

# **VALUATION MANUAL**

NAIC Adoptions Through

April 6, 2016

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**VM-20: REQUIREMENTS FOR PRINCIPLE-BASED RESERVES FOR LIFE PRODUCTS**

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**Section 1. Purpose and Definitions**

- 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 PBR valuation with a net premium reserve floor under the Standard Valuation Law.
- B. These requirements constitute the Commissioner's Reserve Valuation Method (CRVM) for policies of individual life insurance.

C. Definitions

1. The term “anticipated experience assumption” means an expectation of future experience for a risk factor given available, relevant information pertaining to the assumption being estimated.
2. The term “clearly defined hedging strategy” means a strategy undertaken by a company to manage risks that meet the criteria specified in the applicable requirement.
3. The term “deterministic reserve” means a reserve amount calculated under a defined scenario and a single set of assumptions.
4. The term “industry basic table” means an NAIC-approved industry experience mortality table (without the valuation margin).
5. The term “gross reserve” means the minimum reserve held in the absence of any ceded reinsurance.
6. The term “margin” means an amount included in the assumptions, except when the assumptions are prescribed, used to determine the modeled reserve that incorporates conservatism in the calculated value consistent with the requirements of the various sections of the Valuation Manual. It is intended to provide for estimation error and adverse deviation.
7. The term “model segment” means a group of policies and associated assets that are modeled together to determine the path of net asset earned rates.
8. ~~The term “modeling efficiency technique” shall refer to any technique designed to reduce the complexity or run time of an actuarial model without compromising the accuracy of the results calculated by the model.~~ The term “modeled reserve” means the deterministic reserve on the policies determined under Section 2.A.2 plus the greater of the deterministic reserve and the stochastic reserve on the policies determined under Section 2.A.3.

**Guidance Note:** Examples include, but are not limited to:

1. Choosing a reduced set of scenarios from a larger set or an alternative set consistent with prescribed models and parameters.
2. Generating a smaller liability or asset model to represent the full serial model using grouping compression techniques, or other similar simplifications.
9. The term “mortality segment” means a subset of policies for which a separate mortality table representing the prudent estimate assumption will be determined.
10. The term “net asset earned rates” means the path of earned rates reflecting the net general account portfolio rate in each projection interval (net of appropriate default costs and investment expenses).
11. The term “net premium reserve” means the amount determined in Section 3.
12. The term “non-guaranteed element” or “NGE” means either: (a) dividends under participating policies or contracts; or (b) other elements affecting life insurance or annuity policyholder/contract holder costs or values that are both established and subject to change at the discretion of the insurer.
13. The term “policy” means an individual life insurance policy included in the scope of these requirements.
14. The term “policyholder efficiency” means the phenomenon that policyholders will act in their best interest with regard to the value of their policy. A policyholder acting with high policyholder efficiency would take actions permitted in their contract which would provide the greatest relative value. Such actions include but are not limited to not lapsing a low value or no value contract, persisting, surrendering, applying additional premium, and exercising loan and partial surrender provisions.
15. The term “pretax interest maintenance reserve” or “PIMR” means the statutory interest maintenance reserve liability adjusted to a pre-tax basis for each model segment at the projection start date.
16. The term “Principle-Based Reserve Actuarial Report” or “PBR Actuarial Report” means the document containing supporting information prepared by the company as required by VM-31.
17. The term “prudent estimate assumption” means a risk factor assumption developed by applying a margin to the anticipated experience assumption for that risk factor.
18. The term “reinsurance cash flows” means the amount paid under a reinsurance agreement between a ceding

company and an assuming company. Positive reinsurance cash flows shall represent amounts payable from the assuming company to the ceding company; negative reinsurance cash flows shall represent amounts payable from the ceding company to the assuming company.

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

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

20. The term “reinsurance discrete cash flows” means reinsurance cash flows determined by applying reinsurance terms to an individual covered policy, without reference to the circumstances and events of other policies. Examples of reinsurance discrete cash flows would be proportional sharing of one or more items of revenue or expense associated with an underlying reinsured policy.
21. The term “scenario” means a projected sequence of events used in the cash flow model, such as future interest rates, equity performance, or mortality.
22. The term “scenario reserve” means the amount determined on an aggregated basis for a given scenario that is used as a step in the calculation of the stochastic reserve.
23. A “secondary guarantee” is a guarantee that a policy will remain in force for some period of time (the secondary guarantee period) even if its fund value is exhausted, subject to one or more conditions.

~~24. The term “seriatim reserve” means the amount determined for a given policy that is used as a step in the calculation of the deterministic reserve.~~

~~25.~~24. The term “stochastic reserve” means the amount determined in Section 5.

~~26.~~25. The term “stochastic exclusion test” means a test to determine whether a group of policies is required to comply with stochastic modeling requirements.

~~27.~~26. The term “universal life insurance policy” means a life insurance policy where separately identified interest credits (other than in connection with dividend accumulations, premium deposit funds, or other supplementary accounts) and mortality and expense charges are made to the policy. A universal life insurance policy may provide for other credits and charges, such as charges for cost of benefits provided by rider.

~~28.~~27. The term “variable life insurance policy” means a policy that provides for life insurance, the amount or duration of which varies according to the investment experience of any separate account or accounts established and maintained by the insurer as to the policy.

## Section 2. Minimum Reserve

- A. All policies subject to these requirements shall be included in one of the groups defined by paragraphs 1, 2 or 3. The company may elect to exclude one or more groups of policies from the stochastic reserve calculation and the deterministic reserve calculation if the exclusion tests determined pursuant to section 6 are passed. The minimum reserve equals the sum of:
1. For the group of policies that pass both the stochastic exclusion and the deterministic exclusion test: the aggregate net premium reserve for those policies.
  2. For the group of policies that pass the stochastic exclusion test but do not pass the deterministic exclusion test: the aggregate net premium reserve plus the excess, if any, of the deterministic reserve determined pursuant to Section 4 over the quantity (A-B) where A = the aggregate net premium reserve for those policies, and B = any due and deferred premium asset held on account of those policies.
  3. For the group of policies that fail the stochastic exclusion test, and for the group of policies not subject to the exclusion tests: the aggregate net premium reserve plus the excess, if any, of the greater of the deterministic reserve determined pursuant to Section 4 and the stochastic reserve determined pursuant to Section 5 over the quantity (A-B) where A = the aggregate net premium reserve for those policies, and B = any due and deferred premium asset held on account of those policies.
- B. For purposes of this Section, the aggregate net premium reserve for a group of policies is the sum of the net premium reserve pursuant to Section 3 for each of the policies of the group less any net premium reserve credit for reinsurance ceded pursuant to Section 8.B. for the same group of policies.

- C. The minimum reserve for each policy is equal to the net premium reserve for that policy calculated as specified in Section 3 less that policy's portion of any net premium reserve credit for reinsurance ceded as specified in Section 8.B. (the Allocation Net Premium Reserve) plus the policy's allocated portion of any reserve excess defined as: .

For each policy of the group whose reserve is determined according to A.2., that policy's allocated portion of any reserve excess is the Allocation Net Premium Reserve for that policy multiplied by the ratio of the deterministic reserve excess determined by A.2. divided by the aggregate Allocation Net Premium Reserves for that group of policies.

For each policy of the group whose reserve is determined according to A.3., that policy's allocated portion of any reserve excess is the Allocation Net Premium Reserve for that policy multiplied by the ratio of the reserve excess determined by A.3. divided by the aggregate Allocation Net Premium Reserves for that group of policies.

- D. If the company elects to perform the stochastic and deterministic exclusion tests in Section 6 pursuant to section 2.B above, then:
1. Stochastic reserves must be calculated for each group of policies that fail the stochastic exclusion test in Section 6.
  2. Deterministic reserves must be calculated for each group of policies that fail either the deterministic exclusion or stochastic exclusion tests in Section 6.
  3. If a company elects to calculate stochastic reserves for one or more groups of policies, the company is not required to perform the exclusion tests in Section 6 for those policies.
  4. A group of policies for which neither deterministic nor stochastic reserves are required or calculated are not principle-based valuation reserves as defined under the Standard Valuation Law.
- E. The company may calculate the deterministic reserve and the stochastic reserve 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; and
  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 net premium reserve, the deterministic reserve and/or the stochastic reserve 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. This does not preclude use of model segmentation for purposes of determining discount rates.
- ~~In such case, information shall be available to ensure that a deterministic reserve amount calculated as the total of the seriatim (policy by policy, with respect to liability cash flows) reserve calculations produces a reserve not materially different than the deterministic reserve amount calculated using groupings of policies. This does not preclude use of model segmentation for purposes of determining discount rates. VM 31 Section 3.E.3. provides details.~~
- H. The reserves for supplemental benefits and riders shall be calculated consistent with the requirements for "Riders and Supplemental Benefits" in VM-00, Section II.

### Section 3. Net Premium Reserve

#### A. Applicability

1. The net premium reserve for each term policy, universal life insurance with secondary guarantee policy (definitions of products to be included need to be determined) must be determined pursuant to Section 3.
2. Except for policies subject to Section 3.A.1, the net premium reserve 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.

- B. For purposes of this Section 3 and Section 6, the following definitions apply:

1. The “fully funded secondary guarantee” at any time is:
  - a. 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.
  - b. 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.
2. The “actual secondary guarantee” at any time is:
  - a. For a shadow account secondary guarantee, the actual shadow account fund value at that time.
  - b. 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.
3. The “level secondary guarantee” at any time is:
  - a. For a shadow account secondary guarantee, the shadow account fund value at that time assuming payment of the level gross premium determined according to Subsection 3.B.6.c.i.
  - b. For a cumulative premium secondary guarantee, the amount of cumulative level gross premiums determined according to Section 3.B.6.c.i, accumulated with any interest or accumulation factors per the contract provisions for the secondary guarantee.

**Guidance Note:** The definition of the net premium reserve in subsections 4, 5 and 6 is intended to result in a terminal net premium reserve under the assumption of an annual mode gross premium. The gross premium referenced should be the gross premium for the policy assuming an annual premium mode. The reported reserve as of any valuation date should reflect the actual premium mode for the policy and the actual valuation date relative to the policy issue date either directly or through adjusting accounting entries.

4. For all policies other than universal life policies, on any valuation date the net premium reserve 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.
    - i. For policies subject to the shock lapse provisions of Section 3.C.3.b.iii, valuation net premiums for policy years after the shock lapse shall be limited and may result in two uniform percentages, one applicable to policy years prior to the shock lapse and one applicable to policy years following the shock lapse. For these policies, these percentages shall be determined as follows:
    - ii. Compute the actuarial present value of benefits for policy years following the shock lapse.
    - iii. Compute the actuarial present value of valuation net premiums for policy years following the shock lapse.
    - iv. If ii/i is greater than 135%, reduce the net valuation premiums in ii uniformly to produce a ratio of ii/i of 135%.
    - v. 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.
  - d. Actuarial present values are calculated using the interest, mortality, and lapse assumptions prescribed in Section 3.C.
5. For any universal life policy, a reserve shall be determined by the policy features and guarantees of the policy without considering any secondary guarantee provisions. The net premium reserve shall be calculated as follows:
- a. 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.
  - b. Using the level gross premium from Section 3.B.5.a, determine the value of the expense allowance components for the policy at issue as  $x_1$ ,  $y_{2-5}$ , and  $z$  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

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

The expense allowance,  $E_{x+t}$ , shall be amortized as follows over the period for which premiums are permitted to be paid:

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

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

Where:

$VNPR$  = Valuation Net Premium Ratio from 3.B.5.c.

$$C_{x+t} = 0 \quad \text{when } t = 1$$

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

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

- c. 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.
- d. For a policy issued at age  $x$ , on any valuation date  $t$ , the net premium reserve shall equal:

$m_{x+t} \cdot r_{x+t}$  where:

- i.  $m_{x+t}$  = 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,  $E_{x+t}$ ,
- ii.  $r_{x+t}$  = the ratio  $e_{x+t} / f_{x+t}$ , but not greater than 1, with  $(e_{x+t})$  and  $(f_{x+t})$  defined as below:

= the actual policy fund value on the valuation date  $t$

$f_{x+t}$  = The policy fund value on the valuation date  $t$  is that amount which, together with the payment of the future level gross premiums determined in subsection 3.B.5.a 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.

- e. The future benefits used in determining the value of  $m$  shall be based on the policy fund value on the valuation date  $t$  together with the future payment of the level gross premiums determined in subsection 3.B.5.a above, and assuming the policy guarantees of mortality, interest and expenses.
- f. The values of  $\ddot{a}$  are determined using the net premium reserve interest, mortality and lapse assumptions applicable on the valuation date.



- g. Actuarial present values referenced in this subsection 3.B.5 are calculated using the interest, mortality, and lapse assumptions prescribed in Subsection C of this section.
6. For any universal life policy for which the longest secondary guarantee period is more than five years, or if less than five years, specified premium for the secondary guarantee period is less than the net level reserve premium for the secondary guarantee period based on the CSO valuation tables as defined in VM-20 Section 3.C and VM-M, or the applicable valuation interest rate; and the initial surrender charge is less than 100% of the first year annualized specified premium for the secondary guarantee period, during the secondary guarantee period the net premium reserve shall be the greater of the reserve amount determined according to subsection 3.B.5, assuming the policy has no secondary guarantees, and the reserve amount for the policy determined according to the methodology and requirements subsections 3.B.6.b through 3.B.6.e below.
- a. After the expiration of the secondary guarantee period, the net premium reserve shall be the net premium reserve determined according to subsection 3.B.5 only.
- b. If the policy has multiple secondary guarantees, the net premium reserve shall be calculated as below for the secondary guarantee that provides the longest period for which the policy can remain in force under the provisions of the secondary guarantee, such period defined as “n” in this Subsection. The resulting net premium reserve shall be used in the comparison with the net premium reserve calculated in accordance with Subsection 3.B.5.
- c. As of the policy issue date:

- 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 “v” in this Subsection that would keep the policy in force to the end of the secondary guarantee period, based on the secondary guarantee assumptions as to mortality, interest and expenses. In no event shall “v” be greater than “n” for purposes of the net premium reserve calculated in this Subsection.
- ii. Using the level gross premium from subsection 3.B.6.c.i 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,  $E_{x-t}$ , shall be amortized as follows over the period for which premium are permitted to be paid:

$$E_{x+t} = VNPR * \ddot{a}_{x+t:\overline{v-t}|} [(x_1 + z_1)/\ddot{a}_{x:\overline{v}|} + y_{2-5} \cdot C_{x+t}] \quad \text{for } t < v$$

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

Where:

$VNPR$  = Valuation Net Premium Ratio from 3.B.6.c.iii

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

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

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

- iii. 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 and over the secondary guarantee period the actuarial present value of future valuation net premiums shall equal the actuarial present value of future benefits. The valuation net premium ratio determined shall not change for the policy.
- d. After the policy issue date, on each future valuation date,  $t$ , the net premium reserve shall be determined as follows:
- i. Determination should be made of the amount of actual shadow account as of the valuation date,  $ASG_{x+t}$ , as

defined in 3.B.2.

- ii. As of the valuation date for the policy being valued, for policies utilizing shadow accounts, determine the minimum amount of shadow account required to fully fund the guarantee,  $FFSG_{x+t}$ , as defined in 3.B.1. For any policy for which the secondary guarantee cannot be fully funded in advance, solve for the minimum sum of any possible excess funding (either the amount in the shadow account or excess cumulative premium payments depending on the product design) and the present value of future premiums (using the maximum allowable valuation interest rate and the minimum mortality standards allowable for calculating basic reserves) that would fully fund the guarantee. The result from i above should be divided by this number, with the resulting ratio capped at 1.00. 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.
- iii. Compute the net single premium ( $NSP_{x+t}$ ) on the valuation date for the coverage provided by the secondary guarantee for the remainder of the secondary guarantee period, using the interest, lapse and mortality assumptions prescribed in Subsection C of this section. The net single premium shall include consideration for death benefits only.
- iv. The net premium reserve for an insured age  $x$  at issue at time  $t$  shall be according to the formula below:

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

- e. Actuarial present values referenced in this subsection B.6 are calculated using the interest, mortality and lapse assumptions prescribed in Subsection C of this section.
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.

## C. Net Premium Reserve Assumptions

### 1. Mortality Rates

- a. Except as indicated in subsection 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 Subsection B of this Section shall be the 2001 Commissioners Standard Ordinary (CSO) Mortality Table as defined in VM-M Section 1.G. of this manual.
- b. Subject to the conditions defined in 3.C.1.c., the 2017 Commissioners’ Standard Ordinary Mortality Tables as defined in VM-M Section 1.H. is required as the valuation standard for Ordinary Life policies issued on or after January 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 January 1, 2017.
- 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:
    - (a) Composite mortality tables to determine minimum reserve liabilities; or
    - (b) 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.
  - iv. Gender-Blended Tables shall apply in the following circumstances:
 

For any ordinary life insurance policy delivered or issued for delivery that utilizes the same premium rates

and charges for male and female lives or is issued in circumstances where applicable law does not permit distinctions on the basis of gender, a mortality table that is a blend of the 2017 CSO Mortality Table (M) and the 2017 CSO Mortality Table (F) may, at the option of the company for each plan of insurance, be used in determining minimum reserves.

- d. At the election of the company, for any one or more specified plans of insurance and subject to satisfying the conditions stated in 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 January 1, 2017.
- 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 ten 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 valuation basic table 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 valuation basic table 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 ten 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 valuation basic table 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 valuation basic table.
  - 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 and applied to the 2017 CSO consistently with the 2001 CSO.

**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, 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.

## 2. Interest Rates

**Drafting 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 net premium reserve mortality and lapse assumptions, the interest rate used in the net premium reserve 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 net premium reserve amounts calculated according to:
- i. Section 3.B.5 for policies and riders for which nonforfeiture benefits are provided; or
  - ii. Section 3.B.6.

The calendar year net premium reserve interest rate  $I$  shall be determined according to this subsection 3.C.2.a and subsections 3.C.2.b and 3.C.2.c below and the results rounded to the nearer one-quarter of one percent ( $1/4$  of 1%). This rate shall be used in determining the present values described in Subsection B of this Section for all policies issued in the calendar year next following its determination.

$$I = .03 + W * (R_1 - .03) + (W/2) * (R_2 - .09)$$

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 Subsection 2.b. below

$W$  is the weighting factor for a policy, as defined in Subsection 2.c. below

However, if the calendar year net premium reserve 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 one percent ( $1/2$  of 1%), the calendar year net premium reserve interest rate shall be set equal to the corresponding actual rate for the immediately preceding calendar year.

- b. 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, Inc.
- c. The weighting factor  $W$  for a policy shall be determined from the table below:

<u>Guarantee Duration (Years)</u>	<u>Weighting Factor</u>
10 or less	.50
More than 10 but not more than 20	.45
More than 20	.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.

- d. For reserve amounts calculated according to:
- i. Section 3.B.5 of this Section for policies and riders for which no nonforfeiture benefits are provided; or
  - ii. Section 3.B.7 of this Section.

The calendar year net premium reserve interest rate shall be calculated by increasing the rate determined according to Subsections 3.C.2.a through 3.C.2.c above by 1.5%, but in no event greater than 125% of the rate determined according to Subsection 3.C.2.a through 3.C.2.c above rounded to the nearer one-quarter of one percent ( $1/4$  of 1%).

**Drafting 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 policies other than universal life policies or riders which provide nonforfeiture values, universal life policies not containing a secondary guarantee, and universal life policies for which the longest secondary guarantee period is five years or less, the lapse rates used in determining the present values described in subsection 3.B shall be 0% per year during the premium paying period and 0% per year thereafter.
- b. For policies other than universal life policies or riders which provide no nonforfeiture values (i.e., term policies), the annual lapse rates used to determine the present values described in subsection 3.B 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.
  - ii. 6% per year during any level premium period of five or more years, except as noted in iii.
  - iii. 10% per year during any premium paying period after an initial level premium period of less than five years.
  - iv. For policies or riders having a level premium of five years or longer, the lapse rate for the first year of the renewal premium period shall be determined based on the length of the current and renewal premium periods and the percent increase in the gross premium as shown in the table below instead of what would otherwise apply from i or ii above.

Current Premium Years	Length of Renewal Premium	Percent Increase in Gross Premium Per	Rate for First Year of Renewal
≤1	ART	Any	10%
1<PP≤5	ART	Any	50%
1<PP≤5	1<PP≤5	Any	25%
5<PP≤10	ART	< 400%	70%
5<PP≤10	ART	Over 400%	80%
5<PP≤10	1<PP≤5	Any	50%
5<PP≤10	5<PP≤10	Any	25%
10<PP	ART	< 400%	70%
10<PP	ART	Over 400%	80%
10<PP	1<PP≤5	Any	70%
10<PP	5<PP≤10	Any	50%
10<PP	10<PP	Any	50%

- c. For universal life policies, for which the longest secondary guarantee period is more than five years, the lapse rate,  $L_{x+t}$ , used to determine the present values described in Subsection B at time  $t$  for an insured age  $x$  at issue shall be determined as follow:

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

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

Where:

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

$ASG_{x+t}$  = the actual secondary guarantee at time  $t$  for the insured age  $x$  at issue

$LSG_{x+t}$  = the level secondary guarantee at time  $t$  for the insured age  $x$  at issue

- ii. The lapse rate for the policy for durations  $t+1$  and later shall be set equal to:

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

Where  $r_{x+t}$  is the ratio determined in Subsection 3.B.5.d.ii.

#### D. Net Premium Reserve Calculation and Cash Surrender Value Floor

1. For policies other than universal life policies, the net premium reserve 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 determined using the mortality tables for the policy prescribed in subsection 3.C; or
  - 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 net premium reserve on the valuation date.

**Drafting Note:** It may be appropriate to consider potential simplifications for the net premium reserve for YRT reinsurance assumed. The unearned annual tabular cost of insurance (“interpolated  $C_x$ ”) is one potential option to examine.

2. For a universal life policy, the net premium reserve 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 determined using the mortality tables for the policy prescribed in subsection 3.B; or
  - 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 net premium reserve on the valuation date.

#### Section 4. Deterministic Reserve

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

A. Calculate the deterministic reserve equal to the actuarial present value of benefits, expenses, and related amounts less the actuarial present value of premiums and related amounts amounts, less the positive or negative PIMR balance allocated to the group of one or more policies being modeled under Section 7.D.56, where:

1. Cash flows are projected in compliance with the applicable requirements in Sections 7, 8 and 9 over the single economic scenario described in Section 7.G.1.
2. Present values are calculated using the path of discount rates for the corresponding model segment determined in compliance with Section 7.H.4.
3. The actuarial present value of benefits, expenses and related amount equals the sum of:
  - a. Present value of future benefits, but before netting the repayment of any policy loans;

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

- b. Present value of future expenses excluding federal income taxes and expenses paid to provide fraternal benefits in lieu of federal income taxes;
- c. Policy account value invested in the separate account at the valuation date; and

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

- d. Policy loan balance at the valuation date with appropriate reflection of any relevant due, accrued or unearned loan interest, if policy loans are explicitly modeled under Section 7.F.3.

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

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

- a. Future gross premium payments and/or other applicable revenue;
- b. Future net cash flows to or from the general account, or from or to the separate account;
- c. Future net policy loan cash flows, if policy loans are explicitly modeled under Section 7.F.3;

**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.

- d. Future net reinsurance discrete cash flows determined in compliance with Section 8;
  - e. The future net reinsurance aggregate cash flows allocated to this group of policies as described in Subsection B of this section; and
  - f. The future derivative liability program net cash flows (i.e., cash received minus cash paid) that are allocated to this group of policies.
- 5. If a group of policies is excluded from the stochastic reserve requirements, the company may not include future transactions associated with non-hedging derivative programs in determining the deterministic reserve for those policies.

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

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

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

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

- C. Future net reinsurance aggregate cash flows shall be allocated as follows:

- 1. Future net reinsurance aggregate cash flows shall be allocated to each policy reinsured under a given reinsurance agreement in the same proportion as the ratio of each policy's present value of future net

reinsurance discrete cash flows to total present value of future net reinsurance discrete cash flows under the reinsurance agreement.

2. Future net reinsurance aggregate cash flows allocated to a group of policies is equal to the sum of future net reinsurance aggregate cash flows allocated to each policy in the group.

## Section 5. Stochastic Reserve

The company shall calculate the stochastic reserve for all policies (pursuant to section 2.A) or for a group of policies (pursuant to section 2.B) as follows:

- A. Project cash flows in compliance with the applicable requirements in Sections 7, 8 and 9 using the stochastically generated scenarios described in Section 7.G.2.
- 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.5 from the projection start date to the end of the respective projection year.

**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.~~56~~.

- G. The stochastic reserve equals the amount determined in Subsection 5.F. If the company defines two or more subgroups for aggregation purposes as described in Section 7.B.3, the company shall calculate the amount determined in Section 5.F for each subgroup of policies on a standalone basis, and sum together those amounts for each subgroup to determine the total stochastic reserve.

## Section 6. Stochastic and Deterministic Exclusion Tests

- A. Companywide Exemption

1. A company meeting all of the following conditions may file a statement of exemption for the current calendar year with their domestic commissioner prior to July 1 of that year certifying that these conditions are met based on premiums and other values from the prior calendar year financial statements and that any ULSG business issued since the operative date of the Valuation Manual meets the definition for non-material secondary guarantee. The statement of exemption must also be included with the NAIC filing for the second quarter of that year. The Commissioner may reject such statement prior to September 1 and require the company to follow the requirements of VM-20 for the Ordinary Life policies. Otherwise, the minimum reserve requirements for its Ordinary Life policies are those pursuant



to applicable methods required in VM-A and VM-C using the mortality as defined in Section 3.C.1 and VM-M Section 1.H.

2. Conditions for exemption:

- a. The company has less than \$300 million of ordinary life premiums<sup>1</sup> and, if the company is a member of an NAIC group of life insurers, the group has combined ordinary life premiums<sup>1</sup> of less than \$600 million,

And

- b. The company reported Total Adjusted Capital of at least 450% of the authorized control level RBC in the most recent RBC report, and the appointed actuary has provided an unqualified opinion on the reserves,

And

- c. Any ULSG policies issued or assumed by the company with an issue date on or after the operative date of the valuation manual meet the definition of a non-material secondary guarantee ULSG product.

B. Stochastic Exclusion Test

1. Requirements to pass the stochastic exclusion test:

- a. Groups of policies pass the stochastic exclusion test if:

- i. Annually and within 12 months before the valuation date the company demonstrates that the groups of policies pass the stochastic exclusion ratio test defined in Section 6.B.2;
- ii. 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.B.3; or
- iii. For groups of policies other than variable life or universal life with a secondary guarantee, 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 their 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 reserves for the group of policies calculated according to Sections 5–9 of VM-05, VM-A and VM-C 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 7 scenarios.
- (b) A demonstration that the group of policies passed the stochastic exclusion ratio test within 36 months prior to the valuation date and the company has not had a material change in its interest rate risk.

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<sup>1</sup> Premiums are measured as direct plus reinsurance assumed from an unaffiliated company from the Ordinary Life line of business reported in the prior calendar year L & H annual statement, Exhibit 1 Part 1.

- (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 element 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 clearly defined hedging strategies from stochastic reserve requirements.

## 2. Stochastic Exclusion Ratio Test

- a. In order to exclude a group of policies from the stochastic reserve requirements using the method allowed under Section 6.B.1.a, a company shall demonstrate that the ratio of (b-a)/c is less than 6.0% where:
  - i. a = the adjusted deterministic reserve described in subsection 6.B.2.b.i using the baseline economic scenario described in Appendix 1.
  - ii. b = the largest adjusted deterministic reserve described in subsection 6.B.2.b.i under any of the other 15 economic scenarios described in Appendix 1.
  - iii. c = an amount calculated from the baseline economic scenario described in Appendix 1 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."
- b. In calculating the ratio in item a above:
  - i. the company shall calculate an adjusted deterministic reserve for the group of policies for each of the 16 scenarios that is equal to the deterministic reserve defined in Section 4.A, but with the following differences:
    - (a) Using anticipated experience assumptions with no margins;
    - (b) Using the interest rates and equity return assumptions specific to each scenario; and
    - (c) Using net asset earned rates specific to each scenario to discount the cash flows.
  - 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 this VM-20.
  - iii. The company shall use anticipated experience 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. Mortality improvement beyond the projection start date may not be reflected in anticipated experience assumptions for the purpose of the calculating the stochastic exclusion ratio.
  - vi. Alternatively, a company may use gross premium reserves developed from the cash flows from the company's Asset Adequacy Analysis models in lieu of the deterministic reserve. In this case, the company may use the experience assumptions of the company's cash flow analysis as the anticipated

experience assumptions. The interest rates and discount rates will be those defined in b.i.2. and b.i.3. above.

- c. If the ratio calculated in paragraph (a) above is less than 6.0% pre-YRT reinsurance, but is greater than 6.0% post- YRT reinsurance, the group of policies will still pass the Stochastic Exclusion Test if the company can demonstrate that the sensitivity of the adjusted deterministic reserve to economic scenarios is comparable pre- and post- YRT reinsurance.

i. An example of an acceptable demonstration:

1. For convenience in notation • SERT = the ratio (b-a)/c defined in (a) above
  - The pre- YRT reinsurance results are "gross of YRT," with a subscript "gy," so denoted  $SERT_{gy}$
  - The post- YRT results are "net of YRT," with subscript "ny," so denoted  $SERT_{ny}$
2. 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.
3. So, if  $SERT_{gy} \leq 0.060$  but  $SERT_{ny} > 0.060$ , then compute the Largest Percent Increase in Reserve (LPIR) =  $(b - a)/a$ , both "gross of YRT" and "net of YRT."

$$LPIR_{gy} = (b_{gy} - a_{gy})/a_{gy}$$

$$LPIR_{ny} = (b_{ny} - a_{ny})/a_{ny}$$

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

If  $SERT_{gy} \times LPIR_{ny}/LPIR_{gy} < 0.060$ , then the block of policies passes the Stochastic Exclusion Ratio Test.

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

### 3. Stochastic Exclusion Demonstration Test

- a. In order to exclude a group of policies from the stochastic reserve requirements using the method as allowed under Section 6.B.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 stochastic reserve was calculated on a standalone basis for the group of policies subject to the stochastic reserve 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 stochastic reserve 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 stochastic exclusion test for those policies.

- iii. The demonstration may be based on analysis from a date that proceeds the initial or subsequent exclusion period.
- 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 commissioner to demonstrate compliance with subsection 6.B.3.a:
  - i. Demonstrate that the greater of [the quantity A and the quantity B] is greater than the stochastic reserve calculated on a standalone basis, where:

A = the deterministic reserve, and  
B = the net premium reserve 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 deterministic reserve, and  
B = the net premium reserve 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 stochastic reserve calculated on a standalone basis, but using a representative sample of policies in the stochastic reserve calculations, where:

A = the deterministic reserve, and  
B = the net premium reserve less any associated due and deferred premium asset.
  - iv. Demonstrate that any risk characteristics that would otherwise cause the stochastic reserve calculated on a standalone basis to exceed greater of the deterministic reserve and the net premium reserve, 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.

#### C. Deterministic Exclusion Test

- 1. A group of universal life policies with a secondary guarantee that does not meet the definition of a 'non-material secondary guarantee' or a group of policies which is not excluded from the stochastic reserve requirement is deemed to not pass the deterministic reserve exclusion test and the deterministic reserve must be computed for this group of policies.
- 2. Except as provided in subsection 6.C.1, a group of policies passes the deterministic reserve exclusion test if the company demonstrates that the sum of the valuation net premiums for all future years for the group of policies, determined according to paragraph 5 below, is less than the sum of the corresponding guaranteed gross premiums for such policies. The test shall be determined on a direct or assumed basis.
- 3. A company may not group together policies of different contract types with significantly different risk profiles for purposes of the calculation in subsection 6.C.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 each five years going forward.
- 5. For purposes of determining the valuation net premiums used in the demonstration in subsection 6.C.2:

- a. If pursuant to Section 2 the net premium reserve is the minimum reserve required under Section 2.A of the Standard Valuation Law for policies issued prior to the operative date of the Valuation Manual, the valuation net premiums are determined according to those minimum reserve requirements;
- b. If the net premium reserve is determined according to Section 3.A.1, the lapse rates assumed for all durations are 0%;
- c. For policies with guaranteed gross premium patterns that subject the policy to shock lapses, as defined in Section 3.C.3.b.iii, 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 valuation mortality, then the company shall substitute the anticipated mortality to determine the net premium. For this purpose, mortality shall be measured as the present value of future death claims discounted at the valuation interest rate used for the net premium reserve.
- e. The guaranteed gross premium is defined as:
  - i. For universal life policies, the guaranteed gross premium shall be the premium specified in the contract, or if no premium is specified, 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
  - ii. For policies other than universal life policies, the guaranteed gross premium shall be the guaranteed premium specified in the contract.

## Section 7. Cash Flow Models

### A. Model Structure

1. The company shall design and use a cash flow model that:
  - a. Complies with applicable Actuarial Standards of Practice in 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.1.b.
  - 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 deterministic reserve and for each scenario for the stochastic reserve, 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.B.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.

- b. Amounts charged to account values on general accounts business and use those amounts to determine any effects on future policy benefits, and not as revenue.

**Guidance Note:** Amounts charged to account values on general accounts business examples include cost of insurance and expense charges.

- c. All material benefits paid to policyholders, including but not limited to death claims, surrender benefits, and withdrawal benefits, reflecting the impact of all material guarantees.
- 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).
- 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.
- g. Net cash flows associated with any reinsurance as described in Section 8.
- h. Cash flows from derivative liability and derivative asset programs, as described in Section 7.L.
- i. Cash receipts or disbursements associated with investment income, realized capital gains and losses, principal repayments, asset default costs, investment expenses, asset prepayments, and asset sales. Cash flows related to policy loans are handled in the reserve calculation in a manner similar to cash flows to and from separate accounts.

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

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

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

- 3. In determining the stochastic reserve, 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 the

different product types, and that reflects the likelihood of any change in risk offsets that could arise from shifts between product types. If a company is managing the risks of two or more different product types as part of an integrated risk management process, then the products may be combined into the same subgroup.

**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).

C. Non-Guaranteed Element Cash Flows

1. Except as noted in subsection 7.C.5, the company shall include non-guaranteed elements (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; and
  - 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 subsection 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 they 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 such that the aggregate annual statement value of the assets at the projection start date equals the estimated value of the ~~minimum-modeled~~ reserve plus the PIMR balance on the projection start date, allocated to the policies in the appropriate model segment subject to the following:
  - a. Starting asset values shall include the relevant balance of any due, accrued or unearned investment income.
  - b. 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.
- ~~e.2.~~ If for all model segments combined, the aggregate annual statement value of starting assets is less than 98% or greater than the larger of NPR or 102% of the final ~~aggregate-modeled (whether stochastic or deterministic)~~ reserve, the company shall provide documentation in the PBR Actuarial Report that provides reasonable assurance that the ~~aggregate-modeled~~ reserve is not materially understated as a result of the estimate of the amount of starting assets.
- ~~2.3.~~ 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.E.
  - c. 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.
  - d. The negative of any pretax interest maintenance reserve liability that can be allocated to each model segment at the projection start date subject to the following:
  - 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.
- ~~3.4.~~ The aggregate value of general account starting assets is the sum of the amounts in Subsections 7.D.~~2.3~~.b through 7.D.~~2.3~~.d above.

**Guidance Note:** The aggregate value of general account assets in subsection 7.D.~~3-4~~ 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 subsection 7.D.~~2.3~~.d above may include negative assets or short-term borrowing, resulting in a projected interest expense.
- ~~4.5.~~ The company shall calculate the projected values of starting assets in a manner consistent with their values at the start of the projection.
- ~~5.6.~~ Under Sections 4 and 5, any pre-tax interest maintenance reserve (“PIMR”) balance allocated to the group of one or more policies being modeled at the projection start date is included in the calculations of the respective reserves. The determination of the PIMR allocation is subject to the following:
  - i. 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.



- ii. 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).
- iii. 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 model 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. Treasury 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. (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 for interest rate swap spreads.
- f. For purchases of other fixed income investments, if included in the model 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.
- g. Notwithstanding the above requirements, the model investment strategy and/or any non-prescribed asset spreads shall be adjusted as necessary so that the ~~minimum-modeled~~ reserve is not less than would be obtained by substituting an alternative investment strategy in which all fixed income reinvestment assets are 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). The following pertains to this requirement:
  - i. Policy loans, equities, and derivative instruments associated with the execution of a clearly defined hedging strategy (in compliance with Sections 7.L and 7.M) are not impacted by this requirement.

**Guidance Note:** In many cases, particularly if the model 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 model

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.

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. 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 Sections 7.E.1.d and 7.E.1.f above, recognizing that starting assets may have different characteristics than modeled reinvestment assets.
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 ~~minimum-modeled~~ reserve more than 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.J.
  - 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; and
    - 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 deterministic reserve and the stochastic reserve, 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 deterministic reserve and stochastic reserve, 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 which occur automatically upon death or surrender. In calculating the deterministic reserve and the stochastic reserve, include policy loan principle repayments as a positive policy loan cash flow, per Section 4.A.4.
    - v. Model additional policy loan principal. In calculating the deterministic and stochastic reserve, include additional policy loan principal as a negative policy loan cash flow, per Section 4.A.4.
    - 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 all other general account assets by modeling asset cash flows on other assets that are not described in subsections 7.F.1 through 7.F.3 using methods consistent with the methods described in subsections 7.F.1 and 7.F.2. This includes assets that are a hybrid of fixed income and equity investments.
5. Determine cash flows or total investment returns as appropriate for each projection interval for all separate account assets in a manner that is consistent with the prescribed separate account asset returns described in Section 7.G.

G. Economic Scenarios

1. Deterministic Economic Scenarios
  - a. For purposes of calculating the deterministic reserve under Section 4, the company shall use:
    - i. U.S. Treasury interest rate curves following Scenario 12 from the set of prescribed scenarios used in the stochastic exclusion ratio test defined in Section 6.C; and
    - ii. Total investment return paths for general account equity assets 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 stochastic exclusion ratio test defined in Section 6.C.

- b. The company shall map each of the proxy funds defined in Sections 7.J and 7.K 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 stochastic reserve under Section 4, the company shall use:
  - i. U.S. 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 the American Academy of Actuaries for C3P2: Treasuries at different tenors, money market/short term investments, U.S. Intermediate Term Government Bonds, U.S. Long Term Corporate Bonds, Diversified Fixed Income, Diversified Balanced Allocation, Diversified Large Capitalized U.S. Equity, Diversified International Equity, Intermediate Risk Equity, and Aggressive or Specialized Equity).

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

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

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

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

$$\text{Market Price of Risk} = \left( \frac{E[R_X] - r}{\sigma_X} \right) = \left( \frac{E[R_Y] - r}{\sigma_Y} \right)$$

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

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

Clearly, there are many other techniques that could be used to 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 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 shall also perform a periodic analysis of the impact of using a different number of scenarios on the stochastic reserve, noting the difference in results as the number of scenarios is increased. Again, an appropriate subset of the entire inforce block can be used for this analysis.

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

- 1. In calculating the deterministic reserve the company shall determine a path of net asset earned rates 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 net asset earned rate as the ratio of net investment earnings divided by invested assets subject to the requirements in a–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 net asset earned rate 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. Investment income plus capital gains and losses, minus appropriate default costs and investment expenses; and
  - 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.

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

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

43. The company shall use the path of net asset earned rates as the discount rates for each model segment in the deterministic reserve calculations in Section 4, and the stochastic exclusion test in Section 6.
54. The company shall use the path of one-year U.S. 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 stochastic reserve calculations in Section 5.

**Guidance Note:** The use of different discount rate paths for the ~~seriatim-deterministic~~ and scenario reserves is driven by differences in methodology. The ~~seriatim-deterministic~~ reserve 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 deterministic reserve and the stochastic reserve, 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 a clearly defined hedging strategy; and 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.

**Guidance Note:** The prohibition in these ~~minimum-modeled~~ reserve requirements against projecting future hedging transactions other than those associated with a clearly defined hedging strategy is intended to address initial concerns expressed by various parties that reserves could be unduly reduced by reflection of programs whose future execution and performance may have greater uncertainty. The prohibition appears, however, to be in conflict with Principle 2 listed in the Valuation Manual. Companies may actually execute and reflect in their risk assessment and evaluation processes hedging strategies similar in many ways to clearly defined hedging strategies but lack sufficient clarity in one or more of the qualification criteria. By excluding the associated derivative instruments, the investment strategy that is modeled may also not reflect the investment strategy the company actually uses. Further, since the future hedging transactions may be a net cost to the company in some scenarios and a net benefit in other scenarios, the exclusion of such transactions can result in a ~~minimum-modeled~~ reserve that is either lower or higher than it would have been if the transactions were not excluded. The direction of such impact on the reserves could also change from period to period as the actual and projected paths of economic conditions change. A more graded approach to recognition of non-qualifying hedging strategies may be more theoretically consistent with Principle 2. The requirements stated here for handling hedging strategies are essentially consistent with those included in the CTE methodology portion of the September 2006 exposure draft of Actuarial Guideline VACARVM for variable annuity reserving. It is recommended that, as greater experience is gained by actuaries and regulators with the principle-based approach, and as industry hedging programs mature, the various requirements of this section be reviewed.

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 clearly defined hedging strategies, 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.
3. In circumstances where one or more material risk factors related to a derivative program is not fully captured within the cash flow model used to calculate CTE 70, the company shall reflect such risk factors by increasing the stochastic reserve as described in Section 5.E.

**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.

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

L. Clearly Defined Hedging Strategy

1. A clearly defined hedging strategy must identify:
  - a. The specific risks being hedged (e.g., cash flow, policy interest credits, delta, rho, vega, etc.).
  - b. The hedge objectives.
  - c. The risks that are not hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.).
  - d. The financial instruments used to hedge the risks.
  - e. The hedge trading rules including the permitted tolerances from hedging objectives.
  - f. The metrics for measuring hedging effectiveness.
  - g. The criteria used to measure effectiveness.
  - h. The frequency of measuring hedging effectiveness.
  - i. The conditions under which hedging will not take place.
  - j. The person or persons responsible for implementing the hedging strategy.
  - k. Areas where basis, gap or assumption risk related to the hedging strategy have been identified.
  - l. The circumstances under which hedging strategy will not be effective in hedging the risks.
2. A clearly defined hedging strategy may be dynamic, static or a combination of dynamic and static.
3. Hedging strategies involving the offsetting of the risks associated with other products outside of the scope of these requirements is not a clearly defined hedging strategy.

**Guidance Note:** For purposes of the above criteria, “effectiveness” need not be measured in a manner as defined in NAIC *Accounting Practices and Procedures Manual*.

**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 *Accounting Practices and Procedures 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 net premium reserve and its cash flows should not be included in the cash flow models used to calculate the deterministic or stochastic reserve. 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 Net Premium Reserve to Reflect Reinsurance Ceded

1. Determination of the credit to the net premium reserve to reflect reinsurance shall be done in accordance with SSAP No. 61.

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

**Drafting Note:** The wording in subsection 8.B.1 may be replaced after the VM-20 Impact Study is completed.

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 Deterministic Reserve or Stochastic Reserve

In calculations of the deterministic reserve or stochastic reserve pursuant to Sections 4 and 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:
  - a. Stochastically model the risk factors directly in the cash flow model when calculating the stochastic reserve; or
  - 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 stochastic reserve to adequately make provision for the risks of the reinsurance features.

**Guidance Note:** Examples of reinsurance provisions where a single deterministic valuation assumption will not adequately capture the risk are stop-loss reinsurance.

**Drafting Note:** Additional guidance in an ASOP may be needed to explain further what features give rise to this stochastic modeling requirement.

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 deterministic reserve in Section 4 and stochastic reserves 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 deterministic or stochastic reserve 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 deterministic reserve in Section 4 and the stochastic reserve 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.
  - c. ~~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.~~
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 non-guaranteed elements 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 ~~minimum~~ 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 non-guaranteed elements 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 non-guaranteed elements 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.

710. The company shall use assumptions in determining the modeled ~~minimum~~ 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.

811. 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 non-guaranteed elements on policies.

912. The company shall set assumptions in a manner consistent with subsection 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.

4013. The company shall set assumptions in a manner consistent with subsection 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; and
  - 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 will generally not have to be determined by modeling. However, the projected modified coinsurance interest may have to be modeled. In many cases, the modified coinsurance 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 subsections 8.C.12-15 and 8.C.13-16 to reflect potential uncertainty regarding the receipt of cash flows from a counterparty, the company shall take into account the ratings, risk-based capital 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.

D. Determination of a pre-reinsurance-ceded minimum reserves

1. The minimum reserve pursuant to Section 2 is a post-reinsurance-ceded minimum reserve. The company shall also calculate a pre-reinsurance-ceded reserve as specified in 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 excess, if any, of the pre-reinsurance-ceded minimum reserve over the post-reinsurance-ceded minimum reserve. 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 this Valuation Manual VM-20, using methods and assumptions consistent with those used in calculating the minimum reserve, but excluding the effect of ceded reinsurance.
  - a. If, when ceded reinsurance is excluded, a group of policies is not able to pass the exclusion tests pursuant to Section 6, then the required deterministic or stochastic reserves 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 reserves.
  - c. The requirement in section 7.D.1.c regarding the 98% to 102% collar does apply when determining the amount of starting assets excluding the effect of ceded reinsurance.

**Drafting Note:** After the VM-20 Impact Study is completed, the allocation of the reinsurance credit to each reinsurance agreement should be reevaluated. The Task Force needs some basis for the allocation.

**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 prescribed or is not stochastically modeled by applying a margin to the anticipated experience assumption for the risk factor.
2. The company shall establish the prudent estimate assumption for each risk factor in compliance with the requirements in Section 12 of the NAIC Standard Valuation Law 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); and
  - b. Equity performance (e.g., 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 A.3 above, the requirements in this section for determining prudent estimate assumptions for these risk factors do not apply.
5. In determining the stochastic reserve the company shall use prudent estimate assumptions that are consistent with those prudent estimate assumptions used for determining the deterministic reserve, 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 actuary 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 appointed actuary 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 appointed actuary shall set a new, adequate, anticipated experience assumption for the factor.

7. The company shall examine the results of sensitivity testing to understand the materiality of prudent estimate assumptions on the ~~modeled minimum~~ reserve. The company shall update the sensitivity tests periodically as appropriate, considering the materiality of the results of the tests. The company may update the tests less frequently when the tests show less sensitivity of the ~~modeled minimum~~ 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, and
  - b. Using data from prior periods.
8. The company shall vary the prudent estimate assumptions from scenario to scenario within the stochastic reserve 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 assumption independently (i.e., ignoring any correlation among risk factors) in compliance with this section. 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 deterministic reserve as applicable or considering appropriate adverse circumstances for risk factors not stochastically modeled.

If not stochastically modeled or prescribed, assumptions that are generally considered material include but are not limited to mortality, morbidity, interest, equity returns, expenses, lapses, partial withdrawals, loans, and option elections.

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 Subsection 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 not required for assumptions when variations in the assumptions do not have a material impact on the modeled reserve.
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 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 subsection 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 subsection 9.C.3.

- ii. If the company determines company experience mortality rates as provided in subsection 9.C.2, then use the procedure described in subsection 9.C.3 to determine the applicable industry table for each mortality segment to grade company experience to the industry table.
  - iii. Determine the level of credibility of the underlying company experience as provided in subsection 9.C.4.
  - iv. Determine the prescribed mortality margins as provided in subsection 9.C.5. Separate mortality margins are determined for company experience mortality rates and for the applicable industry basic tables.
  - v. Use the procedure described in subsection 9.C.6 to determine the prudent estimate anticipated experience 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 limited, the company can choose to use an applicable industry basic table in lieu of its own company experience, as provided in subsection 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. When determining the company experience mortality rates for each mortality segment, the company can base the mortality on more aggregate experience and use other techniques to further subdivide the aggregate class into various subclasses or mortality segments (e.g., start with aggregate non-smoker 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). In doing so, the company must ensure that when the mortality segments are weighted together, the total number of expected claims is not less than the company experience data for the aggregate class.
  - e. The company shall review, and update as needed, the company experience data described in subsection 9.C.2.b, whether based on actual experience or 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 ten 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 subsection 9.C.6.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 criteria to mortality or longevity experience (for example, criterion and correlations determined through predictive analytics); and
  - 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 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 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 commissioner.

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

### 3. Determination of Applicable Industry Basic Tables

- a. The industry basic table shall be based on the most recent valuation basic table listed in VM-M Section 2, including the Primary, Limited Underwriting and RR Table forms, if available. The industry 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 table without approval by the commissioner.
- c. The company may apply the underwriting criteria scoring procedure described in subparagraph 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 subsection 9.C.6.b.iii.
- d. The underwriting criteria scoring procedure is the algorithm embedded in the Underwriting Criteria Score Calculator, adopted by the Life Actuarial (A) Task Force and maintained on the Society of Actuaries website, ([www.soa.org/Research/Experience-Study/Ind-Life/Valuation/2015-underwriting-criteria-calculator.aspx](http://www.soa.org/Research/Experience-Study/Ind-Life/Valuation/2015-underwriting-criteria-calculator.aspx)), which is used to score every risk class in a preferred risk class structure. The scoring is based on the specific underwriting criteria used by a company.
  - i. In using the underwriting criteria scoring procedure 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 underwriting scoring algorithm but which are applicable to policies that are 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 underwriting criteria scoring procedure is not designed to quantify that risk.

- ii. In using the underwriting criteria scoring procedure 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 underwriting scoring algorithm but which are applicable to such policies.
  - iii. In taking into account factors that are not recognized in the underwriting scoring algorithm, a company may, to the extent it can justify, adjust the industry basic tables up or down two tables from that determined by application of the underwriting criteria scoring procedures. Further adjustments to reflect risk characteristics not captured within the underwriting criteria scoring tool may be allowed upon approval by the commissioner.
- e. As an alternative to the Underwriting Criteria Scoring 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 Underwriting Criteria Scoring 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 UCS.

- 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:** Subsection 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. However, historical mortality improvement from the date of the industry basic table (e.g., 2015 for the 2015 VBT) to the valuation date may be incorporated using the improvement factors for the applicable industry table as determined by the SOA and published on the SOA website: [www.soa.org/Research/Experience-Study/Ind-Life/Valuation/research-YYYY-improve-scale-recommendation.aspx](http://www.soa.org/Research/Experience-Study/Ind-Life/Valuation/research-YYYY-improve-scale-recommendation.aspx).

**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 Subsection 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 start date 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.

#### 4. Credibility of Company Experience

- a. For valuations in which the industry 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 method).

For valuations in which the industry 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. Once chosen, the credibility method must be applied to all business subject to VM-20 and requiring credibility percentages. A company seeking to change credibility methods must request and subsequently receive the approval of the commissioner. The request must include the justification for the change and a demonstration of the rationale supporting the change.

Drafting Note: Determining the credibility using the Bühlmann Empirical Bayesian Method typically requires a statistical agent to calculate. The following formula can be utilized in conjunction with the 2015 VBT industry table to directly approximate:

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

where,

$A = \text{Sum of expected deaths by amount} = \Sigma (\text{amount insured}) \times (\text{exposure}) \times (\text{mortality})$

$B = \Sigma (\text{amount insured})^2 \times (\text{exposure}) \times (\text{mortality})$

$C = \Sigma (\text{amount insured})^2 \times (\text{exposure})^2 \times (\text{mortality})^2$

- b. Credibility may be determined at either the mortality segment level or at a more aggregate level if the mortality for the sub-classes (mortality segments) was determined using an aggregate level of mortality experience.
  - c. 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 (shown in column (1) in table in Subsection 9.C.6.iii) for grading company experience mortality rates into the applicable industry basic table.

#### 5. 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 subsection 9.C.4. The percentages are as follows:

- (i) For valuations in which the industry mortality table is the 2008 VBT:

att age	Credibility Level				
	0-19%	20-39%	40-59%	60-79%	80-100%
<45	21.0%	13.7%	8.4%	6.3%	5.3%
46-47	20.0%	13.0%	8.0%	6.0%	5.0%
48-49	19.0%	12.4%	7.6%	5.7%	4.8%
50-51	18.0%	11.7%	7.2%	5.4%	4.5%
52-53	17.0%	11.1%	6.8%	5.1%	4.3%
54-55	16.0%	10.4%	6.4%	4.8%	4.0%
56-57	15.0%	9.8%	6.0%	4.5%	3.8%
58-59	14.0%	9.1%	5.6%	4.2%	3.5%
60-61	13.0%	8.5%	5.2%	3.9%	3.3%
62-63	12.0%	7.8%	4.8%	3.6%	3.0%
64-68	11.0%	7.2%	4.4%	3.3%	2.8%
69-76	10.0%	6.5%	4.0%	3.0%	2.5%
77+	9.0%	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:

<b>Bühlmann Margins</b>												
<b>Credibility Level</b>												
Ages	0-7%	8-12%	13-17%	18-22%	23-27%	28-32%	33-37%	38-42%	43-47%	48-52%	53-57%	58-62%
<47	20.4%	20.4%	20.4%	20.4%	20.0%	19.3%	18.6%	17.9%	17.1%	16.3%	15.5%	14.6%
46 to 47	20.2%	20.2%	20.2%	20.2%	20.0%	19.3%	18.6%	17.9%	17.1%	16.3%	15.5%	14.6%
48 to 49	20.0%	20.0%	20.0%	20.0%	19.7%	19.1%	18.4%	17.6%	16.9%	16.1%	15.3%	14.4%
50 to 51	19.8%	19.8%	19.8%	19.8%	19.4%	18.8%	18.1%	17.4%	16.7%	15.9%	15.1%	14.2%
52 to 53	19.6%	19.6%	19.6%	19.6%	19.1%	18.5%	17.8%	17.1%	16.4%	15.6%	14.8%	14.0%
54 to 55	19.2%	19.2%	19.2%	19.2%	18.8%	18.2%	17.5%	16.8%	16.1%	15.4%	14.6%	13.7%
56 to 57	18.9%	18.9%	18.9%	18.9%	18.5%	17.9%	17.2%	16.5%	15.8%	15.1%	14.3%	13.5%
58 to 59	18.5%	18.5%	18.5%	18.5%	18.1%	17.5%	16.9%	16.2%	15.5%	14.8%	14.1%	13.2%
60 to 61	18.2%	18.2%	18.2%	18.2%	17.8%	17.2%	16.5%	15.9%	15.2%	14.5%	13.8%	13.0%
62 to 63	17.8%	17.8%	17.8%	17.8%	17.4%	16.8%	16.2%	15.6%	14.9%	14.2%	13.5%	12.7%
64 to 65	17.4%	17.4%	17.4%	17.4%	17.0%	16.4%	15.8%	15.2%	14.6%	13.9%	13.2%	12.4%
66 to 67	16.9%	16.9%	16.9%	16.9%	16.6%	16.0%	15.4%	14.8%	14.2%	13.5%	12.8%	12.1%
68 to 69	16.5%	16.5%	16.5%	16.5%	16.2%	15.6%	15.0%	14.5%	13.8%	13.2%	12.5%	11.8%
70 to 71	16.1%	16.1%	16.1%	16.1%	15.7%	15.2%	14.6%	14.1%	13.5%	12.8%	12.2%	11.5%
72 to 73	15.6%	15.6%	15.6%	15.6%	15.3%	14.7%	14.2%	13.7%	13.1%	12.5%	11.8%	11.1%
74 to 75	15.1%	15.1%	15.1%	15.1%	14.8%	14.3%	13.8%	13.2%	12.7%	12.1%	11.5%	10.8%
76 to 77	14.6%	14.6%	14.6%	14.6%	14.3%	13.8%	13.3%	12.8%	12.2%	11.7%	11.1%	10.4%
78 to 79	14.1%	14.1%	14.1%	14.1%	13.8%	13.3%	12.8%	12.3%	11.8%	11.3%	10.7%	10.1%
80 to 81	13.6%	13.6%	13.6%	13.6%	13.3%	12.8%	12.4%	11.9%	11.4%	10.8%	10.3%	9.7%
82 to 83	13.0%	13.0%	13.0%	13.0%	12.7%	12.3%	11.9%	11.4%	10.9%	10.4%	9.9%	9.3%
84 to 85	12.5%	12.5%	12.5%	12.5%	12.2%	11.8%	11.4%	10.9%	10.4%	10.0%	9.4%	8.9%
86 to 87	11.9%	11.9%	11.9%	11.9%	11.6%	11.2%	10.8%	10.4%	10.0%	9.5%	9.0%	8.5%
88 to 89	11.3%	11.3%	11.3%	11.3%	11.1%	10.7%	10.3%	9.9%	9.5%	9.0%	8.6%	8.1%
90 to 91	10.7%	10.7%	10.7%	10.7%	10.5%	10.1%	9.7%	9.4%	9.0%	8.5%	8.1%	7.6%
92 to 93	10.1%	10.1%	10.1%	10.1%	9.8%	9.5%	9.2%	8.8%	8.4%	8.0%	7.6%	7.2%
94 to 95	9.4%	9.4%	9.4%	9.4%	9.2%	8.9%	8.6%	8.3%	7.9%	7.5%	7.1%	6.7%
96 to 97	8.8%	8.8%	8.8%	8.8%	8.6%	8.3%	8.0%	7.7%	7.4%	7.0%	6.6%	6.3%
98 to 99	8.1%	8.1%	8.1%	8.1%	7.9%	7.7%	7.4%	7.1%	6.8%	6.5%	6.1%	5.8%
100 to 101	7.4%	7.4%	7.4%	7.4%	7.3%	7.0%	6.8%	6.5%	6.2%	5.9%	5.6%	5.3%
102 to 103	6.7%	6.7%	6.7%	6.7%	6.6%	6.3%	6.1%	5.9%	5.6%	5.4%	5.1%	4.8%
104 to 105	6.0%	6.0%	6.0%	6.0%	5.9%	5.7%	5.5%	5.2%	5.0%	4.8%	4.5%	4.3%
106 and over 107	5.3%	5.3%	5.3%	5.3%	5.1%	5.0%	4.8%	4.6%	4.4%	4.2%	4.0%	3.8%

VM-20: REQUIREMENTS FOR PRINCIPLE-BASED RESERVES FOR LIFE PRODUCTS  
Section 9. Assumptions

<b>Buhlmann Margins</b>												
Credibility Level												
Ages	63-67%	68-72%	73-77%	78-82%	83-87%	88-89%	90-91%	92-93%	94-95%	96-97%	98%	99%+
<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%
46 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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 to 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%
106 and over 107	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 by amount method:

Proposed Limited Fluctuation Margins										
Credibility Level										
Ages	0-7%	8-12%	13-17%	18-22%	23-27%	28-32%	33-37%	38-42%	43-47%	48-52%
<45	20.4%	20.4%	17.4%	15.9%	14.5%	13.2%	12.1%	11.0%	10.0%	9.1%
46 to 47	20.2%	20.2%	17.4%	15.9%	14.5%	13.2%	12.1%	11.0%	10.0%	9.1%
48 to 49	20.0%	20.0%	17.2%	15.7%	14.3%	13.0%	11.9%	10.8%	9.9%	9.0%
50 to 51	19.8%	19.8%	17.0%	15.5%	14.1%	12.9%	11.7%	10.7%	9.7%	8.9%
52 to 53	19.6%	19.6%	16.7%	15.2%	13.9%	12.7%	11.5%	10.5%	9.6%	8.7%
54 to 55	19.2%	19.2%	16.4%	15.0%	13.6%	12.4%	11.3%	10.3%	9.4%	8.6%
56 to 57	18.9%	18.9%	16.1%	14.7%	13.4%	12.2%	11.1%	10.2%	9.3%	8.5%
58 to 59	18.5%	18.5%	15.8%	14.4%	13.1%	12.0%	10.9%	10.0%	9.1%	8.3%
60 to 61	18.2%	18.2%	15.5%	14.1%	12.9%	11.7%	10.7%	9.8%	8.9%	8.1%
62 to 63	17.8%	17.8%	15.2%	13.8%	12.6%	11.5%	10.5%	9.6%	8.7%	8.0%
64 to 65	17.4%	17.4%	14.8%	13.5%	12.3%	11.2%	10.2%	9.3%	8.5%	7.8%
66 to 67	16.9%	16.9%	14.5%	13.2%	12.0%	11.0%	10.0%	9.1%	8.3%	7.6%
68 to 69	16.5%	16.5%	14.1%	12.8%	11.7%	10.7%	9.7%	8.9%	8.1%	7.4%
70 to 71	16.1%	16.1%	13.7%	12.5%	11.4%	10.4%	9.5%	8.6%	7.9%	7.2%
72 to 73	15.6%	15.6%	13.3%	12.1%	11.1%	10.1%	9.2%	8.4%	7.7%	7.0%
74 to 75	15.1%	15.1%	12.9%	11.8%	10.7%	9.8%	8.9%	8.1%	7.4%	6.8%
76 to 77	14.6%	14.6%	12.5%	11.4%	10.4%	9.5%	8.6%	7.9%	7.2%	6.5%
78 to 79	14.1%	14.1%	12.0%	11.0%	10.0%	9.1%	8.3%	7.6%	6.9%	6.3%
80 to 81	13.6%	13.6%	11.6%	10.6%	9.6%	8.8%	8.0%	7.3%	6.7%	6.1%
82 to 83	13.0%	13.0%	11.1%	10.1%	9.2%	8.4%	7.7%	7.0%	6.4%	5.8%
84 to 85	12.5%	12.5%	10.6%	9.7%	8.8%	8.1%	7.4%	6.7%	6.1%	5.6%
86 to 87	11.9%	11.9%	10.1%	9.2%	8.4%	7.7%	7.0%	6.4%	5.8%	5.3%
88 to 89	11.3%	11.3%	9.6%	8.8%	8.0%	7.3%	6.7%	6.1%	5.5%	5.1%
90 to 91	10.7%	10.7%	9.1%	8.3%	7.6%	6.9%	6.3%	5.7%	5.2%	4.8%
92 to 93	10.1%	10.1%	8.6%	7.8%	7.1%	6.5%	5.9%	5.4%	4.9%	4.5%
94 to 95	9.4%	9.4%	8.0%	7.3%	6.7%	6.1%	5.6%	5.1%	4.6%	4.2%
96 to 97	8.8%	8.8%	7.5%	6.8%	6.2%	5.7%	5.2%	4.7%	4.3%	3.9%
98 to 99	8.1%	8.1%	6.9%	6.3%	5.7%	5.2%	4.8%	4.4%	4.0%	3.6%
100 to 101	7.4%	7.4%	6.3%	5.8%	5.3%	4.8%	4.4%	4.0%	3.6%	3.3%
102 to 103	6.7%	6.7%	5.7%	5.2%	4.8%	4.3%	4.0%	3.6%	3.3%	3.0%
104 to 105	6.0%	6.0%	5.1%	4.7%	4.3%	3.9%	3.5%	3.2%	2.9%	2.7%
106 and over 107	5.3%	5.3%	4.5%	4.1%	3.7%	3.4%	3.1%	2.8%	2.6%	2.4%

<b><u>Proposed Limited Fluctuation Margins</u></b>									
<b>Credibility Level</b>									
<b>Ages</b>	<b>53-57%</b>	<b>58-62%</b>	<b>63-67%</b>	<b>68-72%</b>	<b>73-77%</b>	<b>78-82%</b>	<b>83-87%</b>	<b>88-92%</b>	<b>93-100%</b>
<45	8.3%	7.6%	6.9%	6.3%	5.8%	5.3%	4.8%	4.4%	4.0%
46 to 47	8.3%	7.6%	6.9%	6.3%	5.8%	5.3%	4.8%	4.4%	4.0%
48 to 49	8.2%	7.5%	6.8%	6.2%	5.7%	5.2%	4.7%	4.3%	3.9%
50 to 51	8.1%	7.4%	6.7%	6.1%	5.6%	5.1%	4.7%	4.2%	3.9%
52 to 53	8.0%	7.3%	6.6%	6.0%	5.5%	5.0%	4.6%	4.2%	3.8%
54 to 55	7.8%	7.2%	6.5%	5.9%	5.4%	4.9%	4.5%	4.1%	3.8%
56 to 57	7.7%	7.0%	6.4%	5.8%	5.3%	4.9%	4.4%	4.0%	3.7%
58 to 59	7.6%	6.9%	6.3%	5.7%	5.2%	4.8%	4.3%	4.0%	3.6%
60 to 61	7.4%	6.8%	6.2%	5.6%	5.1%	4.7%	4.3%	3.9%	3.5%
62 to 63	7.2%	6.6%	6.0%	5.5%	5.0%	4.6%	4.2%	3.8%	3.5%
64 to 65	7.1%	6.5%	5.9%	5.4%	4.9%	4.5%	4.1%	3.7%	3.4%
66 to 67	6.9%	6.3%	5.7%	5.2%	4.8%	4.4%	4.0%	3.6%	3.3%
68 to 69	6.7%	6.1%	5.6%	5.1%	4.7%	4.2%	3.9%	3.5%	3.2%
70 to 71	6.6%	6.0%	5.4%	5.0%	4.5%	4.1%	3.8%	3.4%	3.1%
72 to 73	6.4%	5.8%	5.3%	4.8%	4.4%	4.0%	3.7%	3.3%	3.0%
74 to 75	6.2%	5.6%	5.1%	4.7%	4.3%	3.9%	3.5%	3.2%	2.9%
76 to 77	6.0%	5.4%	5.0%	4.5%	4.1%	3.8%	3.4%	3.1%	2.9%
78 to 79	5.8%	5.2%	4.8%	4.4%	4.0%	3.6%	3.3%	3.0%	2.8%
80 to 81	5.5%	5.0%	4.6%	4.2%	3.8%	3.5%	3.2%	2.9%	2.6%
82 to 83	5.3%	4.8%	4.4%	4.0%	3.7%	3.4%	3.1%	2.8%	2.5%
84 to 85	5.1%	4.6%	4.2%	3.9%	3.5%	3.2%	2.9%	2.7%	2.4%
86 to 87	4.8%	4.4%	4.0%	3.7%	3.4%	3.1%	2.8%	2.5%	2.3%
88 to 89	4.6%	4.2%	3.8%	3.5%	3.2%	2.9%	2.6%	2.4%	2.2%
90 to 91	4.4%	4.0%	3.6%	3.3%	3.0%	2.7%	2.5%	2.3%	2.1%
92 to 93	4.1%	3.7%	3.4%	3.1%	2.8%	2.6%	2.4%	2.2%	2.0%
94 to 95	3.8%	3.5%	3.2%	2.9%	2.7%	2.4%	2.2%	2.0%	1.8%
96 to 97	3.6%	3.3%	3.0%	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%
98 to 99	3.3%	3.0%	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%	1.6%
100 to 101	3.0%	2.8%	2.5%	2.3%	2.1%	1.9%	1.7%	1.6%	1.4%
102 to 103	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%	1.6%	1.4%	1.3%
104 to 105	2.4%	2.2%	2.0%	1.9%	1.7%	1.5%	1.4%	1.3%	1.2%
106 and over 107	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:

<b>Mortality Margin Table</b>			
<b>Attained Age</b>	<b>Load</b>	<b>Attained Age</b>	<b>Load</b>
< 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 on or after January 1, 2017:

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

6. Process to Determine Prudent Estimate Assumptions

- a. If applicable industry basic tables are used in lieu of company experience, the prudent estimate assumptions for each mortality segment shall equal the respective mortality rates in the applicable industry basic tables as provided in subsection 9.C.3, plus the prescribed margin as provided in subsection 9.C.5.c.
- b. If the company determines company experience mortality rates, the prudent estimate assumptions will be determined as follows:
  - i. For each mortality segment, use the company experience mortality rates (as defined in Subsection 9.C.2) for policy durations in which there exists sufficient company experience data (as defined below in paragraph ii), plus the prescribed margin as provided in subsection 9.C.5.b.
  - ii. The company shall determine the sufficient data period by identifying the last policy duration at which sufficient company experience data exists (using all the sources defined in Subsection 9.C.2.b). This period ends at the last policy duration which has 50 or more claims (i.e., no duration beyond this point has 50 claims or more). The sufficient data period may be determined at a more aggregate level than the mortality segment if the company based its mortality on aggregate experience and then used a methodology to subdivide the aggregate class into various sub-classes or mortality segments.

**Guidance Note:** The objective is to use last duration at which there are 50 or more claims; not the first duration in which there are less than 50 claims.

- iii. Beginning in the policy duration at which sufficient company experience data no longer exists, use the guidelines in the applicable table below to linearly grade from the company experience mortality rates with margins to 100% of the applicable industry table with margins (the determination of the applicable industry table is described in Section 9.C.3). Grading must begin and end no later than the policy durations shown in the applicable table below, based on the level of credibility of the data as provided in subsection 9.C.4. For valuations on or after 1/1/2015, if the credibility level is less than 20%, the company is not allowed to use its company experience and must use 100% of the applicable industry table.

- A. The number of years for data to be considered sufficient is equal to the length of the sufficient data period (defined in paragraph ii above) but no greater than the number of years in column (2).
- B. Grading must begin no later than the number of years in column (3) after the duration when sufficient data no longer exists (as defined in paragraph (A) above).
- C. Grading to 100% of the industry table must be completed no later than the number of years in column (4) after the duration when sufficient data no longer exists (as defined in paragraph (A) above).

Table effective for valuations December 31, 2016 and prior:

<b>Credibility of company data (as defined in Section 9.C.4 above)</b>	<b>Maximum # of years for data to be considered sufficient</b>	<b>Maximum # of years in which to begin grading after sufficient data no longer exists</b>	<b>Maximum # of years in which the assumption must grade to 100% to an applicable industry table (from the duration where sufficient data no longer exists)</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
10-19%	10	2	10
20-39%	20	4	15
40-59%	30	6	18
60-79%	40	8	20
80-100%	50	10	25

Table effective for valuations on and after January 1, 2017:

<b>Credibility of company data (as defined in Section 9.C.4 above)</b>	<b>Maximum # of years for data to be considered sufficient</b>	<b>Maximum # of years in which to begin grading after sufficient data no longer exists</b>	<b>Maximum # of years in which the assumption must grade to 100% to an applicable industry table (from the duration where sufficient data no longer exists)*</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
20-39%	10	2	8*
40-59%	20	4	12*
60-79%	35	7	17*
80-100%	50	10	25

Additional standards for valuations on and after January 1, 2017:

\* The maximum # of years in which the assumption must grade to 100% of an applicable industry table shall be the lesser of (a) the appropriate number of years stated in the chart above or (b) the number of years of sufficient data + 15 times the credibility percentage applicable to column (1) in the chart above. This maximum # of years figure shall be rounded to the nearest whole number.

For example, if the number of years of sufficient data was 9 and the credibility percentage over the sufficient data period was 80%, (b) would equal  $9 + 15 * (80\%) = 21$ . The maximum # of years in which the assumption must grade to 100% of an applicable industry table (from the duration where sufficient data no longer exists) would therefore be 21.

- iv. Notwithstanding the guidelines in paragraph b.iii above, the company must grade into 100% of the applicable industry table mortality with margins by the later of attained age [100] or 15 years after policy underwriting.
- c. Smoothing may be utilized within each mortality segment to ensure that an appropriate relationship exists by attained age within each 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. Anticipated experience assumptions shall be determined by removing the prescribed margin from the prudent estimate assumption determined above. 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. The company must disclose this conclusion in the PBR Actuarial Report.

7. Determination of Mortality Margin

- a. The mortality margin shall be in the form of a percentage increase applied to the Anticipated Experience Assumption.
- b. This margin 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 longer the 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.

## 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~~~~minimum~~ reserve, which may include gender, attained age, issue age, policy duration, time to maturity, tax status, level of account and cash 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~~~~minimum~~ 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 are 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. 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 subsection 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 ~~minimum~~ 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 encourages anti-selection.

4. Additional Sensitivity Testing for Policyholder Behavior Assumptions

| The company shall examine the sensitivity of assumptions on the modeled ~~minimum~~ reserve as required under Subsection A.3 of this section 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 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 October 2007. During projection periods in which the cash value 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 October 2007 in five projection years from the last duration where substantially credible experience is available.

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

6. For a term life policy that guarantees level or near level premiums until a specified duration, or for a policy for which level or near level premiums are expected for a period, followed by a material premium increase, for the period following that premium increase the lapse and mortality assumptions shall be adjusted, or margins added, such that the 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 has low or no credibility or relevance.

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 development costs and other capital expenditures over a reasonable number of years in accordance with accepted statutory accounting principles as defined in the Statements of Statutory Accounting Principles.

**Guidance Note:** Care should be taken with regard to the potential interaction with the considerations 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. May 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. 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 Actuarial Standards of Practice. Allocations may not be done for the purpose of decreasing the ~~modeled~~minimum 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 Subparagraph b above.
2. Margins for Prudent Estimate Expense Assumptions

The company shall determine margins for expense assumptions according to the requirements given in subsection 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 9.F.2, assign a PBR credit rating according to the procedure in 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 this section VM-20. Table A of Appendix 2 shall be the initial NAIC table for this purpose.
- 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.

**Drafting Note:** Table H (investment grade spreads) and Table I (below investment grade spreads) in Appendix 2 need to be combined into one table.

- 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 subsection 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 9.F.1.a and 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 9.F.1.c.i for each asset equal to that asset's statement value on the valuation date multiplied by the lesser of 3 years and the asset's WAL on the valuation date.
- iii. Calculate the amount in 9.F.1.c.i above for a hypothetical asset with the following assumed characteristics (the regulatory threshold asset):
  - 1) A PBR credit rating of 9.
  - 2) A WAL equal to the average WAL on the valuation date for the assets in the model segment and subject to this subsection 9.F.1.
  - 3) 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.
  - 4) Investment expense of 0.10%.

**Drafting Note:** Table F of Appendix 2 provides illustrative current benchmark spreads as of a particular date, but the intent of the requirement is that the published spread be as of or close to the valuation date.

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

**Drafting Note:** The maximum net spread adjustment factor still needs further study as to potential reserve volatility it could produce.

## 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 shall mean the weighted average number of years until 100% of the outstanding principal is expected to be repaid, rounded to the nearest whole number but not less than 1. For bonds or preferred stocks that are perpetual or mature after 30 years, the WAL shall be 30. Market conventions and other approximations are acceptable for the purposes of this subsection.

**Guidance Note:** OAS is a metric used for callable corporate bonds and other bonds with optionality such as residential mortgage-backed securities. 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 which must be modeled directly by the company along each scenario in the cash flow model (see 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 of Appendix 2 converts the ratings of NAIC Approved Ratings Organizations (AROs) and NAIC designations to a numeric rating system from 1-20 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 which has~~with~~ 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 CM category, where the latter is assigned by the company in accordance with NAIC Life RBC instructions.

**Guidance Note:** The 1-21 PBR credit rating system attempts to provide a more granular assessment of credit risk than has been used for establishing NAIC designations for risk-based capital and asset valuation reserve 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 Securities Valuation Office*, 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 Valuation of Securities (E) Task Force of the NAIC (VOSTF) implemented an interim solution in 2009 to set designations for non-agency residential mortgage-backed securities based on modeling by a third-party firm. VOSTF is developing a long-term solution for these and other structured securities such as commercial mortgage-backed securities 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 SVO Filing Exempt, such as many private placement bonds. For example, a private placement that was not Filing Exempt 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 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 residential mortgage-backed security 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 U.S. Treasury yield rate most closely coinciding with the dates of purchase and maturity structure of supporting assets plus 25 basis points.

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 subsection 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, and 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. The three-month and six-month points on the swap spread curves represent the corresponding LIBOR spreads over Treasuries.

9. Basis of NAIC Long-Term Benchmark Spreads

**Drafting Note:** The detailed methodology and data source used to create the initial long-term benchmark spread table is described in Appendix 2 of this section VM-20. Until a different table is published by the NAIC,

Table H of Appendix 2 shall be the NAIC table for this purpose. This subsection spells out the principles to be used by the NAIC to apply to any particular data source for developing future tables. It is expected that the current table would be reviewed annually.

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 7-10 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 stochastic reserve calculation model and under the deterministic scenario within the deterministic reserve 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; and
  - 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. GRSI would also 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 actuary 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 GRSI is not included in cash flow projections, applicable projected expenses are also not included.
4. In determining the anticipated experience assumption for 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; and
  - 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 actuary is responsible for reviewing the revenue sharing agreements, verifying compliance with these requirements, and documenting the rationale for any source of GRSI used in the projections.
8. The amount of net revenue sharing income assumed in a given scenario shall not exceed the sum of (a) and (b), where:
  - a. Is the contractually guaranteed GRSI, net of applicable expenses, projected under the scenario; and
  - b. Is the actuary's estimate of non-contractually guaranteed net revenue sharing income multiplied by the following factors:
    - i. 1.0 in the first projection year;
    - ii. 0.9 in the second projection year;
    - iii. 0.8 in the third projection year;
    - iv. 0.7 in the fourth projection year;

- v. 0.6 in the fifth projection year;
- vi. 0.5 in the sixth and all subsequent projection years. The resulting amount of non-contractually guaranteed net revenue sharing income after application of this factor shall not exceed 0.25% per year on separate account assets in the sixth and all subsequent projection years.

**Guidance Note:** Provisions such as one that gives the entity paying the gross revenue sharing income 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 gross revenue sharing income 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 Society of Actuaries' website address, <http://soa.org/research/software-tools/research-scenario.aspx>.

### A. Generating Interest Rates

The prescribed economic scenario generator uses 3 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 test, zero shocks to volatility are used.

When generating scenarios for the test, 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 Society of Actuaries' website address, <http://soa.org/research/software-tools/research-scenario.aspx>.

### B. Generating Equity Returns

The equity returns scenarios can be generated using the prescribed economic scenario generator, located on the Society of Actuaries' website: <http://soa.org/research/software-tools/research-scenario.aspx>

### C. Source of U.S. Treasury Interest Rates

U.S. Treasury interest rates can be found at the website:  
[http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield\\_historical\\_main.shtml](http://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 Stochastic Exclusion Test in VM-20. Starting with yield curve on the valuation date, the scenarios are created using the American Academy of Actuaries' 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  $n^{\text{th}}$  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 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 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 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 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 periodically by the NAIC via website. These tables are needed for insurers to comply with the requirements of Subsection 9.F for asset default costs and asset spreads in VM-20. In some cases, as specified in 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 subsections A-E of this appendix. The actual tables are shown in subsection F 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 (VOSTF), 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, VOSTF has been developing updated methods to assign NAIC designations for C-1 risk based capital 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 VOSTF 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 VOSTF continues to authorize use of underlying ratings, the PBR credit rating will also be based on those ratings. However, VM-20 uses the underlying ratings to assign the PBR credit rating in a somewhat different manner.

Subsection 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 subsection F) was as follows:

1. Determine from historical corporate bond data a matrix of cumulative default rates, for maturities of 1 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 basis points), where for a given rating the Baseline Annual Default Cost Factor for a bond with maturity or weighted average life of  $t = 10,000 * (1 - \text{Recovery Rate}) * (1 - [\text{Cumulative Default Rate}(t)]^{1/t})$ .
4. Items 1 and 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 steps 1 and 2 above are contained in subsections B and 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, uses the CTE 70 for lower quality below investment grade rating classes, and grades in between.

In subsection F below:

1. Table A shows baseline default costs using Moody's data as of February 2008; and
2. Table B shows baseline default cost margin as of February 2008 (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 2 and 3.  $5 = 4 + (2 - 3)$ .
6. Use linear interpolation to determine cumulative default rates for maturities 2 to 4 and 6 to 9.
7. Transform the data into a matrix that varies by rating notch (e.g., Aaa, Aa1, Aa2, Aa3, A1... Caa2, Caa3, Ca) using an algorithm to ensure that in the new matrix the rows are monotonic by maturity, the columns are monotonic by rating, and to the extent possible the new 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.

In subsection F below:

1. Table C shows empirical CTE 70 default rates from Moody's data as of February 2008.
2. Table D shows prescribed cumulative default rates derived from Moody's data as of February 2008.

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.

In subsection F below:

1. 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.

2. 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, since 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. Illustrative 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. Ultimately, the NAIC will need to publish current market benchmark spreads on a website on a quarterly basis. The current process to determine current market benchmark spreads is as follows:

1. Extract valuation date Investment Grade bond index spread data by ratings category and maturity bucket (e.g., download JULI (JPMorgan US Liquid Index) Interpolated Spread over Treasury data for All Industries).
2. Extract valuation date Below Investment Grade bond index spread data by ratings category (e.g., download JPMorgan Domestic High Yield Index Spread to Worst data by Rating Tier), and assume that the Below Investment Grade spread curve is flat across maturities.
3. Transform the data into a matrix that varies by rating notch (e.g., Aaa, Aa1, Aa2, Aa3, A1... Caa2, Caa3, Ca) and maturity (1, 2 ... 30) using an algorithm to ensure that in the new matrix: (a) the rows are monotonic by rating, (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+.

In subsection F below,

1. Table F shows Current Market Benchmark Spreads as of 9/30/2009 for Investment Grade bonds.
2. Table G shows Current Market Benchmark Spreads as of 9/30/2009 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. Ultimately, the NAIC will need to publish these spreads on a website. The current process to determine mean benchmark spreads is as follows:

1. Extract daily Investment Grade bond index spread data for the prescribed observation period by ratings category and maturity bucket (e.g., download JULI (JPMorgan US Liquid Index) Interpolated Spread over Treasury data for All Industries).
2. Extract daily Below Investment Grade bond index spread data for the prescribed observation period by ratings category (e.g., download JPMorgan Domestic High Yield Index Spread to Worst data by Rating Tier), and assume that the Below Investment Grade spread curve is flat across maturities.
3. For the whole letter “A” rated 7-10 year maturity bucket, or nearest similar category, calculate the “85% conditional mean average” by first excluding the 7.5% highest and 7.5% lowest daily observations over the prescribed observation period and then computing the mean of the remaining daily observations.
4. Calculate for each other ratings category and maturity bucket the mean over the prescribed observation period after excluding the observations from the same trading days excluded in step 3. In developing Tables H and I, a 9.25 year averaging period was used, specifically 7/1/2000 through 9/30/2009.
5. Transform the data into a matrix that varies by rating notch (e.g., Aaa, Aa1, Aa2, Aa3, A1..., Caa2, Caa3, Ca) and maturity (1, 2 ... 30) using an algorithm to ensure that in the new matrix: (a) the rows are monotonic by rating, (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+.

**Drafting Note:** A description of the development of the prescribed interest rate swap spreads needs to be added. The process is similar but the data source is different.

**Drafting Note:** Two key considerations for the NAIC going forward will be the source of the spread data and the historical observation period. It has not yet been explored whether a source other than JULI (JP Morgan) would be preferable. Ideally the current and long-term benchmark spreads should come from the same source. A seven-year observation period was originally chosen because consistent and reliable data was only available back to 2000, and examples were being created based on a 2007 valuation date. It is recommended that the observation period be allowed to lengthen as more years of data are available, and that ultimately a rolling average of a maximum numbers of years be established such as 10 years or 15 years.

In subsection F below,

1. Table H shows Long-Term Mean Benchmark Spreads as of 9/30/2009 for Investment Grade bonds.
2. Table I shows Long-Term Mean Benchmark Spreads as of 9/30/2009 for Below Investment Grade bonds.
3. Table J shows Long-Term Benchmark Swap Spreads.

F. Tables

**Table A. Prescribed Baseline Annual Default Costs (in bps) using Moody's Data as of February 2008**

PBR credit rating	Moody's\ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
2	Aa1	0.0	0.1	0.3	0.5	0.5	0.6	0.7	0.8	0.8	0.9
3	Aa2	0.1	0.4	0.8	1.0	1.2	1.3	1.4	1.5	1.7	1.8
4	Aa3	0.2	0.9	1.7	2.2	2.4	2.7	2.9	3.1	3.3	3.7
5	A1	0.4	1.7	3.4	4.1	4.5	4.9	5.2	5.5	5.9	6.4
6	A2	0.8	3.3	6.5	7.5	8.1	8.6	9.2	9.5	10.1	11.1
7	A3	2.8	7.0	10.6	11.8	12.6	13.5	14.4	14.9	15.6	16.7
8	Baa1	6.4	13.0	16.5	18.1	19.1	20.4	21.7	22.7	23.5	24.3
9	Baa2	16.3	26.3	32.5	36.9	39.8	40.3	42.4	44.0	44.7	45.2
10	Baa3	42.0	61.4	70.0	76.8	81.0	80.0	80.6	81.4	81.9	81.8
11	Ba1	90.5	123.4	134.7	143.1	148.8	143.9	140.4	138.4	137.2	135.7
12	Ba2	173.5	226.2	243.5	257.9	267.6	253.8	241.0	232.5	228.0	224.1
13	Ba3	262.0	295.0	311.3	328.6	349.6	334.4	321.0	313.1	308.2	305.9
14	B1	436.4	453.8	468.5	480.1	495.0	464.0	441.5	425.5	415.2	409.4
15	B2	621.8	573.8	565.2	560.8	567.4	525.7	492.9	467.1	449.6	436.4
16	B3	1,009.1	832.5	789.8	779.3	788.6	726.3	689.6	663.7	641.2	626.1
17	Caa1	1,440.9	1,095.2	1,004.3	983.8	999.3	922.7	879.6	855.0	840.7	839.5
18	Caa2	2,026.5	1,427.1	1,253.0	1,191.4	1,191.9	1,089.4	1,023.7	982.5	960.8	952.3
19	Caa3	3,974.3	2,806.9	2,385.2	2,269.9	2,316.1	2,090.5	1,942.9	1,850.2	1,809.0	1,815.6
20	Ca	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1

**Table A. Baseline Annual Default Costs (in bps) using Moody's Data as of December 2014**

PBR credit rating	Moody's\ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.02	0.02	0.05	0.08	0.11	0.12	0.13	0.15	0.16	0.17
2	Aa1	0.13	0.36	0.66	0.99	1.14	1.29	1.40	1.51	1.62	1.74
3	Aa2	0.31	0.96	1.72	2.22	2.49	2.72	2.88	3.04	3.24	3.48
4	Aa3	0.67	2.28	3.91	4.77	5.21	5.61	5.89	6.13	6.48	6.97
5	A1	1.30	4.44	7.76	8.94	9.59	10.14	10.56	10.86	11.40	12.25
6	A2	2.44	8.41	14.74	16.34	17.20	17.97	18.55	18.84	19.65	21.14
7	A3	4.89	11.03	17.12	19.44	21.11	21.83	22.94	23.62	24.65	26.31
8	Baa1	11.31	20.61	26.68	29.95	31.92	33.03	34.72	36.06	37.13	38.36
9	Baa2	22.25	36.07	41.27	45.26	47.99	49.78	52.61	54.87	55.82	55.97
10	Baa3	57.17	84.10	89.06	94.40	97.80	99.06	100.45	102.01	102.62	101.71
11	Ba1	102.06	138.44	146.15	153.95	159.48	156.91	154.86	154.15	153.50	151.93
12	Ba2	161.20	210.26	226.16	239.13	247.83	237.96	228.20	221.98	219.20	216.67
13	Ba3	226.34	265.80	284.74	302.71	323.26	310.19	298.46	291.66	287.48	285.62
14	B1	376.96	408.50	427.77	441.27	456.39	429.01	409.14	394.94	385.77	380.68
15	B2	470.72	468.91	479.56	485.65	498.49	466.35	441.29	421.79	409.08	399.85
16	B3	763.94	677.89	666.64	670.29	687.02	638.71	611.56	593.13	577.21	567.42
17	Caa1	984.17	810.67	782.19	788.37	817.60	766.71	741.56	730.63	727.58	735.32
18	Caa2	1127.78	864.95	819.53	813.84	844.70	801.62	780.85	776.11	785.17	806.41
19	Caa3	2211.76	1608.35	1441.08	1394.89	1424.35	1332.79	1283.03	1264.73	1276.08	1321.70
20	Ca	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14	6993.14

**Table B. Default Cost Margin (in bps) included in Table A 2008**

PBR credit rating	Moody's\ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Aa1	0.0	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4
3	Aa2	0.1	0.3	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9
4	Aa3	0.1	0.6	1.1	1.3	1.4	1.4	1.5	1.6	1.7	1.8
5	A1	0.3	1.2	2.2	2.4	2.5	2.6	2.7	2.8	2.9	3.1
6	A2	0.5	2.3	4.2	4.5	4.5	4.6	4.8	4.9	5.0	5.4
7	A3	1.9	4.9	6.9	7.0	7.0	7.3	7.5	7.6	7.8	8.1
8	Baa1	4.3	9.2	10.7	10.8	10.6	11.0	11.4	11.7	11.8	11.8
9	Baa2	12.4	19.8	23.8	26.2	27.6	26.7	27.4	28.0	28.0	17.6
10	Baa3	24.5	34.2	35.4	36.2	37.4	34.2	32.9	32.1	31.3	34.2
11	Ba1	54.4	71.1	70.9	71.0	72.7	65.6	61.4	58.9	56.8	61.0
12	Ba2	108.7	136.0	137.3	139.8	144.6	129.0	118.7	112.2	108.1	103.7
13	Ba3	154.9	148.9	146.3	153.0	166.2	147.3	134.3	127.9	124.8	124.9
14	B1	258.0	230.2	222.5	227.1	240.0	209.2	189.6	178.9	173.5	173.0
15	B2	348.8	260.2	230.1	222.7	231.4	193.1	165.4	148.4	138.3	133.1
16	B3	587.1	409.8	368.9	371.0	392.0	344.0	320.9	307.4	297.3	294.4
17	Caa1	818.3	513.1	439.6	441.5	475.9	423.6	403.1	393.9	389.7	395.2
18	Caa2	1,095.1	595.6	453.7	416.2	435.6	361.6	317.1	282.1	250.6	224.8
19	Caa3	2,164.5	1,290.9	1,017.4	999.6	1,131.9	987.6	918.2	870.1	841.8	843.8
20	Ca	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1	7,090.1

**Table B. Default Cost Margin (in bps) included in Table A as of December 2014**

PBR credit rating	Moody's \ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.02	0.01	0.03	0.05	0.06	0.07	0.07	0.07	0.08	0.08
2	Aa1	0.09	0.21	0.38	0.56	0.63	0.68	0.72	0.75	0.79	0.83
3	Aa2	0.22	0.57	0.99	1.25	1.39	1.45	1.48	1.52	1.59	1.67
4	Aa3	0.46	1.35	2.24	2.69	2.91	2.98	3.02	3.06	3.17	3.35
5	A1	0.90	2.63	4.44	5.04	5.36	5.40	5.43	5.43	5.59	5.91
6	A2	1.69	4.98	8.44	9.23	9.63	9.58	9.55	9.45	9.66	10.23
7	A3	3.12	6.01	8.95	9.97	10.72	10.39	10.38	10.26	10.35	10.75
8	Baa1	7.21	11.23	13.96	15.39	16.24	15.77	15.76	15.72	15.67	15.76
9	Baa2	14.50	20.31	22.40	24.16	25.41	24.87	25.13	25.29	24.99	24.46
10	Baa3	38.02	48.84	50.05	52.33	53.90	51.82	50.49	49.71	48.79	47.36
11	Ba1	66.78	79.32	80.92	84.26	86.95	80.86	76.35	73.39	70.96	68.43
12	Ba2	103.74	119.01	124.51	130.62	135.26	122.20	111.52	104.16	99.48	95.62
13	Ba3	125.36	138.85	146.55	155.36	166.50	151.02	138.31	129.46	122.82	118.01
14	B1	208.79	214.28	222.03	229.28	238.81	212.68	193.56	179.35	169.00	161.66
15	B2	254.35	241.40	243.63	246.21	253.83	225.67	204.06	187.21	175.08	165.61
16	B3	412.79	351.22	342.58	345.66	358.03	317.58	292.20	273.71	258.16	247.01
17	Caa1	520.13	412.97	394.37	398.52	418.19	376.72	352.30	337.44	328.17	325.76
18	Caa2	596.29	441.30	409.43	402.92	419.36	387.91	369.66	360.96	360.57	367.76
19	Caa3	1169.43	841.65	750.80	732.22	763.92	704.72	671.85	659.72	668.42	703.30
20	Ca	1199.83	1199.83	1199.83	1199.83	1199.83	1199.83	1199.83	1199.83	1199.83	1199.83

**Table C. Empirical CTE 70 Default Rates (%) from Moody's Data as of February 2008**

<b>Rating \ WAL</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Aaa	0.0000	0.0942	0.1884	0.2825	0.3767	0.6800	0.9833	1.2866	1.5899	1.8932
Aa	0.0492	0.2182	0.3873	0.5563	0.7253	0.8800	1.0347	1.1895	1.3442	1.4989
A	0.0583	0.3600	0.6617	0.9634	1.2651	1.6266	1.9881	2.3496	2.7111	3.0726
Baa	0.5481	1.2977	2.0474	2.7971	3.5467	4.1928	4.8389	5.4850	6.1311	6.7771
Ba	2.6013	6.6703	10.7393	14.8082	18.8772	21.0961	23.3149	25.5337	27.7526	29.9714
B	9.9611	16.9257	23.8903	30.8549	37.8196	41.2080	44.5965	47.9850	51.3735	54.7619
Caa	34.5818	41.8637	49.1457	56.4277	63.7096	66.1152	68.5208	70.9263	73.3319	75.7375

**Table C. Empirical CTE 70 Default Rates (%) from Moody's Data as of December 2014**

<b>Rating \ WAL</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>Aaa</b>	0.0000	0.0800	0.1599	0.2399	0.3198	0.5786	0.8373	1.0961	1.3548	1.6136
<b>Aa</b>	0.0929	0.3479	0.6030	0.8581	1.1131	1.2897	1.4662	1.6428	1.8194	1.9959
<b>A</b>	0.1523	0.6283	1.1043	1.5803	2.0563	2.6066	3.1569	3.7073	4.2576	4.8080
<b>Baa</b>	0.5181	1.2453	1.9725	2.6997	3.4268	4.0769	4.7269	5.3769	6.0270	6.6770
<b>Ba</b>	2.4446	6.2608	10.0770	13.8932	17.7095	20.0528	22.3961	24.7394	27.0827	29.4260
<b>B</b>	8.5472	15.3498	22.1524	28.9550	35.7576	38.9637	42.1698	45.3759	48.5820	51.7880
<b>Caa-C</b>	36.5179	44.6644	52.8108	60.9572	69.1037	72.3822	75.6607	78.9392	82.2178	85.4963



VM-20: REQUIREMENTS FOR PRINCIPLE-BASED RESERVES FOR LIFE PRODUCTS  
Appendix 2. Tables for Calculating Asset Default Costs and Asset Spreads, Including Basis of Tables

**Table D. Cumulative Default Rates at CTE 70 derived from Moody's Data as of February 2008**

Rating \ Term	1	2	3	4	5	6	7	8	9	10
Aaa	0.0001%	0.0003%	0.0011%	0.0027%	0.0043%	0.0061%	0.0080%	0.0103%	0.0129%	0.0157%
Aa1	0.0007%	0.0048%	0.0151%	0.0313%	0.0458%	0.0639%	0.0834%	0.1046%	0.1288%	0.1571%
Aa2	0.0017%	0.0128%	0.0393%	0.0701%	0.1004%	0.1354%	0.1715%	0.2107%	0.2576%	0.3142%
Aa3	0.0037%	0.0303%	0.0892%	0.1506%	0.2097%	0.2784%	0.3506%	0.4245%	0.5137%	0.6284%
A1	0.0071%	0.0590%	0.1770%	0.2818%	0.3855%	0.5020%	0.6271%	0.7492%	0.9001%	1.0997%
A2	0.0132%	0.1116%	0.3358%	0.5143%	0.6897%	0.8869%	1.0967%	1.2939%	1.5426%	1.8851%
A3	0.0473%	0.2391%	0.5445%	0.8051%	1.0781%	1.3844%	1.7146%	2.0290%	2.3877%	2.8277%
Baa1	0.1096%	0.4463%	0.8470%	1.2374%	1.6245%	2.0842%	2.5796%	3.0748%	3.5658%	4.0844%
Baa2	0.2684%	0.8635%	1.5933%	2.4024%	3.2287%	3.9116%	4.7777%	5.6428%	6.4307%	7.1958%
Baa3	0.6631%	1.9290%	3.2827%	4.7647%	6.2327%	7.3466%	8.5839%	9.8402%	11.0552%	12.1929%
Ba1	1.3735%	3.7110%	6.0086%	8.4083%	10.7897%	12.4098%	13.9960%	15.6215%	17.2477%	18.7890%
Ba2	2.5368%	6.5040%	10.3058%	14.2473%	18.0898%	20.2970%	22.2031%	24.1689%	26.2970%	28.3259%
Ba3	3.6955%	8.1474%	12.6022%	17.2882%	22.3370%	25.1659%	27.6984%	30.3257%	32.9668%	35.6626%
B1	6.1549%	12.3912%	18.5430%	24.4577%	30.3603%	33.3742%	36.2428%	39.0509%	41.9040%	44.8307%
B2	8.7700%	15.5309%	22.0600%	28.0790%	34.1026%	37.0125%	39.6120%	42.0311%	44.5486%	47.0164%
B3	14.2329%	22.1052%	29.8341%	37.2322%	44.5424%	47.7158%	51.1441%	54.4483%	57.3933%	60.3261%
Caa1	20.3231%	28.5079%	36.7603%	44.9831%	53.2154%	56.6807%	60.4333%	64.2277%	67.8897%	71.6386%
Caa2	28.5824%	36.2037%	44.2010%	52.0905%	60.1578%	63.2458%	66.4304%	69.6787%	73.0350%	76.3641%
Caa3	56.0548%	63.5055%	70.7783%	78.6366%	86.1597%	87.7061%	89.3719%	91.1008%	92.9422%	94.8089%
Ca	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%

**Table D. Cumulative Default Rates at CTE 70 derived from Moody's Data as of December 2014**

PBR credit rating	Moody's\ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.0004	0.0008	0.0024	0.0059	0.0092	0.0127	0.0163	0.0205	0.0251	0.0299
2	Aa1	0.0023	0.0124	0.0343	0.0684	0.0979	0.1330	0.1688	0.2079	0.2515	0.2991
3	Aa2	0.0054	0.0331	0.0892	0.1531	0.2148	0.2819	0.3470	0.4189	0.5030	0.5983
4	Aa3	0.0116	0.0787	0.2023	0.3289	0.4486	0.5796	0.7097	0.8439	1.0029	1.1966
5	A1	0.0224	0.1533	0.4012	0.6155	0.8245	1.0451	1.2694	1.4893	1.7574	2.0940
6	A2	0.0420	0.2900	0.7613	1.1235	1.4753	1.8464	2.2198	2.5722	3.0118	3.5898
7	A3	0.0844	0.3805	0.8840	1.3352	1.8085	2.2401	2.7390	3.2152	3.7647	4.4499
8	Baa1	0.1953	0.7102	1.3751	2.0523	2.7251	3.3724	4.1208	4.8723	5.6223	6.4276
9	Baa2	0.3688	1.1922	2.0381	2.9671	3.9142	4.8494	5.9467	7.0488	8.0248	8.8997
10	Baa3	0.9113	2.6634	4.1989	5.8848	7.5559	9.1079	10.6844	12.2921	13.7957	15.0801
11	Ba1	1.5669	4.2058	6.5817	9.1248	11.6575	13.6119	15.5018	17.4373	19.3168	21.0237
12	Ba2	2.3870	6.1300	9.7142	13.4291	17.0506	19.3646	21.3869	23.4624	25.6933	27.8265
13	Ba3	3.2365	7.4574	11.7245	16.2226	21.0722	23.8314	26.3111	28.8810	31.4630	34.0982
14	B1	5.3904	11.3417	17.2515	22.9503	28.6411	31.6045	34.4276	37.1904	39.9925	42.8641
15	B2	6.7312	12.9610	19.1944	25.0165	30.9095	33.9058	36.6362	39.2060	41.8711	44.4988
16	B3	10.9241	18.4475	25.9587	33.1713	40.3719	43.7108	47.3021	50.7886	53.9438	57.0959
17	Caa1	14.0734	21.8410	29.9421	38.0252	46.2950	50.1804	54.3728	58.6373	62.7962	67.0761
18	Caa2	16.1270	23.2074	31.1980	39.0367	47.4633	51.8329	56.3429	60.9803	65.7630	70.6311
19	Caa3	31.6276	40.7085	49.9568	58.9305	67.9784	71.8793	75.8006	79.7282	83.6881	87.6913
20	Ca	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

**Table EI. Development of Prescribed Recovery Rates from Moody's Data as of February 2008**

**Moody's 2008-02-11 Special Comment Corporate Default & Recovery Rates 1920-2007**

Sorted Version of Exhibit 22—Annual Average Defaulted Bond and Loan Recovery Rates, 1982-2007\*

Summary Statistics

		Sr.		Sr.		Jr.	
Sr. Secured	Sr.	U1	Subordinate	Subordinated	Subordinate		
Bank Loans	Bonds	Bonds	Bonds	Bonds	Bonds	All Bonds	
51.40	33.81	21.45	19.82	12.31	7.79	22.21	
53.40	37.98	23.81	20.75	15.94	10.70	25.18	
58.80	39.23	29.69	23.21	18.19	13.50	25.50	
61.13	40.00	35.79	25.64	19.09	15.50	30.18	
66.16	43.00	36.66	26.06	22.60	16.85	32.31	
67.59	46.54	37.01	28.01	24.42	30.58	34.33	
67.74	47.58	37.13	29.61	24.51	36.50	35.53	
68.32	48.14	38.04	30.88	26.36	47.00	35.57	
73.43	48.37	41.63	33.41	29.99	48.50	38.98	
74.67	48.39	41.87	34.30	31.86	62.00	39.65	
75.25	55.40	43.81	34.57	33.77	NA	40.69	
75.44	59.22	45.24	37.27	35.64	NA	41.54	
75.82	62.02	47.60	41.41	35.96	NA	43.08	
76.02	62.05	49.19	41.82	38.04	NA	43.28	
78.75	63.46	49.41	43.50	38.23	NA	43.64	
82.07	69.25	51.02	43.75	39.42	NA	43.66	
87.74	71.00	52.60	44.73	40.54	NA	45.49	
88.23	71.93	52.72	44.81	41.54	NA	45.57	
NA	72.50	53.73	44.99	42.58	NA	45.89	
NA	73.25	54.25	46.54	44.15	NA	48.38	
NA	74.63	54.88	48.09	44.26	NA	49.39	
I NA	75.50	55.02	49.40	46.89	NA	50.48	
NA	80.54	56.10	50.16	51.25	NA	53.53	
NA	83.63	60.16	51.91	56.11	NA	55.02	
I NA	NA	62.73	54.47	94.00	NA	55.97	
NA	NA	62.75	67.88	NA	NA	59.12	

\* Issuer-Weighted, based on 30-day post-default market prices. Discounted debt excluded.

\*\*Loan recoveries in 2007 are based on 5 loans from 2 issuers, one of the 5 loans is 2nd lien debt

# Observations	18	24	26	26	25	10	26
1-70 CTE	30%	30%	30%	30%	30%	30%	30%
# Obs for 70CTE	5.4	7.2	7.8	7.8	7.5	3.0	7.8
Low 70CTE Est	59.7%	40.1%	30.7%	23.9%	18.8%	10.7%	28.3%
High 70CTE Est	60.9%	41.2%	31.6%	24.7%	19.6%	11.9%	29.3%
70CTE	60.2%	40.3%	31.5%	24.6%	19.2%	10.7%	29.1%
Mean	71.2%	58.6%	45.9%	39.1%	36.3%	28.9%	41.7%
Margin	11.0%	18.3%	14.5%	14.5%	17.1%	18.2%	12.6%

**Table EI. Development of Prescribed Recovery Rates from Moody's Data as of December 2014**  
Sorted Version of Exhibit 22—Annual Average Defaulted Bond and Loan Recovery Rates, 1982-2014\*  
Summary Statistics

	Sr.		Sr.		Jr.	
Sr. Secured	Sr.	Ul	Subordinate	Subordinated	Subordinate	
Bank Loans	Bonds	Bonds	Bonds	Bonds	Bonds	All Bonds
53.4%	31.7%	21.2%	19.8%	12.3%	7.0%	21.58%
53.6%	33.8%	24.2%	20.7%	15.9%	7.8%	25.14%
56.7%	36.0%	29.5%	20.8%	18.2%	10.7%	25.57%
58.4%	37.5%	33.2%	21.4%	18.9%	13.5%	29.67%
60.6%	38.6%	35.8%	22.7%	22.6%	16.9%	32.32%
61.7%	40.0%	36.7%	23.3%	23.4%	30.6%	33.83%
64.9%	46.5%	36.9%	25.5%	23.6%	36.5%	33.85%
66.4%	46.8%	37.1%	26.9%	24.4%	40.0%	33.93%
67.6%	47.6%	38.0%	29.6%	26.4%	47.0%	35.32%
67.9%	48.4%	38.2%	29.6%	26.8%	48.5%	35.51%
68.6%	50.6%	39.5%	32.8%	30.0%	62.0%	38.3%
68.8%	51.2%	41.3%	33.4%	31.9%	NA	38.8%
70.9%	54.9%	41.9%	33.7%	33.1%	NA	41.4%
70.9%	55.4%	43.0%	34.3%	33.7%	NA	41.5%
72.0%	59.2%	43.3%	35.3%	33.8%	NA	43.1%
73.4%	59.5%	43.6%	36.7%	35.4%	NA	43.3%
73.5%	59.8%	43.8%	37.5%	35.6%	NA	43.6%
75.1%	62.0%	45.2%	37.8%	37.3%	NA	44.5%
75.4%	62.1%	47.6%	41.4%	38.0%	NA	44.7%
78.4%	62.5%	49.2%	41.8%	38.0%	NA	45.5%
78.8%	63.3%	49.4%	42.3%	38.8%	NA	45.6%
83.6%	69.2%	51.1%	43.5%	39.7%	NA	45.9%
83.8%	69.3%	51.5%	43.8%	41.1%	NA	46.3%
85.5%	71.0%	52.1%	44.7%	41.4%	NA	46.8%
87.7%	71.9%	52.7%	45.0%	41.5%	NA	47.4%
NA	72.5%	53.7%	46.5%	44.1%	NA	47.8%
NA	73.3%	53.7%	46.8%	44.3%	NA	48.8%
NA	74.6%	54.9%	46.9%	45.3%	NA	51.3%
NA	75.5%	55.0%	48.1%	46.9%	NA	51.8%
NA	80.6%	56.1%	49.4%	51.3%	NA	55.0%
NA	83.6%	60.2%	51.9%	56.1%	NA	55.1%
NA	NA	62.8%	56.2%	94.0%	NA	56.5%
NA	NA	63.8%	67.9%	NA	NA	58.5%

\* Issuer-Weighted, based on 30-day post-default market prices. Discounted debt excluded.

# Observations	25	31	33	33	32	11	33
1-70 CTE	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
# Obs for 70CTE	7.5	9.3	9.9	9.9	9.6	3.3	9.9
Low 70CTE Est	57.4%	38.9%	31.8%	22.6%	19.9%	7.4%	29.5%
High 70CTE Est	58.5%	39.9%	32.5%	23.4%	20.6%	8.5%	30.1%
70CTE	57.9%	39.2%	32.4%	23.3%	20.4%	7.7%	30.1%
Mean	70.3%	57.7%	45.0%	37.5%	35.7%	29.1%	42.1%
Margin	12.4%	18.5%	12.6%	14.2%	15.4%	21.4%	12.0%

**Table E2. Prescribed Recovery Rates from Moody's Data as of February 2008**

PBR Credit	Moody's Rating	Recovery Rate
1	Aaa	41.7%
2	Aa1	41.7%
3	Aa2	41.7%
4	Aa3	41.7%
5	A1	41.7%
6	A2	41.7%
7	A3	41.7%
8	Baa1	41.7%
9	Baa2	39.2%
10	Baa3	36.7%
11	Ba1	34.1%
12	Ba2	31.6%
13	Ba3	29.1%
14	B1	29.1%
15	B2	29.1%
16	B3	29.1%
17	Caa1	29.1%
18	Caa2	29.1%
19	Caa3	29.1%
20	Ca	29.1%

**Table E2. Prescribed Recovery Rates from Moody's as of December 2014**

PBR credit rating	Moody's rating	Recovery rate
1	Aaa	42.07
2	Aa1	42.07
3	Aa2	42.07
4	Aa3	42.07
5	A1	42.07
6	A2	42.07
7	A3	42.07
8	Baa1	42.07
9	Baa2	39.67
10	Baa3	37.27
11	Ba1	34.87
12	Ba2	32.47
13	Ba3	30.07
14	B1	30.07
15	B2	30.07
16	B3	30.07
17	Caa1	30.07
18	Caa2	30.07
19	Caa3	30.07
20	Ca	30.07

**Table F. Illustrative Current Market Benchmark Spreads as of 9/30/2009 for Investment Grade Bonds**

WAL (Weighted Average Life)	Investment Grade PBR credit rating and Moody's / S&P Ratings									
	1	2	3	4	5	6	7	8	9	10
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB	Baa2/BBB	Baa3/BBB-
1	108.9	114.6	120.3	128.6	136.9	145.2	176.6	208.1	239.5	338.7
2	116.4	122.1	127.8	136.1	144.4	152.7	182.8	212.9	243.0	340.4
3	123.9	129.6	135.3	143.6	151.9	160.2	189.0	217.7	246.5	342.2
4	131.3	137.0	142.7	151.0	159.3	167.6	195.0	222.5	249.9	343.9
5	138.8	144.5	150.2	158.5	166.8	175.1	201.2	227.2	253.3	345.6
6	146.2	151.9	157.6	165.9	174.2	182.5	207.2	232.0	256.7	347.3
7	153.7	159.4	165.1	173.4	181.7	190.0	213.4	236.8	260.2	349.0
8	156.6	162.3	168.0	176.3	184.6	192.9	215.8	238.6	261.5	349.7
9	159.5	165.2	170.9	179.2	187.5	195.8	218.2	240.5	262.9	350.4
10	162.4	168.1	173.8	182.1	190.4	198.7	220.5	242.4	264.2	351.0
11	163.3	169.0	174.7	183.0	191.3	199.6	221.3	242.9	264.6	351.2
12	164.1	169.8	175.5	183.8	192.1	200.4	221.9	243.5	265.0	351.4
13	165.0	170.7	176.4	184.7	193.0	201.3	222.7	244.0	265.4	351.6
14	165.8	171.5	177.2	185.5	193.8	202.1	223.3	244.6	265.8	351.8
15	166.7	172.4	178.1	186.4	194.7	203.0	224.1	245.1	266.2	352.0
16	167.5	173.2	178.9	187.2	195.5	203.8	224.7	245.6	266.5	352.2
17	168.4	174.1	179.8	188.1	196.4	204.7	225.4	246.2	266.9	352.4
18	169.2	174.9	180.6	188.9	197.2	205.5	226.1	246.7	267.3	352.6
19	170.1	175.8	181.5	189.8	198.1	206.4	226.8	247.3	267.7	352.8
20	170.9	176.6	182.3	190.6	198.9	207.2	227.5	247.8	268.1	353.0
21	171.8	177.5	183.2	191.5	199.8	208.1	228.2	248.4	268.5	353.2
22	172.6	178.3	184.0	192.3	200.6	208.9	228.9	248.9	268.9	353.4
23	173.5	179.2	184.9	193.2	201.5	209.8	229.6	249.5	269.3	353.6
24	174.3	180.0	185.7	194.0	202.3	210.6	230.3	250.0	269.7	353.8
25	175.2	180.9	186.6	194.9	203.2	211.5	231.0	250.6	270.1	354.0
26	176.0	181.7	187.4	195.7	204.0	212.3	231.7	251.0	270.4	354.1
27	176.9	182.6	188.3	196.6	204.9	213.2	232.4	251.6	270.8	354.3
28	177.7	183.4	189.1	197.4	205.7	214.0	233.1	252.1	271.2	354.5
29	178.6	184.3	190.0	198.3	206.6	214.9	233.8	252.7	271.6	354.7
30	179.4	185.1	190.8	199.1	207.4	215.7	234.5	253.2	272.0	354.9

**Table F. Illustrative Current Market Benchmark Spreads as of 9/30/2015 for Investment Grade Bonds**

WAL (Weighted Average Life)	Investment Grade PBR credit rating and Moody's / S&P Ratings									
	1	2	3	4	5	6	7	8	9	10
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-
1	27.11	38.26	49.41	58.12	66.84	75.55	91.10	106.65	122.20	225.83
2	34.97	47.02	59.06	67.20	75.34	83.48	101.59	119.69	137.80	233.63
3	42.84	55.77	68.71	76.28	83.84	91.41	112.07	132.74	153.40	241.43
4	50.70	64.53	78.36	85.35	92.35	99.34	122.56	145.78	169.00	249.23
5	57.92	72.35	86.79	93.96	101.13	108.30	133.99	159.68	185.38	257.42
6	65.13	80.18	95.22	102.57	109.91	117.26	145.42	173.59	201.75	265.61
7	72.36	89.78	107.19	112.83	118.46	124.10	151.88	179.67	207.45	268.46
8	79.60	99.38	119.16	123.08	127.01	130.93	158.34	185.75	213.16	271.31
9	86.83	104.37	121.90	127.19	132.48	137.77	164.80	191.83	218.86	274.16
10	89.47	107.06	124.64	129.93	135.23	140.52	167.79	195.06	222.33	275.90
11	92.11	109.75	127.38	132.68	137.97	143.27	170.78	198.29	225.80	277.63
12	94.76	112.44	130.12	135.42	140.72	146.02	173.77	201.52	229.27	279.37
13	97.40	115.13	132.86	138.16	143.46	148.76	176.75	204.74	232.73	281.10
14	100.04	117.82	135.60	140.91	146.21	151.51	179.74	207.97	236.20	282.84
15	102.68	120.51	138.34	143.65	148.96	154.26	182.73	211.20	239.67	284.57
16	105.33	123.21	141.08	146.39	151.70	157.01	185.72	214.43	243.14	286.30
17	107.97	125.90	143.83	149.14	154.45	159.76	188.71	217.66	246.61	288.04
18	110.61	128.59	146.57	151.88	157.19	162.51	191.70	220.89	250.08	289.77
19	113.25	131.28	149.31	154.62	159.94	165.26	194.69	224.12	253.55	291.51
20	115.89	133.97	152.05	157.37	162.69	168.01	197.68	227.35	257.02	293.24
21	118.54	136.66	154.79	160.11	165.43	170.75	200.66	230.57	260.48	294.98
22	121.18	139.35	157.53	162.85	168.18	173.50	203.65	233.80	263.95	296.71
23	123.82	142.04	160.27	165.60	170.92	176.25	206.64	237.03	267.42	298.44
24	126.46	144.74	163.01	168.34	173.67	179.00	209.63	240.26	270.89	300.18
25	129.11	147.43	165.75	171.08	176.42	181.75	212.62	243.49	274.36	301.91
26	131.75	150.12	168.49	173.83	179.16	184.50	215.61	246.72	277.83	303.65
27	134.39	152.81	171.23	176.57	181.91	187.25	218.60	249.95	281.30	305.38
28	137.03	155.50	173.97	179.31	184.65	189.99	221.58	253.17	284.76	307.12
29	139.67	158.19	176.71	182.06	187.40	192.74	224.57	256.40	288.23	308.85
30	142.32	160.88	179.45	184.80	190.15	195.49	227.56	259.63	291.70	310.58

**Table G. Illustrative Current Market Benchmark Spreads as of 9/30/2009 for Below Investment Grade Bonds**

WAL (Weighted Average Life)	Below Investment Grade PBR credit rating and Moody's / S&P Ratings									
	11	12	13	14	15	16	17	18	19	20
	Ba1/BB+	Ba2/BB	Ba3/BB-	B1/B+	B2/B	B3/B-	Caa1/CCC+	Caa2/CCC	Caa3/CCC-	Ca/CC
1	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
2	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
3	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
4	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
5	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
6	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
7	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
8	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
9	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
10	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
11	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
12	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
13	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
14	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
15	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
16	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
17	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
18	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
19	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
20	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
21	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
22	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
23	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
24	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
25	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
26	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
27	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
28	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
29	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9
30	437.8	529.8	596.8	663.9	730.9	876.8	1,022.8	1,168.7	1,314.7	1,478.9

**Table G. Illustrative Current Market Benchmark Spreads as of 9/30/2015 for Below Investment Grade Bonds**

WAL (Weighted Average Life)	Below Investment Grade PBR credit rating and Moody's / S&P Ratings									
	11	12	13	14	15	16	17	18	19	20
	Ba1/BB+	Ba2/BB	Ba3/BB-	B1/B+	B2/B	B3/B-	Caa1/CCC+	Caa2/CCC	Caa3/CCC-	Ca/CC
1	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
2	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
3	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
4	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
5	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
6	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
7	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
8	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
9	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
10	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
11	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
12	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
13	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
14	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
15	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
16	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
17	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
18	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
19	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
20	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
21	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
22	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
23	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
24	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
25	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
26	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
27	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
28	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
29	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72
30	329.47	392.96	456.45	519.95	583.44	761.50	939.55	1117.61	1295.67	1473.72



**Table H. Long-Term Benchmark Spreads as of 9/30/2009 for Investment Grade Bonds**

WAL (Weighted Average Life)	Investment Grade PBR credit rating and Moody's / S&P Ratings									
	1	2	3	4	5	6	7	8	9	10
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-
1	60.3	68.3	76.3	83.4	90.5	97.6	125.0	152.5	179.9	242.2
2	66.0	74.0	82.0	89.3	96.6	103.9	130.3	156.6	183.0	243.8
3	71.7	79.7	87.7	95.2	102.7	110.2	135.5	160.8	186.1	245.3
4	77.4	85.4	93.4	101.1	108.7	116.4	140.7	164.9	189.2	246.9
5	83.1	91.1	99.1	107.0	114.8	122.7	145.9	169.1	192.3	248.4
6	88.8	96.8	104.8	112.8	120.9	128.9	151.0	173.2	195.3	249.9
7	94.5	102.5	110.5	118.7	127.0	135.2	156.3	177.3	198.4	251.5
8	96.7	104.7	112.7	121.0	129.4	137.7	158.3	179.0	199.6	252.1
9	99.0	107.0	115.0	123.4	131.7	140.1	160.3	180.6	200.8	252.7
10	101.2	109.2	117.2	125.7	134.1	142.6	162.4	182.2	202.0	253.3
11	101.9	109.9	117.9	126.4	134.8	143.3	163.0	182.7	202.4	253.5
12	102.5	110.5	118.5	127.0	135.5	144.0	163.6	183.1	202.7	253.6
13	103.2	111.2	119.2	127.7	136.2	144.7	164.2	183.6	203.1	253.8
14	103.8	111.8	119.8	128.4	136.9	145.5	164.8	184.1	203.4	254.0
15	104.5	112.5	120.5	129.1	137.6	146.2	165.4	184.6	203.8	254.2
16	105.1	113.1	121.1	129.7	138.3	146.9	166.0	185.0	204.1	254.3
17	105.8	113.8	121.8	130.4	139.0	147.6	166.6	185.5	204.5	254.5
18	106.4	114.4	122.4	131.0	139.7	148.3	167.1	186.0	204.8	254.7
19	107.1	115.1	123.1	131.7	140.4	149.0	167.7	186.5	205.2	254.9
20	107.7	115.7	123.7	132.4	141.1	149.8	168.4	187.0	205.6	255.1
21	108.4	116.4	124.4	133.1	141.8	150.5	169.0	187.4	205.9	255.2
22	109.0	117.0	125.0	133.7	142.5	151.2	169.6	187.9	206.3	255.4
23	109.7	117.7	125.7	134.4	143.2	151.9	170.1	188.4	206.6	255.6
24	110.3	118.3	126.3	135.1	143.8	152.6	170.7	188.9	207.0	255.8
25	111.0	119.0	127.0	135.8	144.5	153.3	171.3	189.3	207.3	255.9
26	111.6	119.6	127.6	136.4	145.2	154.0	171.9	189.8	207.7	256.1
27	112.3	120.3	128.3	137.1	146.0	154.8	172.5	190.3	208.0	256.3
28	112.9	120.9	128.9	137.8	146.6	155.5	173.1	190.8	208.4	256.5
29	113.6	121.6	129.6	138.5	147.3	156.2	173.7	191.2	208.7	256.6
30	114.2	122.2	130.2	139.1	148.0	156.9	174.3	191.7	209.1	256.8

**Table H. Long-Term Benchmark Spreads as of 9/30/2015 for Investment Grade Bonds**

WAL (Weighted Average Life)	Investment Grade PBR credit rating and Moody's / S&P Ratings									
	1	2	3	4	5	6	7	8	9	10
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-
1	44.26	50.93	57.61	68.24	78.86	89.49	114.53	139.58	164.63	244.90
2	51.12	59.66	68.20	78.56	88.92	99.28	123.43	147.58	171.73	248.45
3	57.99	68.39	78.79	88.89	98.98	109.08	132.33	155.58	178.84	252.00
4	64.85	77.12	89.38	99.21	109.04	118.87	141.23	163.58	185.94	255.56
5	71.07	83.73	96.40	106.71	117.02	127.34	150.04	172.75	195.45	260.31
6	77.28	90.35	103.41	114.21	125.00	135.80	158.85	181.91	204.96	265.07
7	78.99	93.05	107.11	117.13	127.15	137.17	160.06	182.94	205.83	265.50
8	80.71	95.76	110.81	120.06	129.30	138.55	161.26	183.98	206.69	265.93
9	82.42	98.47	114.51	122.98	131.45	139.92	162.47	185.01	207.56	266.36
10	83.92	99.87	115.81	124.19	132.57	140.95	163.44	185.93	208.42	266.80
11	85.42	101.27	117.12	125.41	133.70	141.99	164.42	186.85	209.29	267.23
12	86.93	102.67	118.42	126.62	134.82	143.02	165.40	187.77	210.15	267.66
13	88.43	104.08	119.72	127.84	135.95	144.06	166.38	188.70	211.02	268.09
14	89.93	105.48	121.03	129.05	137.07	145.09	167.36	189.62	211.88	268.53
15	91.43	106.88	122.33	130.26	138.20	146.13	168.33	190.54	212.75	268.96
16	92.93	108.28	123.63	131.48	139.32	147.16	169.31	191.46	213.61	269.39
17	94.43	109.69	124.94	132.69	140.44	148.20	170.29	192.38	214.48	269.82
18	95.94	111.09	126.24	133.90	141.57	149.23	171.27	193.30	215.34	270.26
19	97.44	112.49	127.54	135.12	142.69	150.27	172.25	194.23	216.21	270.69
20	98.94	113.89	128.85	136.33	143.82	151.30	173.22	195.15	217.07	271.12
21	100.44	115.30	130.15	137.55	144.94	152.34	174.20	196.07	217.94	271.55
22	101.94	116.70	131.45	138.76	146.06	153.37	175.18	196.99	218.80	271.99
23	103.44	118.10	132.76	139.97	147.19	154.41	176.16	197.91	219.67	272.42
24	104.95	119.50	134.06	141.19	148.31	155.44	177.14	198.83	220.53	272.85
25	106.45	120.91	135.36	142.40	149.44	156.47	178.11	199.75	221.40	273.28
26	107.95	122.31	136.67	143.61	150.56	157.51	179.09	200.68	222.26	273.72
27	109.45	123.71	137.97	144.83	151.69	158.54	180.07	201.60	223.13	274.15
28	110.95	125.11	139.27	146.04	152.81	159.58	181.05	202.52	223.99	274.58
29	112.46	126.52	140.58	147.26	153.93	160.61	182.03	203.44	224.86	275.01
30	113.96	127.92	141.88	148.47	155.06	161.65	183.01	204.36	225.72	275.45

**Table I. Long-Term Benchmark Spreads as of 9/30/2009 for Below Investment Grade Bonds**

WAL (Weighted Average Life)	Below Investment Grade PBR credit rating and Moody's / S&P Ratings									
	11	12	13	14	15	16	17	18	19	20
	Ba1/BB+	Ba2/BB	Ba3/BB-	B1/B+	B2/B	B3/B-	Caa1/CCC+	Caa2/CCC	Caa3/CCC-	Ca/CC
1	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
2	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
3	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
4	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
5	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
6	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
7	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
8	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
9	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
10	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
11	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
12	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
13	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
14	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
15	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
16	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
17	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
18	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
19	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
20	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
21	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
22	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
23	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
24	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
25	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
26	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
27	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
28	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
29	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4
30	304.5	360.4	442.8	525.3	607.7	823.6	1,039.6	1,255.5	1,471.4	1,724.4

**Table I. Long-Term Benchmark Spreads as of 9/30/2015 for Below Investment Grade Bonds**

WAL	Below Investment Grade PBR credit rating and Moody's / S&P Ratings									
(Weighted Average Life)	11	12	13	14	15	16	17	18	19	20
	Ba1/BB+	Ba2/BB	Ba3/BB-	B1/B+	B2/B	B3/B-	Caa1/CCC+	Caa2/CCC	Caa3/CCC-	Ca/CC
1	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
2	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
3	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
4	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
5	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
6	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
7	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
8	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
9	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
10	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
11	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
12	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
13	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
14	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
15	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
16	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
17	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
18	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
19	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
20	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
21	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
22	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
23	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
24	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
25	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
26	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
27	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
28	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
29	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1
30	325.2	386.4	447.6	508.9	570.1	769.3	968.5	1,167.7	1,366.9	1,566.1

**Table J. Long-Term Benchmark Swap Spreads**

(85% Conditional Mean—July 2000 through September 2009)

WAL	Swap Spread
3 M	29.3
6 M	29.9
1 Y	38.8
2 Y	47.5
3 Y	52.3
4 Y	53.4
5 Y	55.2
6 Y	55.4
7 Y	53.8
8 Y	50.6
9 Y	47.0
10 Y	43.6
11 Y	40.0
12 Y	37.7
13 Y	34.9
14 Y	33.3
15 Y	33.0
16 Y	31.7
17 Y	31.4
18 Y	32.0
19 Y	33.3
20 Y	35.1
21 Y	35.7
22 Y	36.4
23 Y	37.4
24 Y	38.5
25 Y	39.7
26 Y	40.7
27 Y	41.7
28 Y	42.7
29 Y	43.8
30 Y	44.2

**Table J. Long-Term Benchmark Swap Spreads**

(85% Conditional Mean—July 2000 through September 2015)

WAL	Swap Spread
<b>3M</b>	20.42
<b>6M</b>	26.20
<b>1</b>	29.11
<b>2</b>	32.52
<b>3</b>	35.45
<b>4</b>	36.48
<b>5</b>	36.72
<b>6</b>	36.14
<b>7</b>	34.24
<b>8</b>	31.07
<b>9</b>	27.40
<b>10</b>	23.91
<b>11</b>	21.03
<b>12</b>	18.69
<b>13</b>	16.82
<b>14</b>	15.39
<b>15</b>	14.34
<b>16</b>	13.61
<b>17</b>	13.16
<b>18</b>	12.95
<b>19</b>	12.93
<b>20</b>	13.09
<b>21</b>	13.30
<b>22</b>	13.51
<b>23</b>	13.73
<b>24</b>	13.97
<b>25</b>	14.23
<b>26</b>	14.47
<b>27</b>	14.64
<b>28</b>	14.73
<b>29</b>	14.71
<b>30</b>	14.59

**Table K. Conversion from NAIC ARO Ratings and NAIC Designations to PBR Numeric Rating**

Moody's Rating	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3
S&P Rating	AAA	AA	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
Fitch Rating	AAA	AA	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
DBRS Rating	AAA	AA high	AA	AA low	A high	A	A low	BBB high	BBB	BBB low
RealPoint Rating	AAA	AA	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
AM Best Rating	aaa	aa+	aa	aa-	a+	a	a-	bbb+	bbb	bbb-
NAIC Designation	1	1	1	1	1	1	1	2	2	2
NAIC Commercial Mortgage Designation							1			2
Numeric Rating	1	2	3	4	5	6	7	8	9	10

Moody's Rating	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca
S&P Rating	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC
Fitch Rating	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC
DBRS Rating	BB high	BB	BB low	B high	B	B low	CCC high	CCC	CCC low	CC
RealPoint Rating	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	D
AM Best Rating	bb+	bb	bb-	b+	b	b-	ccc+	ccc	ccc-	cc
NAIC Designation	3	3	3	4	4	4	5	5	5	6
NAIC Commercial Mortgage Designation	3	4	5							
Numeric Rating	11	12	13	14	15	16	17	18	19	20