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SPECIFICATIONS FOR CALCULATING LIFE INSURANCE POLICY RESERVES UNDER SECTIONS 5 AND 8 OF THE NAIC STANDARD VALUATION LAW AS AMPLIFIED BY THE VALUATION OF LIFE INSURANCE POLICIES MODEL REGULATION

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ABSTRACT

This paper presents specifications for determining life insurance policy reserves in compliance with Sections 5 and 8 of the National Association of Insurance Commissioners' (NAIC) model Standard Valuation Law (SVL) as amplified by the NAIC Valuation of Life Insurance Policies Model Regulation (model regulation). The model regulation is sometimes referred to as Regulation XXX. These specifications are for the SVL and the model regulation in the NAIC Model Laws, Regulations and Guidelines per the NAIC Model Regulation Service updated through July, 1996. The SVL was last modified in December, 1991 and the model regulation was adopted in March, 1995 and has not been amended.

INTRODUCTION

Sections 5 and 8 of the SVL specify minimum formula based reserves. Any requirements for higher reserves, such as those called for in policy provisions or those necessary to make adequate provision for the company's obligations under a policy, are not addressed by this paper.

These specifications address ambiguities and other implementation questions. Specific criteria (instructions and formulas) are presented for determining which of the various types of reserve calculations are to be made for a policy. Also, reserve formulas are provided for each type of reserve calculation.

The reserve formulas presented in this paper are designed to be used to generate reserve factors and these factors are to be used to calculate reserves for life insurance policies using traditional methods and computer systems. These reserve formulas may also be applicable, in whole or in part, to other valuation procedures.

These specifications are intended to enable the actuary to comply with the letter and spirit of the SVL as amplified by the model regulation. They are based on materials listed in the bibliography and on discussions with regulatory and industry personnel involved in the development and implementation of the model regulation.

SECTION 5 RESERVES

Section 5 of the SVL defines the calculation of reserves under the Commissioners' Reserve Valuation Method (CRVM). The first paragraph of Section 5 describes the minimum reserve calculation which is generally applicable to all policies. The second paragraph describes the calculation of another minimum reserve that applies to policies with specified premium and benefit patterns. In this paper, this additional minimum reserve is called the deposit term reserve; this name refers to a particular policy design that triggers the application of this reserve.

The model regulation specifies how to calculate reserves for nonlevel policies, those policies with nonlevel premiums or nonlevel benefits or both. It requires basic reserves and deficiency reserves. The basic reserve calculation is the procedure in the regulation for applying the generally applicable reserve calculation of SVL section 5 to a nonlevel policy. The basic reserves required by the model regulation for nonlevel policies correspond to the generally applicable reserves of SVL section 5 for level policies.

The basic reserves required by the model regulation are the greater of unitary reserves and segmented reserves. Exceptions to this general rule are noted in this paper. If a policy has one or more unusual cash values (as defined in a later section of this paper), then the reserves held may not be less than the unusual cash value pattern reserves. These three types of reserves are defined in the model regulation.

A. *Unitary Reserves*

The unitary reserve calculation is similar to the generally applicable CRVM calculation described in SVL section 5.

B. *Segmented Reserves*

Segmented reserves are calculated by dividing into segments the period of time the policy is scheduled to be in force. Generally, one segment ends and a new segment starts when the percentage increase in premium from one year to the next exceeds the percentage increase in the applicable mortality rate.

There are three different segmented reserve calculations. The insurance company can choose which calculation to use. The three are:

1. Default calculation: the basic segmented reserves at the end of each segment are equal to zero.
2. Option 1: the basic segmented reserves at the end of each segment are equal to the unitary reserve.

3. Option 2: the basic segmented reserves at the end of each segment are equal to the cash surrender value.

C. Unusual Cash Value Pattern Reserves

Unusual cash value pattern reserves are additional minimum reserves for any policy with one or more unusual cash values. The calculation of unusual cash value pattern reserves is similar to the calculation of segmented reserves. The segments are redetermined, however, so that one segment ends and a new segment begins on each policy anniversary which coincides with an unusual cash value. The basic reserve at the end of each segment under this type of calculation is equal to the unusual cash value.

SECTION 8 RESERVES

Section 8 of the SVL defines an additional minimum reserve calculation. This minimum needs to be considered if, in any policy year, the gross premium charged for a policy is less than the net premium calculated as described in SVL section 8. In practice, a reserve required by this section is called a deficiency reserve although this term does not appear in the SVL.

The model regulation specifies how to calculate a deficiency reserve for nonlevel policies. Unlike SVL section 8 which defines a total reserve, the deficiency reserve per the model regulation is not a total reserve, it is an incremental reserve equal to the excess of a recalculated basic reserve over the actual basic reserve. The recalculation of the basic reserve is to be made as specified in the model regulation.

CASH SURRENDER VALUES

The model regulation requires the total reserve to be at least equal to the cash surrender value of the policy.

DEPOSIT TERM RESERVES

SVL sections 5 and 8 require the deposit term reserve as a minimum total reserve for nonlevel polices with specific premium and benefit patterns. The SVL deposit term reserve requirements apply to these nonlevel policies, even though they are subject to the model regulation, because a regulation cannot override a law.

The total reserve required for a policy that triggers the deposit term requirement is the greatest of the total basic and deficiency reserve under the model regulation, the unusual cash value pattern reserve (if applicable), the deposit term reserve, and the cash surrender value.

APPLICABLE CALCULATIONS

This paper includes criteria for determining which types of reserve calculations apply to a policy. For a policy with level premiums and benefits, reserves (other than deficiency reserves) are determined using only the generally applicable calculation from SVL section 5.

If premiums and/or benefits are nonlevel, then the model regulation specifies the calculation of basic reserves. In this case, the basic reserves are generally the greater of the unitary reserves and the segmented reserves and, if applicable, the unusual cash value pattern reserves.

Once the generally applicable reserve has been determined for a level policy or the basic reserve and any unusual cash value pattern reserve has been determined for a nonlevel policy, it is necessary to calculate any applicable deficiency reserve. There are two sets of deficiency reserve procedures. The procedures in SVL section 8 apply to level policies. The procedures in the model regulation apply to nonlevel policies.

Per SVL sections 5 and 8, as amplified by the model regulation:

- The minimum reserve for a policy with level premiums and benefits is the greater of the generally applicable reserve of SVL section 5 and the deficiency reserve of SVL section 8.
- The minimum reserve for a nonlevel policy is the greatest of the total basic and deficiency reserve and, as applicable, the unusual cash value pattern reserve, the deposit term reserve and the cash surrender value.

OTHER MATTERS

The above discussion relates to the determination of terminal reserves. There are additional considerations involved in the determination of interim reserves. These matters are addressed by reserve calculation formulas in these specifications.

In general, the formulas in this paper are based on the assumptions that premiums are payable annually at the beginning of the policy year and death benefits are payable at the end of the policy year of death. This is generally referred to as a curtate calculation. Formulas that are based on other assumptions are presented at the end of this paper.

Also described in this paper are financial statement premium elements for use in connection with the reserves produced by these reserve formulas. These premium elements reflect the actual premium paid-to-date of the policies for which reserves are being calculated.

Another assumption underlying these factors is the uniform distribution of policy issue dates. In the event that policy issue dates are not uniformly distributed, then adjustments should be considered to correct any material misstatements this causes.

The formulas in this paper use commutation functions defined specifically to handle nonlevel benefits and premiums of an insurance policy. There are other algebraically equivalent expressions for these formulas, including some that do not use commutation functions. Symbols have been created as needed and are defined in this paper.

These specifications do not require the calculations to be performed in any particular order nor do they impose rounding rules other than those in the regulation or otherwise attempt to micromanage the precision of the results. Reasonable variations in results between practitioners using different software and/or hardware are expected and are acceptable.

The use of simplifications and shortcuts may be expedient for specific products. This practice should be supportable by a demonstration that any simplifications or shortcuts do not result in reserves less than the minimum required.

The minimum valuation standard for interest, per SVL section 4, is not affected by the model regulation. The valuation interest rate for a policy per the minimum standards is level for the life of the policy. To apply the formulas in this paper using interest rates that are not level, the appropriate duration based interest rates should be used in place of the level interest rate shown in the formulas.

The SVL and the model regulation are both NAIC models. A state or other jurisdiction may modify these models prior to implementing them. No attempt is made in this paper to address any variations between the NAIC models and the actual laws and regulations of any jurisdiction.

The reserve for a single policy may be produced by different formulas for consecutive year-ends. This will complicate the calculation and/or explanation of the analysis of increase in reserves in the statutory annual statement for life insurance companies.

This paper addresses the calculation of reserves for statutory life insurance accounting only. It does not address any implications with respect to the calculation of federal income tax reserves.

CONCLUSION

The model regulation specifies how to apply the generally applicable CRVM reserve formula of SVL section 5 to nonlevel policies and produce basic reserves. It also describes how to calculate deficiency reserves corresponding to these basic reserves to comply with SVL section 8. This paper presents formulas for calculating policy reserves in accordance with SVL sections 5 and 8 taking into account, when appropriate, the requirements of the model regulation.

FORMULAS

1. Definitions

This section contains definitions of generally used terms. Additional terms are defined in subsequent sections.

1-1.	x	=	Age at issue
1-2.	m	=	Benefit period in years
1-3.	n	=	Premium paying period in years
1-4.	k	=	Number of policy years before a segment begins
1-5.	d	=	Length of a segment in years
1-6.	${}_bq_x$	=	Ultimate probability of death for SVL section 5 reserves—basic, et al. (See section 7 on p. 221.)
1-7.	${}_dq_x$	=	Ultimate probability of death for SVL section 8 reserves—deficiency (See section 7 on p. 221.)
1-8.	${}_tSF_x$	=	Select mortality factor for issue age x, policy year t
1-9.	$q_{[x]+t}$	=	$q_{x+t} \circ {}_{t+1}SF_x$ = Select probability of death for issue age x, policy year t (See section 7 on p. 221.) (${}_bq_{[x]+t}$ is the select probability of death for basic, et al. reserve calculations) (${}_dq_{[x]+t}$ is the select probability of death for deficiency reserve calculations)
1-10.	${}_tGG_x$	=	The guaranteed gross premium payable in policy year t for issue age x. This excludes any policy fee which is level over the entire premium paying period and, by custom, excludes substandard extra premium. A nonlevel policy fee, including a one time policy fee, is included in guaranteed gross premium.
1-11.	${}_tSG_x$	=	The scheduled gross premium payable in policy year t for issue age x. This is the smallest illustrated gross premium. This excludes any policy fee which is level over the entire premium paying period and, by custom, excludes substandard extra premium. A nonlevel policy fee, including a one time policy fee, is included in scheduled gross premium. For universal life insurance policies this is the smallest premium that will keep the policy in force at the original schedule of benefits.

1-12.	${}_tR_x^{GG}$	=	${}_tGG_x/{}_1GG_x$ Ratio of the guaranteed gross premium payable in policy year t to the guaranteed gross premium payable in policy year one for issue age x.
1-13.	${}_tIA_x$	=	Initial amount of insurance (death benefit) per unit of coverage in policy year t for issue age x.
1-14.	${}_tAA_x$	=	Average amount of insurance per unit of coverage in policy year t for issue age x.
1-15.	${}_tEC_x$	=	Endowment or coupon payable at the end of policy year t for issue age x.
1-16.	${}_tCV_x$	=	Guaranteed cash surrender value available at the end of policy year t for issue age x.
1-17.	${}_tUCV_x$	=	Unusual guaranteed cash surrender value at the end of policy year t for issue age x. (See section 4 on p. 219.)
1-18.	${}_tSC_x$	=	Surrender charge in policy year t for issue age x.
1-19.	${}_Ri$	=	Reserve interest rate.
1-20.	${}_Ni$	=	Nonforfeiture interest rate.

The following symbols represent reserves produced by different types of reserve calculations.

1-21.	${}_tV_{[x]}^{GEN}$	=	Generally applicable reserve (as defined in the first paragraph of SVL section 5) at the end of policy year t for issue age x.
1-22.	${}_tV_{[x]}^{UNI}$	=	Unitary reserve (as defined in the model regulation) at the end of policy year t for issue age x.
1-23.	${}_tV_{[x]}^{SEG}$	=	Segmented reserve, using no option, (as defined in the model regulation) at the end of policy year t for issue age x.
1-24.	${}_tV_{[x]}^{SA1}$	=	Segmented reserve using option A1, unitary reserve grading, (as defined in the model regulation) at the end of policy year t for issue age x.
1-25.	${}_tV_{[x]}^{SA2}$	=	Segmented reserve using option A2, cash surrender value grading, (as defined in the model regulation) at the end of policy year t for issue age x.
1-26.	${}_tV_{[x]}^{UCVP}$	=	Unusual cash value pattern reserve (as defined in the model regulation) at the end of policy year t for issue age x.
1-27.	${}_tV_{[x]}^{DT}$	=	Deposit term reserve (as defined in the second paragraph of SVL section 5) at the end of policy year t for issue age x.

1-28. ${}_tV^{EX}_{[x]}$ = Reserve per attained age YRT exemption and YRT reinsurance exemption (as defined in the model regulation) at the end of policy year t for issue age x.

2. *Model Regulation Trigger*

The model regulation is operative for a policy that has either or both:

1. guaranteed nonlevel premiums, or
2. guaranteed nonlevel benefits.

The following are exempted from the model regulation:

1. Certain policies issued as a result of a reentry provision,
2. Variable life insurance policies,
3. Variable universal life insurance policies, and
4. Group life insurance unless there is a schedule of maximum gross premiums for a period in excess of one year.

A plan has nonlevel premiums:

2-1. if ${}_tR^{GG}_x \neq 1$ for any t from 2 through n

A plan has nonlevel benefits:

2-2. if ${}_tIA_x \neq {}_1IA_x$ for any t from 2 through m, or
2-3. if ${}_tAA_x \neq {}_1IA_x$ for any t from 1 through m, or
2-4. if ${}_tEC_x \neq {}_1EC_x$ for any t from 2 through m-1.

Note: An endowment or coupon payable in the last policy year is not treated as a nonlevel benefit for this purpose.

(In discussions with regulatory officials, they were generally not concerned about nonlevel endowments, and they did not uniformly agree that a policy would be subject to the model regulation as a result of having nonlevel endowments as described in formula 2-4 above.)

3. *Determination of Segments for Segmented Reserves (with or without options)*

If the model regulation is operative for a policy, then it will usually be necessary to determine policy segments.

Default Segments:

The first policy year is always the first year of a segment.

Each policy year t after the first policy year will be the first year of a new segment:

3-1.

$$\text{if } \underset{\text{PREMIUM RATIO}}{\frac{{}_tR_x^{GG}}{{}_{t-1}R_x^{GG}}} > \underset{\text{MORTALITY RATIO}}{\frac{{}_dq_{[x]+t-1}}{{}_dq_{[x]+t-2}}} \quad \text{for } 2 \leq t \leq n$$

If the premium ratio does not exceed the mortality ratio then policy year t continues the old segment, it does not start a new segment. If $n = 1$, then the entire policy benefit period is one segment.

Optional Segments:
At the company's option, the mortality ratio used in the determination of segments may be modified in any policy year by substituting:

3-2. $\frac{{}_dq_{[x]+t-1}}{{}_dq_{[x]+t-2}} + 0.01$, or

3-3. $\frac{{}_dq_{[x]+t-1}}{{}_dq_{[x]+t-2}} - 0.01$, but not less than 1.00.

The purpose of this tolerance in the mortality ratio is to prevent irrational segment lengths due to such things as premium rounding.

4. *Unusual Guaranteed Cash Surrender Values*

A guaranteed cash surrender value is unusual:

4-1. if ${}_tCV_x > {}_{t-1}CV_x + (1.1 \cdot {}_tSG_x) + (1.1 \cdot {}_Ni \cdot ({}_{t-1}CV_x + {}_tSG_x)) + (.05 \cdot {}_1SC_x)$

This ${}_Ni$ is the nonforfeiture interest rate used for calculating actual policy guaranteed cash surrender values.

4-2. ${}_tUCV_x = {}_tCV_x$ if ${}_tCV_x$ is unusual.

4-3. ${}_tUCV_x = 0$ if ${}_tCV_x$ is not unusual.

5. *Determination of Segments for Unusual Cash Value Pattern Reserves*

If a policy contains one or more unusual guaranteed cash surrender values, then an additional segmented reserve calculation is performed based on a second set of segments. These alternate segments are determined as follows.

The first policy year is always the first year of an unusual cash value segment.

Each policy year after the first policy year will be the first year of an unusual cash value segment if the guaranteed cash surrender value at the end of the preceding policy year is an unusual guaranteed cash surrender value. If the guaranteed cash surrender value at the end of the preceding policy year is not an unusual guaranteed cash surrender value, then the policy year continues the old unusual cash value segment, it does not start a new segment.

6. Deposit Term Trigger

Deposit term minimum reserves apply to policies with certain premium and benefit patterns as specified in the second paragraph of SVL section 5. The first-year premium must exceed the second-year premium, with no comparable additional first-year benefit. Also, the policy must provide cash paid or available from the policy at some future date that exceeds the extra first-year premium.

The first-year premium exceeds the second-year premium:

6-1. if ${}_2R_x^{GG} < 1$

There is no additional first-year benefit:

6-2. if ${}_1IA_x \leq {}_2IA_x$, and

6-3. if ${}_1AA_x \leq {}_2AA_x$, and

6-4. if ${}_1EC_x \leq {}_2EC_x$.

If there is an additional first-year benefit, then the determination as to whether or not the additional benefits are comparable to the extra first-year premium must be made based on the facts and circumstances of the policy.

Cash paid or available from the policy through policy year d exceeds the extra first-year premium:

6-5. if $${}_dCV_x + \sum_{t=1}^{d} {}_tEC_x > {}_1GG_x - {}_2GG_x$$

An alternate interpretation of the law would substitute the term ${}_dEC_x$ for the summation in formula 6-5. This interpretation would create a loophole, however, and a product could be designed to evade this reserve requirement by using multiple endowment payments.

Once a policy has triggered the application of the deposit term reserve formula, then it is necessary to determine the "assumed ending date." The assumed ending date is the earliest policy anniversary, d, for which formula 6-5 is true.

7. *Mortality, Selection Factors, and Select Mortality*

SVL section 4 and the model regulation both prescribe the Commissioners 1980 Standard Ordinary Mortality Table (1980 CSO) or any ordinary mortality table subsequently adopted by the NAIC and approved for this purpose as the minimum valuation standard for mortality for ordinary life policies. The model regulation also specifies the smoker and nonsmoker versions of the 1980 CSO table. These versions fall under the SVL's provision for use of other tables adopted by the NAIC. The 1980 CSO valuation mortality tables are published in the *Transactions of the Society of Actuaries*, Volume XXXIII. Its smoker and nonsmoker versions are published in the *TSA 1982 Reports*.

SVL section 4 permits ten-year select mortality factors. These factors are published in the *Transactions of the Society of Actuaries*, Volume XXXIII. The model regulation permits use of:

1. These same ten-year select mortality factors
2. Factors based on the selection factors included as an appendix to the model regulation
3. Other tables of select factors adopted by the NAIC and approved for this purpose.

As shown in the formulas below, the mortality selection factors based on the appendix to the model regulation (item 2 above) are different depending on whether minimum basic reserves or minimum deficiency reserves are being calculated. Also, there are two ways these factors may be implemented for each type of reserve.

An additional limitation, based on the length of the first segment, is imposed on select mortality. Generally, select mortality may only be used during the first segment. If the first segment is less than ten years, however, then after the first segment, the appropriate ten-year select mortality factors (item 1 above) may be used for the rest of the first ten policy years. The ten-year select mortality factors may be used *after* the first segment (through the tenth policy year) even if the new selection factors introduced by the model regulation (item 2 above) are used *during* the first segment.

In this section, d is the length of the first segment for segmented reserve purposes, per section 3 of these formulas.

A. No Selection

When using mortality without selection:

7-1. $_bq_{[x]+t} = {}_dq_{[x]+t} = q_{x+t}$ for all t

B. Ten-Year Mortality Selection Factors

$_t10SF_x$ = Ten-year selection factor for issue age x, policy year t, published in the *Transactions of the Society of Actuaries*, Volume XXXIII.

For the ten-year select factors, use the published values for the first ten policy years. All factors equal 100% for policy years after the tenth.

7-2. $_t10SF_x = 1.00$ for $t > 10$

When using the ten-year select mortality factors with *no* selection after the first segment:

7-3. $_bq_{[x]+t} = {}_dq_{[x]+t} = q_{x+t} \cdot {}_{t-1}10SF_x$ for $0 \leq t \leq d-1$

7-4. $_bq_{[x]+t} = {}_dq_{[x]+t} = q_{x+t}$ for $t \geq d$

When using the ten-year select mortality factors with selection after the first segment:

7-5. $_bq_{[x]+t} = {}_dq_{[x]+t} = q_{x+t} \cdot {}_{t+1}10SF_x$ for all t

(Note: For $t > 10$, $_bq_{[x]+t} = {}_dq_{[x]+t} = q_{x+t}$ because $_{t+1}10SF_x = 1.00$)

C. Model Regulation Mortality Selection Factors

$_tBVSF_x$ = Base Valuation Selection Factor for issue age x, policy year t, published in the appendix to the model regulation.

The manner in which the select factors introduced by the model regulation may be used is different for basic reserves and deficiency reserves.

Model Regulation Mortality Selection Factors for Basic Reserves. If the model regulation factors are used for basic reserves, they may be applied in either of the following two ways.

1. Use 150% of the model regulation factors:

7-6. $_tSF_x = 1.50 \cdot {}_tBVSF_x/100$, but not greater than 1.00 for all t

2. Use 150% of the model regulation factors for the first ten policy years then linearly grade to 100% at policy year 16:

7-7. ${}_tSF_x = 1.50 \cdot {}_tBVSF_x/100$, but not greater than 1.00 for $t \leq 10$

7-8. ${}_tSF_x = \frac{16-t}{6} \cdot {}_{10}\mathrm{SF}_x + \frac{t-10}{6} \cdot 1.00$ for $10 \leq t \leq 16$

7-9. ${}_tSF_x = 1.00$ for $t \geq 16$

No rounding is permitted when using formulas 7-6 through 7-9.

When using the selection factors in the appendix to the model regulation with *no* selection after the first segment:

7-10. ${}_bq_{[x]+t} = q_{x+t} \cdot {}_{t+1}SF_x$ for $0 \leq t \leq d-1$

7-11. ${}_bq_{[x]+t} = q_{x+t}$ for $t \geq d$

When using the selection factors in the appendix to the model regulation with selection after the first segment:

7-12. ${}_bq_{[x]+t} = q_{x+t} \cdot {}_{t+1}SF_x$ for $0 \leq t \leq d-1$

7-13. ${}_bq_{[x]+t} = q_{x+t} \cdot {}_{t+1}10SF_x$ for $t \geq d$

Model Regulation Mortality Selection Factors for Deficiency Reserves. If the model regulation factors are used for deficiency reserves, they may be applied in either of the following two ways:

1. Use 120% of the model regulation factors:

7-14. ${}_tSF_x = 1.20 \cdot {}_tBVSF_x/100$, but not greater than 1.00 for all t

2. Use 120% of the model regulation factors for the first ten policy years then linearly grade to 100% at policy year 16:

7-15. ${}_tSF_x = 1.20 \cdot {}_tBVSF_x/100$, but not greater than 1.00 for $t \leq 10$

7-16. ${}_tSF_x = \frac{16-t}{6} \cdot {}_{10}SF_x + \frac{t-10}{6} \cdot 1.00$ for $10 \leq t \leq 16$

7-17. ${}_tSF_x = 1.00$ for $t \geq 16$

No rounding is permitted when using formulas 7-14 through 7-17.

When using the selection factors in the appendix to the model regulation with *no* selection after the first segment:

7-18. ${}_dq_{[x]+t} = q_{x+t} \cdot {}_{t+1}SF_x$ for $0 \leq t \leq d-1$

7-19. ${}_dq_{[x]+t} = q_{x+t}$ for $t \geq d$

When using the selection factors in the appendix to the model regulation with selection after the first segment:

7-20. $_{d}q_{[x]+t} = q_{x+t} \cdot {}_{t+1}SF_x$ for $0 \le t \le d-1$

7-21. $_{d}q_{[x]+t} = q_{x+t} \cdot {}_{t+1}10SF_x$ for $t \ge d$

The length of policy segments is determined using the valuation mortality rate for deficiency reserves, as described in section 3 of this paper. Deficiency reserve mortality should be determined in the manner described below for this purpose.

D. No Selection

Use formula 7-1 to determine deficiency reserve mortality for all purposes.

E. Ten-Year Mortality Selection Factors

Use formula 7-3 to determine deficiency reserve mortality for determining the length of the first segment.

F. Model Regulation Mortality Selection Factors

Use formula 7-18 to determine deficiency reserve mortality for determining the length of the first segment.

After the length of the first segment, d, has been determined based on select mortality calculated as specified in D, E or F above, then the length of subsequent segments can be determined based on select mortality calculated using this value of d and the appropriate formulas for the deficiency reserve valuation mortality rate as specified in A, B or C above.

8. Reserve Building Blocks

Various definitions of traditional commutation functions,

D_x, N_x, C_x, M_x, $\overline{D}_x$, $\overline{N}_x$, $\overline{C}_x$, and $\overline{M}_x$,

may be found in actuarial literature, including the following publications listed in the bibliography: Society of Actuaries 1983 and Jordan 1975. The following formulas may be used:

8-1. $v = 1/(1+i)$

The minimum valuation standard for interest, per SVL section 4, is not affected by the model regulation. The valuation interest rate for a policy is level for the life of the policy.

8-2. l_0 = radix (number of lives at age zero)

8-3. $d_x = l_x \cdot q_x$ (number of deaths during age x)

The q_x in formula 8-3 is $_bq_x$ when calculating SVL section 5 reserves and $_dq_x$ when calculating SVL section 8 (deficiency) reserves.

8-4. $l_{x+1} = l_x - d_x$

8-5. $D_{[x]+t} = v^{x+t} \cdot l_{[x]+t}$

8-6. $N_{[x]+t} = \sum_{s=0}^{\omega-(x+t+1)} D_{[x]+t+s}$

8-7. $C_{[x]-t} = v^{x+t+1} \cdot d_{[x]+t}$

8-8. $M_{[x]+t} = \sum_{s=0}^{\omega-(x\div t+1)} C_{[x]+t+s}$

8-9. $\overline{D}_{[x]+t} = (D_{[x]+t} + D_{[x]+t+1})/2$

8-10. $\overline{N}_{[x]+t} = (N_{[x]+t} + N_{[x]+t+1})/2 = N_{[x]+t} - (D_{[x]-t}/2)$

8-11. $\overline{C}_{[x]+t} = C_{[x]+t} \cdot (1 + i)^{1/2}$

8-12. $\overline{M}_{[x]+t} = \sum_{s=0}^{\omega-(x+t+1)} \overline{C}_{[x]+t+s}$

8-13. $_GN_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R_x$

8-14. $_G\overline{N}_{[x]+t} = \sum_{s=t}^{n-1} \overline{D}_{[x]+s} \cdot {}_{1+s}R_x$

8-15. $_GM_{[x]+t} = \sum_{s=t}^{m-1} \left[C_{[x]+s} \cdot {}_{s+1}AA_x + D_{[x]+s+1} \cdot {}_{s+1}EC_x\right]$

8-16. $_G\overline{M}_{[x]+t} = \sum_{s=t}^{m-1} \left[\overline{C}_{[x]+s} \cdot {}_{s+1}AA_x + D_{[x]+s+1} \cdot {}_{s+1}EC_x\right]$

8-17. $_{GD}M_{[x]+t} = \sum_{s=t}^{m-1} C_{[x]+s} \cdot {}_{s+1}AA_x$

8-18. $_{GD}\overline{M}_{[x]+t} = \sum_{s=t}^{m-1} \overline{C}_{[x]+s} \cdot {}_{s+1}AA_x$

9. Expense Allowances

The values defined in this section are used for calculating the expense allowances for the various types of reserve calculations.

One-year term premium for benefits provided in the first policy year

9-1. $c_{[x]} = \dfrac{{}_{G}M_{[x]} - {}_{G}M_{[x]+1}}{D_{[x]}}$

Renewal year average level amount

9-2. j = lesser of 10 and m (benefit period)

9-3. $ALA_{[x]+1} = \sum_{t=2}^{j} \dfrac{{}_{t}A_{x}}{j - 1}$

The renewal year average level amount is specified by Actuarial Guideline XVII. It is used in the calculation of the expense allowance for the two reserve formulas in SVL section 5; the generally applicable reserve formula and the deposit term reserve formula. (In accordance with Society of Actuaries 1983, the value of j is not reduced if the deposit term ending date is less than ten years after issue.)

Renewal year equivalent level amount

9-4. $ELA_{[x]+1} = \dfrac{{}_{GD}M_{[x]+1}}{M_{[x]+1} - M_{[x]+m}}$

The renewal year equivalent level amount is used, per the model regulation, for the calculation of the expense allowance for unitary reserves, segmented reserves (with and without options), and unusual cash value pattern reserves. The phrase "equivalent level amount" is defined in a previously applicable section of the NAIC Standard Nonforfeiture Law. The above formula is consistent with that definition.

Net level annual premium on the nineteen-year premium whole life plan of insurance for the renewal year average level amount

9-5. ${}_{19}PA_{[x]+1} = ALA_{[x]+1} \cdot \dfrac{M_{[x]+1}}{N_{[x]+1} - N_{[x]+20}}$

Net level annual premium on the nineteen-year premium whole life plan of insurance for the renewal year equivalent level amount

9-6. ${}_{19}PE_{[x]+1} = ELA_{[x]-1} \cdot \dfrac{M_{[x]+1}}{N_{[x]+1} - N_{[x]+20}}$

10. Generally Applicable Reserves

The first paragraph of SVL section 5 defines the calculation of generally applicable reserves.

A. Expense Allowance:

Net level premium

10-1. $^{GEN}P^{NL}_{[x]} = \dfrac{{}^{G}M_{[x]}}{{}_{G}N_{[x]}}$

Net level premium for benefits after the first policy year

10-2. $^{GEN}P^{NL}_{[x]+1} = \dfrac{{}_{G}M_{[x]+1}}{{}_{G}N_{[x]+1}}$

(= 0 if the policy's premium paying period is only one year)

10-3. $(a-b)^{GEN}$ is the lesser of the following, but not less than zero:

$^{GEN}P^{NL}_{[x]+1} - c_{[x]}$, and

${}_{19}PA_{[x]+1} - c_{[x]}$

B. Net Premiums:

Base premium

10-4. ${}_{B}P^{GEN}_{[x]} = \dfrac{{}_{G}M_{[x]} + (a-b)^{GEN} \cdot D_{[x]}}{{}_{G}N_{[x]}}$

Net premium for the first year

10-5. ${}_{1}P^{GEN}_{[x]} = {}_{B}P^{GEN}_{[x]} - (a-b)^{GEN}$

Renewal net premiums

10-6. ${}_{t}P^{GEN}_{[x]} = {}_{B}P^{GEN}_{[x]} \cdot {}_{t}R^{GG}_{x}$ for $t > 1$

C. Terminal Reserves:

10-7. ${}_{t}R^{GEN}_{x} = \dfrac{{}_{t}P^{GEN}_{[x]}}{{}_{B}P^{GEN}_{[x]}}$

10-8. ${}_{G}N^{GEN}_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{GEN}_{x}$

10-9. $${}_{t}V_{[x]}^{GEN} = \frac{{}_{G}M_{[x]+t}}{D_{[x]+t}} - {}_{B}P_{[x]}^{GEN} \cdot \frac{{}_{G}N_{[x]+t}^{GEN}}{D_{[x]+t}}$$

D. Mean Reserves:

10-10. $${}_{t}MV_{[x]}^{GEN} = .5\ ({}_{t-1}V_{[x]}^{GEN} + {}_{t}V_{[x]}^{GEN} + {}_{t}P_{[x]}^{GEN})$$

E. Mid-Terminal Reserves:

10-11. $${}_{t}IV_{[x]}^{GEN} = .5\ ({}_{t-1}V_{[x]}^{GEN} + {}_{t}V_{[x]}^{GEN})$$

11. Unitary Reserves

The model regulation defines the calculation of the unitary reserve.

A. Expense Allowance:

Net level premium

11-1. $${}^{UNI}P_{[x]}^{NL} = \frac{{}_{G}M_{[x]}}{{}_{G}N_{[x]}}$$

Net level premium for benefits after the first policy year

11-2. $${}^{UNI}P_{[x]+1}^{NL} = \frac{{}_{G}M_{[x]+1}}{{}_{G}N_{[x]+1}}$$

(= 0 if the policy's premium paying period is only one year)

11-3. $(a-b)^{UNI}$ is the lesser of the following, but not less than zero:

$${}^{UNI}P_{[x]+1}^{NL} - c_{[x]}, \text{ and}$$

$${}_{19}PE_{[x]+1} - c_{[x]}$$

B. Net Premiums:

Base premium

11-4. $${}_{B}P_{[x]}^{UNI} = \frac{{}_{G}M_{[x]} + (a-b)^{UNI} \cdot D_{[x]}}{{}_{G}N_{[x]}}$$

Net premium for the first year

11-5. $${}_{1}P_{[x]}^{UNI} = {}_{B}P_{[x]}^{UNI} - (a-b)^{UNI}$$

Renewal net premiums

11-6. $_tP^{UNI}_{[x]} \quad = \quad {}_BP^{UNI}_{[x]} \cdot {}_tR^{GG}_x$ for $t > 1$

C. *Terminal Reserves:*

11-7. $$_tR^{UNI}_x \quad = \quad \frac{_tP^{UNI}_{[x]}}{_BP^{UNI}_{[x]}}$$

11-8. $$_GN^{UNI}_{[x]+t} \quad = \quad \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{UNI}_x$$

11-9. $$_tV^{UNI}_{[x]} \quad = \quad \frac{_GM_{[x]+t}}{D_{[x]+t}} \quad - \quad {}_BP^{UNI}_{[x]} \cdot \frac{_GN^{UNI}_{[x]+t}}{D_{[x]+t}}$$

D. *Mean Reserves:*

11-10. $$_tMV^{UNI}_{[x]} \quad = \quad .5\ ({}_{t-1}V^{UNI}_{[x]} + {}_tV^{UNI}_{[x]} + {}_tP^{UNI}_{[x]})$$

E. *Mid-Terminal Reserves:*

11-11. $$_tIV^{UNI}_{[x]} \quad = \quad .5\ ({}_{t-1}V^{UNI}_{[x]} + {}_tV^{UNI}_{[x]})$$

12. Segmented Reserves with No Option

The model regulation defines the calculation of segmented reserves. Segments, for this calculation, are defined in section 3 of these formulas.

A. *Expense Allowance*

Net level premium for benefits in the first segment

12-1. $$_{SEG}P^{NL}_{[x]} \quad = \quad \frac{_GM_{[x]} - {}_GM_{[x]+d} + {}_dUCV_x \cdot D_{[x]+d}}{_GN_{[x]} - {}_GN_{[x]+d}}$$

Net level premium for benefits in the first segment excluding the benefits in the first policy year

12-2. $$_{SEG}P^{NL}_{[x]+1} \quad = \quad \frac{_GM_{[x]+1} - {}_GM_{[x]+d} + {}_dUCV_x \cdot D_{[x]+d}}{_GN_{[x]+1} - {}_GN_{[x]+d}}$$

(= 0 if the first segment is only one year long or if no premiums are due in the first segment after the first policy year)

12-3. $(a-b)^{SEG}$ is the lesser of the following, but not less than zero:

$$ {}^{SEG}P^{NL}_{[x]+1} \quad - \quad c_{[x]}, \text{ and} $$

$$ {}_{19}PE_{[x]+1} \quad - \quad c_{[x]} $$

B. Net Premiums—First Segment:

Base premium for the first segment

12-4. $$ {}_{B}P^{SEG}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + (a-b)^{SEG} \cdot D_{[x]} + {}_{d}UCV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}} $$

Net premium for the first year of the first segment

12-5. $$ {}_{1}P^{SEG}_{[x]} = {}_{B}P^{SEG}_{[x]} - (a-b)^{SEG} $$

Renewal net premiums within the first segment
For all t within the segment: $1 < t \le d$

12-6. $$ {}_{t}P^{SEG}_{[x]} = {}_{B}P^{SEG}_{[x]} \cdot {}_{t}R^{GG}_{x} $$

C. Net Premiums—Segments after the First Segment:

Net premium for the first year of each segment after the first segment

12-7. $$ {}_{k+1}P^{SEG}_{[x]} = \frac{{}_{G}M_{[x]+k} - {}_{G}M_{[x]+k+d} + {}_{k+d}UCV_{x} \cdot D_{[x]+k+d} - {}_{k}UCV_{x} \cdot D_{[x]+k}}{({}_{G}N_{[x]+k} - {}_{G}N_{[x]+k+d}) / {}_{k+1}R^{GG}_{x}} $$

Renewal net premiums within a segment after the first segment
For all t within the segment: $k+1 \le t \le k+d$

12-8. $$ {}_{t}P^{SEG}_{[x]} = {}_{k+1}P^{SEG}_{[x]} \cdot \frac{{}_{t}R^{GG}_{x}}{{}_{k+1}R^{GG}_{x}} $$

D. Terminal Reserves:

12-9. $$ {}_{t}R^{SEG}_{x} = \frac{{}_{t}P^{SEG}_{[x]}}{{}_{B}P^{SEG}_{[x]}} $$

12-10. $$ {}_{G}N^{SEG}_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{SEG}_{x} $$

12-11. $$ {}_{t}V^{SEG}_{[x]} = \frac{{}_{G}M_{[x]+t}}{D_{[x]+t}} - {}_{B}P^{SEG}_{[x]} \cdot \frac{{}_{G}N^{SEG}_{[x]+t}}{D_{[x]+t}} $$

E. Mean Reserves:

12-12. $${}_{t}MV^{SEG}_{[x]} = .5\ ({}_{t-1}V^{SEG}_{[x]} + {}_{t}V^{SEG}_{[x]} + {}_{t}P^{SEG}_{[x]})$$

F. Mid-Terminal Reserves:

12-13. $${}_{t}IV^{SEG}_{[x]} = .5\ ({}_{t-1}V^{SEG}_{[x]} + {}_{t}V^{SEG}_{[x]})$$

13. Segmented Reserves with Option A1—Unitary Reserve Grading

The model regulation defines the calculation of segmented reserves.

Segments, for this calculation, are the same as for segmented reserve calculations; see section 3 of these formulas.

The variable $V^{UNI}_{[x]}$, where used in this section, may not have a value less than zero. And if UCV_x is greater than $V^{UNI}_{[x]}$ then use UCV_x instead of $V^{UNI}_{[x]}$.

A. Expense Allowance:

Net level premium for benefits in the first segment

13-1. $${}^{SA1}P^{NL}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + {}_{d}V^{UNI}_{[x]} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net level premium for benefits in the first segment excluding the benefits in the first policy year

13-2. $${}^{SA1}P^{NL}_{[x]+1} = \frac{{}_{G}M_{[x]+1} - {}_{G}M_{[x]+d} + {}_{d}V^{UNI}_{[x]} \cdot D_{[x]+d}}{{}_{G}N_{[x]+1} - {}_{G}N_{[x]+d}}$$

(= 0 if the first segment is only one year long or if no premiums are due in the first segment after the first policy year)

13-3. $(a-b)^{SA1}$ is the lesser of the following, but not less than zero:

$${}^{SA1}P^{NL}_{[x]+1} - c_{[x]}, \text{ and}$$

$${}_{19}PE_{[x]+1} - c_{[x]}$$

B. Net Premiums—First Segment:

Base premium for the first segment

13-4. $${}_{B}P^{SA1}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + (a-b)^{SA1} \cdot D_{[x]} + {}_{d}V^{UNI}_{[x]} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net premium for the first year of the first segment

13-5. $${}_1P^{SA1}_{[x]} = {}_BP^{SA1}_{[x]} - (a-b)^{SA1}$$

Renewal net premiums within the first segment
For all t within the segment: $1 < t \le d$

13-6. $${}_tP^{SA1}_{[x]} = {}_BP^{SA1}_{[x]} \cdot {}_tR^{GG}_x$$

C. Net Premiums—Segments after the First Segment:

Net premium for the first year of each segment after the first segment

13-7. $${}_{k+1}P^{SA1}_{[x]} = \frac{{}_GM_{[x]+k} - {}_GM_{[x]+k+d} + {}_{k+d}V^{UNI}_{[x]} \cdot D_{[x]+k+d} - {}_kV^{UNI}_{[x]} \cdot D_{[x]+k}}{\left({}_GN_{[x]+k} - {}_GN_{[x]+k+d}\right)/{}_{k+1}R^{GG}_x}$$

Renewal net premiums within a segment after the first segment
For all t within the segment: $k+1 \le t \le k+d$

13-8. $${}_tP^{SA1}_{[x]} = {}_{k+1}P^{SA1}_{[x]} \cdot \frac{{}_tR^{GG}_x}{{}_{k+1}R^{GG}_x}$$

D. Terminal Reserves:

13-9. $${}_tR^{SA1}_x = \frac{{}_tP^{SA1}_{[x]}}{{}_BP^{SA1}_{[x]}}$$

13-10. $${}_GN^{SA1}_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{SA1}_x$$

13-11. $${}_tV^{SA1}_{[x]} = \frac{{}_GM_{[x]+t}}{D_{[x]+t}} - {}_BP^{SA1}_{[x]} \cdot \frac{{}_GN^{SA1}_{[x]+t}}{D_{[x]+t}}$$

E. Mean Reserves:

13-12. $${}_tMV^{SA1}_{[x]} = .5\left({}_{t-1}V^{SA1}_{[x]} + {}_tV^{SA1}_{[x]} + {}_tP^{SA1}_{[x]}\right)$$

F. Mid-Terminal Reserves:

13-13. $${}_tIV^{SA1}_{[x]} = .5\left({}_{t-1}V^{SA1}_{[x]} + {}_tV^{SA1}_{[x]}\right)$$

14. Segmented Reserves with Option A2—Cash Surrender Value Grading

The model regulation defines the calculation of segmented reserves.

Segments, for this calculation, are the same as for segmented reserve calculations; see section 3 of these formulas.

A. Expense Allowance:

Net level premium for benefits in the first segment

14-1. $${}^{SA2}P^{NL}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + {}_{d}CV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net level premium for benefits in the first segment excluding the benefits in the first policy year

14-2. $${}^{SA2}P^{NL}_{[x]+1} = \frac{{}_{G}M_{[x]+1} - {}_{G}M_{[x]+d} + {}_{d}CV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]+1} - {}_{G}N_{[x]+d}}$$

(= 0 if the first segment is only one year long or if no premiums are due in the first segment after the first policy year)

14-3. $(a-b)^{SA2}$ is the lesser of the following, but not less than zero:

${}^{SA2}P^{NL}_{[x]+1} - c_{[x]}$, and

${}_{19}PE_{[x]+1} - c_{[x]}$

B. Net Premiums—First Segment:

Base premium for the first segment

14-4. $${}_{B}P^{SA2}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + (a-b)^{SA2} \cdot D_{[x]} + {}_{d}CV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net premium for the first year of the first segment

14-5. $${}_{1}P^{SA2}_{[x]} = {}_{B}P^{SA2}_{[x]} - (a-b)^{SA2}$$

Renewal net premiums within the first segment
For all t within the segment: $1 < t \leq d$

14-6. $${}_{t}P^{SA2}_{[x]} = {}_{B}P^{SA2}_{[x]} \cdot {}_{t}R^{GG}_{x}$$

C. Net Premiums—Segments after the First Segment:

Net premium for the first year of each segment after the first segment

14-7. $${}_{k+1}P^{SA2}_{[x]} = \frac{{}_{G}M_{[x]+k} - {}_{G}M_{[x]+k+d} + {}_{k+d}CV_{x} \cdot D_{[x]+k+d} - {}_{k}CV_{x} \cdot D_{[x]+k}}{({}_{G}N_{[x]+k} - {}_{G}N_{[x]+k+d}) / {}_{k+1}R^{GG}_{x}}$$

Renewal net premiums within a segment after the first segment
For all t within the segment: $k+1 \le t \le k+d$

14-8. $${}_{t}P^{SA2}_{[x]} = {}_{k+1}P^{SA2}_{[x]} \cdot \frac{{}_{t}R^{GG}_{x}}{{}_{k+1}R^{GG}_{x}}$$

D. Terminal Reserves:

14-9. $${}_{t}R^{SA2}_{x} = \frac{{}_{t}P^{SA2}_{[x]}}{{}_{B}P^{SA2}_{[x]}}$$

14-10. $${}_{G}N^{SA2}_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{SA2}_{x}$$

14-11. $${}_{t}V^{SA2}_{[x]} = \frac{{}_{G}M_{[x]+t}}{D_{[x]+t}} - {}_{B}P^{SA2}_{[x]} \cdot \frac{{}_{G}N^{SA2}_{[x]+t}}{D_{[x]+t}}$$

E. Mean Reserves:

14-12. $${}_{t}MV^{SA2}_{[x]} = .5\left({}_{t-1}V^{SA2}_{[x]} + {}_{t}V^{SA2}_{[x]} + {}_{t}P^{SA2}_{[x]}\right)$$

F. Mid-Terminal Reserves:

14-13. $${}_{t}IV^{SA2}_{[x]} = .5\left({}_{t-1}V^{SA2}_{[x]} + {}_{t}V^{SA2}_{[x]}\right)$$

15. Unusual Cash Value Pattern Reserves

The model regulation defines the calculation of unusual cash value pattern reserves.

These calculations are only required if the policy has at least one unusual guaranteed cash surrender value as defined in section 4 of these formulas. All unusual cash value pattern reserves equal zero if the policy has no unusual guaranteed cash surrender values.

Segments are defined differently for this calculation than for segmented reserve calculations; see section 5 of these formulas.

A. Expense Allowance:

Net level premium for benefits in the first segment

15-1. $${}^{UCVP}P^{NL}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + {}_{d}UCV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net level premium for benefits in the first segment excluding the benefits in the first policy year

15-2. $${}^{UCVP}P^{NL}_{[x]+1} = \frac{{}_{G}M_{[x]+1} - {}_{G}M_{[x]+d} + {}_{d}UCV_{[x]} \cdot D_{[x]+d}}{{}_{G}N_{[x]+1} - {}_{G}N_{[x]+d}}$$

(= 0 if the first segment is only one year long or if no premiums are due in the first segment after the first policy year)

15-3. $(a-b)^{UCVP}$ is the lesser of the following, but not less than zero:

$${}^{UCVP}P^{NL}_{[x]+1} - c_{[x]}, \text{ and}$$

$${}_{19}PE_{[x]+1} - c_{[x]}$$

B. Net Premiums—First Segment:

Base premium for the first segment [Note: $(a-b)^{UCVP}$ must be determined based on the length of the first segment which ends at the first unusual guaranteed cash surrender value.]

15-4. $${}_{B}P^{UCVP}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + (a-b)^{UCVP} \cdot D_{[x]} + {}_{d}UCV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net premium for the first year of the first segment

15-5. $${}_{1}P^{UCVP}_{[x]} = {}_{B}P^{UCVP}_{[x]} - (a-b)^{UCVP}$$

Renewal net premiums within the first segment
For all t within the segment: $1 < t \leq d$

15-6. $${}_{t}P^{UCVP}_{[x]} = {}_{B}P^{UCVP}_{[x]} \cdot {}_{t}R^{GG}_{x}$$

C. Net Premiums—Segments after the First Segment:

Net premium for the first year of each segment after the first segment

15-7. $${}_{k+1}P^{UCVP}_{[x]} = \frac{{}_{G}M_{[x]+k} - {}_{G}M_{[x]+k+d} + {}_{k+d}UCV_{x} \cdot D_{[x]+k+d} - {}_{k}UCV_{x} \cdot D_{[x]+k}}{({}_{G}N_{[x]+k} - {}_{G}N_{[x]+k+d})/{}_{k+1}R^{GG}_{x}}$$

Renewal net premiums within a segment after the first segment
For all t within the segment: $k+1 \leq t \leq k+d$

15-8. $${}_{t}P^{UCVP}_{[x]} = {}_{k+1}P^{UCVP}_{[x]} \cdot \frac{{}_{t}R^{GG}_{x}}{{}_{k+1}R^{GG}_{x}}$$

D. Terminal Reserves:

15-9. $${}_{t}R^{UCVP}_{x} = \frac{{}_{t}P^{UCVP}_{[x]}}{{}_{B}P^{UCVP}_{[x]}}$$

15-10. $_{G}N^{UCVP}_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+t} \cdot {}_{1+s}R^{UCVP}_{x}$

15-11. $_{t}V^{UCVP}_{[x]} = \frac{_{G}M_{[x]+t}}{D_{[x]+t}} - {}_{B}P^{UCVP}_{[x]} \cdot \frac{_{G}N^{UCVP}_{[x]+t}}{D_{[x]+t}}$

E. Mean Reserves:

15-12. $_{t}MV^{UCVP}_{[x]} = .5\left({}_{t-1}V^{UCVP}_{[x]} + {}_{t}V^{UCVP}_{[x]} + {}_{t}P^{UCVP}_{[x]}\right)$

F. Mid-Terminal Reserves:

15-13. $_{t}IV^{UCVP}_{[x]} = .5\left({}_{t-1}V^{UCVP}_{[x]} + {}_{t}V^{UCVP}_{[x]}\right)$

16. Deposit Term Reserves

The second paragraph of SVL section 5 defines the calculation of the deposit term reserve.

These calculations are only required if the policy triggers the deposit term reserve requirement as described in section 6 of these formulas. All deposit term reserves equal zero if the policy does not trigger this requirement.

Note that d is the number of years before the deposit term assumed ending date, as determined per section 6 of these formulas.

A. Expense Allowance:

Net level premium for benefits before the deposit term assumed ending date

16-1. $^{DT}P^{NL}_{[x]} = \frac{_{G}M_{[x]} - {}_{G}M_{[x]+d} + {}_{d}CV_{x} \cdot D_{[x]+d}}{_{G}N_{[x]} - {}_{G}N_{[x]+d}}$

Net level premium for benefits before the deposit term assumed ending date excluding the benefits in the first policy year

16-2. $^{DT}P^{NL}_{[x]+1} = \frac{_{G}M_{[x]+1} - {}_{G}M_{[x]+d} + {}_{d}CV_{x} \cdot D_{[x]+d}}{_{G}N_{[x]+1} - {}_{G}N_{[x]+d}}$

(= 0 if no premiums are due after the first policy year and before the assumed ending date)

16-3. $(a-b)^{DT}$ is the lesser of the following, but not less than zero:

$^{DT}P^{NL}_{[x]+1} - (c_{[x]} + .15 \cdot ({}_{1}GG_{x} - {}_{2}GG_{x}))$, and

$_{19}PA_{[x]+1} - (c_{[x]} + .15 \cdot ({}_{1}GG_{x} - {}_{2}GG_{x}))$

B. Net Premiums—Through Assumed Ending Date:

Base premium

16-4. $${}_{B}P^{DT}_{[x]} = \frac{{}_{G}M_{[x]} - {}_{G}M_{[x]+d} + (a-b)^{DT} \cdot D_{[x]} + {}_{d}CV_{x} \cdot D_{[x]+d}}{{}_{G}N_{[x]} - {}_{G}N_{[x]+d}}$$

Net premium for the first year

16-5. $${}_{1}P^{DT}_{[x]} = {}_{B}P^{DT}_{[x]} - (a-b)^{DT}$$

Renewal net premiums
For all t through the assumed ending date: $1 < t \leq d$

16-6. $${}_{t}P^{DT}_{[x]} = {}_{B}P^{DT}_{[x]} \cdot {}_{t}R^{GG}_{x}$$

C. Net Premiums—After Assumed Ending Date:

For all t after the assumed ending date: $t > d$

16-7. $${}_{t}P^{DT}_{[x]} = 0$$

D. Terminal Reserves:

16-8. $${}_{t}R^{DT}_{x} = \frac{{}_{t}P^{DT}_{[x]}}{{}_{B}P^{DT}_{[x]}}$$

16-9. $${}_{G}N^{DT}_{[x]+t} = \sum_{s=t}^{d-1} D_{[x]+s} \cdot {}_{1+s}R^{DT}_{x} \text{ for } t < d$$

16-10. $${}_{G}N^{DT}_{[x]+t} = 0 \text{ for } t \geq d$$

For all t through the assumed ending date: $1 < t \leq d$

16-11. $${}_{t}V^{DT}_{[x]} = \frac{{}_{G}M_{[x]+t} - {}_{G}M_{[x]+d} + {}_{d}CV_{x} \cdot D_{[x]+d}}{D_{[x]+t}} - {}_{B}P^{DT}_{[x]} \cdot \frac{{}_{G}N^{DT}_{[x]+t}}{D_{[x]+t}}$$

For all t after the assumed ending date: $t > d$

16-12. $${}_{t}V^{DT}_{[x]} = 0$$

E. Mean Reserves:

16-13. $${}_{t}MV^{DT}_{[x]} = .5\left({}_{t-1}V^{DT}_{[x]} + {}_{t}V^{DT}_{[x]} + {}_{t}P^{DT}_{[x]}\right)$$

F. Mid-Terminal Reserves:

16-14. $_{t}IV^{DT}_{[x]} = .5\left({}_{t-1}V^{DT}_{[x]} + {}_{t}V^{DT}_{[x]}\right)$

The calculation of interim deposit term reserves, as shown above, is not identical to the procedures in Society of Actuaries, 1983. The methodology presented in this paper is preferred because it does not mix terminal reserves from different types of reserve calculations to produce an interim reserve. Instead, interim reserves are produced for each type of reserve calculation based on its own terminal reserves. This reserve consistency has the advantage that related financial statement elements, such as those based on net premiums, can be properly related to the reserve held.

17. Deficiency Reserves

Some valuation systems use deficiency reserve factors to produce an additional liability equal to the value of the premium deficiency in *future* policy years. Any deficiency in the current policy year is addressed in the "cost of collection" liability. This procedure is not followed in this paper.

In these specifications, deficiency reserves are calculated as the excess, if greater than zero, of a recalculated reserve over the originally calculated reserve. This calculation includes provision for all deficiencies after the valuation date, including those within the current policy year.

$_{t}V_{[x]}$ is the originally calculated terminal reserve.

$_{t}DV_{[x]}$ is the same terminal reserve recalculated on a deficiency reserve basis.

		DEFICIENCY RESERVE BASIS		BASIC RESERVE BASIS	
17-1.	Terminal Excess = $_{t}E_{[x]}$ =	$_{t}DV_{[x]}$	−	$_{t}V_{[x]}$,	but not less than zero.

A. Level Policies

Deficiency Reserves Trigger

The deficiency calculation applies to level policies if, in any policy year, the guaranteed gross premium is less than the valuation net premium calculated using the minimum valuation standards of mortality and interest. This condition is met:

17-2. if $_{t}GG_{x} < {}_{t}P^{GEN}_{[x]}$ for any t from 1 through n.

If this condition is not met, then the deficiency calculation does not apply and the deficiency/excess reserve is equal to zero.

Deficiency Reserves Calculation

For level policies, which are subject to the generally applicable reserve formula defined in SVL section 5, the recalculated reserve, ${}_tDV_{[x]}$, is described in SVL section 8. The recalculated reserve is consistent with the originally calculated reserve, ${}_tV_{[x]}$, except:

1. The minimum valuation standard of mortality is used, which may be different from the mortality used for the originally calculated reserves
2. The minimum valuation standard of interest is used, which may be different from the interest used for the originally calculated reserves
3. Guaranteed gross premiums are used instead of net premiums when the guaranteed gross premiums are less than the corresponding net premiums. This adjustment may be accomplished by replacing formula 10-7 with the following:

17-3. $${}_tR_x = \frac{\text{Lesser of } {}_tP_{[x]} \text{ and } {}_tGG_x}{{}_BP_{[x]}}$$

The other formulas do not change, but they are based on the minimum valuation standards of mortality and interest.

For deficiency reserve calculations, including the deficiency trigger, the guaranteed gross premiums, ${}_tGG_x$, may include policy fees. This includes level policy fees, which are excluded per the definition of ${}_tGG_x$ and are not used in the general reserve calculations. It also includes nonlevel and one time policy fees, which are included in ${}_tGG_x$ and in general reserve calculations.

B. Nonlevel Policies

The deficiency reserve for nonlevel policies is based on the same type of reserve calculation as the basic reserve, whichever is greater—the unitary basic reserve or the segmented basic reserve. In the event the unitary basic reserve and the segmented basic reserve are equal then the deficiency reserve shall be calculated using the segmented reserve formula.

Deficiency Reserves Trigger

The deficiency calculation applies to nonlevel policies if, in any policy year, the guaranteed gross premium is less than the valuation net premium, for the type of reserve calculation that produced the basic reserve, calculated using the deficiency reserve standard of mortality and the minimum valuation standard of interest. This condition is met:

17-4. if ${}_tGG_x < {}_tP^*_{[x]}$ for any t from 1 through n.

If this condition is not met, then the deficiency calculation does not apply, and the deficiency/excess reserve is equal to zero.

Deficiency Reserves Calculation

For unitary reserves and segmented reserves—with and without options—the recalculated reserve, ${}_tDV_{[x]}$, is described in the model regulation. The recalculated reserve is consistent with the originally calculated reserve, ${}_tV_{[x]}$, except:

1. The minimum mortality permitted for deficiency reserves is used, which may be different from the mortality used for the originally calculated reserves;
2. The minimum valuation interest rate is used, which may be different from the interest rate used for the originally calculated reserves; and
3. Guaranteed gross premiums are used instead of net premiums when the guaranteed gross premiums are less than the corresponding net premiums. This adjustment may be accomplished by replacing formulas 11-7, 12-9, 13-9, and 14-9 for ${}_tR_x$ with formula 17-3. The other formulas do not change, but they are based on the deficiency reserve standard of mortality and the minimum valuation standard of interest.

For deficiency reserve calculations, including the deficiency trigger, the guaranteed gross premiums, ${}_tGG_x$, may include policy fees. This includes level policy fees, which are excluded per the definition of ${}_tGG_x$ and are not used in the basic reserve calculations. It also includes nonlevel and one time policy fees, which are included in ${}_tGG_x$ and in basic reserve calculations.

Deficiency reserves are not applicable to unusual cash value pattern reserves or to deposit term reserves. These reserves are minimums that are to be compared with the total of the basic and deficiency reserves produced by other types of reserve calculations.

Safe Harbor

If the length of the first segment as determined for segmented reserves is not greater than five (5) years then gross premiums do not need to be substituted for net premiums during the first segment when calculating unitary deficiency reserves or segmented deficiency reserves.

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* Based on the type of reserve calculation (UNI, SEG, SA1, or SA2) that produced the basic reserve and calculated using the deficiency reserve standard of mortality and the minimum valuation standard of interest.

For unitary and segmented deficiency reserves, if d (the length of the first segment—determined for segmented reserves, not for unusual cash value pattern reserves) ≤ 5 then, at the company's option, instead of using formula 17-3, deficiency reserves may be calculated by using the following for formulas 11-7, 12-9, 13-9, and 14-9.

17-5. $$ {}_tR_x = \frac{{}_tP_{[x]}}{{}_BP_{[x]}} \text{ for } 1 \leq t \leq d $$

and

17-6. $$ {}_tR_x = \frac{\text{Lesser of } {}_tP_{[x]} \text{ and } {}_tGG_x}{{}_BP_{[x]}} \text{ for } t > d $$

Use of this safe harbor requires an annual actuarial opinion that reserves held are adequate.

C. Interim Reserves

Interim deficiency reserves are the excess, if greater than zero, of recalculated interim reserves over the originally calculated interim reserves.

Mean Reserve

${}_tMV_{[x]}$ is the originally calculated mean reserve.
${}_tDMV_{[x]}$ is the same mean reserve recalculated on the deficiency reserve basis described above.

		DEFICIENCY RESERVE BASIS		BASIC RESERVE BASIS	
17-7.	Mean Excess = ${}_tME_{[x]}$ =	${}_tDMV_{[x]}$	$-$	${}_tMV_{[x]}$,	but not less than zero.

Mid-terminal reserve

${}_tIV_{[x]}$ is the originally calculated mid-terminal reserve.
${}_tDIV_{[x]}$ is the same mid-terminal reserve recalculated on the deficiency reserve basis described above.

		DEFICIENCY RESERVE BASIS		BASIC RESERVE BASIS	
17-8.	Mid-Terminal Excess = ${}_tIE_{[x]}$ =	${}_tDIV_{[x]}$	$-$	${}_tIV_{[x]}$,	but not less than zero.

18. Minimum Terminal Reserves

A. Level Policies

Procedures for determining the minimum terminal reserves for level policies in accordance with SVL sections 5 and 8.

The minimum total terminal reserve at the end of policy year t for issue age x is equal to:

18-1. $\quad {}_tV^{GEN}_{[x]} + {}_tE_{[x]}$

B. Nonlevel Policies

Procedures for determining the minimum terminal reserves for nonlevel policies in accordance with the model regulation.

Basic Reserve

The minimum terminal basic reserve at the end of policy year t for issue age x is based on the four types of reserve calculation.

18-2. $\quad {}_tV^{min}_{[x]}$ equals the greater of:

(1) ${}_tV^{UNI}_{[x]}$ (see note below)

(2) ${}_tV^{SEG}_{[x]}$ or, at the company's option,

${}_tV^{SA1}_{[x]}$ or ${}_tV^{SA2}_{[x]}$

Note: Item (1) in formula 18-2 is not applicable if the policy is exempt from the unitary reserve requirement. Exemption criteria are described in section 21 of these formulas.

Deficiency Reserve

The terminal deficiency reserve is based on the type of reserve calculation (UNI, SEG, SA1, or SA2) that produced the minimum terminal basic reserve.

The terminal deficiency reserve is the excess, if greater than zero, of a recalculated terminal reserve over the basic terminal reserve. Procedures for the recalculation are in section 17 of these formulas.

	DEFICIENCY RESERVE BASIS		BASIC RESERVE BASIS	
18-3. Terminal Excess = ${}_tE_{[x]}$ =	${}_tDV_{[x]}$	$-$	${}_tV_{[x]}$,	but not less than zero.

The minimum total terminal reserve at the end of policy year t for issue age x is the greatest of:

18-4. (1) ${}_tV^{min}_{[x]} + {}_tE_{[x]}$

(2) ${}_tV^{UCVP}_{[x]}$

(3) ${}_tV^{DT}_{[x]}$

(4) ${}_tCV_x$

Note: If the policy is exempt as described in section 22 of these formulas, then both values in item (1) of formula 18-4 may be determined based on formula 22-4 instead of formula 18-2:

$$({}_tV^{min}_{[x]} = {}_tV^{EX}_{[x]}).$$

19. Minimum Mean Reserves

A. Level Policies

Procedures for determining minimum mean reserves for level policies in accordance with SVL sections 5 and 8.

The minimum total mean reserve at the end of policy year t for issue age x is equal to:

19-1. ${}_tMV^{GEN}_{[x]} + {}_tME_{[x]}$

B. Nonlevel Policies

Procedures for determining the minimum mean reserves for nonlevel policies in accordance with the model regulation.

Basic Reserve

The minimum mean basic reserve during policy year t for issue age x for a policy subject to the model regulation is based on the four types of reserve calculation and on the tabular cost of insurance.

19-2. ${}_tMV^{min}_{[x]}$ equals the greatest of:

(1) ${}_tMV^{UNI}_{[x]}$ (see note below)

(2) ${}_tMV^{SEG}_{[x]}$ or, at the company's option,

${}_tMV^{SA1}_{[x]}$ or ${}_tMV^{SA2}_{[x]}$

(3) ${}_tAA_x \cdot \dfrac{C_{[x]+t-1}}{2 \cdot D_{[x]+t-1}}$

Note: Item (1) in formula 19-2 is not applicable if the policy is exempt from the unitary reserve requirement. Exemption criteria are described in section 21 of these formulas.

Deficiency Reserve

The mean deficiency reserve is based on the type of reserve calculation (UNI, SEG, SA1, or SA2) that produced the mean basic reserve or, in the absence of the tabular cost term, item (3) in formula 19-2, would have produced the mean basic reserve.

The mean deficiency reserve is the excess, if greater than zero, of a recalculated mean reserve over the basic mean reserve. Procedures for the reserve recalculation are in section 17 of this paper.

	DEFICIENCY RESERVE BASIS		BASIC RESERVE BASIS	
19-3. Mean Excess = $_tME_{[x]}$ =	$_tDMV_{[x]}$	−	$_tMV_{[x]}$,	but not less than zero.

Minimum Reserve

The minimum total mean reserve at the end of policy year t for issue age x is the greatest of:

19-4. (1) $_tMV^{min}_{[x]} + {_tME_{[x]}}$

(2) $_tMV^{UCVP}_{[x]}$

(3) $_tMV^{DT}_{[x]}$

(4) the cash surrender value.

Note: If the policy is exempt as described in section 22 of these formulas, then both values in item (1) of formula 19-4 may be determined based on formula 22-5 instead of formula 19-2:

$$({_tMV^{min}_{[x]}} = {_tMV^{EX}_{[x]}}).$$

20. Minimum Mid-Terminal Reserves

A. Level Policies

Procedures for determining the minimum mid-terminal reserves for level policies in accordance with SVL sections 5 and 8.

The minimum total mid-terminal reserve at the end of policy year t for issue age x is equal to:

20-1. $_tIV^{GEN}_{[x]} + {}_tIE_{[x]}$

B. Nonlevel Policies

Procedures for determining the minimum mid-terminal reserves for nonlevel policies in accordance with the model regulation.

Basic Reserve

The minimum mid-terminal basic reserve during policy year t for issue age x for a policy subject to the model regulation is based on the four types of reserve calculation and on the tabular cost of insurance.

20-2. $_tIV^{min}_{[x]}$ equals the greatest of:

(1) $_tIV^{UNI}_{[x]}$ (see note below)

(2) $_tIV^{SEG}_{[x]}$ or, at the company's option,

$_tIV^{SA1}_{[x]}$ or $_tIV^{SA2}_{[x]}$

(3) $\left({}_tAA_x \cdot \frac{C_{[x]+t-1}}{D_{[x]+t-1}} - \right.$ the net premium for the greater of (1) and (2))/2

Note: Item (1) in formula 20-2 is not applicable if the policy is exempt from the unitary reserve requirement. Exemption criteria are described in section 21 of these formulas.

Deficiency Reserve

The mid-terminal deficiency reserve is based on the type of reserve calculation (UNI, SEG, SA1, or SA2) that produced the mid-terminal basic reserve or, in the absence of the tabular cost term, item (3) in formula 20-2, would have produced the mid-terminal basic reserve.

The mid-terminal deficiency reserve is the excess, if greater than zero, of a recalculated mid-terminal reserve over the basic mid-terminal reserve. Procedures for the recalculation are in section 17 of this paper.

	DEFICIENCY RESERVE BASIS		BASIC RESERVE BASIS	
20-3. Mid-Terminal Excess = $_tIE_{[x]}$ =	$_tDIV_{[x]}$	$-$	$_tIV_{[x]}$,	but not less than zero.

The minimum total mid-terminal reserve at the end of policy year t for issue age x is the greatest of:

20-4. (1) ${}_tJV^{min}_{[x]} + {}_tJE_{[x]}$

(2) ${}_tJV^{UCVP}_{[x]}$

(3) ${}_tJV^{DT}_{[x]}$

(4) the cash surrender value.

Note: If the policy is exempt as described in section 22 of these formulas, then the values in item (1) of formula 20-4 may be determined based on formula 22-7 instead of formula 20-2:

$$\left({}_tJV^{min}_{[x]} \;=\; {}_tJV^{EX}_{[x]}\right).$$

21. Exemptions from Unitary Reserves

A. d-Year Renewable Term Exemption

Unitary reserves are not required for a policy (neither unitary basic reserves nor unitary deficiency reserves) if:

1. The policy is a series of d-year term periods where d is the same for all periods and the current and maximum premium rates within each d-year term period are level
2. The maximum premium rates for all d-year periods are not less than the net premiums
3. The policy has no cash surrender values.

In formulas 21-1 through 21-6:

m is the number of years in the policy benefit period
d is the length of a term period as defined above
each value of t represents a different term period
each value of s represents a different policy year within a term period.

Item 1 above is met:

21-1. if m/d is an integer

21-2. if ${}_{(t\cdot d)+s}GG_x = {}_{(t\cdot d)+1}GG_x$ for $0 \le t \le (m/d) - 1$ and $1 \le s \le d$

21-3. if ${}_{(t\cdot d)+s}SG_x = {}_{(t\cdot d)+1}SG_x$ for $0 \le t \le (m/d) - 1$ and $1 \le s \le d$.

Net premiums for each d-year term period for item 2 above

21-4. $${}_{t+1}P_{[x]} = \frac{{}_GM_{[x]+t\cdot d} - {}_GM_{[x]+(t+1)\cdot d}}{D_{[x]+(t\cdot d)}} \quad 0 \le t \le (m/d) - 1$$

Only the ten-year mortality selection factors are permitted.

Item 2 above is met:

21-5. if ${}_tGG_x \geq {}_tP_{[x]}$ for $1 \leq t \leq m/d$

Item 3 above is met:

21-6. if ${}_tCV_x = 0$ for $1 \leq t \leq m$

B. Juvenile Policy Exemption

Unitary reserves are not required for a policy (neither unitary basic reserves nor unitary deficiency reserves) if (based on the initial current premium scale):

1. The policy issue age is age twenty-four (24) or younger,
2. Gross premiums and death benefits are level and there are no cash surrender values before the end of the juvenile period which must end at or before age twenty-five (25), and
3. Gross premiums and death benefits are level after the end of the juvenile period.

In formulas 21-7 through 21-12:

x is the age at issue
m is the number of years in the policy benefit period
n is the number of years in the premium paying period
d is the number of years from issue to the end of the juvenile period.

Item 1 above is met:

21-7. if $x \leq 24$

Item 2 above is met:

21-8. if $x+d \leq 25$, and

21-9. if ${}_tSG_x = {}_tGG_x = {}_1GG_x$ for $1 \leq t \leq d$,

21-10. if ${}_tDB_x = {}_1DB_x$ for $1 \leq t \leq d$, and

21-11. if ${}_tCV_x = 0$ for $1 \leq t \leq d$.

Item 3 above is met:

21-12. if ${}_tSG_x = {}_tGG_x = {}_{d+1}GG_x$ for $d+1 \leq t \leq n$, and

21-13. if ${}_tDB_x = {}_{d+1}DB_x$ for $d+1 \leq t \leq m$.

22. *Exemption Formula for Certain Policies*

A. Reinsurance Exemption

An alternate reserve calculation is available for reinsurance written on a yearly renewable term (YRT) basis. This alternate calculation may be used, at the company's option, instead of the other requirements of the model regulation for applying the generally applicable reserve calculation of SVL section 5 to a policy with nonlevel premiums. It is only available if:

1. The current and maximum reinsurance premium rates are independent of the direct policy's premium rates and plan of coverage
2. Only the mortality risk is reinsured.

The independence requirement is intended to prevent the use of this exemption when a direct YRT policy is coinsured and the reinsurer receives a portion of the direct premium. If interpreted broadly, the requirement for independence of reinsurance premiums and plan of coverage could prevent the use of this exemption for many reinsurance arrangements. The independence requirement is not intended to prevent the use of this exemption just because there are different reinsurance premiums for different classes of risk such as preferred and standard policies or smoker and nonsmoker policies.

This alternate calculation may be based on the ten-year mortality selection factors, but it may not be based on the select mortality factors introduced by the model regulation.

B. Attained-Age-Based Yearly Renewable Term Exemption

An alternate reserve calculation is available for attained-age-based yearly renewable term (YRT) life insurance policies. This alternate calculation may be used, at the company's option, instead of the other requirements of the model regulation for applying the generally applicable reserve calculation of SVL section 5 to a policy with nonlevel premiums. It is only available if:

1. The current and maximum premium rates are based only on the attained age of the insured and not on the policy duration
2. The current and maximum premium rates are the same for everyone of the same sex, risk class, plan of insurance, and attained age.

If a policy meets the attained-age-based YRT requirements:

1. After an initial period that is the same length for all insureds of the same sex, risk class, and plan of insurance
2. After an initial period that runs to a common attained age for all insureds of the same sex, risk class, and plan of insurance

then this attained-age-based YRT exemption may be used after the initial period.

If this exemption is used, it must be used for all of the company's attained-age-based YRT policies.

This alternative calculation may be based on the ten-year mortality selection factors, but it may not be based on the select mortality factors introduced by the model regulation.

C. Reserve Formulas for Exempted Policies

Following are the formulas for the alternate reserve calculation for policies eligible for the exemption for reinsurance written on a YRT basis and for the attained-age-based YRT exemption.

One-year term premium (tabular cost of insurance) for each policy year

$$22\text{-}1. \quad {}_tP^{EX}_{[x]} = c_{[x]+t-1} = {}_tAA_x \cdot \frac{C_{[x]+t-1}}{D_{[x]+t-1}}$$

Terminal Reserve

$$22\text{-}2. \quad {}_tR^{EX}_x = \frac{{}_tP^{EX}_{[x]}}{{}_1P^{EX}_{[x]}}$$

For deficiency reserve calculations, replace formula 22-2 with 17-3 or, at the company's option, with formulas 17-5 and 17-6.

$$22\text{-}3. \quad {}_GN^{EX}_{[x]+t} = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{EX}_x$$

$$22\text{-}4. \quad {}_tV^{EX}_{[x]} = \frac{{}_GM_{[x]+t}}{D_{[x]+t}} - {}_1P^{EX}_{[x]} \cdot \frac{{}_GN^{EX}_{[x]+t}}{D_{[x]+t}}$$

$= 0$ for basic reserve, but may be higher on deficiency basis

Mean Reserve

$$22\text{-}5. \quad {}_tMV^{EX}_{[x]} = 0.5\,({}_{t-1}V^{EX}_{[x]} + {}_tV^{EX}_{[x]} + {}_tP^{EX}_{[x]})$$

22-6. $= 0.5 \cdot {}_tP_{[x]}^{EX}$ for basic reserve, but may be higher on deficiency basis

Mid-Terminal Reserve

22-7. ${}_tIV_{[x]}^{EX} = .5\left({}_{t-1}V_{[x]}^{EX} + {}_tV_{[x]}^{EX}\right)$

$= 0$ for basic reserve, but may be higher on deficiency basis

23. Universal Life Insurance Policies with Secondary Guarantees

Basic reserves for policies with secondary guarantees are the segmented reserves during the secondary guarantee period. Segments and segmented reserves are based on the specified premiums or minimum premiums that keep the policy in force. Deficiency reserves for these policies are also based on the specified premiums or minimum premiums that keep the policy in force.

Minimum reserves during the secondary guarantee period are the greater of:

1. The basic reserves plus the deficiency reserves
2. The minimum reserves otherwise applicable to universal life insurance policies.

A universal life insurance policy has a secondary guarantee if:

1. It is guaranteed to remain in force at the original schedule of benefits over a period exceeding five years, subject only to the payment of specified premiums
2. The minimum premium for any policy year after the fifth is less than the tabular cost of insurance based on 1980 CSO mortality with or without ten-year select factors or another table subsequently adopted for this purpose.

The secondary guarantee period is the longest period the policy is guaranteed to remain in force subject only to a secondary guarantee. If a guarantee period is extended after issue, reserves for secondary guarantees must be recalculated from issue based on the extended period.

Specified premiums are guaranteed to keep the policy in force at the original schedule of benefits even though they would be insufficient if maximum mortality and expense charges and minimum interest credits were made.

Minimum premiums produce a zero account value at the end of the policy year when paid into a policy with a zero account value at the beginning of the policy year, based on policy charges and credits guaranteed at issue.

24. Financial Statement Premium Elements Related to Reserves

The formulas in this paper are generally based upon the assumption that premiums are payable annually at the beginning of the policy year. In practice, the actual premium payment mode is often more frequent than annual, and a premium is sometimes paid before or after it is due.

A. Deferred Premiums

Mean reserves based on annual net premium payments at the beginning of the policy year overstate the reserves for policies with more frequent modes of premium payment. Therefore, a deferred premium adjustment may be made to correct for the overstatement of mean reserves.

Deferred gross premiums are modal premiums that are due after the valuation date and before the next policy anniversary. Deferred net premiums are the net premiums corresponding to deferred gross premiums.

Deferred net premiums are to be based on the net premium for the type of reserve calculation (GEN, UNI, SEG, SA1, SA2, UCVP, DT, or EX) which produces the minimum total mean reserve. If the unearned tabular cost term, item (3) in formula 19-2, produces the minimum total mean reserve, then use the tabular cost as the net premium. The net premium should be the deficiency basis net premium if the deficiency basis reserve is held.

B. Unearned Premium Reserve

Mid-terminal reserves based on annual net premium payments at the beginning of the policy year understate the reserves for policies with premiums paid to a date after the valuation date. Therefore, an unearned premium reserve is held for a portion of the period covered by the last premium due before the valuation date. The unearned premium reserve is equal to the net premium for the period from the valuation date to the next premium due date after the valuation date.

The net premium to be used for determining the unearned premium reserve is based on the type of reserve calculation (GEN, UNI, SEG, SA1, SA2, UCVP, DT, or EX) which produces the minimum total mid-terminal reserve or, in the absence of the tabular cost term, item (3) in formula 20-2, would produce the minimum total mid-terminal reserve. The net premium should be the deficiency basis net premium if the deficiency basis reserve is held.

The mid-terminal reserve, formula 20-2, includes a tabular cost element, term (3). This tabular cost element makes sure that the total reserve, including the net unearned premium reserve, is at least equal to the tabular cost for the remainder of the current policy year. If premiums have not been paid to the end of the policy year then this term can cause total reserves to be higher than the required minimum—the tabular cost to the paid to date.

C. Due Premiums (Uncollected)

Mean reserve methods and mid-terminal reserve methods are based on receipt of all premiums due on or before the valuation date. If due premiums have not been received, then reserves are overstated. Therefore, a due premium adjustment may be made to correct for this overstatement.

Due premiums are premiums that are due before the valuation date but which have not been received by the insurance company as of the valuation date. Due net premiums are the net premiums corresponding to due premiums.

When using mean reserve methodology, due net premiums are to be based on the same net premiums as used to calculate deferred net premiums. When using mid-terminal reserve methodology, due net premiums are to be based on the same net premiums as used to calculate the unearned premium reserve.

D. Advance Premium Liability

The liability for premiums that are not due until after the valuation date but which have been received by the company and credited to the premium account before the valuation date is held as advance premium liability offsetting the asset of the cash received. This liability is based on the gross premium, not the net premium. This definition of advance premium liability makes provision for all premiums received which were not due until after the valuation date, regardless of whether they were due before or after the *policy* year-end.

25. Timing of Payments—Other Assumptions

A. Curtate Reserves

The formulas in the preceding sections of these formulas are based on the following assumptions:

1. Net premiums are payable annually at the beginning of each policy year

2. Death benefits are payable at the end of the policy year of death.

Reserves based on these assumptions are called curtate reserves.

Following are alternative assumptions for reserve calculations.

B. Semicontinuous Reserves

Semicontinuous reserves are based on the following assumptions:

1. Net premiums are payable annually at the beginning of each policy year
2. Death benefits are payable at the moment of death.

C. Fully Continuous Reserves

Fully continuous reserves are based on the following assumptions:

1. Net premiums are payable continuously throughout the policy year
2. Death benefits are payable at the moment of death.

D. Discounted Continuous Reserves

Discounted continuous reserves are based on the following assumptions:

1. Net premiums are payable annually at the beginning of each policy year with a refund of the unearned portion of the current year's premium at death
2. Death benefits are payable at the moment of death.

E. Formulas

Reserve formulas reflecting these alternative assumptions differ from the curtate formulas presented. In general:

Semicontinuous reserve formulas can be obtained from curtate formulas by substituting

$\overline{M}$ for M and $\overline{C}$ for C.

Fully continuous reserve formulas can be obtained from semicontinuous formulas by substituting

$\overline{N}$ for N and $\overline{D}$ for D when it represents a premium payment.

Discounted continuous mean reserves can be calculated by multiplying the fully continuous net premium in the mean reserve formula by the interest factor d/δ (the discount rate/the force of interest).

Sample formulas reflecting appropriate modifications are shown below. They are based on the formulas for segmented reserves with no options. The number of the corresponding curtate formula is shown in parentheses as a cross-reference.

F. Semicontinuous Formulas

Expense Allowance

One-year term premium for benefits provided in first policy year

25-1.
(9-1)
$$c(\overline{A}_{[x]}) = \frac{{}_G\overline{M}_{[x]} - {}_G\overline{M}_{[x]+1}}{D_{[x]}}$$

Net level premium for benefits in the first segment

25-2.
(12-1)
$${}^{SEG}P^{NL}(\overline{A}_{[x]}) = \frac{{}_G\overline{M}_{[x]} - {}_G\overline{M}_{[x]+d} + {}_dUCV_x \cdot D_{[x]+d}}{{}_GN_{[x]} - {}_GN_{[x]+d}}$$

Net level premium for benefits in the first segment excluding the benefits in the first policy year

25-3.
(12-2)
$${}^{SEG}P^{NL}(\overline{A}_{[x]+1}) = \frac{{}_G\overline{M}_{[x]+1} - {}_G\overline{M}_{[x]+d} + {}_dUCV_x \cdot D_{[x]+d}}{{}_GN_{[x]+1} - {}_GN_{[x]+d}}$$

Renewal year equivalent level amount

25-4.
(9-4)
$$\overline{ELA}_{[x]+1} = \frac{{}_{GD}\overline{M}_{[x]+1}}{\overline{M}_{[x]+1} - \overline{M}_{[x]+m}}$$

Net level annual premium on the nineteen-year premium whole life plan of insurance for the renewal year equivalent level amount

25-5.
(9-6)
$${}_{19}PE(\overline{A}_{[x]+1}) = \overline{ELA}_{[x]+1} \cdot \frac{\overline{M}_{[x]+1}}{N_{[x]+1} - N_{[x]+20}}$$

25-6. $(a-b)^{SEG}(\overline{A})$ is the lesser of the following, but not less than zero:
(12-3)
$${}^{SEG}P^{NL}(\overline{A}_{[x]+1}) - c(\overline{A}_{[x]}), \text{ and}$$
$${}_{19}PE(\overline{A}_{[x]+1}) - c(\overline{A}_{[x]})$$

First Segment

Base premium for the first segment

25-7.
(12-4)
$${}_BP^{SEG}(\overline{A}_{[x]}) = \frac{{}_G\overline{M}_{[x]} - {}_G\overline{M}_{[x]+d} + (a-b)^{SEG}(\overline{A}) \cdot D_{[x]} + {}_dUCV_x \cdot D_{[x]+d}}{{}_GN_{[x]} - {}_GN_{[x]+d}}$$

Net premium for the first year of the first segment

25-8. $_{1}P^{SEG}(\overline{A}_{[x]}) = {}_{B}P^{SEG}(\overline{A}_{[x]}) - (a-b)^{SEG}(\overline{A})$
(12-5)

Renewal net premiums within the first segment
For all t within the segment: $1 < t \leq d$

25-9. $_{t}P^{SEG}(\overline{A}_{[x]}) = {}_{B}P^{SEG}(\overline{A}_{[x]}) \cdot {}_{t}R_{x}^{GG}$
(12-6)

Segments after the First Segment

Net premium for the first year of a segment after the first segment
25-10.
(12-7)

$$_{k+1}P^{SEG}(\overline{A}_{[x]}) = \frac{{}_{G}\overline{M}_{[x]+k} - {}_{G}\overline{M}_{[x]+k+d} + {}_{k+d}UCV_{x} \cdot D_{[x]+k+d} - {}_{k}UCV_{x} \cdot D_{[x]+k}}{({}_{G}N_{[x]+k} - {}_{G}N_{[x]+k+d}) \;/\; {}_{k+1}R_{x}^{GG}}$$

Renewal net premiums within a segment after the first segment
For all t within the segment: $k+1 \leq t \leq k+d$

25-11.
(12-8) $_{t}P^{SEG}(\overline{A}_{[x]}) = {}_{k+1}P^{SEG}(\overline{A}_{[x]}) \cdot \dfrac{{}_{t}R_{x}^{GG}}{{}_{k+1}R_{x}^{GG}}$

Terminal Reserve

25-12.
(12-9) $_{t}R^{SEG}(\overline{A}_{[x]}) = \dfrac{{}_{t}P^{SEG}(\overline{A}_{[x]})}{{}_{B}P^{SEG}(\overline{A}_{[x]})}$

25-13.
(12-10) $_{G}N^{SEG}(\overline{A}_{[x]+t}) = \sum_{s=t}^{n-1} D_{[x]+s} \cdot {}_{1+s}R^{SEG}(\overline{A}_{[x]})$

25-14.
(12-11) $_{t}V^{SEG}(\overline{A}_{[x]}) = \dfrac{{}_{G}\overline{M}_{[x]+t}}{D_{[x]+t}} - {}_{B}P^{SEG}(\overline{A}_{[x]}) \cdot \dfrac{{}_{G}N^{SEG}(\overline{A}_{[x]+t})}{D_{[x]+t}}$

Mean Reserve

25-15. $_{t}MV^{SEG}(\overline{A}_{[x]}) = 0.5({}_{t-1}V^{SEG}(\overline{A}_{[x]}) + {}_{t}V^{SEG}(\overline{A}_{[x]}) + {}_{t}P^{SEG}(\overline{A}_{[x]}))$
(12-12)

Mid-Terminal Reserve

25-16. $_{t}IV^{SEG}(\overline{A}_{[x]}) = 0.5({}_{t-1}V^{SEG}(\overline{A}_{[x]}) + {}_{t}V^{SEG}(\overline{A}_{[x]}))$
(12-13)

G. Fully Continuous Formulas

One-year term premium for benefits provided in first policy year

25-17.
(9-1) $$\bar{c}(\bar{A}_{[x]}) = {}_1AA_x \cdot \frac{{}_G\bar{M}_{[x]} - {}_G\bar{M}_{[x]+1}}{\bar{D}_{[x]}}$$

Net level premium for benefits in the first segment

25-18.
(12-1) $${}^{SEG}\bar{P}^{NL}_{[x]}(\bar{A}_{[x]}) = \frac{{}_G\bar{M}_{[x]} - {}_G\bar{M}_{[x]+d} + {}_dUCV_x \cdot D_{[x]+d}}{{}_G\bar{N}_{[x]} - {}_G\bar{N}_{[x]+d}}$$

Net level premium for benefits in the first segment excluding the benefits in the first policy year of the first segment

25-19.
(12-2) $${}^{SEG}\bar{P}^{NL}(\bar{A}_{[x]+1}) = \frac{{}_G\bar{M}_{[x]+1} - {}_G\bar{M}_{[x]+d} + {}_dUCV_x \cdot D_{[x]+d}}{{}_G\bar{N}_{[x]+1} - {}_G\bar{N}_{[x]+d}}$$

Renewal year equivalent level amount

25-20.
(9-4) $$\overline{ELA}_{[x]+1} = \frac{{}_{GD}\bar{M}_{[x]+1}}{\bar{M}_{[x]+1} - \bar{M}_{[x]+m}}$$

Net level annual premium on the nineteen-year premium whole life plan of insurance for the renewal year equivalent level amount

25-21.
(9-6) $${}_{19}\overline{PE}(\bar{A}_{[x]+1}) = \overline{ELA}_{[x]+1} \cdot \frac{\bar{M}_{[x]+1}}{\bar{N}_{[x]+1} - \bar{N}_{[x]+20}}$$

25-22. $\overline{(a-b)}^{SEG}(\bar{A})$ is the lesser of the following, but not less than zero:
(12-3)

$${}^{SEG}\bar{P}^{NL}(\bar{A}_{[x]+1}) - \bar{c}(\bar{A}_{[x]}),\ \text{and}$$

$${}_{19}\overline{PE}(\bar{A}_{[x]+1}) - \bar{c}(\bar{A}_{[x]})$$

First Segment

Base premium for the first segment

25-23.
(12-4) $${}_B\bar{P}^{SEG}(\bar{A}_{[x]}) = \frac{{}_G\bar{M}_{[x]} - {}_G\bar{M}_{[x]+d} + \overline{(a-b)}^{SEG}(\bar{A}) \cdot D_{[x]} + {}_dUCV_x \cdot D_{[x]+d}}{{}_G\bar{N}_{[x]} - {}_G\bar{N}_{[x]+d}}$$

Net premium for the first year of the first segment

25-24.
(12-5) $${}_1\bar{P}^{SEG}(\bar{A}_{[x]}) = {}_B\bar{P}^{SEG}(\bar{A}_{[x]}) - \overline{(a-b)}^{SEG}(\bar{A})$$

Renewal net premiums within the first segment
For all t within the segment: $1 < t \leq d$

25-25. (12-6) $${}_t\overline{P}^{SEG}(\overline{A}_{[x]}) = {}_B\overline{P}^{SEG}(\overline{A}_{[x]}) \cdot {}_tR_x^{GG}$$

Segments after the First Segment

Net premium for the first year of a segment after the first segment

25-26. (12-7)

$${}_{k+1}\overline{P}^{SEG}(\overline{A}_{[x]}) = \frac{{}_G\overline{M}_{[x]+k} - {}_G\overline{M}_{[x]+k+d} + {}_{k+d}UCV_x \cdot D_{[x]+k+d} - {}_kUCV_x \cdot D_{[x]+k}}{({}_G\overline{N}_{[x]+k} - {}_G\overline{N}_{[x]+k+d}) \;/\; {}_{k+1}R_x^{GG}}$$

Renewal net premiums within a segment after the first segment
For all t within the segment: $k+1 \leq t \leq k + d$

25-27. (12-8) $${}_t\overline{P}^{SEG}(\overline{A}_{[x]}) = {}_{k+1}\overline{P}^{SEG}(\overline{A}_{[x]}) \cdot \frac{{}_tR_x^{GG}}{{}_{k+1}R_x^{GG}}$$

Terminal Reserve

25-28. (12-9) $${}_t\overline{R}^{SEG}(\overline{\text{A}}_{[x]}) = \frac{{}_t\overline{P}^{SEG}(\overline{A}_{[x]})}{{}_B\overline{P}^{SEG}(\overline{A}_{[x]})}$$

25-29. (12-10) $${}_G\overline{N}^{SEG}(\overline{A}_{[x]+t}) = \sum_{s=t}^{n-1} \overline{D}_{[x]+s} \cdot {}_{1+s}\overline{R}^{SEG}(\overline{A}_{[x]})$$

25-30. (12-11) $${}_t\overline{V}^{SEG}(\overline{A}_{[x]}) = \frac{{}_G\overline{M}_{[x]+t}}{D_{[x]+t}} - {}_B\overline{P}^{SEG}(\overline{A}_{[x]}) \cdot \frac{{}_G\overline{N}^{SEG}(\overline{A}_{[x]+t})}{D_{[x]+t}}$$

Mean Reserve

25-31. (12-12) $${}_t\overline{MV}^{SEG}(\overline{A}_{[x]}) = .5({}_{t-1}\overline{V}^{SEG}(\overline{\text{A}}_{[x]}) + {}_t\overline{V}^{SEG}(\overline{A}_{[x]}))$$

Mid-Terminal Reserve

25-32. (12-13) $${}_t\overline{IV}^{SEG}(\overline{A}_{[x]}) = .5({}_{t-1}\overline{V}^{SEG}(\overline{A}_{[x]}) + {}_t\overline{V}^{SEG}(\overline{A}_{[x]}))$$

Note: 25-31 and 25-32 are equivalent because premiums are payable continuously.

H. Discounted Continuous Formulas

These formulas are identical to the fully continuous formulas except formula 25-31, which becomes:

25-33.
(12-12) $_t\overline{MV}^{SEG}(\overline{A}_{[x]}) = .5({}_{t-1}\overline{V}^{SEG}(\overline{A}_{[x]}) + {}_t\overline{V}^{SEG}(\overline{A}_{[x]}) + \frac{d}{\delta} \cdot {}_t\overline{P}^{SEG}(\overline{A}_{[x]}))$

d/δ is an interest factor: the discount rate/the force of interest.

APPENDIX
REFERENCES

AG	Actuarial Guidelines (NAIC)
JOR	*Life Contingencies* by C.W. Jordan
MR	Model Regulation
SNFL	Standard Nonforfeiture Law
SOA	Specifications for 1980 CSO Tables
SVL	Standard Valuation Law
TSA	*Transactions of the Society of Actuaries*

Paper Section	Paragraph/Sentence or Formula Number	References
1	1-10	MR:4B (definition of GP), 5E
1	1-11	MR:4F, 7A3, 7A4
1	1-21	SVL:5 paragraph 1
1	1-22	MR:4J
1	1-23	MR:4G
1	1-24	MR:6A1
1	1-25	MR:6A2
1	1-26	MR:6D
1	1-27	SVL:5 paragraph 2
1	1-28	MR:6E,6F
2	1/1	MR:3B(1)
2	2/1	MR:3A
2	the rest	Interpretation
3	1/1	MR:3B(1), 6A, 4G
3	the rest	MR:4B & interpretation
3	3-1	MR:4B (paragraph 1 & formulas)
3	3-2 & 3-3	MR:4B (note by R(t) definition)
4	4-1	MR:6D3
4	4-2 & 4-3	Definitions (used in reserve formulas)
5	all	MR:6D1, 6D2, 6D2a, & interpretation
6	1/1&2	SVL:5 paragraph 2
6	6-1 thru 6-5	Interpretation

Paper Section	Paragraph/Sentence or Formula Number	References
6	last paragraph	SVL:5 paragraph 2
7	1/1	SVL:4A; MR:5A, 4E
7	1/2	MR:4E
7	1/3	SVL:4A
7	1/4	TSA XXXIII:656–657, 673–674;
7	1/5	TSA 1982 Reports: 380–383
7	2/1	SVL:4A
7	2/2	TSA XXXIII: 669
7	2/3	MR:5A1, 5A2, 5A3, & 5A4
7	2/4	MR:5A2, 5B1b, 5A3, 5B1c
7	3	MR:5D
7	A	Interpretation
7	B	MR:5A1, 5B1a; TSA XXXIII: 669; interpretation
7	C-1/1	MR:appendix
7	7-3 thru 7-5	SOA:1.5; MR:5D
7	7-6	MR:5A2, 5C
7	7-7 thru 7-9	MR:5A3, 5C
7	7-10 thru 7-13	MR:5D
7	7-14	MR:5B1b, 5C
7	7-15 thru 7-17	MR:5B1c, 5C
7	7-18 thru 7-21	MR:5D
7	the rest	Interpretation
8	1/1	SOA:4
8	8-1 note	Interpretation
8	8-3 note	MR:5
9	9-1	SVL:5B; MR:4G1dii, 4J1bii; SOA:5.1
9	9-2 & 9-3	Actuarial Guideline:17
9	9-4	MR:4G1di, 4J1bi; SNFL:5
9	9-5	SVL:5A; SOA:5.5
9	9-6	MR:4G1di, 4J1bi
10	all	SVL:5 paragraph 1; SOA:5.3 thru 5.12
11	all	MR:4J; consistent with 10
12	all	MR:4G; consistent with 10
12	12-1	MR:4G1b
12	12-4	MR:4G1d
13	all	consistent with 12
13	13-1, 13-4 & 13-7	MR:6A1 (Does not override 4G1b & 4G1c)

Paper Section	Paragraph/Sentence or Formula Number	References
14	all	consistent with 12
14	14-1, 14-4 & 14-7	MR:6A2
15	all	MR:6D1, 6D2; consistent with 12
16	all	SVL:5 paragraph 2; consistent with 12
17	A	SVL:8 paragraph 1
17	B	MR:6B, 5B, 5E
18	18-1	SVL:8 paragraph 1
18	18-2	MR:6A
18	18-2 note	MR:6G, 6H
18	18-4	MR:6A, 6B, 6C, 6D; SVL:5 paragraph 2
18	18-4 note	MR:6E, 6F
19	19-1	SVL:8 paragraph 1
19	19-2	MR:6A, 6C
19	19-2 note	MR:6G, 6H
19	19-4	MR:6A, 6B, 6C, 6D; SVL:5 paragraph 2
19	19-4 note	MR:6E, 6F
20	20-1	SVL:8 paragraph 1
20	20-2	MR:6A, 6C
20	20-2 note	MR:6G, 6H
20	20-4	MR:6A, 6B, 6C, 6D; SVL:5 paragraph 2
20	20-4 note	MR:6E, 6F
21	A	MR:6G
21	B	MR:6H
22	A	MR:6E
22	B	MR:6F
22	C	MR:6E, 6F, & consistent with 10
23	all	MR:7
24	D	

Advance premium liability is defined in the Life Company Annual Statement Handbook and the NAIC Annual Statement Instructions. Recent NAIC Annual Statement Instructions, however, provide inconsistent definitions; the liability (on page 3) continues to be defined as in this paper but for revenue (in Exhibit 1) a revised definition excludes advance premiums due after the valuation date in the current policy year. It is unclear how this inconsistency is supposed to be reconciled.

If the revised definition is used, and a net unearned premium reserve is held for premiums due after the valuation date instead of an advance (gross) premium liability, then income will be immediately recognized to the extent of the premium loading. This acceleration of income is inconsistent with the nature of statutory accounting. Per Actuarial Standard of Practice No. 10, subsection 5.6.8, this income should not even be recognized under Generally Accepted Accounting Principles until the premium is due.

In this paper the historical definition of advance premium, which is based on the premium due date in the insurance contract, continues to be used. Revised calculations of premium elements will be necessary to implement a revised definition of advance premiums.

BIBLIOGRAPHY

1. ACTUARIAL STANDARDS BOARD. *Actuarial Standards of Practice—1990 to date.*
2. AMERICAN ACADEMY OF ACTUARIES. *Life & Health Valuation Law Manual*, Second Edition, 1995.
3. BOOKE & COMPANY. *Life Company Annual Statement Handbook*, 1990.
4. BOWERS, N. L., ET AL. *Actuarial Mathematics*, Itasca, Ill.: Society of Actuaries, 1986.
5. JORDAN, C. W. *Life Contingencies*, Chicago, Ill.: Society of Actuaries, 1975.
6. NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS. *Annual Statement Instructions—Life, Accident and Health*, 1992 and later years.
7. ———. *Model Laws, Regulations and Guidelines*, as revised 1996.
8. SOCIETY OF ACTUARIES. "Report of the Committee on Specifications for Monetary Values—1980 CSO Tables," 1983.
9. ———. "1980 CSO and 1980 CET Mortality Tables on an Age Last Birthday Basis," *Transactions of the Society of Actuaries*, Vol. XXXIII (1981): 671–674.
10. ———. "Report of the Special Committee to Recommend New Mortality Tables for Valuation," *Transactions of the Society of Actuaries*, Vol. XXXIII (1981): 617–670.
11. ——— "Report of the Task Force on Smoker/Nonsmoker Mortality," *TSA 1982 Reports*, pp. 343–390.
12. TULLIS, MARK A., AND POLKINGHORN, PHILIP K. *Valuation of Life Insurance Liabilities*, Winstead, Conn.: ACTEX Publication, 1990.