Guideline XLII—The Application of the Model Regulation Permitting the Recognition of Preferred Mortality Tables for Use in Determining Minimum Reserve Liabilities* (AG 42).

Guidance Note: The *Valuation Manual* can be updated by the NAIC to define a new valuation table. Because of the various implications to systems, form filings and related issues (such as product tax issues), lead time is needed to implement new requirements without market disruption. It is recommended that this transition be for a period of about 4.5 years—that is, that the table be adopted by July 1 of a given year, that it be permitted to be used starting Jan. 1 of the second following calendar year, that it be optional until Jan. 1 of the fifth following calendar year, and thereafter mandatory. It is further intended that the adoption of such tables would apply to all

---

business issued since the adoption of this *Valuation Manual*. The details of how to implement any unlocking of mortality tables will need to be addressed in the future.

  f. For policies issued on a substandard basis, the company shall increase the CSO mortality rates in a manner commensurate with the substandard rating, subject to a cap that ensures that mortality rates do not exceed 1,000 per 1,000. Alternatively, a company may choose to reserve for the substandard extra mortality separately in Exhibit 5, for groups of policies for which the NPR dominates the DR and SR.

  g. For a group of policies where the anticipated mortality experience exceeds the prescribed CSO mortality rates determined in Section 3.C.1.a through 3.C.1.f above, the company shall adjust the CSO mortality rates as follows:

    i. For policies that pass the Life PBR Exemption, the CSO mortality rates used to determine the basic reserve for each policy shall be adjusted in a manner commensurate with the anticipated mortality experience for the policies. The methodology used to test whether adjustments are needed can be performed on an aggregate basis for the group of policies using a reasonable method to compare the respective mortality rates, such as comparing the present value of future death claims discounted at the valuation interest rate used for VM-A and VM-C. However, for the purposes of this comparison, a company may not group together policies with significantly different risk profiles. If an adjustment is needed, the determination of the adjustment factors should use a reasonable methodology, subject to a cap that ensures that mortality rates do not exceed 1,000 per 1,000.

    ii. For policies where the Life PBR Exemption is not utilized, the CSO mortality rates used in the NPR calculation shall be adjusted in a manner commensurate with the anticipated mortality experience for the policies.

      a) When the company elects to use the DET in Section 6.B for a group of policies, the methodology used to test whether adjustments are needed should be consistent with the methodology used in Section 6.B.5.d (that is, using a comparison of the PV of future death claims discounted at the valuation rate used for the NPR). For the purposes of this comparison, a company may not group together policies with significantly different risk profiles. The determination of the adjustment factors should use a reasonably consistent methodology to the one used in Section 6.B.5.d, subject to a cap that ensures that the mortality rates do not exceed 1,000 per 1,000.

      b) For the group of policies where the DET is not used, the company should use a reasonably consistent approach to the one described in paragraph a) above to test whether adjustments are needed and to determine the adjustment factors. The resulting adjustment factors are not required to be identical to the adjustment factors determined in paragraph a) above.

The resulting NPR must not be lower than the NPR calculated without adjustments to the CSO mortality rates.

> **Guidance Note:** It is anticipated that the 3.C.1.g adjustments are generally applicable but not limited to policies with limited underwriting, such as simplified issue or final expense. The intent of Section 3.C.1.g is not to test every possible group of policies (e.g., attained age blocks, individual underwriting classes with lower credibility, etc.) to determine if its mortality experience is higher than the CSO table even though more aggregate mortality experience is lower than the CSO table. However, if a large, credible block or group of policies (e.g., a block of business assumed from another company that has significantly different mortality experience than the rest of the assuming company's business, or a large block of business from an era when the company had significantly more permissive underwriting, etc.) is expected to have worse experience than the CSO table, then the adjustments in 3.C.1.g should be made.

2.   Interest Rates

> **Guidance Note:** This section describing the determination of the "calendar year net premium reserve interest rate" is intended to communicate that, unlike the "unlocking" of the NPR mortality and lapse assumptions, the interest rate used in the NPR calculation for a block of policies issued in a particular calendar year does not change for the duration of each of the policies in that issue year block.

a.   For NPR amounts calculated according to Section 3.B.5.d:

The calendar year NPR interest rate I shall be determined according to Section 3.C.2.a and the results rounded to the nearest one-quarter of 1%. This rate shall be used in determining the present values described in Section 3.B.5 for all policies issued in the calendar year next following its determination.

i. $I = .03 + W \bullet (R_1 - .03) + (W/2) \bullet (R_2 - .09)$

Where: R_1 is the lesser of R and .09

R_2 is the greater of R and .09

R is the reference interest rate defined in Section 2.a.ii below

W is the weighting factor for a policy, as defined in Section 2.a.iii below

However, if the calendar year NPR interest rate I in any calendar year determined without reference to this sentence differs from the corresponding actual rate for the immediately preceding calendar year by less than one-half of 1%, the calendar year NPR interest rate shall be set equal to the corresponding actual rate for the immediately preceding calendar year.

ii.   The reference interest rate R for a calendar year shall equal the lesser of the average over a period of 36 months and the average over a period of 12 months, ending on June 30 of the calendar year preceding the year of issue, of the monthly average of the composite yield on seasoned corporate bonds, as published by Moody's Investors Service (MIS).

iii.   The weighting factor W for a policy shall be determined from the table below:

Guarantee Duration (Years)	Weighting Factor
10 or less	0.50
More than 10 but not more than 20	0.45
More than 20	0.35

The guarantee duration for the coverage guarantee is the maximum number of years the life insurance can remain in force on the basis guaranteed in the policy or under options to convert to plans of life insurance with premium rates or nonforfeiture values or both, which are guaranteed in the original policy.

b.   For NPR amounts calculated according to Section 3.B.4 or Section 3.B.5.c:

The calendar year NPR interest rate shall be calculated by increasing the rate determined according to Section 3.C.2.a above by 1.5%, but in no event greater than 125% of the rate determined according to Section 3.C.2.a above rounded to the nearest one-quarter of 1%.

> **Guidance Note:** If a policy contains multiple coverage guarantees and each coverage guarantee stream is valued separately, it may be important to define which reserve interest rate(s) should be used for reporting and analysis purposes.

3.   Lapse Rates

a.   For NPR amounts calculated according to Section 3.B.5.d, the lapse rates used shall be 0% per year during the premium paying period and 0% per year thereafter.

b.   For NPR amounts calculated according to Section 3.B.4, the annual lapse rates used shall vary by level premium period as stated below:

i.   10% per year during any level premium period of less than five years, except as noted in iii, v and vi.

ii.   6% per year during any level premium period of five or more years, except as noted in iii, iv, v and vi.

iii.   For any policy that provides an endowment benefit at the end of an initial level premium period that is materially less than the policy face amount, such as a return of premium benefit, the annual lapse rate is 6% for the first half of the initial level premium period and 0% for the remainder of the initial level premium period except the final year thereof.

> **Guidance Note**: Therefore, the first 0% lapse rate would, for example, be at the end of year 11 for a 20-year level plan and at the end of year 8 for a 15-year level plan.

iv.   10% per year during any premium paying period after an initial level premium period of less than five years, except as noted in v and vi.

v.   0% per year for any policy whose final premium has by then been payable.

vi.   The lapse rate for the final year of a level premium period, applied after

any benefits assumed payable in the final year, and prior to the payment of the increased premium rate, shall be determined based on the length of the level premium periods before and after the increase, as well as the percent increase in the gross premium (including policy fee) per $1,000 of the face amount as shown in the table below instead of what would otherwise apply from i through v above.

Length of Level Premium Period Prior to Increase	Length of Level Premium Period After Increase	Percent Increase in Gross Premium per $1000	Lapse Rate for the Final Year of the Level Premium Period (Shock Lapse)
1<PP≤5	1	Any	50%
1<PP≤5	1<PP	Any	25%
5<PP≤10	1	< 400%	70%
5<PP≤10	1	≥ 400%	80%
5<PP≤10	1<PP≤5	Any	50%
5<PP≤10	5<PP	Any	25%
10<PP	1	< 400%	70%
10<PP	1	≥ 400%	80%
10<PP	1<PP≤5	Any	70%
10<PP	5<PP	Any	50%

    c.   For NPR amounts calculated according to Section 3.B.5.c, the lapse rate, L_{x+t}, for an insured age x at issue for all durations subsequent to the valuation date shall be determined as follows:

        i.   Determine the ratio R_{x+t} where:

$$R_{x+t} = [FFSG_{x+t} - ASG_{x+t}]/[FFSG_{x+t} - LSG_{x+t}] \text{ but not} > 1 \text{ and not} < 0$$

Where:

$FFSG_{x+t}$ = the fully funded secondary guarantee on the valuation date for the insured age x at issue

ASG_{x+t} = the actual secondary guarantee on the valuation date for the insured age x at issue

LSG_{x+t} = the level secondary guarantee on the valuation date for the insured age x at issue

> **Guidance Note:** The $FFSG_{x+t}$, ASG_{x+t}, and LSG_{x+t} are based on the secondary guarantee values as of the valuation date and will remain constant throughout the cash flow projection. This will result in a constant lapse assumption, calculated as of the valuation date, that does not vary by duration throughout the cash flow projection for the NPR calculation.

        ii.   As of the valuation date, which is t years after issue, the annual lapse rate for the policy shall be assumed to be level for all future years and denoted as L_{x+t}, which shall be set equal to:

$$L_{x+t} = R_{x+t} \bullet 0.01 + (1 - R_{x+t}) \bullet 0.005 \bullet r_{x+t}$$

Where r_{x+t} is the ratio determined in Section 3.B.5.d.iv.2.

Guidance Note: By similar logic, it follows (from ASG_{x+t} being 0 when t=0) that the level annual lapse rate to be used in the calculations in Section 3.B.5.c.i.2 and 3.B.5.c.i.3 is 1%. On the other hand, when performing the calculations in Section 3.B.5.d.ii.3, L_{x+t}, though level, is not generally equal to what it was for the same policy on the previous valuation date.

---

4. The NPR shall reflect continuous deaths and the immediate payment of death claims, including death claims on any riders or supplemental benefits for which the NPR is being calculated.

D. NPR Calculation and Cash Surrender Value Floor

 1. For policies other than universal life policies, the NPR shall not be less than the greater of:

  a. The cost of insurance to the next paid to date. The cost of insurance for this purpose shall be based on the policy year in which the valuation date falls, using the mortality tables for the policy prescribed in Section 3.C.

  b. The policy cash surrender value calculated as of the valuation date and in a manner that is consistent with that used in calculating the NPR on the valuation date.

 2. For a universal life policy, the NPR shall not be less than the greater of:

  a. The amount needed to cover the cost of insurance to the next processing date on which cost of insurance charges are deducted with respect to the policy. The cost of insurance for this purpose shall be based on the policy year in which the valuation date falls, using the mortality tables for the policy prescribed in Section 3.C, and it shall be based upon the net amount at risk. "Cost of insurance," as used here, refers to the valuation mortality rate, not the UL policy's contractual cost of insurance or expense charges.

  b. The policy cash surrender value calculated as of the valuation date and in a manner that is consistent with that used in calculating the NPR on the valuation date.

E. The policy minimum NPR is defined to be the policy NPR determined in Section 3.A through Section 3.D, less a credit for reinsurance ceded as defined in Section 8.

Section 4: Deterministic Reserve

For a group of one or more policies for which a DR is to be calculated, the company shall calculate the DR for the group using the method described in either Section 4.A or Section 4.B below.

A. Calculate the DR equal to the actuarial present value of benefits, expenses and related amounts less the actuarial present value of premiums and related amounts, less the positive or negative PIMR balance at the valuation date allocated to the group of one or more policies being modeled under Section 7.D.7, plus the balance of separate account assets on the valuation date, and plus the policy loan balance at the valuation date with appropriate reflection of any relevant due, accrued or unearned loan interest (if policy loans are explicitly modeled under Section 7.F.3.b), where:

 1. Cash flows are projected in compliance with the applicable requirements in Section 7, Section 8 and Section 9 over economic scenario 12 described in Section 7.G.1, and further described in Appendix 1.E.

2. Present values are calculated using the path of discount rates for the corresponding model segment determined in compliance with Section 7.H.3.

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

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

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

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

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

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

    b. Future cash flows to the general account from the separate account, less cash flows from the general account to the separate account.

    c. Future net policy loan cash flows, if policy loans are explicitly modeled under Section 7.F.3.b.

> **Guidance Note:** Future net policy loan cash flows include: policy loan interest paid in cash plus repayments of policy loan principal, including repayments occurring at death or surrender (note that the future benefits in Section 4.A.3.a are before consideration of policy loans), less additional policy loan principal (but excluding policy loan interest that is added to the policy loan principal balance).

    d. Future net reinsurance cash flows determined in compliance with Section 8.

    e. The future derivative liability program net cash flows (i.e., cash received minus cash paid) that are allocated to this group of policies.

5. If a group of policies is excluded from the SR requirements, the company may not include future transactions associated with non-hedging derivative programs in determining the DR for those policies.

B. Calculate the DR as a – b, where

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

1. Cash flows are projected in compliance with the applicable requirements in Section 7, Section 8 and Section 9 over economic scenario 12 described in Section 7.G.1 and found in Appendix 1.

2. The requirements for future benefits and premiums in Section 4.A apply as well to the calculation of the DR under this subsection.

3. The balance of policy loans on the valuation date (if explicitly modeled under Section 7.F.3.b) and the balance of separate account assets on the valuation date are modeled each period in compliance with the applicable changes in these asset

balances as defined in Section 7.

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

C.   If a group of policies for which a DR is calculated includes policies from more than one VM-20 reserving category, where VM-20 reserving category is as defined in VM-01, a DR shall be determined for each subgroup of the group of policies consisting of only those policies from each individual VM-20 reserving category by following the process of Section 4.A and Section 4.B above. The NAER used for discounting each such subgroup may be the NAER for the group of policies. If the sum of the DR for these subgroups does not equal the total DR calculated for the group of policies as a whole, the DR for the group of policies shall be allocated to each such subgroup proportionally.

Section 5: Stochastic Reserve

For a group of one or more policies for which a SR is to be calculated, the company shall calculate the SR as follows:

A.   Project cash flows in compliance with the applicable requirements in Section 7, Section 8 and Section 9 using the stochastically generated scenarios described in Section 7.G.2., and further described in Appendix 1. In determining the SR, the company shall determine the number and composition of subgroups for aggregation purposes in a manner that is consistent with how the company manages risks across products with significantly different risk profiles, and that reflects the likelihood of any change in risk offsets that could arise from distributional shifts between product types due to, for example, differing policyholder behavior. If a company is managing the risks of two or more products with significantly different risk profiles as part of an integrated risk management process, then the products may be combined into the same subgroup for aggregation purposes. If policies from more than one VM-20 reserving category are included in such a subgroup, the reserve for each VM-20 reserving category shall also be determined, as described in Section 5.G.

> **Guidance Note:** Aggregation refers to the number and composition of subgroups of policies that are used to combine cash flows. Aggregating policies into a common subgroup allows the cash flows arising from the policies for a given stochastic scenario to be netted against each other (i.e., allows risk offsets between policies to be recognized). Note Section 5.G regarding the calculation of the SR on a stand-alone basis for each VM-20 reserving category.

B.   Calculate the scenario reserve for each stochastically generated scenario as follows:

1.   For each model segment at the model start date and end of each projection year, calculate the discounted value of the negative of the projected statement value of general account and separate account assets using the path of discount rates for the model segment determined in compliance with Section 7.H.4 from the projection start date to the end of the respective projection year. The balance of policy loans on the valuation date (if explicitly modeled under Section 7.F.3.b) and the balance of separate account assets on the valuation date are modeled each period in compliance with the applicable changes in these asset balances as defined in Section 7.

> **Guidance Note:** The projected statement value of general account and separate account assets for a model segment may be negative or positive.

2.   Sum the amounts calculated in Subparagraph 1 above across all model segments at the model start date and end of each projection year.

Guidance Note: The amount in Subparagraph 2 above may be negative or positive.

---

    3.   Set the scenario reserve equal to the sum of the statement value of the starting assets across all model segments and the maximum of the amounts calculated in Subparagraph 2 above.

C.   Rank the scenario reserves from lowest to highest.

D.   Calculate CTE 70.

E.   Determine any additional amount needed to capture any material risk included in the scope of these requirements but not already reflected in the cash-flow models using an appropriate and supportable method and supporting rationale.

F.   Add the CTE amount (D) plus any additional amount (E) less the positive or negative PIMR balance allocated to the group of one or more policies being modeled under Section 7.D.7.

G.   The SR equals the amount determined in Section 5.F. If the company includes policies from two or more VM-20 reserving category in a subgroup for aggregation purposes as described in Section 5.A, the company shall calculate the SR for policies from each VM-20 reserving category on a stand-alone basis by following the process of A through F above.

Section 6: Stochastic and Deterministic Exclusion Tests

A.   Stochastic Exclusion Test (SET)

    1.   Requirements to pass the SET:

        a.   Groups of policies pass the SET if one of the following is met:

            i.   Stochastic Exclusion Ratio Test (SERT) - Annually and within 12 months before the valuation date the company demonstrates that the groups of policies pass the SERT defined in Section 6.A.2.

            ii.   Stochastic Exclusion Demonstration Test - In the first year and at least once every three calendar years thereafter, the company provides a demonstration in the PBR Actuarial Report as specified in Section 6.A.3.

            iii.   SET Certification Method - For groups of policies other than variable life or ULSG, in the first year and at least every third calendar year thereafter, the company provides a certification by a qualified actuary that the group of policies is not subject to material interest rate risk or asset return volatility risk (i.e., the risk on non-fixed-income investments having substantial volatility of returns, such as common stocks and real estate investments). The company shall provide the certification and documentation supporting the certification to the commissioner upon request.

Guidance Note: The qualified actuary should develop documentation to support the actuarial certification that presents his or her analysis clearly and in detail sufficient for another actuary to understand the analysis and reasons for the actuary's conclusion that the group of policies is not subject to material interest rate risk or asset return volatility risk. Examples of methods a qualified actuary could use to support the actuarial certification include, but are not limited to:

a)   A demonstration that NPRs for the group of policies calculated according to Section 3 are at least as great as the assets required to support the group of policies using the company's

---

cash-flow testing model under each of the 16 scenarios identified in Section 6 or alternatively each of the New York seven scenarios.

b)   A demonstration that the group of policies passed the SERT within 36 months prior to the valuation date and the company has not had a material change in its interest rate risk.

c)   A qualitative risk assessment of the group of policies that concludes that the group of policies does not have material interest rate risk or asset return volatility. Such assessment would include an analysis of product guarantees, the company's non-guaranteed elements (NGEs) policy, assets backing the group of policies and the company's investment strategy.

b.   A company may not exclude a group of policies for which there is one or more <u>future hedging strategy supporting the policies</u> from SR requirements, except in the case where all <u>future hedging strategies supporting the policies</u> are solely associated with product features that are determined to not be material under VM-20 Section 7.B.1 due to low utilization.

2.   Stochastic Exclusion Ratio Test

a.   In order to exclude a group of policies from the SR requirements using the method allowed under Section 6.A.1.a, a company shall demonstrate that the ratio of (b–a)/c is less than 6% where:

i.   a = the adjusted DR described in Section 6.A.2.b.i using economic scenario 9, the baseline economic scenario, as described in Appendix 1.E.

ii.   b = the largest adjusted DR described in Section 6.A.2.b.i under any of the other 15 economic scenarios described in Appendix 1.E.

iii.   c = an amount calculated from the baseline economic scenario described in Appendix 1.E that represents the present value of benefits for the policies, adjusted for reinsurance by subtracting ceded benefits. For clarity, premium, ceded premium, expense, reinsurance expense allowance, modified coinsurance reserve adjustment and reinsurance experience refund cash flows shall not be considered "benefits," but items such as death benefits, surrender or withdrawal benefits and policyholder dividends shall be. For this purpose, the company shall use the benefits cash flows from the calculation of quantity "a" and calculate the present value of those cash flows using the same path of discount rates as used for "a."

Guidance Note: Note that the numerator should be the largest adjusted DR for scenarios other than the baseline economic scenario, minus the adjusted DR for the baseline economic scenario. This is not necessarily the same as the biggest difference from the adjusted DR for the baseline economic scenario, or the absolute value of the biggest difference from the adjusted DR for the baseline economic scenario, both of which could lead to an incorrect test result.

b.   In calculating the ratio in Section 6.A.2.a above:

i.   The company shall calculate an adjusted DR for the group of policies for each of the 16 scenarios that is equal to either (a) or (b) below:

a)   The DR defined in Section 4.A, but with the following differences:

      1)   Using anticipated experience assumptions with no margins.

      2)   Using the interest rates and equity return assumptions specific to each scenario.

      3)   Using NAER and discount rates defined in Section 7.H specific to each scenario to discount the cash flows.

    b)   The gross premium reserve developed from the cash flows from the company's asset adequacy analysis models, using the experience assumptions of the company's cash-flow analysis, but with the following differences:

      1)   Using the interest rates and equity return assumptions specific to each scenario.

      2)   Using the methodology to determine NAER and discount rates defined in Section 7.H specific to each scenario to discount the cash flows, but using the company's cash-flow testing assumptions for default costs and reinvestment earnings.

   ii.   The company shall use the most current available baseline economic scenario and the 15 other economic scenarios published by the NAIC. The methodology for creating these scenarios can be found in Appendix 1 of VM-20.

   iii.   The company shall use assumptions within each scenario that are dynamically adjusted as appropriate for consistency with each tested scenario.

   iv.   The company may not group together contract types with significantly different risk profiles for purposes of calculating this ratio.

   v.   Anticipated mortality improvement beyond the projection start date shall be reflected in the mortality assumption for the purpose of calculating the stochastic exclusion ratio. The future mortality improvement factors shall be no greater than the unloaded factors determined by the SOA, adopted by the Life Actuarial (A) Task Force, and published on the SOA website, at https://www.soa.org/research/topics/indiv-val-exp-study-list/, (Individual Life Insurance Mortality Improvement Scale – for Use with AG38/VM20 – 20XX).

Guidance Note: Mortality improvement may be positive or negative (i.e., deterioration). The anticipated mortality improvement may be lower than the rates published by the SOA—for example, if the company's best estimate for mortality improvement for a particular block, such as simplified issue, is lower.

      To allow time for companies to reflect the updated mortality improvement rates, the rates that are to be used in the year-end YYYY valuation should be adopted by the Life Actuarial (A) Task Force and published on the SOA website by September of YYYY. If this timeline is not met, then at the company's option they may use the mortality improvement rates for the prior year (year YYYY-1).

    c. If the ratio calculated in Section 6.A.2.a above is less than 6% pre-YRT reinsurance, but is greater than 6% post-YRT reinsurance, the group of policies will still pass the SERT if the company can demonstrate that the sensitivity of the adjusted DR to economic scenarios is comparable pre- and post-YRT reinsurance.

        i. An example of an acceptable demonstration:

            a) For convenience in notation • SERT = the ratio (b–a)/c defined in (a) above

                1) The pre-YRT reinsurance results are "gross of YRT," with a subscript "gy," so denoted SERT_{gy}

                2) The post-YRT results are "net of YRT," with subscript "ny," so denoted SERT_{ny}

            b) If a block of business being tested is subject to one or more YRT reinsurance cessions as well as other forms of reinsurance, such as coinsurance, take "gross of YRT" to mean net of all non-YRT reinsurance but ignoring the YRT contract(s), and "net of YRT" to mean net of *all* reinsurance contracts. That is, treat YRT reinsurance as the last reinsurance in, and compute certain values below with and without that last component.

            c) So, if $\text{SERT}_{gy} \leq 0.060$ but $\text{SERT}_{ny} > 0.060$, then compute the largest percent increase in reserve (LPIR) = (b–a)/a, both "gross of YRT" and "net of YRT."

$$\text{LPIR}_{gy} = (b_{gy} - a_{gy})/a_{gy}$$

$$\text{LPIR}_{ny} = (b_{ny} - a_{ny})/a_{ny}$$

                Note that the scenario underlying b_{gy} could be different from the scenario underlying b_{ny}.

                If $\text{SERT}_{gy} \times \text{LPIR}_{ny}/\text{LPIR}_{gy} < 0.060$, then the block of policies passes the SERT.

        ii. Another more qualitative approach is to calculate the adjusted DR for the 16 scenarios both gross and net of reinsurance to demonstrate that there is a similar pattern of sensitivity by scenario.

    d. The SERT may not be used for a group of polices if, using the current year's data, (i) the stochastic exclusion demonstration test had already been attempted using the method of Section 6.A.3.b.i or Section 6.A.3.b.ii and did not pass; or (ii) the qualified actuary had actively undertaken to perform the certification method of Section 6.A.1.a.iii and concluded that such certification could not legitimately be made.

3. Stochastic Exclusion Demonstration Test

    a. In order to exclude a group of policies from the SR requirements using the method as allowed under Section 6.A.1.a.ii above, the company must provide a demonstration in the PBR Actuarial Report in the first year and at least once every three calendar years thereafter that complies with the following:

       i.   The demonstration shall provide a reasonable assurance that if the SR was calculated on a stand-alone basis for the group of policies subject to the SR exclusion, the minimum reserve for those groups of policies would not increase. The demonstration shall take into account whether changing conditions over the current and two subsequent calendar years would be likely to change the conclusion to exclude the group of policies from the SR requirements.

       ii.   If, as of the end of any calendar year, the company determines the minimum reserve for the group of policies no longer adequately provides for all material risks, the exclusion shall be discontinued, and the company fails the SERT for those policies.

       iii.   The demonstration may be based on analysis from a date that precedes the valuation date for the initial year to which it applies if the demonstration includes an explanation of why the use of such a date will not produce a material change in the outcome, as compared to results based on an analysis as of the valuation date.

       iv.   The demonstration shall provide an effective evaluation of the residual risk exposure remaining after risk mitigation techniques, such as derivative programs and reinsurance.

  b.   The company may use one of the following or another method acceptable to the insurance commissioner to demonstrate compliance with Section 6.A.3.a:

       i.   Demonstrate that the greater of [the quantity A and the quantity B] is greater than the SR calculated on a stand-alone basis, where:

              A = the DR, and

              B = the NPR less any associated due and deferred premium asset.

       ii.   Demonstrate that the greater of [the quantity A and the quantity B] is greater than the scenario reserve that results from each of a sufficient number of adverse deterministic scenarios, where:

              A = the DR, and

              B = the NPR less any associated due and deferred premium asset.

       iii.   Demonstrate that the greater of [the quantity A and the quantity B] is greater than the SR calculated on a stand-alone basis, but using a representative sample of policies in the SR calculations, where:

              A = the DR, and

              B = the NPR less any associated due and deferred premium asset.

       iv.   Demonstrate that any risk characteristics that would otherwise cause the SR calculated on a stand-alone basis to exceed greater of the DR and the NPR, less any associated due and deferred premium asset, are not present or have been substantially eliminated through actions such as hedging, investment strategy, reinsurance or passing the risk on to the policyholder by contract provision.

B.   Deterministic Exclusion Test (DET)

1.   Scope of Products

a.   A group of ULSG policies that does not meet the definition of a "non-material secondary guarantee" or a group of policies that is not excluded from the SR requirement is deemed to not pass the DET, and the DR must be computed for this group of policies.

b.   The DET may not be used for term insurance policies, or term riders pursuant to Paragraph E in the Riders and Supplemental Benefits Requirements in Section II, and these policies may not be excluded from the DR requirements of Section 4.

2.   Except as provided in Section 6.B.1, a group of policies passes the DET if one of the following is met:

a. Deterministic Net Premium Test - The company demonstrates that the sum of the valuation net premiums for all future years for the group of policies, determined according to Section 6.B.5 below, is less than or equal to the sum of the corresponding guaranteed gross premiums for such policies. The test shall be performed on a direct or assumed basis.

b. DET Certification Method - For a group of policies where all policyholders have elected to convert to a product other than term life, variable life, indexed life, or ULSG with a material secondary guarantee, in the first year and at least every third calendar year thereafter the company shall provide a certification by a qualified actuary that, for each policy in the group of policies, the total reserve for the policy (including either the NPR adjusted for excess conversion mortality or the NPR plus an additional reserve for excess reserve mortality) includes a prudent provision for the additional mortality associated with the conversion and reasonably exceeds the value of a DR, which otherwise would have been calculated for this group of policies.

> **Guidance Note:** An example of a method that a qualified actuary could use to support the actuarial certification includes, but is not limited to, holding a net single premium as an additional reserve for a converted policy.

3.   A company may not group together policies of different contract types with significantly different risk profiles for purposes of the calculation in Section 6.B.2.

4.   If a group of policies being tested is no longer adding new issues, and the test has been passed for three consecutive years, the group passes until determined otherwise. For this group, the test must be computed at least once every five years going forward.

5.   For purposes of determining the valuation net premiums used in the demonstration in Section 6.B.2:

a.   If pursuant to Section 2, the NPR for the group of policies is the minimum reserve required under VM-A and VM-C, then the valuation net premiums are determined according to those minimum reserve requirements.

b.   If the NPR is determined according to Section 3.B.4 or Section 3.B.5, then the lapse rates assumed for all durations shall for the purposes of the DET be set to 0%;

> **Guidance Note:** The DET no longer applies to term insurance, but in the event that companies or state insurance regulators wish to see DET results for term for some academic purpose, the step b instruction above and the step c instruction below have been retained.

    c.   For policies with guaranteed gross premium patterns that subject the policy to shock lapses, as defined in Section 3.C.3.b.vi, the valuation net premiums comparison to the guaranteed gross premiums indicated in paragraph 2 shall be performed considering only the initial premium period;

    d.   If the anticipated mortality for the group of policies exceeds the prescribed CSO mortality rates for the NPR determined in Section 3.C.1.a through 3.C.1.g, then the company shall use the anticipated mortality to determine the valuation net premium. For this purpose, mortality shall be measured as the present value of future death claims as of the valuation date discounted at the valuation interest rate used for the NPR.

6.   For purposes of determining the guaranteed gross premiums used in the demonstration in Section 6.B.2:

    a.   For universal life policies, the guaranteed gross premium shall be the premium specified in the contract, inclusive of any applicable policy fee, or if no premium is specified, then the level annual gross premium at issue that would keep the policy in force for the entire period coverage is to be provided based on the policy guarantees of mortality, interest and expenses; and

    b.   For policies other than universal life policies, the guaranteed gross premium shall be the guaranteed premium specified in the contract, inclusive of any applicable policy fee.

Section 7: Cash-Flow Models

A.   Model Structure

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

    a.   Complies with applicable ASOPs in developing cash-flow models and projecting cash flows.

    b.   Uses model segments consistent with the company's asset segmentation plan, investment strategies or approach used to allocate investment income for statutory purposes. Assets of segments that cover policies both subject to and not subject to these requirements may be allocated as defined in Section 7.D.2.

    c.   Assigns each policy subject to these requirements to only one model segment and shall use a separate cash-flow model for each model segment.

    d.   Projects cash flows for a period that extends far enough into the future so that no obligations remain.

2.   The company may use simplifications or modeling efficiency techniques to develop cash flows, if the approach is consistent with Section 2.G.

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

B.   General Description of Cash-Flow Projections

1.   For the DR and for each scenario for the SR, the company shall project cash flows ignoring federal income taxes and reflecting the dynamics of the expected cash flows for the entire model segment. The company shall reflect the effect of all material product features, both guaranteed and non-guaranteed. The company shall project cash flows including the following:

   a.   Revenues received by the company including gross premiums received from the policyholder (including any due premiums as of the projected start date).

> **Guidance Note:** To be consistent with quantity B defined in Section 2.A.2 and Section 2.A.3, and quantity B defined in Section 6.A.3.b, all due premiums as of the projection start date are assumed to be collected after the projection start date, but the company needs to determine an assumption as to the timing of when the due premiums will be received.

> **Guidance Note:** Because the projection of cash flows reflects premium mode directly, deferred premiums are zero under this approach.

   b.   All material benefits projected to be paid to policyholders—including, but not limited to, death claims, surrender benefits and withdrawal benefits—reflecting the impact of all material guarantees and adjusted to take account of amounts projected to be charged to account values on general account business. For ULSG products with multiple secondary guarantees, all secondary guarantees should, therefore, be taken into account.

> **Guidance Note:** Amounts charged to account values on general account business are not revenue; examples include cost of insurance and expense charges.

   c.   NGE cash flows as described in Section 7.C.

   d.   Net cash flows between the general account and separate account for variable products.

> **Guidance Note:** Cash flows going out from the general account to the separate account increase the reserve, and cash flows coming in to the general account from the separate account decrease the reserve. Examples include allocation of net premiums to the separate account, policyholder-initiated transfers between fixed and variable investment options, transfers of separate account values to pay death or withdrawal benefits, and amounts charged to separate account values for cost of insurance, expense, etc.

   e.   Insurance company expenses (including overhead expenses), commissions, fund expenses, contractual fees and charges, and taxes (excluding federal income taxes and expenses paid to provide fraternal benefits in lieu of federal income taxes), as described in Section 9.E.

   f.   Revenue-sharing income received by the company (net of applicable expenses) and other applicable revenue and fees associated with the policies and adjusting the revenue to reflect the uncertainty of revenue-sharing income that is not guaranteed, as described in Section 9.G.

g.   Net cash flows associated with any reinsurance as described in Section 8.C.

h.   Cash flows from derivative liability and derivative asset programs, as described in Section 7.K.

i.   Cash receipts or disbursements associated with invested assets (other than policy loans) as described in Section 7.F, including investment income, realized capital gains and losses, principal repayments, asset default costs, investment expenses, asset prepayments, and asset sales.

j.   If modeled explicitly, cash flows related to policy loans as described in Section 7.F.3.b, including interest income, new loan payments and principal repayments.

2.   In determining the DR and SR, the company may perform the cash-flow projections for each policy in force on the date of valuation or by grouping policies using modeling efficiency techniques. If such techniques are used, the company shall develop the groups in a manner consistent with Section 2.G.

C.   NGE Cash Flows

1.   Except as noted in Section 7.C.5, the company shall include NGE in the models to project future cash flows beyond the time the company has authorized their payment or crediting.

2.   The projected NGE shall reflect factors that include, but are not limited to, the following (not all of these factors will necessarily be present in all situations):

a.   The nature of contractual guarantees.

b.   The company's past NGE practices and established NGE policies.

c.   The timing of any change in NGE relative to the date of recognition of a change in experience.

d.   The benefits and risks to the company of continuing to authorize NGE.

3.   Projected NGE shall be established based on projected experience consistent with how actual NGE are determined.

4.   Projected levels of NGE in the cash-flow model must be consistent with the experience assumptions used in each scenario. Policyholder behavior assumptions in the model must be consistent with the NGE assumed in the model.

5.   The company may exclude any portion of an NGE that:

a.   Is not based on some aspect of the policy's or contract's experience.

b.   Is authorized by the board of directors and documented in the board minutes, where the documentation includes the amount of the NGE that arises from other sources.

However, if the board has guaranteed a portion of the NGE into the future, the company must model that amount (unless excluded by Section 7.C.6). In other words, the company cannot exclude from its model any NGE that the board has guaranteed for future years, even if it could have otherwise excluded them, based on this subsection.

6. The liability for policyholder dividends declared but not yet paid that has been established according to statutory accounting principles as of the valuation date is reported separately from the statutory reserve. The policyholder dividends that give rise to this dividend liability as of the valuation date may or may not be included in the cash-flow model at the company's option.

    a. If the policyholder dividends that give rise to the dividend liability are not included in the cash-flow model, then no adjustment is needed to the resulting aggregate modeled (whether deterministic or stochastic) reserve.

    b. If the policyholder dividends that give rise to the dividend liability are included in the cash-flow model, then the resulting aggregate modeled (whether stochastic or deterministic) reserve should be reduced by the amount of the dividend liability.

D. Starting Assets

1. For each model segment, the company shall select starting assets based on an iterative process.

Guidance Note:

A reasonable initial set of starting assets for the iteration might be such that the aggregate annual statement value of the assets at the projection start date equals (a) the estimated value of the modeled reserve plus the associated PIMR balance on the projection start date; (b) the NPR for the same set of policies net of any corresponding due and deferred premium asset; or (c) an amount between (a) and (b).

Iteration may continue until the asset collar of Section 7.D.3 is satisfied or the company may stop iteration before the asset collar is satisfied and provide the required documentation in Section 7.D.3 that the modeled reserve is not thereby materially understated.

---

2. For an asset portfolio that supports both policies that are subject and not subject to these requirements, the company shall determine an equitable method to apportion the total amount of starting assets between the subject and non-subject policies.

3. If for all model segments combined, the aggregate annual statement value of the final starting assets, less the corresponding PIMR balance, is

    (a) less than:

        (i) 98% of the modeled reserve if modeled reserve is positive;

        (ii) 102% of the modeled reserve if modeled reserve is negative; or

(b) greater than the largest of:

(i) 102% of the modeled reserve;

(ii) the NPR for the same set of policies, net of due and deferred premiums thereon:

and

(iii) zero,

then the company shall provide documentation in the PBR Actuarial Report that provides reasonable assurance that the modeled reserve is not materially understated as a result of the estimate of the amount of starting assets.

4. The company shall select starting assets for each model segment that consists of the following:

a. All separate account assets supporting the policies.

b. All policy loans supporting the policies that are explicitly modeled under Section 7.F.3.b.

c. The relevant balance of any due, accrued or unearned investment income.

d. All derivative instruments held at the projection start date that are part of a derivative program and can be appropriately allocated to the model segment.

e. An amount of other general account assets such that the aggregate value of starting assets meets the requirements in Section 7.D.1. These assets shall generally be selected on a consistent basis from one reserve valuation to the next. Any material change in the selection methodology shall be documented in the PBR Actuarial Report.

5. The aggregate value of general account starting assets is the sum of the amounts in Section 7.D.4.b through Section 7.D.4.e above.

> **Guidance Note:** The aggregate value of general account assets in Section 7.D.5 may be negative. This may occur, for example, for model segments in which a substantial portion of policyholder funds are allocated to separate accounts. The assets in Section 7.D.4.e above may include negative assets or short-term borrowing, resulting in a projected interest expense.

6. The company shall calculate the projected values of starting assets in a manner consistent with their values at the start of the projection.

7. Under Section 7.D.1, any PIMR balance allocated to the group of one or more policies being modeled at the projection start date is included when determining the amount of starting assets and is then subtracted out, under Section 4 and Section 5, as the final step in calculating the modeled reserves. The determination of the PIMR allocation is subject to the following:

a. The amount of PIMR allocable to each model segment is the approximate statutory interest maintenance reserve liability that would have developed for the model

segment, assuming applicable capital gains taxes are excluded. The allocable PIMR may be either positive or negative.

    b.   In performing the allocation to each model segment, the company shall use a reasonable approach to allocate any portion of the total company balance that is disallowable under statutory accounting procedures (i.e., when the total company balance is an asset rather than a liability). The company shall use a reasonable approach to allocate the total company balance between PBR and non-PBR business and then allocate the PBR portion among model segments in an equitable fashion.

    c.   The company may use a simplified approach to allocate the PIMR, if the impact of the PIMR on the minimum reserve is minimal.

E.   Reinvestment Assets and Disinvestment

    1.   At the valuation date and each projection interval as appropriate, model the purchase of general account reinvestment assets with available cash and net asset and liability cash flows in a manner that is representative of and consistent with the company's investment policy for each model segment, subject to the following requirements:

        a.   The modeled company investment strategy may incorporate a representation of the actual investment policy that ranges from relatively complex to relatively simple. In any case, the PBR Actuarial Report shall include documentation supporting the appropriateness of the representation relative to actual investment policy.

> **Guidance Note:** A complex model representation may include, for example, illiquid or callable assets whereas a simple model representation may involve mapping of more complex assets to combinations of, for example, public non-callable corporate bonds, U.S. Treasuries and cash.

        b.   The final maturities and cash-flow structures of assets purchased in the model, such as the patterns of gross investment income and principal repayments or a fixed or floating rate interest basis, shall be determined by the company as part of the model representation.

        c.   The combination of price and structure for fixed income investments and derivative instruments associated with fixed income investments shall appropriately reflect the then-current U.S. Department of the Treasury (Treasury Department) curve along the relevant scenario and the requirements for gross asset spread assumptions stated below.

        d.   For purchases of public non-callable corporate bonds, use the gross asset spreads over Treasuries prescribed in Section 9.F.8.a through Section 9.F.8.c. (For purposes of this subsection, "public" incorporates both registered and 144a securities.) The prescribed spreads reflect current market conditions as of the model start date and grade to long-term conditions based on historical data at the start of projection year four.

        e.   For transactions of derivative instruments associated with fixed income investments, reflect the prescribed assumptions in Section 9.F.8.d for interest rate swap spreads.

        f.   For purchases of other fixed income investments, if included in the modeled company investment strategy, set assumed gross asset spreads over Treasuries in a manner that is consistent with, and results in reasonable relationships to, the

prescribed spreads for public non-callable corporate bonds and interest rate swaps as defined in Section 9.F.8.

g.   Notwithstanding the above requirements, the modeled reserve shall be the higher of that produced by the modeled company investment strategy and that produced by substituting an alternative investment strategy in which the fixed income reinvestment assets have the same weighted average life (WAL) as the reinvestment assets in the modeled company investment strategy and are all public non-callable corporate bonds with gross asset spreads, asset default costs and investment expenses by projection year that are consistent with a credit quality blend of 50% PBR credit rating 6 (A2/A) and 50% PBR credit rating 3 (Aa2/AA).

Policy loans, equities and derivative instruments associated with the execution of <u>future hedging strategies supporting the policies</u> are not affected by this requirement.

> **Guidance Note:** VM-31 requires a demonstration of compliance with VM-20 Section 7.E.1.g. In many cases, particularly if the modeled company investment strategy does not involve callable assets, it is expected that the demonstration of compliance will not require running the reserve calculation twice. For example, an analysis of the weighted average net reinvestment spread on new purchases by projection year (gross spread minus prescribed default costs minus investment expenses) of the modeled company investment strategy compared to the weighted average net reinvestment spreads by projection year of the alternative strategy may suffice. The assumed mix of asset types, asset credit quality or the levels of non-prescribed spreads for other fixed income investments may need to be adjusted to achieve compliance. Or, the company may be able to rely on a previous year's determination as to which strategy produces a higher reserve, if the assets and strategy have not changed very substantially since then.

2.   Model at each projection interval any disinvestment in a manner that is consistent with the company's investment policy and that reflects the company's cost of borrowing where applicable, provided that the assumed cost of borrowing is not lower than the rate at which positive cash flows are reinvested in the same time period, taking into account duration, ratings, and other attributes of the borrowing mechanism. Gross asset spreads used in computing market values of assets sold in the model shall be consistent with, but not necessarily the same as, the gross asset spreads in Section 7.E.1.d and Section 7.E.1.f above, recognizing that starting assets may have different characteristics than modeled reinvestment assets.

> **Guidance Note:** The simple language above "provided that the assumed cost of borrowing is not lower than the rate at which positive cash flows are reinvested in the same time period" is intended to prevent excessively optimistic borrowing assumptions. If in any case, the assumed cost of borrowing restriction cannot be fully applied or followed precisely, then as with all other simplifications/approximations, the company shall not allow borrowing assumptions to materially reduce the reserve.

3.   Determine the values of reinvestment assets at the valuation date and each projection interval in a manner consistent with the values of starting assets that have similar investment characteristics.

F.   Cash Flows from Invested Assets

The company shall determine cash flows from invested assets, including starting and reinvestment assets, as follows:

1.   Determine cash flows for each projection interval for general account fixed income assets, including derivative asset programs associated with these assets, as follows:

   a.   Model gross investment income and principal repayments in accordance with the contractual provisions of each asset and in a manner consistent with each scenario. Grouping of assets is allowed if the company can demonstrate that grouping does not materially understate the modeled reserve that would have been obtained using a seriatim approach.

   b.   Reflect asset default costs as prescribed in Section 9.F and anticipated investment expenses through deductions to the gross investment income.

   c.   Model the proceeds arising from modeled asset sales and determine the portion representing any realized capital gains and losses.

> **Guidance Note:** Examples of general account fixed income assets include public bonds, convertible bonds, preferred stocks, private placements, asset backed securities, commercial mortgage loans, residential mortgage loans, mortgage-backed securities and collateralized mortgage obligations.

   d.   Reflect any uncertainty in the timing and amounts of asset cash flows related to the paths of interest rates, equity returns or other economic values directly in the projection of asset cash flows. Asset defaults are not subject to this requirement since asset default assumptions must be determined by the prescribed method in Section 9.F.

2.   Determine cash flows for each projection interval for general account equity assets (i.e., non-fixed income investments having substantial volatility of returns, such as common stocks and real estate investments), including derivative programs associated with these assets, as follows:

   a.   Determine the grouping for equity asset categories (e.g., large cap stocks, international stocks, owned real estate, etc.) and the allocation of specific assets to each category as described in Section 7.I.

   b.   Project the gross investment return including realized and unrealized capital gains for each investment category in a manner that is consistent with the prescribed general account equity return described in Section 7.G.

   c.   Model the timing of an asset sale in a manner that is consistent with the investment policy of the company for that type of asset. Reflect expenses through a deduction to the gross investment return using prudent estimate assumptions.

3.   Determine cash flows for each projection interval for policy loan assets by modeling existing loan balances either explicitly or by substituting assets that are a proxy for policy loans (e.g., bonds, cash, etc.) subject to the following:

   a.   If the company substitutes assets that are a proxy for policy loans, the company must demonstrate that such substitution:

      i.   Produces reserves that are no less than those that would be produced by modeling existing loan balances explicitly.

      ii.   Complies with the policyholder behavior requirements stated in Section 9.D.

b.   If the company models policy loans explicitly, the company shall:

     i.   Treat policy loan activity as an aspect of policyholder behavior and subject to the requirements of Section 9.D.

     ii.   For both the DR and the SR, assign loan balances either to exactly match each policy's utilization or to reflect average utilization over a model segment or sub-segments.

     iii.   Model policy loan interest in a manner consistent with policy provisions and with the scenario. In calculating the DR and SR, include interest paid in cash as a positive policy loan cash flow in that projection interval, per Section 4.A.4, but do not include interest added to the loan balance as a policy loan cash flow. (The increased balance will require increased repayment cash flows in future projection intervals.)

     iv.   Model policy loan principal repayments, including those that occur automatically upon death or surrender. In calculating the DR and the SR, include policy loan principal repayments as a positive policy loan cash flow, per Section 4.A.4.

     v.   Model additional policy loan principal. In calculating the deterministic and SR, include additional policy loan principal as a negative policy loan cash flow, per Section 4.A.4 (but do not include interest added to the loan balance as a negative policy loan cash flow).

     vi.   Model any investment expenses allocated to policy loans and include them either with policy loan cash flows or insurance expense cash flows.

4.   Determine cash flows for each projection interval for assets used in the hedging of credited amounts for indexed accounts within life insurance products (including indexed life products and indexed accounts within other types of life insurance products) as follows:

a.   In lieu of the economic scenario 12 equity returns, as described in Section 7.G.1.a.ii for the DR, use X% of the amount spent on options, accumulated to the end of the option settlement period, where X is equal to 100% in projection years 1–20 and 108% in projection years 21+. The one-year Treasury Department rate from scenario 12 applicable to the projection year will be used for accumulation.

b.   For the scenarios described in Section 7.G.2 for the SR, use scenario equity returns applicable to the underlying basis for credited interest, along with mechanics of the underlying options that reflect caps, floors and participation rates.

5.   Determine cash flows for each projection interval for all other general account assets by modeling asset cash flows on other assets that are not described in Section 7.F.1 through Section 7.F.4 using methods consistent with the methods described in Section 7.F.1 and Section 7.F.2. This includes assets that are a hybrid of fixed income and equity investments.

6.   Determine cash flows or total investment returns as appropriate for each projection interval for all separate account assets as follows:

a.   Determine the grouping for each variable fund and subaccount (e.g., bonds funds, large cap stocks, international stocks, owned real estate, etc.) as described in Section 7.J.

    b.   Project the total investment return for each variable fund and subaccount in a manner that is consistent with the prescribed returns described in Section 7.G.

G.   Economic Scenarios

    1.   Deterministic Economic Scenarios

        a.   For purposes of calculating the DR under Section 4, the company shall use:

            i.   Treasury interest rate curves following Scenario 12 from the set of prescribed scenarios used in the SERT defined in Section 6.A.2; and

            ii.   Total investment return paths for general account equity assets (excluding assets used in the hedging of credited amounts for indexed accounts as described in Section 7.F.4) and separate account fund performance consistent with the total investment returns for corresponding investment categories contained in Scenario 12 from the set of prescribed scenarios used in the SERT defined in Section 6.A.2.

        b.   The company shall map each of the proxy funds defined in Section 7.I and Section 7.J to the prescribed fund returns defined in Section 7.G.1.a following the mapping process described in Section 7.G.2.b.

        c.   The Scenario 12 interest rate yield curves and total investment returns are based on approximately a one standard deviation shock to the economic conditions as of the projection start date, where the shock is spread uniformly over the first 20 years of the projection. The values in Scenario 12 are based on the same generator that is used for the stochastic scenarios, as described in Appendix 1.

    2.   Stochastic Economic Scenarios

        a.   For purposes of calculating the SR under Section 5, the company shall use:

            i.   Treasury interest rate curves following the prescribed economic scenario generator with prescribed parameters, as described in Appendix 1; and

            ii.   Total investment return paths for general account equity assets and separate account fund performance generated from a prescribed economic scenario generator with prescribed parameters, as described in Appendix 1.

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

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

> **Guidance Note:** Mapping of the returns on the proxy funds to the prescribed funds returns is left to the judgment of the qualified actuary to whom responsibility for this group of policies is assigned, but the returns so generated must be consistent with the prescribed returns. This does not imply a strict functional relationship between the model parameters for various markets/funds, but it would generally be inappropriate to assume that a market or fund consistently "outperforms" (lower risk, higher expected return relative to the efficient frontier) over the long term.
>
> When parameters are fit to historic data without consideration of the economic setting in which the historic data emerged, the market price of risk may not be consistent with a reasonable long-term model of market equilibrium. One possibility for establishing "consistent" parameters (or scenarios) across all funds would be to assume that the market price of risk is constant (or nearly constant) and governed by some functional (e.g., linear) relationship. That is, higher expected returns can be garnered only by assuming greater risk. (For example, the standard deviation of log returns is often used as a measure of risk.)
>
> Specifically, two return distributions X and Y would satisfy the following relationship:
>
> $$\text{Market Price of Risk} = \left(\frac{E[R_X] - r}{\sigma_X}\right) = \left(\frac{E[R_Y] - r}{\sigma_Y}\right)$$
>
> Where $E[R]$ and σ are, respectively, the (unconditional) expected returns and volatilities, and r is the expected risk-free rate over a suitably long holding period commensurate with the projection horizon. One approach to establish consistent scenarios would set the model parameters to maintain a near-constant market price of risk.
>
> A closely related method would assume some form of "mean-variance" efficiency to establish consistent model parameters. Using the historic data, the mean-variance (alternatively, "drift-volatility") frontier could be constructed from a plot of (mean, variance) pairs from a collection of world market indices. The frontier could be assumed to follow some functional form (quadratic polynomials and logarithmic functions tend to work well) with the coefficients determined by standard curve fitting or regression techniques. Recognizing the uncertainty in the data, a "corridor" could be established for the frontier. Model parameters then would be adjusted to move the proxy market (fund) inside the corridor.
>
> Clearly, there are many other techniques that could be used to establish consistency between the return on the proxy funds and the prescribed returns. While appealing, the above approaches do have drawbacks, and the actuary should not be overly optimistic in determining the fund returns.

    c.   Use of fewer scenarios rather than a higher number of scenarios is permissible as a model efficiency technique provided that:

        i.   The smaller set of scenarios is generated using the scenario picker tool provided within the prescribed scenario generator, and

        ii.   The use of the technique is consistent with Section 2.G.

    d.   The number of scenarios required to comply with Section 2.G will depend on the specific nature of the company's assets and liabilities and may change from time to time. Compliance with Section 2.G would ordinarily be tested by comparing scenario reserves of a simpler model or a representative subset of policies, run using the reduced scenario set, with the scenario reserves of the same subset or simpler model run using the larger scenario set.

    e.   Companies also shall perform a periodic analysis of the impact of using a different number of scenarios on the SR, noting the difference in results as the number of

scenarios is increased. Again, an appropriate subset of the entire in-force block can be used for this analysis.

H.   Determination of NAER and Discount Rates

1.   In calculating the DR, under Section 4.A, the company shall determine a path of NAER for each model segment that reflects the net general account portfolio rate in each projection interval (i.e., monthly, quarterly, annually) in compliance with Section 7, which will depend primarily on:

   a.   Projected net investment earnings from the portfolio of starting assets.

   b.   Pattern of projected asset cash flows from the starting assets and subsequent reinvestment assets.

   c.   Pattern of net liability cash flows.

   d.   Projected net investment earnings from reinvestment assets.

2.   The company shall calculate the NAER as the ratio of net investment earnings divided by invested assets subject to the requirements in a through e below. All items reflected in the ratio are consistent with statutory asset valuation and accrual accounting, including reflection of due, accrued or unearned investment income where appropriate.

   a.   The impact of separate accounts and policy loans is excluded.

   b.   The NAER for each projection interval is calculated in a manner that is consistent with the timing of cash flows and length of the projection interval of the related cash-flow model.

   c.   Net investment earnings include:

      i.   Gross investment income plus capital gains and losses, minus prescribed default costs as defined in Section 9.F, and minus investment expenses.

      ii.   Income from derivative asset programs.

   d.   Invested assets are determined in a manner that is consistent with the timing of cash flows within the cash-flow model and the length of the projection interval of the cash-flow model.

   e.   The annual statement value of derivative instruments or a reasonable approximation thereof is in invested assets.

      All items reflected in the ratio are consistent with statutory asset valuation and accrual accounting, including reflection of due, accrued or unearned investment income where appropriate.

Guidance Note: Section 7.A.2 permits the use of modeling efficiency techniques to calculate the DR and SR. This availability for simplification includes ways to determine appropriate NAER. Small to intermediate size companies, or any size company with smaller blocks of business, have options to create NAER with modeling efficiency techniques if the results are consistent with Section 2.G.

---

3.   The company shall use the path of NAER as the discount rates for each model segment in the DR calculations in Section 4.A.

4.   The company shall use the path of one-year Treasury interest rates in effect at the beginning of each projection year multiplied by 1.05 for each model segment within each scenario as the discount rates in the SR calculations in Section 5.

Guidance Note: The use of different discount rate paths for the deterministic and scenario reserves is driven by differences in methodology. The DR is based on a present value of all liability cash flows, with the discount rates reflecting the investment returns of the assets backing the liabilities. The scenario reserve is based on a starting estimate of the reserve and assets that support that estimate, plus the greatest present value of accumulated deficiencies. Here, the discount rates are a standard estimate of the investment returns of only the marginal assets needed to eliminate either a positive or negative deficiency.

I.   Grouping of Equity Investments in the General Account

1.   The company may group the portion of the general account starting assets that are equity investments (e.g., common stocks, real estate investments) for modeling using an approach that establishes various equity investment categories with each investment category defined to reflect the different types of equity investments in the portfolio.

2.   The company shall design a proxy for each equity investment category in order to develop the investment return paths and map each investment category to an appropriately crafted proxy investment category normally expressed as a linear combination of recognized market indices (or sub-indices). The company shall include an analysis in the proxy construction process that establishes a firm relationship between the investment return on the proxy and the specific equity investment category.

J.   Grouping of Variable Funds and Subaccounts for Separate Accounts

1.   Similar to the approach used for general account equity investments, the company may group the portion of the starting asset amount held in the separate account represented by the variable funds and the corresponding account values for modeling using an approach that recognizes the investment guidelines and objectives of the funds.

2.   Similar to the approach used for general account equity investments, the company shall design an appropriate proxy for each variable subaccount in order to develop the investment return paths and map each variable account to an appropriately crafted proxy fund normally expressed as a linear combination of recognized market indices (or sub-indices). The company shall include an analysis in the proxy construction process that establishes a firm relationship between the investment return on the proxy and the specific variable funds.

K.   Modeling of Derivative Programs

1.   When determining the DR and the SR, the company shall include in the projections the appropriate costs and benefits of derivative instruments that are currently held by the company in support of the policies subject to these requirements. The company shall also include the appropriate costs and benefits of anticipated future derivative instrument transactions associated with the execution of <u>future hedging strategies supporting the policies</u>, as well as the appropriate costs and benefits of anticipated future derivative instrument transactions associated with non-hedging derivative programs (e.g., replication, income generation) undertaken as part of the investment strategy supporting the policies, provided they are normally modeled as part of the company's risk assessment and evaluation processes.

2.   For each derivative program that is modeled, the company shall reflect the company's established investment policy and procedures for that program; project expected program performance along each scenario; and recognize all benefits, residual risks and associated frictional costs. The residual risks include, but are not limited to: basis, gap, price, parameter estimation and variation in assumptions (mortality, persistency, withdrawal, etc.). Frictional costs include, but are not limited to: transaction, margin (opportunity costs associated with margin requirements) and administration. For <u>future hedging strategies supporting the policies</u>, the company may not assume that residual risks and frictional costs have a value of zero, unless the company demonstrates in the PBR Actuarial Report that "zero" is an appropriate expectation. VM-21, Section 1.B, Principle 5 applies as a general principle for the modeling of future hedging strategies.

3.   In circumstances where one or more material risk factors related to a derivative program are not fully captured within the cash-flow model used to calculate CTE 70, the company shall reflect the approximation, simplification or model limitations in the modeling of such risk factors by increasing the SR as described in Section 5.E. The company shall also be able to justify that the method appropriately reflects the potential error using historical experience, e.g., analysis of historical performance or backtesting.

> **Guidance Note:** The previous two paragraphs address a variety of possible situations. Some hedging programs may truly have zero or minimal residual risk exposure, such as when the hedge program exactly replicates the liability being hedged. With dynamic hedging strategies, residual risks are typically expected; however, in some cases, the cash-flow model supporting the CTE calculation may be able to adequately reflect such risks through margins in program assumptions, adjustments to costs and benefits, etc. In other cases, reference to additional external models or analyses may be necessary where such results cannot be readily expressed in a format directly amenable to a CTE calculation. In such cases, the company will need to combine the results of such models by some method that is consistent with the objectives of these requirements. Emerging actuarial practice will be relied on to provide approaches for a range of situations that may be encountered.

4.   In circumstances where documentation outlining the future hedging strategies is incomplete, the company shall reflect the future hedging strategies not being clearly defined by increasing the SR as described in Section 5.E. To support no increase to the SR, there should be very robust documentation outlining each future hedging strategy. In particular, if the documentation is materially incomplete for any of the individual CDHS attributes (a) through (j), as listed in VM-01, the SR shall be at least as great as the SR that would result if a future hedging strategy were not reflected in the SR.

Any increases required to the SR to reflect that documentation is not available to support that the future hedging strategies are clearly defined shall be in addition to increases to the SR pursuant to Section 7.K.3 above.

> **Guidance Note:** Section 5.E requires that the company "Determine any additional amount needed to capture any material risk included in the scope of these requirements but not already reflected in the cash-flow models using an appropriate and supportable method and supporting rationale." In the case of a derivative program that is a future hedging strategy, Section 7.K.3 requires such an increase for disconnects between the hedge modeling and the future hedging strategy, while Section 7.K.4 requires such an increase for disconnects between the loosely defined future hedging strategy and what may actually take place.

> **Guidance Note:** Statutes, laws or regulations of any state or jurisdiction related to the use of derivative instruments for hedging purposes supersede these provisions. Therefore, these provisions should not be used to determine whether a company is permitted to use such instruments in any state or jurisdiction.

Section 8: Reinsurance

A. General Considerations

1. In this section, reinsurance includes retrocession, and assuming company includes retrocessionaire.

> **Guidance Note:** In determining reserves, one party to a reinsurance transaction may make use of reserve calculations of the other party. In this situation, if the company chooses assumptions that differ from those used by the other party, the company must either rerun the reserve calculation or be prepared to demonstrate that appropriate adjustments to the other party's calculations have been made.

2. The company shall assume that the laws and regulations in place as of the valuation date regarding credit for reinsurance remain in effect throughout the projection period.

3. A company shall include a reinsurance agreement or amendment in calculating the minimum reserve if, under the terms of the AP&P Manual, the agreement or amendment qualifies for credit for reinsurance.

4. If a reinsurance agreement or amendment does not qualify for credit for reinsurance but treating the reinsurance agreement or amendment as if it did so qualify would result in a reduction to the company's surplus, then the company shall increase the minimum reserve by the absolute value of such reductions in surplus.

> **Guidance Note:** Section 8.A.3 provides that, in general, if a treaty does not meet the requirements for credit for reinsurance, it should not be allowed to reduce the reserve. Thus, it should not be allowed a reinsurance credit to the NPR, and its cash flows should not be included in the cash-flow models used to calculate the DR or SR. Section 8.A.4 introduces the exception that if allowing a net premium credit and including the treaty cash flows in the cash-flow models would produce a more conservative result, then that more conservative result should prevail.

B. Determination of a Credit to the NPR to Reflect Reinsurance Ceded

1.   Determination of the credit to the NPR to reflect reinsurance shall be done in accordance with *SSAP No. 61R—Life, Deposit-Type and Accident and Health Reinsurance* in the AP&P Manual.

> **Guidance Note:** The credit taken under a coinsurance arrangement shall be calculated using the same methodology and assumptions used in determining its NPR, but only for the percentage of the risk that was reinsured. If the reinsurance is on a YRT basis, the credit shall be calculated using the assumptions used in determining the NPR, but for the net amount at risk.

2.   If a company cedes a portion of a policy under more than one reinsurance agreement, then the company shall calculate a credit separately for each such agreement. The credit for reinsurance ceded for the policy shall be the sum of the credits for all such agreements.

3.   The credit for reinsurance ceded applied to a group of policies shall be the sum of the credit for reinsurance ceded for each of the policies of the group.

C.   Reflection of Reinsurance Cash Flows in the DR or SR

For non-guaranteed YRT reinsurance ceded or assumed, the cash-flow modeling requirements in Sections 8.C.1 through 8.C.14 below do not apply since non-guaranteed YRT reinsurance ceded or assumed does not need to be modeled; see Section 8.C.18 below. YRT shall include other reinsurance arrangements that are similar in effect to YRT.

For policies issued on or after Jan. 1, 2017, and before Jan. 1, 2020, the company may elect, with domiciliary commissioner approval, a phase-in of the current methodology for non-guaranteed YRT reinsurance with allowance for future mortality improvement from the methodology in the 2021 *Valuation Manual* for non-guaranteed YRT reinsurance without allowance for future mortality improvement, provided that the company uses a weighted average of the results from the two methodologies, with the weight for the prior methodology being no more than (20XX-YYYY)/(20XX-2021), where YYYY is the current valuation year, and 20XX is the final year of the phase-in. A company may elect to phase in these requirements over a 3-year period beginning Jan. 1, 2022, and ending Dec. 31, 2024. A company may elect a longer phase-in period of up to seven years beginning Jan. 1, 2022, and ending Dec. 31, 2028, with approval of the domiciliary commissioner.

In calculations of the DR or SR pursuant to Section 4 and Section 5:

1.   The company shall use assumptions and margins that are appropriate for each company pursuant to a reinsurance agreement. In such instance, the ceding and assuming companies are not required to use the same assumptions and margins for the reinsured policies.

2.   To the extent that a single deterministic valuation assumption for risk factors associated with certain provisions of reinsurance agreements will not adequately capture the risk, the company shall do one of the following:

a.   Stochastically model the risk factors directly in the cash-flow model when calculating the SR.

b.   Perform a separate stochastic analysis outside the cash-flow model to quantify the impact on reinsurance cash flows to and from the company. The company shall use the results of this analysis to adjust prudent estimate assumptions or to determine an amount to adjust the SR to adequately make provision for the risks of the reinsurance features.

> **Guidance Note:** An example of reinsurance provisions where a single deterministic valuation assumption will not adequately capture the risk is stop-loss reinsurance.

3.　The company shall determine cash flows for reinsurance ceded subject to the following:

　　a.　The company shall include the effect of projected cash flows received from or paid to assuming companies under the terms of ceded reinsurance agreements in the cash flows used in calculating the DR in Section 4 and SR in Section 5.

　　b.　If cash flows received from or paid to assuming companies under the terms of any reinsurance agreement are dependent upon cash flows received from or paid to assuming companies under other reinsurance agreements, the company shall first determine reinsurance cash flows for reinsurance agreements with no such dependency and then use the reinsurance cash flows from these independent agreements to determine reinsurance cash flows for the remaining dependent agreements.

　　c.　The company shall use assumptions to project cash flows to and from assuming companies that are consistent with other assumptions used by the company in calculating the DR or SR for the reinsured policies and that reflect the terms of the reinsurance agreements.

4.　The company shall determine cash flows for reinsurance assumed subject to the following:

　　a.　The company shall include the effect of cash flows projected to be received from and paid to ceding companies under the terms of assumed reinsurance agreements in the cash flows used in calculating the DR in Section 4 and the SR in Section 5.

　　b.　If cash flows received from or paid to ceding companies under the terms of any reinsurance agreement are dependent upon cash flows received from or paid to ceding companies under other reinsurance agreements, the company shall first determine reinsurance cash flows for reinsurance agreements with no such dependency and then use the reinsurance cash flows from these independent agreements to determine reinsurance cash flows for the remaining dependent agreements.

5.　If a company assumes a policy under more than one reinsurance agreement, then the company may treat each agreement separately for the purposes of calculating the reserve.

6.　An assuming company shall use assumptions to project cash flows to and from ceding companies that reflect the assuming company's experience for the business segment to which the reinsured policies belong and reflect the terms of the reinsurance agreement.

7.　The company shall assume that the counterparties to a reinsurance agreement are knowledgeable about the contingencies involved in the agreement and likely to exercise the terms of the agreement to their respective advantage, taking into account the context of the agreement in the entire economic relationship between the parties. In setting assumptions for the NGE in reinsurance cash flows, the company shall include, but not be limited to, the following:

　　a.　The usual and customary practices associated with such agreements.

　　b.　Past practices by the parties concerning the changing of terms, in an economic environment similar to that projected.

    c.   Any limits placed upon either party's ability to exercise contractual options in the reinsurance agreement.

    d.   The ability of the direct-writing company to modify the terms of its policies in response to changes in reinsurance terms.

    e.   Actions that might be taken by a party if the counterparty is in financial difficulty.

8.   The company shall account for any actions that the ceding company and, if different, the direct-writing company have taken or are likely to take that could affect the expected cash flows of the reinsured business in determining assumptions for the modeled reserve.

> **Guidance Note:** Examples of actions the direct-writing company could take include: 1) instituting internal replacement programs or special underwriting programs, both of which could change expected mortality rates; or 2) changing NGE in the reinsured policies, which could affect mortality, policyholder behavior, and possibly expense and investment assumptions. Examples of actions the ceding company could take include: 1) the exercise of contractual options in a reinsurance agreement to influence the setting of NGEs in the reinsured policies; or 2) the ability to participate in claim decisions.

9.   For actions taken by the ceding company and, if different, the direct-writing company, set assumptions in a manner consistent with Section 9.D. Note that these assumptions are in addition to, rather than in lieu of, assumptions as to the behavior of the underlying policyholders.

10.   The company shall use assumptions in determining the modeled reserve that account for any actions that the assuming company has taken or is likely to take that could affect the expected cash flows of the reinsured business.

> **Guidance Note:** Examples of such actions include, but are not limited to, changes to the current scale of reinsurance premiums and changes to expense allowances.

11.   The company shall consider all elements of a reinsurance agreement that the assuming company can change, and assumptions for those elements are subject to the requirements in Section 7.C. Appropriate assumptions for these elements may depend on the scenario being tested. The company shall take into account all likely consequences of the assuming company changing an element of the reinsurance agreement, including any potential impact on the probability of recapture by the ceding company.

> **Guidance Note:** The ability of an assuming company to change elements of a reinsurance agreement, such as reinsurance premiums or expense allowances, may be thought of as comparable to the ability of a direct-writing company to change NGE on policies.

12.   The company shall set assumptions in a manner consistent with Section 8.C.8, taking into account any ceding company option to recapture reinsured business. Appropriate assumptions may depend on the scenario being tested (analogous to interest-sensitive lapses).

> **Guidance Note:** The right of a ceding company to recapture is comparable to policyholder surrender options for a direct-writing company. Cash flows associated with recapture include recapture fees or other termination settlements.

13.   The company shall set assumptions in a manner consistent with Section 8.C.10, taking into account an assuming company's right to terminate in-force reinsurance business. In the

case in which the assuming company's right to terminate is limited to cases of non-payment of amounts due by the ceding company or other specific, limited circumstances, the company may assume that the termination option would be expected to have insignificant value to either party and, therefore, may exclude recognition of this right to terminate in the cash-flow projections. However, if a reinsurance agreement contains other termination provisions with material impact, the company shall set appropriate assumptions for these provisions consistent with the particular scenario being tested.

14. If, under the terms of the reinsurance agreement, some of the assets supporting the reserve are held by the counterparty or by another party, the company shall:

    a. Consider the following in order to determine whether to model such assets for purposes of projecting cash flows:

        i. The degree of linkage between the portfolio performance and the calculation of the reinsurance cash flows.

        ii. The sensitivity of the valuation result to the asset portfolio performance.

    b. If the company concludes that modeling is unnecessary, document the testing and logic leading to that conclusion.

    c. If the company determines that modeling is necessary, comply with the requirements in Section 7.E and Section 9.F, taking into account:

        i. The investment strategy of the company holding the assets, as codified in the reinsurance agreement or otherwise based on current documentation provided by that company.

        ii. Actions that may be taken by either party that would affect the net reinsurance cash flows (e.g., a conscious decision to alter the investment strategy within the guidelines).

> **Guidance Note:** In some situations, it may not be necessary to model the assets held by the other party. An example would be modeling by an assuming company of a reinsurance agreement containing provisions, such as experience refund provisions, under which the cash flows and effective investment return to the assuming company are the same under all scenarios.

> **Guidance Note:** Special considerations for modified coinsurance: Although the modified coinsurance (ModCo) reserve is called a reserve, it is substantively different from other reserves. It is a fixed liability from the ceding company to the assuming company in an exact amount, rather than an estimate of a future obligation. The ModCo reserve is analogous to a deposit. This concept is clearer in the economically identical situation of funds withheld. Therefore, the value of the modified coinsurance reserve generally will not have to be determined by modeling. However, the projected ModCo interest may have to be modeled. In many cases, the ModCo interest is determined by the investment earnings of an underlying asset portfolio, which, in some cases, will be a segregated asset portfolio or in others the ceding company's general account. Some agreements may use a rate not tied to a specific portfolio.

15. If a ceding company has knowledge that an assuming company is financially impaired, the ceding company shall establish a margin for the risk of default by the assuming company. In the absence of knowledge that the assuming company is financially impaired, the ceding company is not required to establish a margin for the risk of default by the assuming company.

16.   If an assuming company has knowledge that a ceding company is financially impaired, the assuming company shall establish a margin for the risk of default by the ceding company. Such margin may be reduced or eliminated if the assuming company has a right to terminate the reinsurance upon non-payment by the ceding company. In the absence of knowledge that a ceding company is financially impaired, the assuming company is not required to establish a margin for the risk of default by the ceding company.

17.   In setting any margins required by Section 8.C.15 and Section 8.C.16 to reflect potential uncertainty regarding the receipt of cash flows from a counterparty, the company shall take into account the ratings, RBC ratio or other available information related to the probability of the risk of default by the counterparty, as well as any security or other factor limiting the impact on cash flows.

18.   When the reinsurance ceded or assumed is on a non-guaranteed YRT or similar basis, the corresponding reinsurance cash flows do not need to be modeled. This includes retrocession arrangements covering non-guaranteed YRT reinsurance and similar agreements. Rather, for a ceding company, the post-reinsurance-ceded DR or SR shall be the pre-reinsurance-ceded DR or SR pursuant to Section 8.D.2, plus any applicable provision pursuant to Section 8.C.15 and Section 8.C.17, minus the NPR reinsurance credit from Section 8.B. For an assuming company, the DR or SR for the business assumed on a non-guaranteed YRT or similar basis shall be set equal to the NPR from Section 3.B.8, plus any applicable provision pursuant to Section 8.C.16 and Section 8.C.17. In the case where there are also other reinsurance arrangements that are not on a non-guaranteed YRT or similar basis, the reinsurance credit shall include the modeled reinsurance credit reflecting those other reinsurance arrangements. In particular, where there are also other reinsurance arrangements that are dependent on the non-guaranteed YRT or similar arrangements, actuarial judgment shall be used to project cash flows consistent with the above outlined treatment for non-guaranteed YRT or similar arrangements.

For policies issued on or after Jan. 1, 2017, and before Jan. 1, 2020, the company may elect, with domiciliary commissioner approval, a phase-in of the current methodology for non-guaranteed YRT reinsurance with allowance for future mortality improvement from the methodology in the 2021 *Valuation Manual* for non-guaranteed YRT reinsurance without allowance for future mortality improvement, provided that the company uses a weighted average of the results from the two methodologies, with the weight for the prior methodology being no more than (20XX-YYYY)/(20XX-2021), where YYYY is the current valuation year and 20XX is the final year of the phase-in. A company may elect to phase in these requirements over a 3-year period beginning Jan. 1, 2022, and ending Dec. 31, 2024. A company may elect a longer phase-in period of up to seven years beginning Jan. 1, 2022, and ending Dec. 31, 2028, with approval of the domiciliary commissioner.

D.   Determination of a Pre-Reinsurance-Ceded Minimum Reserve

1.   The minimum reserve pursuant to Section 2 is a post-reinsurance-ceded minimum reserve. The company also shall calculate a pre-reinsurance-ceded reserve as specified in Section 8.D.2 below, for financial statement purposes where such a pre-reinsurance-ceded amount is required. Similarly, where a reserve credit for reinsurance may be required, the credit for reinsurance ceded shall be the pre-reinsurance-ceded minimum reserve, minus the minimum reserve (post-reinsurance-ceded). This credit may be negative. Note that due allowance for reasonable approximations may be used where appropriate.

2. The pre-reinsurance-ceded minimum reserve shall be calculated pursuant to the requirements of VM-20, using methods and assumptions consistent with those used in calculating the minimum reserve, but excluding the effect of ceded reinsurance.

    a. If, on a pre-reinsurance-ceded basis, a group of policies is not able to pass the exclusion tests pursuant to Section 6, then the required DR or SR shall be calculated in determining the pre-reinsurance-ceded minimum reserve, even if not required for the minimum reserve.

    b. The company shall use assumptions that represent company experience in the absence of reinsurance—for example, assuming that the business was managed in a manner consistent with the manner that retained business is managed—when computing such exclusion tests and reserves.

    c. The requirement in Section 7.D.3 regarding the 98% to 102% collar does apply when determining the amount of starting assets excluding the effect of ceded reinsurance.

Section 9: Assumptions

A. General Assumption Requirements

    1. The company shall use prudent estimate assumptions in compliance with this section for each risk factor that is not stochastically modeled by applying a margin to the anticipated experience assumption for the risk factor if such a risk factor has been categorized as a material risk.

    2. The company shall establish the prudent estimate assumption for each risk factor in compliance with the requirements in Section 12 of Model #820 and must periodically review and update the assumptions as appropriate in accordance with these requirements.

    3. The company shall model the following risk factors stochastically unless the company elects the stochastic modeling exclusion defined in Section 6:

        a. Interest rate movements (i.e., Treasury interest rate curves).

        b. Equity performance (e.g., Standard & Poor's 500 index [S&P 500] returns and returns of other equity investments).

    4. If the company elects to stochastically model risk factors in addition to those listed in Section 9.A.3 above, the requirements in this section for determining prudent estimate assumptions for these risk factors do not apply.

        It is expected that companies will not stochastically model risk factors other than the economic scenarios, such as policyholder behavior or mortality, until VM-20 has more specific guidance and requirements available. Companies shall discuss with domiciliary regulators if they wish to stochastically model other risk factors.

    5. In determining the SR, the company shall use prudent estimate assumptions that are consistent with those prudent estimate assumptions used for determining the DR, modified as appropriate to reflect the effects of each scenario.

    6. The company shall use its own experience, if relevant and credible, to establish an anticipated experience assumption for any risk factor. To the extent that company experience is not available or credible, the company may use industry experience or other

data to establish the anticipated experience assumption, making modifications as needed to reflect the circumstances of the company.

    a.   For risk factors (such as mortality) to which statistical credibility theory may be appropriately applied, the company shall establish anticipated experience assumptions for the risk factor by combining relevant company experience with industry experience data, tables or other applicable data in a manner that is consistent with credibility theory and accepted actuarial practice.

    b.   For risk factors (such as premium patterns on flexible premium contracts) that do not lend themselves to the use of statistical credibility theory, and for risk factors (such as the current situation with some lapse assumptions) to which statistical credibility theory can be appropriately applied but cannot currently be applied due to lack of industry data, the company shall establish anticipated experience assumptions in a manner that is consistent with accepted actuarial practice and that reflects any available relevant company experience, any available relevant industry experience, or any other experience data that are available and relevant. Such techniques include:

        i.   Adopting standard assumptions published by professional, industry or regulatory organizations to the extent they reflect any available relevant company experience or reasonable expectations.

        ii.   Applying factors to relevant industry experience tables or other relevant data to reflect any available relevant company experience and differences in expected experience from that underlying the base tables or data due to differences between the risk characteristics of the company experience and the risk characteristics of the experience underlying the base tables or data.

        iii.   Blending any available relevant company experience with any available relevant industry experience and/or other applicable data using weightings established in a manner that is consistent with accepted actuarial practice and that reflects the risk characteristics of the underlying policies and/or company practices.

    c.   For risk factors that have limited or no experience or other applicable data to draw upon, the assumptions shall be established using sound actuarial judgment and the most relevant data available, if such data exists.

    d.   For any assumption that is set in accordance with the requirements of Section 9.A.6.c, the qualified actuary to whom responsibility for this group of policies is assigned shall use sensitivity testing and disclose the analysis performed to ensure that the assumption is set at the conservative end of the plausible range.

        The qualified actuary, to whom responsibility for this group of policies is assigned, shall annually review relevant emerging experience for the purpose of assessing the appropriateness of the anticipated experience assumption. If the results of statistical or other testing indicate that previously anticipated experience for a given factor is inadequate, then the qualified actuary shall set a new, adequate, anticipated experience assumption for the factor.

    7.   The company shall sensitivity test risk factors that are not stochastically modeled and examine the impact on the modeled reserve. The company shall update the sensitivity tests periodically as appropriate. The company may update the tests less frequently when the tests show less sensitivity of the modeled reserve to changes in the assumptions being

tested or the experience is not changing rapidly. Providing there is no material impact on the results of the sensitivity testing, the company may perform sensitivity testing:

a.   Using samples of the policies in force rather than performing the entire valuation for each alternative assumption set.

b.   Using data from prior periods.

Guidance Note: Sensitivity testing every risk factor on an annual basis is not required.

For some risk factors, it may be reasonable, in lieu of sensitivity testing, to employ statistical measures for margins, such as adding one or more standard deviations to the anticipated experience assumption.

---

8.   The company shall vary the prudent estimate assumptions from scenario to scenario within the SR calculation in an appropriate manner to reflect the scenario-dependent risks.

B.   Assumption Margins

The company shall include margins to provide for adverse deviations and estimation error in the prudent estimate assumption for each risk factor that is not stochastically modeled or prescribed, subject to the following:

1.   The company shall determine an explicit set of initial margins for each material risk independently (that is, without regard to any margins in other risk factors and ignoring any correlation among risk factors). Next, if applicable, the level of a particular initial margin may be adjusted to take into account the fact that risk factors are not normally 100% correlated. However, in recognition that risk factors may become more heavily correlated as circumstances become more adverse, the initially determined margin may only be reduced to the extent the company can demonstrate that the method used to justify such a reduction is reasonable, considering the range of scenarios contributing to the CTE calculation or considering the scenario used to calculate the DR as applicable or considering appropriate adverse circumstances for risk factors not stochastically modeled. It is not permissible to adjust the initial margin to recognize, in whole or in part, implicit or prescribed margins that are present, or are believed to be present, in other risk factors.

Risks that are stochastically modeled (e.g., interest rates, equity returns) or have prescribed margins (e.g., mortality, revenue sharing) shall be considered material risks. Other risks generally considered to be material include, but are not limited to, lapses/premium persistency, YRT premiums, maintenance expenses and inflation. In some cases, the list of material risks may also include morbidity, acquisition expenses, partial withdrawals, policy loans, term conversions, NGEs, and/or option elections that contain an element of anti-selection.

2.   The greater the uncertainty in the anticipated experience assumption, the larger the required margin, with the margin added or subtracted as needed to produce a larger modeled reserve than would otherwise result. For example, the company shall use a larger margin when:

a.   The experience data have less relevance or lower credibility.

b.   The experience data are of lower quality, such as incomplete, internally inconsistent or not current.

       c.   There is doubt about the reliability of the anticipated experience assumption, such as, but not limited to, recent changes in circumstances or changes in company policies.

       d.   There are constraints in the modeling that limit an effective reflection of the risk factor.

3.   In complying with the sensitivity testing requirements in Section 9.A.7 above, greater analysis and more detailed justification are needed to determine the level of uncertainty when establishing margins for risk factors that produce greater sensitivity on the modeled reserve.

4.   A margin is permitted but not required for assumptions that do not represent material risks.

5.   A margin should reflect the magnitude of fluctuations in historical experience of the company for the risk factor, as appropriate.

6.   The company shall apply the method used to determine the margin consistently on each valuation date but is permitted to change the method from the prior year if the rationale for the change and the impact on the modeled reserve is disclosed.

C.   **Mortality Assumptions**

1.   Procedure for Setting Prudent Estimate Mortality Assumptions

       a.   The company shall determine mortality segments for the purpose of determining separate prudent estimate mortality assumptions for groups of policies that the company expects will have different mortality experience than other groups of policies (such as male vs. female, smoker vs. non-smoker, preferred vs. super-preferred vs. residual, etc.).

       b.   For each mortality segment, the company shall establish prudent estimate mortality assumptions using the following procedure:

          i.   Determine the company experience mortality rates as provided in Section 9.C.2. If company experience data is limited or not available, the company can use an applicable industry basic table in lieu of company experience as provided in Section 9.C.3.

          ii.   Use the procedure described in Section 9.C.3 to determine the applicable industry table for each mortality segment.

          iii.   Determine the anticipated experience assumptions as provided in Section 9.C.4.

          iv.   Determine the level of credibility of the underlying company experience as provided in Section 9.C.5.

          v.   Determine the prescribed mortality margins as provided in Section 9.C.6. Separate mortality margins are determined for company experience mortality rates and for the applicable industry basic tables.

          vi.   Use the procedure described in Section 9.C.7 to determine the prudent estimate mortality assumptions.

2.   Determination of Company Experience Mortality Rates

a.   For each mortality segment, the company shall determine company experience mortality rates derived from company experience data. If company experience data is not available or is limited, the company can choose to use an applicable industry basic table in lieu of its own company experience, as provided in Section 9.C.3.

b.   Company experience data shall be based on experience from the following sources:

   i.   Actual company experience for books of business within the mortality segment.

   ii.   Experience from other books of business within the company with similar underwriting.

   iii.   Experience data from other sources, if available and appropriate, such as actual experience data of one or more mortality pools in which the policies participate under the term of a reinsurance agreement. Data from other sources is appropriate if the source has underwriting and expected mortality experience characteristics that are similar to policies in the mortality segment.

c.   The company experience mortality rates shall not be lower than the mortality rates the company expects to emerge, which the company can justify, and which are disclosed in the PBR Actuarial Report.

d.   The company may base mortality on the aggregate company experience for a group of mortality segments when determining the company experience mortality rates for each of the individual mortality segments in the group if the mortality segments were subject to the same or similar underwriting processes.

   i.   For directly written policies, "underwriting processes" means the processes by which the direct-writing company determines which risks to accept and to which risk class each policy is assigned, including any impacts on these determinations due to distribution systems and target markets.

   ii.   For assumed policies, "underwriting processes" means the processes by which the assuming company determines which risks to accept and to which risk class each policy is assigned, when such processes are separate and distinct from the underwriting processes used by the direct-writing company. For an assuming company that depends upon the direct-writing company's underwriting processes, "underwriting processes" means the direct-writing company's underwriting processes.

   iii.   An underwriting process that is expected to produce similar mortality to that of a previously established underwriting process, or for which the expected mortality differs from that of a previously established underwriting process only as the result of one or more specific, identifiable modifications to the established underwriting process for which the expected difference in mortality may be reasonably estimated, may be treated as similar to the previously established underwriting process if these expectations regarding mortality are supported by relevant, pursuant to Section 9.A.6, third-party proprietary experience studies (such as those of reinsurers or consulting firms) or published medical, clinical, actuarial or industry studies.

iv.   An underwriting process that has been shown to produce similar mortality to that of a previously established underwriting process based on a retrospective demonstration using statistical analyses, predictive model back-testing, or other modeling methods, or for which the expected difference in mortality due to one or more specific, identifiable modifications to a previously established underwriting process has been estimated, based on a retrospective demonstration using statistical analyses, predictive model back-testing, or other modeling methods, may be treated as similar to the previously established underwriting process. Such a retrospective demonstration shall be carried out and repeated at least once every three years, until such a time as the estimated change in expected mortality has been shown to be stable and unlikely to change based on further review. Notwithstanding the above, a retrospective demonstration is not required if the difference between the modified underwriting process and the established underwriting process is minor, such as a change in the thresholds associated with a risk characteristic, and it is clearly and reasonably expected to result in mortality experience that is not materially worse.

v.   To the extent that, when treating an underwriting process as similar, the judgment of the similarity of expected mortality or the estimate of the expected difference in mortality increases uncertainty in the mortality assumption, the margin applicable to the mortality assumption should be increased pursuant to Section 9.C.6.d.

vi.   If the company uses the aggregate company experience for a group of mortality segments when determining the company experience mortality rates for each of the individual mortality segments in the group, the company shall use one of the following methods:

     a.   Use techniques to further subdivide the aggregate experience into the various mortality segments (e.g., start with aggregate non-smoker and then use the conservation of total deaths principle, normalization or other approach to divide the aggregate mortality into super preferred, preferred and residual standard non-smoker class assumptions).

     b.   Use techniques to adjust the experience of each mortality segment in the group to reflect the aggregate company experience for the group (e.g., by credibility weighting the individual mortality segment experience with the aggregate company experience for the group).

     c.   Use a two-step sequential method, which
        1)   forms subgroups that are groups of mortality segments and are subsets of the aggregate class of mortality segments being aggregated,
        2)   uses techniques as in (b) to adjust the experience of each subgroup from (1) to reflect the aggregate company experience for the group and conserve deaths, and
        3)   finally, uses techniques as in (a) to further subdivide the subgroups' adjusted experience from (2) into the various

mortality segments while conserving each subgroup's deaths determined in step (2)'s conservation of deaths.

For example, if mortality segments vary by sex, risk class, and face bands, then

1) segments that differ by face band are aggregated to form subgroups that vary just by sex and risk class,

2) the subgroup's mortality experience is credibility weighted with the aggregate company experience for the group and normalized, and

3) the subgroups' adjusted mortality experience are then subdivided into the various mortality segments based on credible, external face band relativities, and conservation of deaths is applied to each subgroup's normalized deaths determined in (2).

In doing so, the company must ensure that when the mortality segments are weighted together, the total amount of expected claims is not less than the aggregate company experience data for the group.

> **Guidance Note:** There are several examples of the two mortality aggregation methods outlined in VM-20 Section 9.C.2.d.vi.a and VM-20 Section 9.C.2.d.vi.b in a Mortality Aggregation Excel Spreadsheet, along with a Mortality Aggregation Presentation from the 2019 Summer Meeting, located on the NAIC website (*https://content.naic.org/pbr_data.htm*). These may be useful reference documents when using aggregate company experience for a group of mortality segments in determining the company experience mortality rates.

e. The company shall review, and update as needed, the company experience data described in Section 9.C.2.b, based on either an updated company mortality study or updated mortality study data from other sources, at least every three years. If updated experience becomes available prior to the end of three years since the last review or update, which alters the company's expected mortality for the mortality segments in a significant manner and such impact is expected to continue into the future, the company shall reflect the changes implied by the updated data in the current year.

i. The company experience data for each mortality segment shall include the most recent experience study and shall include the in-force and claim data pertaining to the study period for all policies currently in the mortality segment or that would have been in the mortality segment at any time during the period over which experience is being evaluated.

ii. The period of time used for the experience study should be at least three exposure years and should not exceed 10 exposure years.

f. The company may remove from the company experience data any policies for which the experience is reflected through adjustments to the prudent estimate assumptions as provided under Section 9.C.7.e below, including policies insuring impaired lives and those for which there is a reasonable expectation, due to conditions such as changes in premiums or other policy provisions, that policyholder behavior will lead to mortality results that vary significantly from those that would otherwise be expected.

The company may adjust the company experience rates for each mortality segment to reflect the expected incremental change due to the adoption of risk selection and underwriting practices different from those underlying the company experience data identified above, provided that:

    i.   The adjustments are supported by published medical or clinical studies or other published studies that correlate a specific risk selection criterion to mortality or longevity experience (for example, criterion and correlations determined through predictive analytics).

    ii.   The rationale and support for the use of the study and for the adjustments are disclosed in the PBR Actuarial Report.

> **Guidance Note:** It is anticipated that the adjustment described in Section 9.C.2.f to experience will rarely be made. Since these adjustments are expected to be rare, and since it is difficult to anticipate the nature of these adjustments, the insurance commissioner may wish to determine the level of documentation or analysis that is required to allow such adjustments. The NAIC may want to consider whether approval by a centralized examination office would be an acceptable alternative to approval by the insurance commissioner.

    g.   Company experience mortality rates shall be based on amount of insurance, not number of policies. The amounts of insurance used in the numerators of the mortality rates shall be computed consistently with how the amounts in the denominators are calculated. A ceiling on the amount of insurance for a given policy is not permitted. Smoothing and graduation may generally be used in developing company experience mortality rates if it is done in a manner that does not result in a material change in total expected claims. However, in the case of catastrophic, non-recurring events, this does not preclude actuarially appropriate adjustments to company experience mortality rates, even if such adjustments result in a material change in total expected claims.

    h.   Mortality improvement shall not be incorporated beyond the valuation date in the company experience mortality rates. However, historical mortality improvement from the central point of the underlying company experience data to the valuation date may be incorporated.

> **Guidance Note:** Future mortality improvement is not applied to the company experience mortality rates since it would be duplicative of the future mortality improvement that is applied to the prudent estimate assumptions for mortality in Section 9.C.7.f.

    3.   Determination of Applicable Industry Basic Tables

    a.   The industry basic table shall be based on the most recent VBT listed in VM-M Section 2, including the Primary, Limited Underwriting and Relative Risk (RR) Table forms, if available. The industry basic table used should be based on the table form that most appropriately reflects the risk characteristics of the respective mortality segment.

    b.   A modified industry basic table is permitted in a limited number of situations where an industry basic table does not appropriately reflect the expected mortality experience, such as joint life mortality, simplified underwriting, or substandard or rated lives. In cases other than modification of the table to reflect joint life

mortality, the modification must not result in mortality rates lower than those in the industry basic table without approval by the insurance commissioner.

c. The company may apply the Relative Risk Tool described in Subsection 9.C.3.d below to determine:

    i. The industry basic table that can serve as the industry experience rates when company experience data is limited or not available.

    ii. The applicable industry basic table for grading company experience mortality to industry experience mortality using the grading method described in Section 9.C.7.b.

d. The Relative Risk Tool was adopted by the Life Actuarial (A) Task Force and contains an algorithm that scores every risk class in a preferred risk class structure based on the specific underwriting criteria used by a company. The Relative Risk Tool can be found by clicking on the Relative Risk Tool link on the SOA web page, *https://www.soa.org/research/topics/indiv-val-exp-study-list/*.

    i. In using the Relative Risk Tool to determine the appropriate industry basic table for a particular mortality segment, the company shall take into account factors that are not recognized in the Relative Risk Tool but are applicable to policies issued in that mortality segment.

> **Guidance Note:** Examples of such factors include the number of underwriting exceptions that are made, the quality and experience level of the underwriters, and characteristics of the distribution system. For example, if a company deviates from its preferred criteria on a regular basis, then it needs to take that into consideration since the Relative Risk Tool is not designed to quantify that risk.

    ii. In using the Relative Risk Tool to determine the appropriate industry basic table for policies that are issued subject to simplified underwriting and policies that are issued without underwriting, the company shall take into account factors not recognized in the Relative Risk Tool but are applicable to such policies.

    iii. In taking into account factors that are not recognized in the Relative Risk Tool, a company may, to the extent it can justify, adjust the industry basic tables up or down two Relative Risk Tables from that determined by application of the Relative Risk Tool. Further adjustments to reflect risk characteristics not captured within the Relative Risk Tool may be allowed upon approval by the insurance commissioner.

e. As an alternative to the Relative Risk Tool, the company may use other actuarially sound methods to determine the applicable basic tables related to subdivisions of mortality segments. The company shall document the analysis performed to demonstrate the applicability of the chosen method and resulting choice in tables and reasons why the results using the Relative Risk Tool may not be suitable.

> **Guidance Note:** For example, the company may determine a more all-inclusive basic table as a table appropriate for the whole mortality segment (appropriately modified by the removal of classified lives, term conversions or any other legitimately excludable class) and then subdivide that segment using actuarially sound methods including, but not limited to, the Relative Risk Tool.

  f. If no industry basic table appropriately reflects the risk characteristics of the mortality segment, the company may use any well-established industry table that is based on the experience of policies having the appropriate risk characteristics in lieu of an industry basic table.

> **Guidance Note:** Section 9.C.3.f above is intended to provide flexibility needed to handle products based on group-type mortality, etc., for which there might not be an industry basic table.

  g. Mortality improvement shall not be incorporated beyond the valuation date in the industry basic table. However, historical mortality improvement from the date of the industry basic table (e.g., Jan. 1, 2008, for the 2008 VBT and July 1, 2015, for the 2015 VBT) to the valuation date shall be incorporated using the improvement factors for the applicable industry basic table as determined by the SOA, adopted by the Life Actuarial (A) Task Force and published on the SOA website, *https://www.soa.org/research/topics/indiv-val-exp-study-list/* (Individual Life Insurance Mortality Improvement Scale – for Use with AG38/VM20 – 20XX).

> **Guidance Note:** Future mortality improvement is not applied to the industry basic table since it would be duplicative of the future mortality improvement that is applied to the prudent estimate assumptions for mortality in Section 9.C.7.f.

    To allow time for companies to reflect the updated mortality improvement rates, the rates that are to be used in the year-end YYYY valuation should be adopted by the Life Actuarial (A) Task Force and published on the SOA website by September of YYYY. If this timeline is not met, then at the company's option, they may use the most recent set of prior mortality improvement rates adopted by the Life Actuarial (A) Task Force and published on the SOA website.

> **Guidance Note:** The improvement factors for the industry basic table will be determined by the SOA. YYYY is the calendar year of valuation.

> **Guidance Note:** The start date for the improvement factors to be applied to the industry basic tables differs from that used for determining company experience mortality rates as described in Section 9.C.2.h, as the industry basic tables have already been improved from the mid-point of the exposure period of the data underlying the table to the year of the table; e.g., the 2015 VBT has already been improved from the mid-point of the underlying data supporting the table to 2015.

  h. For any mortality segment, if the quantity (A – B) is positive, then the industry basic table for the mortality segment shall be adjusted upward by the number of tables necessary, or the industry basic table rates shall be multiplied by an appropriate scalar—i.e., a single factor applied to all rates in the table, subject to a cap that ensures that mortality rates do not exceed 1,000 per 1,000—such that the quantity (A – C) is negative, where:

    A = the present value of projected expected claims at the duration where grading to the industry table begins, calculated using the company experience mortality rates.

    B = the present value of projected expected claims at the duration where grading to the industry table begins, calculated using mortality rates from the industry basic table determined as per Sections 9.C.3.d, 9.C.3.e or 9.C.3.f .

C = the present value of projected expected claims at the duration where grading to the industry table begins, calculated using the mortality rates from the basic industry table that has been adjusted as described at the beginning of this paragraph.

The expected claims are not to reflect mortality improvement beyond the valuation date.

4. Anticipated Experience Assumptions

   a. If the company uses an applicable industry basic table in lieu of its own company experience, as described in Section 9.C.2.a, then the anticipated experience assumptions shall be the applicable industry basic table.

   b. If the company uses company experience as described in Section 9.C.2.a, then the anticipated experience assumptions shall equal the company experience mortality rates described in Section 9.C.

   c. The mortality rates from the resulting anticipated experience assumptions must be no lower than the mortality rates that are actually expected to emerge and that the company can justify.

   d. In satisfying Section 9.C.4.c, the company must ensure that any excess mortality is appropriately reflected in the anticipated experience mortality rates. This includes but is not limited to excess mortality associated with policies issued via conversion from term policies or from group life contracts.

5. Credibility of Company Experience

   a. For valuations in which the industry basic mortality table is the 2008 VBT, determine an aggregate level of credibility over the entire exposure period using a methodology to determine the level of credibility that follows common actuarial practice as published in actuarial literature (for example, but not limited to, the Limited Fluctuation Method or Bühlmann Empirical Bayesian Method).

   For valuations in which the industry basic mortality table is the 2015 VBT, determine an aggregate level of credibility following either the Limited Fluctuation Method by amount, such that the minimum probability is at least 95% with an error margin of no more than 5% or Bühlmann Empirical Bayesian Method by amount.

   Not all blocks of a company's business subject to VM-20 necessarily need to use the same credibility method. However, a company seeking to change the credibility method for a given block of business must request and subsequently receive the approval of the insurance commissioner. The request must include the justification for the change and a demonstration of the rationale supporting the change.

   The formula to determine the credibility level by amount under the Limited Fluctuation Method is as follows:

   Limited Fluctuation $Z = \min\{1, rm/z\sigma\}$

   Where,

   r = error margin ≤ 5%

z = normal distribution quantile $\geq 95\%$

m = mortality ratio—i.e., actual to expected (A/E) ratio by amount

σ = standard deviation of the mortality ratio

The following formula can be used in conjunction with the 2015 VBT industry table to directly approximate the credibility based on the Bühlmann Empirical Bayesian Method:

$$\textbf{Bühlmann Z} = \frac{A}{A + \dfrac{(109\% * B) - (120.4\% * C)}{(0.019604 * A)}}$$

Where,

A = Sum of expected deaths by amount = Σ (amount insured) x (exposure) x (mortality)

B = Σ(amount insured)^2 x (exposure) x (mortality)

C = Σ(amount insured)^2 x (exposure)^2 x (mortality)^2

For both the Limited Fluctuation Method and the Bühlmann Empirical Bayesian Method, the credibility percentage shall be based on amounts of insurance, uncapped.

b.   Credibility may be determined at either the mortality segment level or at a more aggregate level if the mortality for the individual mortality segments was determined using an aggregate level of mortality experience pursuant to Section 9.C.2.d.

A single level of credibility shall be determined over the entire exposure period, rather than for each duration, within the exposure period. This overall level of credibility will be used to:

i.   Determine the prescribed margin for company experience mortality rates.

ii.   Determine the grading period (based on the credibility percentage shown in the first column in the Grading Table in Section 9.C.7.b.i) for grading company experience mortality rates into the applicable industry basic table.

6.   Prescribed Mortality Margins

a.   Separate prescribed margins will be added to company experience mortality rates and to the applicable industry basic tables. The mortality margin shall be in the form of a prescribed percentage increase applied to each mortality rate.

b.   The prescribed margin percentages for the company experience mortality rates will vary by attained age (att age), by the level of credibility of the underlying company experience, based on the level of credibility and the method used to determine the credibility in Section 9.C.5. The percentages are given in the following tables. To determine the margin percentage for each table, round the credibility level amount to the nearest whole integer.

i.   For valuations in which the industry mortality table is the 2008 VBT limited underwriting table:

<div align="center">Credibility Level</div>

Att Age	20%–39%	40%–59%	60%–79%	80%–100%
<46	13.7%	8.4%	6.3%	5.3%
46–47	13.0%	8.0%	6.0%	5.0%
48–49	12.4%	7.6%	5.7%	4.8%
50–51	11.7%	7.2%	5.4%	4.5%
52–53	11.1%	6.8%	5.1%	4.3%
54–55	10.4%	6.4%	4.8%	4.0%
56–57	9.8%	6.0%	4.5%	3.8%
58–59	9.1%	5.6%	4.2%	3.5%
60–61	8.5%	5.2%	3.9%	3.3%
62–63	7.8%	4.8%	3.6%	3.0%
64–68	7.2%	4.4%	3.3%	2.8%
69–76	6.5%	4.0%	3.0%	2.5%
77+	5.9%	3.6%	2.7%	2.3%

ii. For valuations in which the industry mortality table is the 2015 VBT and where the credibility is determined using the Bühlmann Empirical Bayesian Method by amount method:

	Bühlmann Margins								
	Credibility Level								
Att Age	20%–22%	23%–27%	28%–32%	33%–37%	38%–42%	43%–47%	48%–52%	53%–57%	58%–62%
<46	20.4%	20.0%	19.3%	18.6%	17.9%	17.1%	16.3%	15.5%	14.6%
46–47	20.2%	20.0%	19.3%	18.6%	17.9%	17.1%	16.3%	15.5%	14.6%
48–49	20.0%	19.7%	19.1%	18.4%	17.6%	16.9%	16.1%	15.3%	14.4%
50–51	19.8%	19.4%	18.8%	18.1%	17.4%	16.7%	15.9%	15.1%	14.2%
52–53	19.6%	19.1%	18.5%	17.8%	17.1%	16.4%	15.6%	14.8%	14.0%
54–55	19.2%	18.8%	18.2%	17.5%	16.8%	16.1%	15.4%	14.6%	13.7%
56–57	18.9%	18.5%	17.9%	17.2%	16.5%	15.8%	15.1%	14.3%	13.5%
58–59	18.5%	18.1%	17.5%	16.9%	16.2%	15.5%	14.8%	14.1%	13.2%
60–61	18.2%	17.8%	17.2%	16.5%	15.9%	15.2%	14.5%	13.8%	13.0%
62–63	17.8%	17.4%	16.8%	16.2%	15.6%	14.9%	14.2%	13.5%	12.7%
64–65	17.4%	17.0%	16.4%	15.8%	15.2%	14.6%	13.9%	13.2%	12.4%
66–67	16.9%	16.6%	16.0%	15.4%	14.8%	14.2%	13.5%	12.8%	12.1%
68–69	16.5%	16.2%	15.6%	15.0%	14.5%	13.8%	13.2%	12.5%	11.8%
70–71	16.1%	15.7%	15.2%	14.6%	14.1%	13.5%	12.8%	12.2%	11.5%
72–73	15.6%	15.3%	14.7%	14.2%	13.7%	13.1%	12.5%	11.8%	11.1%
74–75	15.1%	14.8%	14.3%	13.8%	13.2%	12.7%	12.1%	11.5%	10.8%
76–77	14.6%	14.3%	13.8%	13.3%	12.8%	12.2%	11.7%	11.1%	10.4%
78–79	14.1%	13.8%	13.3%	12.8%	12.3%	11.8%	11.3%	10.7%	10.1%
80–81	13.6%	13.3%	12.8%	12.4%	11.9%	11.4%	10.8%	10.3%	9.7%
82–83	13.0%	12.7%	12.3%	11.9%	11.4%	10.9%	10.4%	9.9%	9.3%
84–85	12.5%	12.2%	11.8%	11.4%	10.9%	10.4%	10.0%	9.4%	8.9%
86–87	11.9%	11.6%	11.2%	10.8%	10.4%	10.0%	9.5%	9.0%	8.5%
88–89	11.3%	11.1%	10.7%	10.3%	9.9%	9.5%	9.0%	8.6%	8.1%
90–91	10.7%	10.5%	10.1%	9.7%	9.4%	9.0%	8.5%	8.1%	7.6%
92–93	10.1%	9.8%	9.5%	9.2%	8.8%	8.4%	8.0%	7.6%	7.2%
94–95	9.4%	9.2%	8.9%	8.6%	8.3%	7.9%	7.5%	7.1%	6.7%
96–97	8.8%	8.6%	8.3%	8.0%	7.7%	7.4%	7.0%	6.6%	6.3%
98–99	8.1%	7.9%	7.7%	7.4%	7.1%	6.8%	6.5%	6.1%	5.8%
100–101	7.4%	7.3%	7.0%	6.8%	6.5%	6.2%	5.9%	5.6%	5.3%
102–103	6.7%	6.6%	6.3%	6.1%	5.9%	5.6%	5.4%	5.1%	4.8%
104–105	6.0%	5.9%	5.7%	5.5%	5.2%	5.0%	4.8%	4.5%	4.3%
>105	5.3%	5.1%	5.0%	4.8%	4.6%	4.4%	4.2%	4.0%	3.8%

						Bühlmann Margins						
						Credibility Level						
Att Age	63%–67%	68%–72%	73%–77%	78%–82%	83%–87%	88%–89%	90%–91%	92%–93%	94%–95%	96%–97%	98%	99%+
<46	13.7%	12.7%	11.6%	10.3%	8.9%	8.0%	7.3%	6.5%	5.7%	4.6%	3.3%	2.3%
46–47	13.7%	12.7%	11.6%	10.3%	8.9%	8.0%	7.3%	6.5%	5.7%	4.6%	3.3%	2.3%
48–49	13.5%	12.5%	11.4%	10.2%	8.8%	7.9%	7.2%	6.4%	5.6%	4.6%	3.2%	2.3%
50–51	13.3%	12.3%	11.2%	10.0%	8.7%	7.8%	7.1%	6.4%	5.5%	4.5%	3.2%	2.2%
52–53	13.1%	12.1%	11.1%	9.9%	8.6%	7.7%	7.0%	6.3%	5.4%	4.4%	3.1%	2.2%
54–55	12.9%	11.9%	10.9%	9.7%	8.4%	7.5%	6.9%	6.1%	5.3%	4.3%	3.1%	2.2%
56–57	12.6%	11.7%	10.7%	9.5%	8.3%	7.4%	6.8%	6.0%	5.2%	4.3%	3.0%	2.1%
58–59	12.4%	11.5%	10.5%	9.4%	8.1%	7.3%	6.6%	5.9%	5.1%	4.2%	3.0%	2.1%
60–61	12.1%	11.2%	10.3%	9.2%	7.9%	7.1%	6.5%	5.8%	5.0%	4.1%	2.9%	2.1%
62–63	11.9%	11.0%	10.0%	9.0%	7.8%	7.0%	6.4%	5.7%	4.9%	4.0%	2.8%	2.0%
64–65	11.6%	10.8%	9.8%	8.8%	7.6%	6.8%	6.2%	5.6%	4.8%	3.9%	2.8%	2.0%
66–67	11.3%	10.5%	9.6%	8.6%	7.4%	6.6%	6.1%	5.4%	4.7%	3.8%	2.7%	1.9%
68–69	11.0%	10.2%	9.3%	8.3%	7.2%	6.5%	5.9%	5.3%	4.6%	3.7%	2.6%	1.9%
70–71	10.7%	9.9%	9.1%	8.1%	7.0%	6.3%	5.7%	5.1%	4.4%	3.6%	2.6%	1.8%
72–73	10.4%	9.7%	8.8%	7.9%	6.8%	6.1%	5.6%	5.0%	4.3%	3.5%	2.5%	1.8%
74–75	10.1%	9.4%	8.5%	7.6%	6.6%	5.9%	5.4%	4.8%	4.2%	3.4%	2.4%	1.7%
76–77	9.8%	9.0%	8.3%	7.4%	6.4%	5.7%	5.2%	4.7%	4.0%	3.3%	2.3%	1.7%
78–79	9.4%	8.7%	8.0%	7.1%	6.2%	5.5%	5.0%	4.5%	3.9%	3.2%	2.3%	1.6%
80–81	9.1%	8.4%	7.7%	6.9%	5.9%	5.3%	4.9%	4.3%	3.8%	3.1%	2.2%	1.5%
82–83	8.7%	8.1%	7.4%	6.6%	5.7%	5.1%	4.7%	4.2%	3.6%	2.9%	2.1%	1.5%
84–85	8.3%	7.7%	7.0%	6.3%	5.5%	4.9%	4.5%	4.0%	3.5%	2.8%	2.0%	1.4%
86–87	7.9%	7.4%	6.7%	6.0%	5.2%	4.7%	4.2%	3.8%	3.3%	2.7%	1.9%	1.3%
88–89	7.6%	7.0%	6.4%	5.7%	4.9%	4.4%	4.0%	3.6%	3.1%	2.6%	1.8%	1.3%
90–91	7.1%	6.6%	6.0%	5.4%	4.7%	4.2%	3.8%	3.4%	3.0%	2.4%	1.7%	1.2%
92–93	6.7%	6.2%	5.7%	5.1%	4.4%	3.9%	3.6%	3.2%	2.8%	2.3%	1.6%	1.1%
94–95	6.3%	5.8%	5.3%	4.8%	4.1%	3.7%	3.4%	3.0%	2.6%	2.1%	1.5%	1.1%
96–97	5.9%	5.4%	5.0%	4.4%	3.8%	3.4%	3.1%	2.8%	2.4%	2.0%	1.4%	1.0%
98–99	5.4%	5.0%	4.6%	4.1%	3.5%	3.2%	2.9%	2.6%	2.2%	1.8%	1.3%	0.9%
100–101	5.0%	4.6%	4.2%	3.7%	3.2%	2.9%	2.6%	2.4%	2.1%	1.7%	1.2%	0.8%
102–103	4.5%	4.2%	3.8%	3.4%	2.9%	2.6%	2.4%	2.1%	1.9%	1.5%	1.1%	0.8%
104–105	4.0%	3.7%	3.4%	3.0%	2.6%	2.3%	2.1%	1.9%	1.7%	1.4%	1.0%	0.7%
>105	3.5%	3.3%	3.0%	2.7%	2.3%	2.1%	1.9%	1.7%	1.5%	1.2%	0.8%	0.6%

iii. For valuations in which the industry mortality table is the 2015 VBT and where the credibility is determined using the Limited Fluctuation Method:

Limited Fluctuation Margins						
Credibility Level						
Att Age	20%–22%	23%–27%	28%–32%	33%–37%	38%–42%	43%–47%	48%–52%
<46	15.9%	14.5%	13.2%	12.1%	11.0%	10.0%	9.1%
46–47	15.9%	14.5%	13.2%	12.1%	11.0%	10.0%	9.1%
48–49	15.7%	14.3%	13.0%	11.9%	10.8%	9.9%	9.0%
50–51	15.5%	14.1%	12.9%	11.7%	10.7%	9.7%	8.9%
52–53	15.2%	13.9%	12.7%	11.5%	10.5%	9.6%	8.7%
54–55	15.0%	13.6%	12.4%	11.3%	10.3%	9.4%	8.6%
56–57	14.7%	13.4%	12.2%	11.1%	10.2%	9.3%	8.5%
58–59	14.4%	13.1%	12.0%	10.9%	10.0%	9.1%	8.3%
60–61	14.1%	12.9%	11.7%	10.7%	9.8%	8.9%	8.1%
62–63	13.8%	12.6%	11.5%	10.5%	9.6%	8.7%	8.0%
64–65	13.5%	12.3%	11.2%	10.2%	9.3%	8.5%	7.8%
66–67	13.2%	12.0%	11.0%	10.0%	9.1%	8.3%	7.6%
68–69	12.8%	11.7%	10.7%	9.7%	8.9%	8.1%	7.4%
70–71	12.5%	11.4%	10.4%	9.5%	8.6%	7.9%	7.2%
72–73	12.1%	11.1%	10.1%	9.2%	8.4%	7.7%	7.0%
74–75	11.8%	10.7%	9.8%	8.9%	8.1%	7.4%	6.8%
76–77	11.4%	10.4%	9.5%	8.6%	7.9%	7.2%	6.5%
78–79	11.0%	10.0%	9.1%	8.3%	7.6%	6.9%	6.3%
80–81	10.6%	9.6%	8.8%	8.0%	7.3%	6.7%	6.1%
82–83	10.1%	9.2%	8.4%	7.7%	7.0%	6.4%	5.8%
84–85	9.7%	8.8%	8.1%	7.4%	6.7%	6.1%	5.6%
86–87	9.2%	8.4%	7.7%	7.0%	6.4%	5.8%	5.3%
88–89	8.8%	8.0%	7.3%	6.7%	6.1%	5.5%	5.1%
90–91	8.3%	7.6%	6.9%	6.3%	5.7%	5.2%	4.8%
92–93	7.8%	7.1%	6.5%	5.9%	5.4%	4.9%	4.5%
94–95	7.3%	6.7%	6.1%	5.6%	5.1%	4.6%	4.2%
96–97	6.8%	6.2%	5.7%	5.2%	4.7%	4.3%	3.9%
98–99	6.3%	5.7%	5.2%	4.8%	4.4%	4.0%	3.6%
100–101	5.8%	5.3%	4.8%	4.4%	4.0%	3.6%	3.3%
102–103	5.2%	4.8%	4.3%	4.0%	3.6%	3.3%	3.0%
104–105	4.7%	4.3%	3.9%	3.5%	3.2%	2.9%	2.7%
>105	4.1%	3.7%	3.4%	3.1%	2.8%	2.6%	2.4%

	Limited Fluctuation Margins								
	Credibility Level								
Att Age	53%–57%	58%–62%	63%–67%	68%–72%	73%–77%	78%–82%	83%–87%	88%–92%	93%–100%
<46	8.3%	7.6%	6.9%	6.3%	5.8%	5.3%	4.8%	4.4%	4.0%
46–47	8.3%	7.6%	6.9%	6.3%	5.8%	5.3%	4.8%	4.4%	4.0%
48–49	8.2%	7.5%	6.8%	6.2%	5.7%	5.2%	4.7%	4.3%	3.9%
50–51	8.1%	7.4%	6.7%	6.1%	5.6%	5.1%	4.7%	4.2%	3.9%
52–53	8.0%	7.3%	6.6%	6.0%	5.5%	5.0%	4.6%	4.2%	3.8%
54–55	7.8%	7.2%	6.5%	5.9%	5.4%	4.9%	4.5%	4.1%	3.8%
56–57	7.7%	7.0%	6.4%	5.8%	5.3%	4.9%	4.4%	4.0%	3.7%
58–59	7.6%	6.9%	6.3%	5.7%	5.2%	4.8%	4.3%	4.0%	3.6%
60–61	7.4%	6.8%	6.2%	5.6%	5.1%	4.7%	4.3%	3.9%	3.5%
62–63	7.2%	6.6%	6.0%	5.5%	5.0%	4.6%	4.2%	3.8%	3.5%
64–65	7.1%	6.5%	5.9%	5.4%	4.9%	4.5%	4.1%	3.7%	3.4%
66–67	6.9%	6.3%	5.7%	5.2%	4.8%	4.4%	4.0%	3.6%	3.3%
68–69	6.7%	6.1%	5.6%	5.1%	4.7%	4.2%	3.9%	3.5%	3.2%
70–71	6.6%	6.0%	5.4%	5.0%	4.5%	4.1%	3.8%	3.4%	3.1%
72–73	6.4%	5.8%	5.3%	4.8%	4.4%	4.0%	3.7%	3.3%	3.0%
74–75	6.2%	5.6%	5.1%	4.7%	4.3%	3.9%	3.5%	3.2%	2.9%
76–77	6.0%	5.4%	5.0%	4.5%	4.1%	3.8%	3.4%	3.1%	2.9%
78–79	5.8%	5.2%	4.8%	4.4%	4.0%	3.6%	3.3%	3.0%	2.8%
80–81	5.5%	5.0%	4.6%	4.2%	3.8%	3.5%	3.2%	2.9%	2.6%
82–83	5.3%	4.8%	4.4%	4.0%	3.7%	3.4%	3.1%	2.8%	2.5%
84–85	5.1%	4.6%	4.2%	3.9%	3.5%	3.2%	2.9%	2.7%	2.4%
86–87	4.8%	4.4%	4.0%	3.7%	3.4%	3.1%	2.8%	2.5%	2.3%
88–89	4.6%	4.2%	3.8%	3.5%	3.2%	2.9%	2.6%	2.4%	2.2%
90–91	4.4%	4.0%	3.6%	3.3%	3.0%	2.7%	2.5%	2.3%	2.1%
92–93	4.1%	3.7%	3.4%	3.1%	2.8%	2.6%	2.4%	2.2%	2.0%
94–95	3.8%	3.5%	3.2%	2.9%	2.7%	2.4%	2.2%	2.0%	1.8%
96–97	3.6%	3.3%	3.0%	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%
98–99	3.3%	3.0%	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%	1.6%
100–101	3.0%	2.8%	2.5%	2.3%	2.1%	1.9%	1.7%	1.6%	1.4%
102–103	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%	1.6%	1.4%	1.3%
104–105	2.4%	2.2%	2.0%	1.9%	1.7%	1.5%	1.4%	1.3%	1.2%
>105	2.1%	2.0%	1.8%	1.6%	1.5%	1.4%	1.2%	1.1%	1.0%

c.   The prescribed margin percentages for the applicable industry basic tables will vary by attained age and are as follows:

i.   For valuations in which the industry mortality table is the 2008 VBT limited underwriting table:

Mortality Margin Table			
Attained Age	**Load**	**Attained Age**	**Load**
< 40	21%	65	11%
40	21%	66	11%
41	21%	67	11%
42	21%	68	11%
43	21%	69	10%
44	21%	70	10%
45	21%	71	10%
46	20%	72	10%
47	20%	73	10%
48	19%	74	10%
49	19%	75	10%
50	18%	76	10%
51	18%	77	9%
52	17%	78	9%
53	17%	79	9%
54	16%	80	9%
55	16%	81	9%
56	15%	82	9%
57	15%	83	9%
58	14%	84	9%
59	14%	85	9%
60	13%	86	9%
61	13%	87	9%
62	12%	88	9%
63	12%	89	9%
64	11%	90	9%

ii.   For valuations in which the industry table is the 2015 VBT:

Mortality Margin (Loading) for Industry Table			
Attained Age	**Load**	**Attained Age**	**Load**
0–45	20.4%	76–77	14.6%
46–47	20.2%	78–79	14.1%
48–49	20.0%	80–81	13.6%
50–51	19.8%	82–83	13.0%
52–53	19.6%	84–85	12.5%
54–55	19.2%	86–87	11.9%
56–57	18.9%	88–89	11.3%
58–59	18.5%	90–91	10.7%
60–61	18.2%	92–93	10.1%
62–63	17.8%	94–95	9.4%
64–65	17.4%	96–97	8.8%
66–67	16.9%	98–99	8.1%
68–69	16.5%	100–101	7.4%
70–71	16.1%	102–103	6.7%
72–73	15.6%	104–105	6.0%
74–75	15.1%	106 and over	5.3%

     d.   The prescribed margin percentages shall be increased, as appropriate, to reflect the level of uncertainty related to situations, including, but not limited to, the following:

         i.   The reliability of the company's experience studies is low due to imprecise methodology, length of time since the data was updated or other reasons.

         ii.   The length of time since the experience data was updated.

         iii.   The underwriting or risk selection risk criteria associated with the mortality segment have changed since the experience on which the company experience mortality rates are based was collected.

         iv.   The data underlying the company experience mortality rates lack homogeneity.

         v.   Unfavorable environmental or health developments are unfolding and are expected to have a material and sustained impact on the insured population.

         vi.   Changes to the company's marketing or administrative practices or market forces expose the policies to the risk of anti-selection.

> **Guidance Note:** For example, the secondary market for life insurance policies.

         vii.   Underwriting is less effective than expected.

     e.   In the event that the prescribed mortality margins set forth above do not produce a reserve increase of adequate magnitude, and in particular when the prescribed margins produce a decrease in the reserve, the company shall derive and use margins that produce an appropriately conservative result.

> **Guidance Note:** This can occur, for example, when a rider, such as a long-term care (LTC) rider, is being valued together with the base policy, pursuant to Section II, Subsection 6 of the *Valuation Manual.* Reductions to mortality rates, rather than additions, would potentially be needed in such cases. Such a product/rider combination would likely need to be in its own separate mortality segment.

7.   Process to Determine Prudent Estimate Assumptions

     a.   If applicable industry basic tables are used in lieu of company experience as the anticipated experience assumptions, or if the level of credibility of the data as provided in Section 9.C.5 is less than 20%, the prudent estimate assumptions for each mortality segment shall equal the respective mortality rates in the applicable industry basic tables as provided in Section 9.C.3, adjusted as necessary pursuant to Section 9.C.7.e and for any applicable improvement pursuant to Section 9.C.3.g, plus the prescribed margin as provided in Section 9.C.6.c, and further adjusted by any applicable margin changes pursuant to Section 9.C.6.d.v, Section 9.C.6.d.vi, and/or Section 9.C.6.e. Future mortality improvement, pursuant to Section 9.C.7.f, shall be applied to the prudent estimate assumption for mortality.

     b.   If the company uses company experience mortality rates as the anticipated experience assumptions, the following process shall be used to develop prudent estimate assumptions:

  i. Determine the values of A, B and C from the Grading Table below, based on the level of credibility of the data as provided in Section 9.C.5.

Grading Table

Credibility of company data (as defined in Section 9.C.5 above) rounded to nearest %	A	B	C
20% - 30%	10	2	8
31%–32%	11	3	8
33%–34%	12	3	8
35%–36%	13	3	9
37%–38%	14	3	9
39%–40%	15	3	10
41%–42%	16	3	10
43%–44%	17	3	10
45%–46%	18	3	11
47%–48%	19	3	11
49%	20	3	11
50%	20	4	12
51%	21	4	12
52%–53%	22	4	12
54%	23	4	13
55%	24	4	13
56%	25	4	13
57%	25	5	13
58%	26	5	14
59%	27	5	14
60%–61%	28	5	14
62%	29	5	15
63%	30	6	15
64%–65%	31	6	15
66%	32	6	16
67%	33	6	16
68%–69%	34	6	16
70%	35	7	17
71%	36	7	17

72%	37	7	17
73%	38	7	18
74%	39	7	18
75%	40	7	18
76%	41	7	19
77%	42	8	19
78%	43	8	19
79%	44	8	20
80%	45	8	20
81%	46	8	20
82%	47	8	21
83%	48	9	21
84%	49	9	21
85%–87%	50	9	22
88%–89%	50	9	23
90%	50	10	23
91%–93%	50	10	24
94%–100%	50	10	25

ii.   Determine the value of D, which represents the last policy duration that has a substantial volume of claims, using the chosen data source(s) as specified in Section 9.C.2.b. D is defined as the last policy duration at which there are 50 or more claims (<u>not</u> the first policy duration in which there are fewer than 50 claims), not counting riders. This may be determined at either the mortality segment level or at a more aggregate level if the mortality for the individual mortality segments was determined using an aggregate level of mortality experience pursuant to Section 9.C.2.d.

> **Guidance Note:** The same level of aggregation is used in Section 9.C.2.d for determining company experience mortality rates, Section 9.C.5.b for determining credibility, and Section 9.C.7.b.ii for determining the value of D. Thus, when determining the value of D, all claims being aggregated will have used the same credibility method in Section 9.C.5.

iii.   Establish the sufficient data period S, as follows:

$S = \min\{A, D\}$

iv.   For each issue age x, determine the values of M, E, Z and G, where:

$M = \min\{(S + B), 100 - x\}$ = the maximum number of policy durations for which the company is permitted to use 100% of the company experience mortality rates.

E = the last policy duration at which the company chooses to use 100% of the company experience mortality rates, equal to any policy duration chosen by the company that is less than or equal to M.

$Z = \min\{(S + C), 100 - x\}$ = the last policy duration at which the company is permitted to use less than 100% of the industry mortality rate.

G = the last policy duration at which the company chooses to use less than 100%

of the industry mortality rate, which must be greater than or equal to E and less than or equal to Z.

v.   For each policy in a given mortality segment, from the start of the projection through policy duration E, the prudent estimate mortality assumptions are the company experience mortality rates (as defined in Section 9.C.2), plus the prescribed margin pursuant to Section 9.C.6.b, and further adjusted by any applicable margin changes pursuant to Section 9.C.6.d or Section 9.C.6.e.

vi.   Beginning in the first policy duration after policy duration E, the prudent estimate mortality assumptions for each policy in a given mortality segment are determined as a weighted average of the company experience mortality rates with margins and the applicable industry basic table with margins, in which the weights on the company rates grade linearly from 100% down to 0%. This grading must be completed—i.e., must reach 100% of industry table—no later than the beginning of the first policy duration after policy duration Z (the determination of the applicable industry basic table is described in Section 9.C.3). Thus, the prudent estimate mortality rate, prior to any adjustments pursuant to Sections 9.C.7.c, 9.C.7.d, 9.C.7.e, and 9.C.7.f below, is:

$$(W_t)(_{com}q_{[x]+t-1}) + (1-W_t)(_{ind}q_{[x]+t-1})$$

Where

$W_t = 1$ for $1 \leq t \leq E$

$= [G+1-t] / [G+1-E]$ for $E < t \leq G$

$= 0$ for $t > G$

$_{com}q_{[x]+t-1}$ is the company experience mortality rate, including any applicable improvement pursuant to Section 9.C.2.h, with margin for policy year t.

$_{ind}q_{[x]+t-1}$ is the industry table mortality rate, including any applicable improvement pursuant to Section 9.C.3.g, plus margin for policy year t.

vii. For each policy within a given mortality segment, the sufficient data period, grading period and policy durations are measured from the issue date of the policy, not from the valuation date. The projection for a policy commences at the valuation date, using the prudent estimate mortality rate for whatever duration the policy is in at that point.

Guidance Note: The following examples for a policy issued at age 35 on Jan. 1, 2021, illustrate how grading is to be performed.

Example 1

Suppose the valuation date is Dec. 31, 2025. Assume a credibility score of 96%. Based on the Grading Table:

A = 50

B = 10

C = 25

Assume the last policy duration that has 50 or more claims is 30, so D = 30.

S = min{A,D} = min{50, 30} = 30 = sufficient data period

M = min{(S + B), 100 – x} = min{(30 + 10), 65} = 40

E = 40

Z = min{(S + C), 100 – x} = min{(30 + 25), 65} = 55

G = 55

In this example, the company would set the prudent estimate mortality assumption at 100% of company experience mortality, plus the prescribed margin, plus any additional margin, for policy durations 1–40. However, policy durations 1–5 are already in the past and would not come into play. For this particular policy, only the first 35 years of the projection (policy durations 6–40) would use prudent mortality rates that are 100% company experience. Starting in policy duration 41, the company would linearly grade from the company experience mortality rates with margins to 100% of the applicable industry basic table with margins. The company must be using 100% of the applicable industry basic table with margins no later than the beginning of policy duration 56. Thus, for policy duration 47, for instance, the prudent estimate mortality rate would be:

$$(9/16)(_{com}q_{[35]+47-1}) + (7/16)(_{ind}q_{[35]+47-1})$$

At a valuation date two years later at Dec. 31, 2027, if a new mortality study had not been run and S was still 30, only the first 33 years of the projection (policy durations 8–40) would be using prudent mortality rates that are 100% company experience.

More newly issued policies with issue age 35 would be using more years of 100% company experience than the policy in this example.

Example 2

Suppose that for the same case the company elected to begin grading five years earlier than required, but not end the grading any sooner than required. In this case, grading must be completed no later than the beginning of policy duration 56, just as in the example above. Electing to begin grading early does not change the policy duration by which grading to 100% of the applicable industry basic table with margins must be completed. The policy duration 47 prudent mortality rate would be:

$$(9/21)(_{com}q_{[35]+47-1}) + (12/21)(_{ind}q_{[35]+47-1})$$

Example 3

Same as Example 1, but the company elected to end grading seven years earlier than required. The company would therefore reach 100% of industry rates at the start of policy duration 49 instead of the start of policy duration 56. In this case, the company would set the prudent estimate mortality assumption at 100% of company experience mortality, plus the prescribed margin, plus any additional margin, for policy durations 1–40. The policy duration 47 prudent rate would be:

$$(2/9)(_{com}q_{[35]+47-1}) + (7/9)(_{ind}q_{[35]+47-1})$$

    c.   Smoothing may be used within each mortality segment to ensure that an appropriate relationship exists by attained age within each mortality segment. Such

smoothing must be done in a manner that does not result in a material change in total expected claims for the mortality segment.

d. The company may adjust the resulting mortality rates within each mortality segment to ensure the resulting prudent estimate produces a reasonable relationship with assumptions in other mortality segments that reflects the underwriting class or risk class of each mortality segment. Such adjustments must be done in a manner that does not result in a material change in total expected claims for all mortality segments in the aggregate.

e. Adjust the prudent estimate mortality assumptions to reflect differences associated with impaired lives and differences due to policyholder behavior if there is a reasonable expectation that due to conditions such as changes in premiums or other policy provisions, policyholder behavior will lead to mortality results that vary from the mortality results that would otherwise be expected.

   i. The adjustment for impaired lives shall follow established actuarial practice, including the use of mortality adjustments determined from clinical and other data.

   ii. The adjustment for policyholder behavior shall follow common actuarial practice, including the use of dynamic adjustments to base mortality.

f. Twenty years of future mortality improvement that the company anticipates beyond the valuation date shall be applied to the prudent estimate assumptions for mortality, using prudent future mortality improvement factors no greater than the loaded factors determined by the SOA, adopted by the Life Actuarial (A) Task Force, and published on the SOA website, at https://www.soa.org/research/topics/indiv-val-exp-study-list/, (Individual Life Insurance Mortality Improvement Scale – for Use with AG38/VM20 – 20XX).

> **Guidance Note:** Mortality improvement may be positive or negative (i.e., deterioration). The anticipated mortality improvement may be lower than the rates published by the SOA, even zero, for example, if the company's best estimate for mortality improvement for a particular block, such as simplified issue, is lower.

To allow time for companies to reflect the updated mortality improvement rates, the rates that are to be used in the year-end YYYY valuation should be adopted by the Life Actuarial (A) Task Force and published on the SOA website by September of YYYY. If this timeline is not met, then at the company's option it may use the mortality improvement rates for the prior year (year YYYY-1).

D. Policyholder Behavior Assumptions

1. General Prudent Estimate Policyholder Behavior Assumption Requirements

The company shall determine prudent estimate policyholder behavior assumptions such that the assumptions:

a. Reflect expectations regarding variations in anticipated policyholder behavior relative to characteristics that have a material impact on the modeled reserve, which may include gender, attained age, issue age, policy duration, time to maturity, tax status, level of account and cash surrender value, surrender charges, transaction fees or other policy charges, distribution channel, product features, and whether the policyholder and insured are the same person.

b. Are appropriate for the block of business being valued, giving due consideration to other assumptions used in conjunction with the cash-flow model and to the scenarios whose results are likely to contribute to the modeled reserve.

c. Are based on actual experience data directly applicable to the block of business being valued (i.e., direct data) when available. In the absence of directly applicable data, the company should next use available data from any other block of business that is similar to the block of business being valued, whether or not that block of business is directly written by the company. If data from a similar block of business are used, the company shall adjust the anticipated experience assumption to reflect material differences between the business being valued and the similar block of business.

d. Reflect the outcomes and events exhibited by historical experience only to the extent such experience is relevant to the risk being modeled.

e. Reflect the likelihood that policyholder behavior will be affected by any significant increase in the value of a product option, such as term conversion privileges or policy loans.

f. Are assigned to policies in a manner that provides an appropriate level of granularity.

> **Guidance Note:** Anticipated experience policyholder behavior assumptions for policyholder behavior risk factors include, but are not limited to, assumptions for premium payment patterns, premium persistency, surrenders, withdrawals, allocations between available investment and crediting options, benefit utilization, and other option elections that could contain an element of anti-selection. For fixed premium products, many of the premium payment patterns, premium persistency and partial withdrawal behavior assumptions may not apply and do not need to be considered.

2. Dynamic Modeling

a. The company shall use a dynamic model or other scenario-dependent formulation to determine anticipated policyholder behavior unless the behavior can be appropriately represented by static assumptions.

b. For risk factors that are modeled dynamically, the company shall use a reasonable range of future expected behavior that is consistent with the economic scenarios and other variables in the model.

c. The company is not required to model extreme or "catastrophic" forms of behavior in the absence of evidence to the contrary.

3. Margins for Prudent Estimate Policyholder Behavior Assumptions

The company shall establish margins for policyholder behavior assumptions in compliance with Section 9.B subject to the following:

a. To the extent that there is an absence of relevant and fully credible data, the company shall determine the margin such that the policyholder behavior assumption is shifted toward the conservative end of the plausible range of behavior, which is the end of the range that serves to increase the modeled reserve.

b.   The company must assume that policyholders' efficiency will increase over time unless the company has relevant and credible experience or clear evidence to the contrary.

c.   The company must reflect the data uncertainty associated with using data from a similar but not identical block of business to determine the anticipated experience assumption.

d.   The company shall establish a higher margin for partial withdrawal and surrender assumptions in the case where the company's marketing or administrative practices encourage anti-selection.

e.   The company shall perform testing to determine whether the modeled reserve is materially affected by variations in the size and direction of the margin, and it shall do so using a methodology that recognizes that the appropriate size and/or direction of a margin in the early durations may be quite different from that in later durations. If the impact on the modeled reserve is material, the company shall establish margins accordingly.

Guidance Note: For example, the lapse rate margins on a level term plan may increase lapses in the first few years but decrease lapses for the remainder of the level term period.

---

4.   Additional Sensitivity Testing for Policyholder Behavior Assumptions

The company shall examine the sensitivity of assumptions on the modeled reserve as required under Section 9.A.7 and shall at a minimum sensitivity test:

a.   Premium payment patterns, premium persistency, surrenders, partial withdrawals, allocations between available investment and crediting options, benefit utilization, and other option elections if relevant to the risks in the product.

b.   For policies that give policyholders flexibility in the timing and amount of premium payments:

i.   Minimum premium scenario.

ii.   No further premium payment scenario.

iii.   Pre-payment of premiums – Single premium scenario.

iv.   Pre-payment of premiums – Level premium scenario.

5.   For a universal life policy that guarantees coverage to remain in force as long as the secondary guarantee requirement is met and during projection periods in which the cash surrender value is zero or minimal, industry experience, for purposes of complying with Section 9.A.6, shall be the *Lapse Experience Under Term-to-100 Insurance Policies* published by the Canadian Institute of Actuaries in September 2015. During projection periods in which the cash surrender value of such policy is zero or minimal, the assumption shall grade from credible company experience to the rates in the *Lapse Experience Under Term-to-100 Insurance Policies* published by the Canadian Institute of Actuaries in September 2015 in five projection years from the last duration where substantially credible experience is available.

> **Guidance Note:** The term "minimal cash surrender value" means that the cash surrender value is of such small value that its presence would not significantly affect a policyholder's decision to lapse the policy in comparison to a situation with zero cash surrender value.

6.   Post-Level Term Period

   a.   For the calculation of the DR, for a term life policy issued Jan. 1, 2017, and later in which level or near level premiums are guaranteed or expected for a specified duration, followed by a substantial premium increase, for the period following that substantial premium increase, the company shall compare the present value of cash inflows to the present value of cash outflows. If the present value of cash inflows exceeds the present value of cash outflows for the policy, then the company shall assume a 100% lapse rate at the end of the level term period so that no post-level term profits are reflected in the DR calculation. If the present value of cash inflows is less than the present value of cash outflows for the policy, the post-level term losses shall be reflected in the DR calculation.

   b.   For the calculation of the SR for a term life policy subject to Section 9.D.6.a and for the calculation of the DR and the SR for a term policy issued before Jan. 1, 2017, in which level or near level premiums are guaranteed or expected for a specified duration, followed by a substantial premium increase, for the period following that substantial premium increase, the lapse and mortality assumptions shall be adjusted, or margins added, such that the policy's present value of cash inflows in excess of cash outflows assumed shall be limited to reflect the relevance and credibility of the experience, approaching zero for periods where the underlying data have low or no credibility or relevance.

> **Guidance Note:** A seriatim comparison of the present value of post-level term cash inflows and outflows must be performed. For policies subject to Section 9.D.6.a, the 100% lapse rate assumption at the end of the level term period applies only to those policies with post-level term profits. Similarly, for policies subject to Section 9.D.6.b, adjustments to limit post-level term profits must be made at a seriatim level, and post-level term losses must be reflected in the reserve calculations.
>
> This does not preclude a company from using a simplified approach consistent with VM-20 Section 2.G. For example, testing on a representative number of key cells could be performed to verify that no post-level term profits are reflected in the DR calculation.

> **Guidance Note:** Section 9.D.6.b applies to a term policy issued before Jan. 1, 2017, that is valued using *Actuarial Guideline XLVIII—Actuarial Opinion and Memorandum Requirements for the Reinsurance of Policies Required to be Valued under Sections 6 and 7 of the NAIC Valuation of Life Insurance Policies Model Regulation (Model 830)* (AG 48) or Model #787.

E.   Expense Assumptions

   1.   General Prudent Estimate Expense Assumption Requirements

   In determining prudent estimate expense assumptions, the company:

   a.   Shall use expense assumptions for the deterministic and stochastic scenarios that are the same except for differences arising from application of inflation rates.

     b.   May spread certain information technology (IT) development costs and other capital expenditures over a reasonable number of years in accordance with accepted statutory accounting principles as defined in the SSAPs.

> **Guidance Note:** Care should be taken with regard to the potential interaction with the inflation assumption above.

     c.   Shall assume that the company is a going concern.

     d.   Shall choose an appropriate expense basis that properly aligns the actual expense to the assumption. If values are not significant, they may be aggregated into a different base assumption.

> **Guidance Note:** For example, death benefit expenses should be modeled with an expense assumption that is per death incurred.

     e.   Shall reflect the impact of inflation.

     f.   Shall not assume future expense improvements.

     g.   Shall not include assumptions for federal income taxes (and expenses paid to provide fraternal benefits in lieu of federal income taxes) and foreign income taxes.

     h.   Shall use assumptions that are consistent with other related assumptions.

     i.   Shall use fully allocated expenses.

> **Guidance Note:** Expense assumptions should reflect the direct costs associated with the block of policies being modeled, as well as indirect costs and overhead costs that have been allocated to the modeled policies.

     j.   Shall allocate expenses using an allocation method that is consistent across company lines of business. Such allocation must be determined in a manner that is within the range of actuarial practice and methodology and consistent with applicable ASOPs. Allocations may not be done for the purpose of decreasing the modeled reserve.

     k.   Shall reflect expense efficiencies that are derived and realized from the combination of blocks of business due to a business acquisition or merger in the expense assumption only when any future costs associated with achieving the efficiencies are also recognized.

> **Guidance Note:** For example, the combining of two similar blocks of business on the same administrative system may yield some expense savings on a per unit basis, but any future cost of the system conversion should also be considered in the final assumption. If all costs for the conversion are in the past, then there would be no future expenses to reflect in the valuation.

     l.   Shall reflect the direct costs associated with the policies being modeled, as well as an appropriate portion of indirect costs and overhead (i.e., expense assumptions representing fully allocated expenses should be used), including expenses categorized in the annual statement as "taxes, licenses and fees" (Exhibit 3 of the annual statement) in the expense assumption.

m. Shall include acquisition expenses associated with business in force as of the valuation date and significant non-recurring expenses expected to be incurred after the valuation date in the expense assumption.

n. For policies sold under a new policy form or due to entry into a new product line, the company shall use expense factors that are consistent with the expense factors used to determine anticipated experience assumptions for policies from an existing block of mature policies taking into account:

    i. Any differences in the expected long-term expense levels between the block of new policies and the block of mature policies.

    ii. That all expenses must be fully allocated as required under Section 9.E.1.i above.

2. Margins for Prudent Estimate Expense Assumptions

The company shall determine margins for expense assumptions according to the requirements given in Section 9.B.

F. Asset Assumptions

> **Guidance Note:** This subsection includes requirements for prescribed asset default costs, certain prescribed asset spreads, and handling of uncertainty of timing and amounts of cash flows due to embedded options in the assets.

1. Procedure for Setting Annual Default Cost Factors by Projection Year for Starting Fixed Income Assets with an NAIC Designation

The company shall determine a set of total annual default cost factors, by projection year, for each starting fixed income asset that has an NAIC designation, expressed as percentages of the statement value in each projection year. In making such determination for each asset, the company shall use certain inputs from company records according to Section 9.F.2, assign a PBR credit rating according to the procedure in Section 9.F.3, and use prescribed tables or other sources as indicated in this subsection and contained or referenced in Appendix 2. The total annual default cost factor in each year shall be the sum of three prescribed components (a) + (b) + (c) as follows:

a. The "baseline annual default cost factor" in all projection years shall be taken from the most current available baseline default cost table published by the NAIC using the PBR credit rating and weighted average life (WAL) of the asset on the valuation date. The methodology for creating this table can be found in Appendix 2 of VM-20.

b. The "spread related factor" shall grade linearly in yearly steps from the prescribed amount in year one to zero in years four and after. The prescribed amount in year one may be positive or negative and shall be calculated as follows:

    i. Multiply 25% by the result of (ii) minus (iii).

    ii. The current market benchmark spread published by the NAIC consistent with the PBR credit rating and WAL of the asset on the valuation date.

    iii. The most current available long-term benchmark spread published by the NAIC.

iv. The resulting amount shall not be less than the negative of the baseline annual default cost in year one and shall not be greater than two times the baseline annual default cost in year one.

c. The "maximum net spread adjustment factor" shall be the same amount for each starting fixed income asset within a model segment and shall grade linearly in yearly steps from the prescribed amount in year one to zero in years four and after. The prescribed amount in year one shall be calculated as follows:

i. For each asset included in the model segment and subject to this Section 9.F.1, calculate a preliminary year one net spread equal to the option adjusted spread of the asset on the valuation date less the sum of the amounts from Section 9.F.1.a and Section 9.F.1.b for the asset and less the investment expense for the asset.

ii. Calculate a weighted average preliminary year one net spread for the model segment using a weight applied to the amount in Section 9.F.1.c.i for each asset equal to that asset's statement value on the valuation date multiplied by the lesser of three years and the asset's WAL on the valuation date.

iii. Calculate the amount in Section 9.F.1.c.i for a hypothetical asset with the following assumed characteristics (the regulatory threshold asset):

a) A PBR credit rating of 9.

b) A WAL equal to the average WAL on the valuation date for the assets in the model segment and subject to Section 9.F.1.

c) An option adjusted spread equal to the current market benchmark spread published by the NAIC for the assumed PBR credit rating and WAL. The methodology for determining this published spread can be found in Appendix 2.

d) Investment expense of 0.10%.

iv. The prescribed amount in year one is the excess, if any, of the result in Section 9.F.1.c.ii over the result in Section 9.F.1.c.iii.

Guidance Note: A broader explanation for this factor: For each model segment, a comparison is to be made of two spread amounts, both being net of the default costs calculated thus far and net of investment expenses. In each case, the gross option adjusted spread is based on current market prices at the valuation date. The first result represents the weighted average net spread for all the assets in the model segment (and subject to this subparagraph), as if all the assets were purchased at their current market spreads. The second result represents the net spread for a portfolio of index Baa bonds (NAIC 2, PBR credit rating of 9) as if the index Baa portfolio were purchased at the current average market spread. If the first result is higher than the second, additional default costs must be added to each asset until the two results are equal for the first projection year. This additional amount of default cost on each asset then grades off linearly in the model until it reaches zero in year four and after. This process is repeated each actual valuation date. A company that invests in an asset mix earning an average gross spread greater than Baa bonds initially or an asset mix whose average market spread could widen significantly relative to market spreads for Baa bonds are examples of situations likely to trigger additional assumed default costs either initially or in the future.

---

2.   Company-Determined Inputs for Each Asset

The company shall determine certain items for each asset that are necessary to calculate the total annual default cost factors:

a.   "Investment expense" for each asset shall mean the company's anticipated experience assumption for assets of the same type, expressed as an annual percentage of statement value.

b.   "Option adjusted spread (OAS)" for each asset shall mean the average spread over zero coupon Treasury bonds that equates a bond's market price as of the valuation date with its modeled cash flows across an arbitrage free set of stochastic interest rate scenarios. For floating rate bonds, the OAS shall be calculated as the equivalent spread over Treasuries if the bonds were swapped to a fixed rate. Market conventions and other approximations are acceptable for the purposes of this subsection.

c.   "Weighted average life (WAL)" for each asset means, for any fixed-income security that has either a maturity date or a redemption date, the weighted average number of years from the valuation date until 100% of the outstanding principal is expected to be repaid. Market conventions and other approximations are acceptable.

In selecting the Benchmark Spread from Table F, Table G, Table H or Table I, identify the appropriate term from the "WAL" column as follows:

(i) For a bond that has a maturity date, or a preferred stock issue that has a redemption date, use the WAL, rounded to the nearest term available in the "WAL" column, but not exceeding 30; and

(ii) For a bond that does not have a maturity date, or a preferred stock issue that does not have a redemption date, use 30.

Then select the spread corresponding to that term and the bond's PBR credit rating.

For a swap, refer to the nearest Term to Maturity shown in Table J.

> **Guidance Note:** OAS is a metric used for callable corporate bonds and other bonds with optionality, such as residential mortgage-backed securities (RMBS). Any excess of the nominal spread of an asset over its OAS represents additional return for taking on the risk of embedded options. This additional return is not considered when using OAS to make adjustments to annual default cost factors because the additional return is assumed to be related to the cost of embedded options that must be modeled directly by the company along each scenario in the cash-flow model. (See Section 9.F.8.) OAS is dependent on market prices, which may be gathered by companies in a variety of ways for financial reporting purposes. For instance, prices and OAS may be developed internally for assets with less relative liquidity, such as private placements. The general sources of market prices used to determine OAS, as well as the method or source for the OAS calculation, should be documented in the PBR Actuarial Report. In some cases, OAS may not be available due to unavailability of market prices. When such is the case, the asset may be excluded from the particular calculation.

3.   Determination of PBR Credit Rating

a.   Table K, referenced in Appendix 2 Section H, converts the ratings of NAIC approved ratings organizations (AROs) and NAIC designations to a numeric rating

system from 1 through 20 that is to be used in the steps below. A rating of 21 applies for any ratings of lower quality than those shown in the table.

b. For an asset with an NAIC designation that is derived solely by reference to underlying ARO ratings without adjustment, the company shall determine the PBR credit rating as the average of the numeric ratings corresponding to each available ARO rating, rounded to the nearest whole number.

c. For an asset that is not a commercial mortgage and that has an NAIC designation that is not derived solely by reference to underlying ARO ratings without adjustment, the company shall determine the PBR credit rating as the second least favorable numeric rating associated with that NAIC designation.

d. For a commercial or agricultural mortgage loan, the company shall determine the PBR credit rating as the Table K lookup of the numeric rating corresponding to the loan's NAIC commercial mortgages (CM) category, where the latter is assigned by the company in accordance with NAIC life RBC instructions.

> **Guidance Note:** The 1 through 21 PBR credit rating system attempts to provide a more granular assessment of credit risk than has been used for establishing NAIC designations for RBC and asset valuation reserve (AVR) purposes. The reason is that unlike for RBC and AVR, the VM-20 reserve cash-flow models start with the gross yield of each asset and make deductions for asset default costs. The portion of the yield represented by the purchase spread over Treasuries is often commensurate with the more granular rating assigned, such as A+ or A-. Thus, use of the PBR credit rating system may provide a better match of risk and return for an overall portfolio in the calculation of VM-20 reserves. However, for assets that have an NAIC designation that does not rely directly on ARO ratings, a more granular assessment consistent with the designation approach is not currently available.

> **Guidance Note:** The *Purposes and Procedures Manual of the NAIC Investment Analysis Office* (P&P Manual)*,* which establishes the rules for setting NAIC designations, underwent significant change during 2009–2010, particularly in the area of assessing the credit risk of structured securities. The NAIC Valuation of Securities (E) Task Force implemented an interim solution in 2009 to set designations for non-agency RMBS based on modeling by a third-party firm. The Task Force is developing a long-term solution for these and other structured securities, such as commercial mortgage-backed securities (CMBS), that may involve a combination of modeling and other methods, such as "notching up" or "notching down" the result derived by reference to ARO ratings. In all such cases where the ARO rating basis is either not used at all or is adjusted in some way, the intent is that paragraph (c) be used to determine the PBR credit rating. Another common example where (c) is to be used would be securities that are not Securities Valuations Office (SVO) filing exempt (FE), such as many private placement bonds. For example, a private placement that was not FE and was rated by the SVO as NAIC 1 would be assigned a PBR credit rating of 6 (second least favorable), equivalent to A2.

4. Special Situations

For an asset handled under Section 9.F.3.c and for which the NAIC designation varies depending on the company's carrying value of the asset, the company must avoid overstatement of the net return of the asset when projecting future payments of principal and interest together with the prescribed annual default costs.

> **Guidance Note:** For example, if a non-agency RMBS is rated NAIC 2 if held at a particular company's carrying value but NAIC 4 if held at par, and that company's cash-flow model first projects the full recovery of scheduled principal and interest, it would be more appropriate to then

deduct annual default costs consistent with NAIC 4 rather than NAIC 2. If the company's cash-flow model has already incorporated a reduced return of principal and interest consistent with the company's carrying value, then it would be more appropriate to deduct annual default costs consistent with NAIC 2. Modeling of assets with impairments is an emerging topic, and methods for handling in vendor and company projection models vary.

5.   Annual Default Cost Factors for Starting Fixed Income Assets without an NAIC Designation

For starting assets that do not have an NAIC designation, the default assumption shall be established such that the net yield shall be capped at 104% of the applicable corresponding historical Treasury yield rate most closely coinciding with the dates of purchase and maturity structure of supporting assets plus 25 basis points (bps).

6.   Annual Default Cost Factors for Reinvestment Fixed Income Assets

The sets of annual default cost factors for reinvestment fixed income assets are determined following the same process as for starting fixed income assets except that Section 9.F.1.c does not apply to reinvestment assets.

7.   Amount of Assumed Default Costs

The assumed default costs in the cash-flow model for a projection interval shall be the sum over all fixed income assets of the result of the total annual default cost factor for each asset, adjusted appropriately for the length of the projection interval, multiplied by the appropriate credit exposure for each asset.

8.   Procedure for Setting Prescribed Gross Asset Spreads by Projection Year for Certain Asset Transactions and Operations in the Cash-Flow Model

     a.   Gross asset spreads over Treasuries for public non-callable corporate bonds purchased in projection year one shall be the current market benchmark spreads published by the NAIC consistent with the PBR credit rating and WAL of assets purchased.

     b.   Gross asset spreads over Treasuries for public non-callable corporate bonds purchased in projection years four and after shall be the most current available long-term benchmark spreads published by the NAIC consistent with the PBR credit rating and WAL of assets purchased.

     c.   The prescribed gross asset spreads for these asset types shall grade linearly between year one and year four in yearly steps.

     d.   Interest rate swap spreads over Treasuries shall be prescribed by the NAIC for use throughout the cash-flow model wherever appropriate for transactions and operations including, but not limited to, purchase, sale, settlement, cash flows of derivative positions and reset of floating rate investments. A current and long-term swap spread curve shall be prescribed for year one and years four and after, respectively, with yearly grading in between.

         i.   The current prescribed swap spread curve shall be the Secured Overnight Financing Rate (SOFR) swap curve.

         ii.   The long-term SOFR swap spread curve, given that the SOFR swap market did not emerge before late 2021 and the SOFR is an index for

which there is no official data before April 2, 2018, shall be calculated based on 15 year moving averages of prescribed estimates of historical SOFR swap spreads for valuation dates prior to June 30, 2037.

> **Guidance Note:** Actuarial judgment may be required in the use of prescribed swap spreads (e.g., in the case where the company has a financial instrument with floating rate payments based on an index that is not prescribed by the NAIC [e.g., one-month SOFR or three-month London Interbank Offered Rate (LIBOR)]).

9. Basis of NAIC Long-Term Benchmark Spreads

The prescribed long-term benchmark spread table established by the NAIC shall to the extent practicable:

a. Reflect recent historical market data based on actual daily trading activity.

b. Reflect an expanding observation period that uses the most recent reported data, with a minimum observation period of seven years expanding to a maximum observation period of 15 years.

c. Be based on an "85% conditional mean" of the periodic market data. This measure is defined as the mean obtained after excluding from the observation period the trading days involving the 7.5% highest and 7.5% lowest observed spreads for "A" rated 7- to 10-year maturities or other most similar asset category available from the source data. For other asset categories, the mean shall be obtained after excluding the same trading days that were excluded for the primary asset category.

d. Provide a table of bond spreads by PBR credit rating and WAL and swap spreads by maturity. If needed, interpolation and/or smoothing techniques should be applied to the source data to provide sufficient granularity and logical relationships by credit quality.

> **Guidance Note:** Long-term prescribed spreads are targeted at the historical mean because any biased measure could either add or subtract conservatism depending on whether assets are predominantly being purchased or being sold in the cash-flow model. The conditional mean concept is intended to limit the volatility of the long-term prescribed spreads from one valuation date to the next by excluding a limited number of observations in both tails within the averaging period. Empirical analysis during the 2000–2009 time period showed little change in volatility or the level of prescribed spreads from excluding more than the highest and lowest 7.5% observations.

10. Modeling of Embedded Options in Assets

Reflect any uncertainty in the timing and amounts of asset cash flows related to the paths of interest rates, equity returns, or other economic values contained in the various scenarios directly in the projection of asset cash flows under the various scenarios within the SR calculation model and under the deterministic scenario within the DR calculation model.

> **Guidance Note:** For example, model the impact on cash flows of embedded prepayment, extension and call, and put options in a manner consistent with current asset adequacy analysis practice.

G. Revenue-Sharing Assumptions

1. The company may include income from projected future revenue sharing (as defined in these requirements equals gross revenue-sharing income (GRSI)) net of applicable projected expenses (net revenue-sharing income) in cash-flow projections, if:

a. The GRSI is received by the company.

b. A signed contractual agreement or agreements are in place as of the valuation date and support the current payment of the GRSI.

c. The GRSI is not already accounted for directly or indirectly as a company asset.

2. For purposes of this section, GRSI is considered to be received by the company if it is paid directly to the company through a contractual agreement with either the entity providing the GRSI or an affiliated company that receives the GRSI. The GRSI also would be considered to be received if it is paid to a subsidiary that is owned by the company and if 100% of the statutory income from that subsidiary is reported as statutory income of the company. In this case, the company shall assess the likelihood that future GRSI is reduced due to the reported statutory income of the subsidiary being less than future GRSI received.

3. If the requirements in Section 9.G.1 are not met, and the GRSI is not included in cash-flow projections, applicable projected expenses also are not included.

4. In determining the anticipated experience assumption for the GRSI, the company shall reflect factors that include, but are not limited to, the following (not all of these factors will necessarily be present in all situations):

a. The terms and limitations of the agreement(s), including anticipated revenue, associated expenses and any contingent payments incurred or made by either the company or the entity providing the GRSI as part of the agreement(s).

b. The relationship between the company and the entity providing the GRSI that might affect the likelihood of payment and the level of expenses.

c. The benefits and risks to both the company and the entity paying the GRSI of continuing the arrangement.

d. The likelihood that the company will collect the GRSI during the term(s) of the agreement(s) and the likelihood of continuing to receive future revenue after the agreement(s) has ended.

e. The ability of the company to replace the services provided to it by the entity providing the GRSI or to provide the services itself, along with the likelihood that the replaced or provided services will cost more to provide.

f. The ability of the entity providing the GRSI to replace the services provided to it by the company or to provide the services itself, along with the likelihood that the replaced or provided services will cost more to provide.

5. The company shall include all expenses required or assumed to be incurred by the company in conjunction with the arrangement providing the GRSI, as well as any assumed expenses incurred by the company in conjunction with the assumed replacement of the services provided to it in the projections as a company expense. In addition, the company shall include expenses incurred by either the entity providing the net revenue-sharing income or an affiliate of the company in the applicable expenses that reduce the GRSI.

6. In determining the prudent estimate of projected GRSI, the company shall reflect a margin (which decreases the assumed GRSI) related to the uncertainty of the revenue. Such uncertainty is driven by many factors, including, but not limited to, the potential for changes in industry trends. Contractually guaranteed GRSI shall not reflect a margin,

although company expenses related to contractually guaranteed GRSI shall reflect a margin.

7.   The company is responsible for reviewing the revenue-sharing agreements that apply to that group of policies and verifying compliance with these requirements.

8.   The amount of net revenue-sharing income assumed in a given scenario shall be applied with a margin to reflect any uncertainty but shall not exceed the sum of (a) and (b), where:

    a.   Is the contractually guaranteed GRSI, net of applicable expenses, projected under the scenario.

    b.   Is the company's estimate of non-contractually guaranteed net revenue-sharing income before reflecting any margins for uncertainty multiplied by the following factors:

        i.   1.0 in the first projection year.

        ii.   0.95 in the second projection year.

        iii.   0.90 in the third projection year.

        iv.   0.85 in the fourth projection year.

        v.   0.80 in the fifth and all subsequent projection years.

> **Guidance Note:** Provisions such as one that gives the entity paying the GRSI the option to stop or change the level of income paid would prevent the income from being guaranteed. However, if such an option becomes available only at a future point in time, and the revenue up to that time is guaranteed, the income is considered guaranteed up to the time the option first becomes available.

> **Guidance Note:** If the agreement allows the company to unilaterally take control of the underlying fund fees that ultimately result in the GRSI, then the revenue is considered guaranteed up until the time at which the company can take such control. Since it is unknown whether the company can perform the services associated with the revenue-sharing arrangement at the same expense level, it is presumed that expenses will be higher in this situation. Therefore, the revenue-sharing income shall be reduced to account for any actual or assumed additional expenses.

Appendix 1: Additional Description of Economic Scenarios

The prescribed economic scenario generator can be found on the SOA's website at *www.soa.org/tables-calcs-tools/research-scenario/*.

A.   Generating Interest Rates

The prescribed economic scenario generator uses three random numbers per period. These are:

1.   A random shock to the 20-year Treasury rate.

2.   A random shock to the spread between 1-year and 20-year Treasury rates.

3.   A random shock to the volatility.

In generating the scenarios for the SERT, zero shocks to volatility are used.

When generating scenarios for the SERT, upward shocks to the 20-year Treasury are associated with downward shocks to the spread, making the yield curve less steep (or potentially inverted).

The prescribed mean reversion parameter described in Section D shall be used in calculating the scenarios based on the prescribed scenario generator.

The prescribed economic scenario generator can be found on the SOA's website at *www.soa.org/tables-calcs-tools/research-scenario/*.

B.   Generating Equity Returns

The equity returns scenarios can be generated using the prescribed economic scenario generator, located on the SOA's website at *www.soa.org/tables-calcs-tools/research-scenario/*.

C.   Source of U.S. Treasury Interest Rates

Treasury interest rates can be found at the website: *www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield_historical_main.shtml*.

D.   Prescribed Mean Reversion Parameter

The mean reversion point for the 20-year Treasury bond rate is dynamic, based on historical interest rates as they emerge.

The formula for the dynamic mean reversion point is:

20% of the median 20-year Treasury bond rate over the last 600 months.

+ 30% of the average 20-year Treasury bond rate over the last 120 months.

+ 50% of the average 20-year Treasury bond rate over the last 36 months.

The result is then rounded to the nearest 0.25%.

The mean reversion point for use in the generator changes once per year, in January, and is based on historical rates through the end of the prior year. While the mean reversion point is dynamic depending on the date from which a scenario starts, it remains constant (rather than dynamic) across all time periods after the scenario start date, for purposes of generating the scenario.

The historical 20-year Treasury bond rate for each month is the rate reported for the last business day of the month.

E.   This section describes the set of 16 scenarios for the SERT in VM-20. Starting with the yield curve on the valuation date, the scenarios are created using the Academy's stochastic scenario generator using predefined sets of random numbers, where each random number is a sample from a normal distribution with mean zero and variance 1.

The rationale for this approach is twofold. First, the scenarios should be realistic in that they could be produced by the generator. Second, in some way the likelihood of any scenario occurring can be measured.

One way to measure the likelihood of a scenario occurring is to measure the likelihood of its series of random shocks—that is, the random numbers used in the generator. Given any sequence of random numbers, their sum can be compared with a mean of zero and a standard error equal to the square root of the number of deviates in the sequence. With the mean and standard error, we can determine, in a crude way, where the sum of deviates in our sequence lies in the distribution of the sum of all such sequences.

For example, if we want a sequence that is always one standard error above average, we start with a value of 1.0 as the first deviate. The value of the nth deviate is the excess of the square root of n over the square root of n-1. So, the second value is 1.414 – 1 = 0.414, and the third value is 1.732 – 1.414 = 0.318.

Scenario 1 – Pop up, high equity

Interest rate shocks are selected to maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 90% level.

Scenario 2 – Pop up, low equity

Interest rate shocks are selected to maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 10% level.

Scenario 3 – Pop down, high equity

Interest rate shocks are selected to maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 90% level.

Scenario 4 – Pop down, low equity

Interest rate shocks are selected to maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 10% level.

Scenario 5 – Up/down, high equity

Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during "up" periods and at the 10% level during "down" periods.

Equity returns are selected to maintain the cumulative equity return at the 90% level.

Scenario 6 – Up/down, low equity

Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during "up" periods and at the 10% level during "down" periods.

Equity returns are selected to maintain the cumulative equity return at the 10% level.

Scenario 7 – Down/up, high equity

Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during "up" periods and at the 10% level during "down" periods.

Equity returns are selected to maintain the cumulative equity return at the 90% level.

Scenario 8 – Down/up, low equity

Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during "up" periods and at the 10% level during "down" periods.

Equity returns are selected to maintain the cumulative equity return at the 10% level.

Scenario 9 – Baseline scenario

All shocks are zero.

Scenario 10 – Inverted yield curves

There are no shocks to long-term rates and equities.

There are shocks to the spread between short and long rates that are consistently in the same direction for each three-year period. The shocks for the first three-year period are in the direction of reducing the spread (usually causing an inverted yield curve). Shocks for each subsequent three-year period alternate in direction.

Scenario 11 – Volatile equity returns

There are no shocks to interest rates. There are shocks to equity returns that are consistently in the same direction for each two-year period and then switch directions.

Scenario 12 – Deterministic scenario for valuation

There are uniform downward shocks each month for 20 years, sufficient to get down to the one standard deviation point (84%) on the distribution of 20-year shocks. After 20 years, shocks are zero.

Scenario 13 – Delayed pop up, high equity

There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks—each 1.414 (square root of 2) times those in the first 10 years of Scenario 1. This gives the same 20-year cumulative shock as scenario 1, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 1.

Equity returns are selected to maintain the cumulative equity return at the 90% level.

Scenario 14 – Delayed pop up, low equity

There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks—each 1.414 (square root of 2) times those in the first 10 years of Scenario 2. This gives the same 20-year cumulative shock as scenario 2, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 1.

Equity returns are selected to maintain the cumulative equity return at the 10% level.

Scenario 15 – Delayed pop down, high equity

There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks—each 1.414 (square root of 2) times those in the first 10 years of Scenario 3. This gives the same 20-year cumulative shock as scenario 3, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 3.

Equity returns are selected to maintain the cumulative equity return at the 90% level.

Scenario 16 – Delayed pop down, low equity

There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks—each 1.414 (square root of 2) times those in the first 10 years of Scenario 4. This gives the same 20-year cumulative shock as scenario 4, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 4.

Equity returns are selected to maintain the cumulative equity return at the 10% level.

Appendix 2: Tables for Calculating Asset Default Costs and Asset Spreads, Including Basis of Tables

This appendix describes the basis for certain prescribed asset default cost and asset spread tables to be updated and published by the NAIC. Asset default cost tables will be updated on an annual basis. The data source used to update the asset default cost tables is Moody's. The current market benchmark spreads and the current benchmark swap spreads will be updated on a monthly basis. The long-term benchmark spreads and the long-term benchmark swap spreads will be updated on a quarterly basis. The data sources used to update the spread tables are JP Morgan and Bank of America. The NAIC will provide access to the published tables via links that may be found on the NAIC website home page (*www.naic.org*) under the Industry tab. These tables are needed for insurers to comply with the requirements of Section 9.F for asset default costs and asset spreads in VM-20. In some cases, as specified in Section 9.F, tables published in this appendix will serve as the NAIC published table until a different table is published. The development of the various tables is described in Section A through Section G of this appendix. Certain tables were developed based on various source material referenced herein. Other tables are simply compilations or presentations of data from such sources.

It is important to note up front that the development of prescribed default costs is based entirely on analysis of corporate bonds. Default costs for other fixed income securities and commercial and agricultural mortgages are assumed to follow those of corporate bonds with similar NAIC designations through a mapping tool called "PBR credit rating." Examples of other fixed income securities are structured securities, private placements and preferred stocks. Discussions at the NAIC during 2009–2010, particularly at the Valuation of Securities (E) Task Force, focused on the observation that similarly rated assets of different types may have similar likelihood of default or loss of principal but may have a significantly different distribution of the severity of that loss. Discussions have particularly focused on the different drivers of severity between structured securities and corporate bonds. As a result, the Valuation of Securities (E) Task Force has been developing updated methods to assign NAIC designations for C-1 RBC purposes for structured securities in order to better take into account these differences. The VM-20 procedure to assign a PBR credit rating has been structured so that in the cases where the Task Force decides to go away from directly using the ratings of approved ratings organizations, the PBR credit rating will be based on the NAIC designation rather than underlying ratings. Where the Task Force continues to authorize use of underlying ratings, the PBR credit rating also will be based on those ratings. However, VM-20 uses the underlying ratings to assign the PBR credit rating in a somewhat different manner.

Section 9.F.3 describes the process the company must follow to assign a PBR credit rating for any fixed income asset with an NAIC designation.

A.   Baseline Annual Default Cost Factors

The general process followed to determine the baseline annual default cost factors shown in Table A (see Section H) was as follows:

1.   Determine from historical corporate bond data a matrix of cumulative default rates, for maturities of one to 10 years and for 20 ratings classes (Aaa, Aa1, Aa2, Aa3 … Caa2, Caa3, Ca).

2.   Determine also from historical corporate bond data a set of recovery rates that varies only by rating class.

3.   Determine a matrix of baseline annual default cost factors (in bps), where for a given rating, the baseline annual default cost factor for a bond with maturity or weighted average life of $t = 10{,}000 * (1 - \text{Recovery Rate}) * (1 - [1 - \text{Cumulative Default Rate } (t)]^{1/t})$.

4.   Item 1 and Item 2 above were determined from Moody's reports that were published in February 2008. In February 2009 and February 2010, Moody's published updated versions of these reports, but there is no commitment from Moody's to continue updating these reports in the future. It was not explored whether another source for one or both elements might be preferable. If the NAIC decides to use Moody's as the source going forward, then the matrix of baseline annual default cost factors could be updated after Moody's publishes any updated research.

Details of step 1 and step 2 above are contained in Section B and Section C below. Essentially, step 1 involved gathering from Moody's historical data the cumulative default rates for key maturities over many cohort years, ranking those rates and applying a CTE 70 metric. For example, for the period 1970–2007, representing 37 years, there were 37 one-year cohorts, 33 five-year cohorts and 28 10-year cohorts. A CTE 70 for 10-year maturities involved averaging the eight cohorts with the highest 10-year cumulative default rates. Step 2 involved gathering from Moody's historical data the annual recovery rates for various bond categories from 1982–2007, ranking those rates, and calculating sample mean and CTE 70 statistics. The final recovery rate table uses the mean for higher quality investment grade rating classes and uses the CTE 70 for lower quality below investment grade rating classes and grades in between.

Among tables published on the NAIC website (See Section H):

a.   Table A shows baseline default costs using Moody's data.

b.   Table B shows the baseline default cost margin (Table A rates minus the historical mean rates).

B.   Cumulative Default Rates Used in Baseline Annual Default Cost Factors

The current process to determine cumulative default rates is as follows:

1.   Obtain the most recent Moody's report on default rates (e.g., Moody's 2008-02-11 Special Comment – Corporate Default & Recovery Rates 1920–2007).

2.   Extract one-year, five-year and 10-year average cumulative default rate data by whole letter rating (e.g., Aaa, Aa, … CCC) from the report (e.g., Exhibit 27 – Average Cumulative Issuer-Weighted Global Default Rates, 1970–2007).

3.   Extract one-year, five-year and 10-year cumulative default rate cohort data by whole letter rating from the report (e.g., Exhibit 36 – Cumulative Issuer-Weighted Default Rates by Annual Cohort, 1970–2007). Calculate the mean of these one-year, five-year and 10-year cumulative default rates, which should be close to the result in item 2 for each whole letter rating.

4.   Sort the data in item 3 to calculate preliminary CTE 70 one-year, five-year and 10-year cumulative default rates at each whole letter rating.

5.   Adjust the result in item 4 to reflect any differences between the result in item 2 and the result in item 3:

(i.e., the result in item 5 = the result in item 4 + (the result in item 2 – the result in item 3).

6.   Use linear interpolation to determine cumulative default rates for maturities two to four years and six to nine years.

7. Transform the data into a matrix that varies by ratings category (e.g., Aaa, Aa1, Aa2, Aa3, A1 … Caa2, Caa3, Ca) using a smoothing algorithm to ensure that in the matrix, the rows are monotonic by maturity, the columns are monotonic by rating, and to the extent possible the matrix has a shape comparable to another Moody's cumulative default rate table that varies by notch (e.g., Moody's Idealized Cumulative Default Rates).

8. For maturities greater than 10 years, define baseline annual default cost factors as equal to those for 10-year maturities.

   Among tables published on the NAIC website (See Section H):

   a. Table C shows empirical CTE 70 default rates from Moody's.

   b. Table D shows prescribed cumulative default rates derived from Moody's data.

C. Recovery Rate Used in Baseline Annual Default Cost Factors

   The current process to determine the recovery rate is as follows:

   1. Obtain the most recent Moody's report on recovery rates (e.g., Moody's 2008-02-11 Special Comment – Corporate Default & Recovery Rates 1920–2007).

   2. Extract historical annual data on recovery rates (e.g., the All Bonds column from Exhibit 22 – Annual Average Defaulted Bond and Loan Recovery Rates, 1982–2007).

   3. Determine the mean and CTE 70 of the annual sample observations for each of the different lien position categories, as well as for the All Bonds category.

   Among tables published on the NAIC website (See Section H):

   a. Table E1 shows a sorted version of "Exhibit 22 – Annual Average Defaulted Bond and Loan Recovery Rates, 1982–2007," and develops the CTE 70 recovery rates and the implied margin.

      Table E1 develops mean and CTE 70 recovery rates for all bonds, as well as for senior bank loans and five bond lien position categories that make up the All Bonds statistics. Implementation will be facilitated if VM-20 uses one recovery rate based on All Bonds rather than using all six lien position categories. Using the more detailed data would require either companies or the SVO to assign each asset to one of the categories.

      Table E1 also illustrates that bonds that are more senior in the issuer's capital structure tend to have higher recovery rates than bonds that are subordinated.

   b. Table E2 shows the final recovery rates that vary by PBR credit rating. This table was determined by assuming CTE 70 applies for Ba3/BB- and below, mean applies for Baa1/BBB+ and above, and interpolated recovery rates apply for ratings that are between Ba3/BB- and Baa1/BBB+. This approach recognizes that investment-grade bonds are more likely to be senior in the issuer's capital structure, and below-investment-grade bonds are more likely to be subordinated. Differentiating by actual seniority position of each bond was not considered practical. In addition, because recovery rates and default rates are not 100% correlated and the cumulative default rates were set at CTE 70, use of the mean recovery rate, at least for the higher-quality bonds, helps to avoid overly conservative prescribed default costs for those bonds.

D.   Current Market Benchmark Spreads

Current market benchmark spreads published by the NAIC are intended to represent average market spreads at the valuation date for public non-callable corporate bonds and interest rate swaps. They are used to establish the initial spread environment in the cash-flow model for purposes of modeling reinvestment assets and disinvestment and for modeling prescribed default costs. Section 9.F calls for both spreads and default costs to grade from initial to long-term conditions by the start of projection year four. The current process to determine current market benchmark spreads is as follows:

1.   Extract the Investment Grade bond index spread data determined as of the last business day of the month by ratings category and maturity bucket from JP Morgan and Bank of America. Adjust the Bank of America Investment Grade spread data for the maturity buckets 10–15 years and 15+ years to a single maturity bucket of 10+ years (using a weighting process) to align with the JP Morgan maturity bucket of 10+ years. Average the JP Morgan and Bank of America Investment Grade bond spreads as of the last business day of the month by ratings category and maturity bucket.

2.   Extract the Below Investment Grade bond index spread data determined as of the last business day of the month by ratings category and assume that the Below Investment Grade spread curve is flat across maturities. Average the JP Morgan and Bank of America Below Investment Grade bond spreads as of the last business day of the month by ratings category.

3.   Transform the averaged spread data into a matrix that varies by ratings category (e.g., Aaa, Aa1, Aa2, Aa3, A1 …, Caa2, Caa3, Ca) and maturity (1, 2 …, 30) using a smoothing algorithm to ensure that in the matrix: (a) the rows are monotonic by rating category; (b) the investment grade columns are monotonic by maturity; and (c) the columns on the borderline between investment grade and below investment grade (Baa3/BBB-) is interpolated between Baa2/BBB and Ba1/BB+.

4.   Publish the resulting Investment Grade and Below Investment Grade current market benchmark spreads in separate tables.

        Among tables published on the NAIC website (See Subsection H):

        a.   Table F shows Current Market Benchmark Spreads for Investment Grade bonds.

        b.   Table G shows Current Market Benchmark Spreads for Below Investment Grade bonds.

E.   Long-Term Benchmark Spreads

Long-term benchmark spreads published by the NAIC are the assumed long-term average spreads for non-callable public bonds and interest rate swaps. They are used to establish the long-term spread environment in the cash-flow model for purposes of modeling reinvestment assets and disinvestment. They are also used as the normative spreads when calculating the spread related factor in the asset default cost methodology. The current process to determine the long-term benchmark spreads is as follows:

1.   Extract the daily Investment Grade bond index spread data for the prescribed observation period (rolling 15-year period) ending on the last business day of the quarter by ratings category and maturity bucket from JP Morgan and Bank of America. Adjust the Bank of America Investment Grade spread data for the maturity buckets 10–15 years and the 15+ years to a single maturity bucket of 10+ years (using a weighting process) to align with the JP Morgan maturity bucket of 10+ years. Average the JP Morgan and Bank of America

daily Investment Grade Bond spreads over the observation period by ratings category and maturity bucket.

2.   Extract the daily Below Investment Grade bond index spread data for the prescribed observation period (rolling 15–year period) ending on the last business day of the quarter by ratings category and assume that the Below Investment Grade spread curve is flat across maturities. Average the JP Morgan and Bank of America daily Below Investment Grade bond spreads over the observation period by ratings category.

3.   For the primary asset rating category (whole letter "A" rated 7- to 10-year maturity bucket), calculate the "85% conditional mean" by excluding the 7.5% highest and 7.5% lowest daily observations over the prescribed observation period and then computing the mean of the remaining business trading day observations.

4.   Calculate the "85% conditional mean" for each of the other ratings categories and maturity buckets over the prescribed observation period after excluding the observations from the same business trading days excluded in step 3.

5.   Transform the averaged spread data into a matrix that varies by rating category (e.g., Aaa, Aa1, Aa2, Aa3, A1…,Caa2, Caa3, Ca) and maturity (1, 2 … 30) using a smoothing algorithm to ensure that in the matrix: (a) the rows are monotonic by rating category; (b) the investment grade columns are monotonic by maturity; and (c) the columns on the borderline between investment grade and below investment grade (Baa3/BBB-) are interpolated between Baa2/BBB and Ba1/BB+.

6.   Publish the resulting Investment Grade and Below Investment Grade long-term benchmark spreads in separate tables.

        Among tables published on the NAIC website (See Subsection H):

        a.   Table H shows Long-Term Mean Benchmark Spreads for Investment Grade bonds.

        b.   Table I shows Long-Term Mean Benchmark Spreads for Below Investment Grade bonds.

F.   Current Benchmark Swap Spreads

1.   For tenors of three months, six months, and one year through 30 years, extract swap spread data determined as of the last business day of the month by maturity from at least two nationally recognized providers of this data. If the data source provides swap rates rather than swap spreads, convert the swap rate for each maturity to a swap spread by subtracting the corresponding maturity Treasury yield from the swap rate.

2.   Average the swap spreads from the data sources by maturity determined as of the last business day of the month.

3.   Publish the Current Benchmark Swap Spreads by maturity in a table.

Guidance Note: Three-month and six-month SOFR swap rates are defined herein as the fixed rate one party pays at the end of three months or six months in exchange for receiving at such time three-month SOFR or six-month SOFR, calculated on a compounded in arrears basis.

G.   Long-Term Benchmark Swap Spreads

1.   Extract daily swap spread data over the prescribed observation period (rolling 15-year

period) ending on the last business day of the quarter <u>from at least two nationally recognized providers of this data</u>. If the data source provides swap rates rather than swap spreads, convert the daily swap rate for each maturity to a swap spread by subtracting the corresponding maturity Treasury yield from the swap rate.

2. <u>For a valuation date during or after 2023 and before 2037, calculate SOFR swap spreads as follows for each business day on or after the effective date of the adoption by the Life Actuarial (A) Task Force of SOFR swap spreads as the replacement for swap spreads previously prescribed:</u>

    a. <u>For each maturity, "m" = 0.25, 0.5, 1 … 30 years, and business day "u":</u>

        <u>SOFR swap spread (m,u) = SOFR swap rate (m,u) - Treasury yield (m,u).</u>

3. <u>For a valuation date during or after 2023 and before 2037, for each business day before the effective date of the adoption by the Life Actuarial (A) Task Force of SOFR swap spreads as the replacement for swap spreads previously prescribed, utilize Bloomberg's 2021-03-05 published USD Spread Adjustments as follows:</u>

    a. <u>For each maturity, "m" = 3 or 6 months, and business day "u":</u>

        i. <u>SOFR swap spread (3 months,u) = LIBOR swap spread (3 months,u) - 0.26161% (the USD 3-month Spread Adjustment)</u>

        ii. <u>SOFR swap spread (6 months,u) = LIBOR swap spread (6 months,u) - 0.42826% (the USD 6-month Spread Adjustment)</u>

    b. <u>For each maturity, "m" = 1 … 30 years, and business day "u":</u>

        <u>SOFR swap spread (m,u) = LIBOR swap spread (m,u) - 0.26161% (the USD 3-month Spread Adjustment)</u>

4. <u>For a valuation date during or after 2037, calculate SOFR swap spreads as follows for each business day:</u>

    a. <u>For each maturity, "m" = 0.25, 0.5, 1 … 30 years, and business day "u":</u>

        <u>SOFR swap spread (m,u) = SOFR swap rate (m,u) - Treasury yield (m,u).</u>

5. Average the swap spread data from the data sources by maturity over the prescribed observation (rolling 15-year period).

6. Calculate the Long-Term Benchmark Swap Spreads as the 85% conditional mean for each of the 32 maturity categories (three-month, six-month, one-year, two-year, … 30-year) using the same business trading days as were used in the 85% conditional mean for long-term bonds spreads.

7. Publish the Long-Term Benchmark Swap Spreads in a table.

    Among tables published on the NAIC website (See Subsection H). Table J shows Long-Term Benchmark Swap Spreads.

H. Tables

    Current and historical versions of Tables A through K used for calculating asset default costs and asset spreads are available on the NAIC website home page (*www.naic.org*) under the Industry tab

of the website.