



AMERICAN ACADEMY *of* ACTUARIES

**American Academy of Actuaries' C3 Life and Annuity Capital Work Group
Proposed Simplification Methods**

**Presented to the National Association of Insurance Commissioners'
Life Risk Based Capital (E) Working Group**

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C3 Life and Annuity Capital Work Group

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The American Academy of Actuaries' Life Capital Work Group (LCWG) and Annuity Capital Work Group have been merged into a single work group – the C3 Life and Annuity Capital Work Group (C3WG). The merger of the two groups occurred in September 2008 and this document is presented as a product of the newly formed C3WG, its first report.

The purpose of this document is to provide further discussion as to the purpose and possible application of the two simplification methods included in the September 2008 American Academy of Actuaries C3 Life and Annuity Capital Work Group Report (September 2008 Report).

The two simplification methods are referred to in the September 2008 Report as the Stochastic Exclusion Test and the Alternative Amount respectively.

Details and requirements of The Stochastic Exclusion Test may be found in Section 10 of the September 2008 Report, excerpted as Appendix 1 in this document.

Details and requirements of The Alternative Amount may be found in Section 6H of the September 2008 Report, excerpted as Appendix 2 in this document.

Below is an example of how the actuary might avail himself/herself of the two simplification options:

1. Determine which blocks of business to test for exclusion via the Stochastic Exclusion Test [optional step]. For each block
 - a. Apply test to block.
 - b. If block passes test, then determine C3 RBC for these policies by either:
 - i. using existing C3 RBC factors to determine the Factor-based amount, or
 - ii. using one of the two options in Step 2.
 - c. If block fails test, go to Step 2 below.
2. For those blocks which:
 - a. the Stochastic Exclusion Test is not applied to, or
 - b. pass the Stochastic Exclusion Test but for which the actuary chooses not to determine C3 RBC using the Factor-based amount, or
 - c. fail the Stochastic Exclusion Test;

Then, determine C3 RBC by either:

- i. using the Alternative Amount option, or
- ii. performing the stochastic projections and determining the Stochastic Amount.

Through the course of development of the C3WG recommendation, the C3WG has had concerns about requiring a large number of stochastic scenarios for products that have little or no tail risk arising from interest rate movements or equity performance (tail risk). The group also has concerns about the potential volume of work involved in performing the calculations for large inforce blocks. To that end, the C3WG has proposed two simplification methods that are consistent with both the purpose of Risk-Based Capital (RBC), and the C3WG's recommendation.

The C3WG supports the use of simplified methods to the extent that such methods produce a result consistent with the recommended approach.

Stochastic Exclusion Test

The Stochastic Exclusion Test is a concept which exists in the current exposure of VM-20, Principle-based Reserving for Life Products, and which was thought to have application in the C3 process. It is proposed that the same exclusion test as in VM-20 be used in determining C3 requirements, but with an additional stand-alone reserve adequacy requirement

The specific details of the proposed test are given in Appendix 1 at the end of this document. These are excerpted from the March 2008 American Academy of Actuaries Life Reserves Work Group Modeling Subgroup Report on the Stochastic Exclusion Test. Note that the specific scenario details and test pass / fail ratios for purposes of VM-20 have not been finalized by the NAIC at this time.

The Stochastic Exclusion Test identifies those blocks of policies not having material tail risk, i.e., not having significant variation in financial results depending upon future economic conditions.

Those blocks of policies that pass the test are not considered to have material tail risk for the risks of interest rate movements or equity performance. Such blocks of policies are not the primary focus of the risks being addressed in this project and as such, it is proposed that for such blocks, the existing C3 RBC factors may optionally continue to be used to establish the C3 amount. Passing the test does not preclude the actuary from performing the stochastic projections and establishing a lower C3 amount than under the current factor-based approach should the stochastic projections result in a lower C3 requirement.

The Stochastic Exclusion Test constitutes a series of deterministic scenarios which establish a range of results. If the range of results is beyond the specified tolerance for variability then the block of policies are considered to have material tail risk and do not pass the test.

Blocks of policies which pass the exclusion test are considered not to have material tail risk. Those blocks of policies which pass the exclusion test must also meet a reserve

adequacy requirement in order that the existing C3 RBC factors may optionally continue to be used to establish the C3 amount for such blocks. The adequacy of a given block of policies is to be determined using the same methods and assumptions as applied to the block of policies in performing the annual Asset Adequacy Analysis and is to be determined on a stand-alone basis for that block.

The stand-alone reserve adequacy requirement is added so that the combination of reserves and C3 amount based on existing RBC factors results in an appropriate total balance sheet provision. Reserves are adequate, and the C3 amount based on existing RBC factors is deemed sufficient to cover the C3 risk.

The Stochastic Exclusion Test serves essentially as a filter, focusing the actuary's time and effort on blocks of policies which are considered to have material tail risk.

For a given block of policies, failing the test eliminates the option of using the existing RBC factors and requires that an explicitly determined C3 amount be calculated.

Alternative Amount

The Alternative Amount serves as a second possible simplification option for the actuary. In the event that a given block of policies fails the Stochastic Exclusion Test, the actuary cannot use the existing C3 RBC factors, but must explicitly quantify the C3 amount to be held with respect to the given block of policies under one of two options.

One option is to follow the steps involved in computing the Stochastic Amount, as outlined in the September 2008 Report.

A second option is to make use of the Alternative Amount simplification.

As in the case of the Stochastic Amount, the Alternative Amount provides for all material C3 risks of a group of policies, including material tail risk arising from sensitivities to changing economic conditions.

In this context C3 risk is the risk of losses due to cashflow mismatch as a result of changes in interest rate levels and / or changes in equity market levels and, in this context C3 risk would not include the effects of changes in anticipated asset default rates in response to changes in interest rate levels and / or changes in equity market levels.

It equals the amount determined by the actuary, using methods and assumptions deemed appropriate by the actuary, subject to satisfying a minimum floor and a set of requisite criteria. The minimum floor and requisite criteria is given in Appendix 2, which is excerpted from section 6H of the September 2008 Report.

The actuary must be able to demonstrate how he/she came to the conclusion that the Alternative Amount covers adverse experience at a comparable CTE level as the Stochastic Amount which would have been calculated for such policies had the stochastic modeling exclusion not been made. The actuary must also demonstrate how he/she came to the conclusion that Alternative Amount considers the dynamics of the liability and supporting asset cashflows in response to changes in interest rates and market movements.

Purpose of the Alternative Amount

The purpose of the Alternative Amount is to address two concerns:.

First, the C3WG had concerns about requiring a large number of stochastic scenarios for products that had little or no tail risk. The thought was that for this class of policies an off-line calculation might be relatively easy to develop by the actuary, which would reduce the number of scenarios.

Second, the C3WG had concerns about the potential volume of work involved in performing the calculations for large inforce blocks. The thought was that companies might be willing to trade some conservatism in the C3 amount determined if it lessened the work and cost involved. As an example, if companies wanted to simply run the single worst-case scenario and hold that C3 amount, then it should be possible to do that without specifically having to go through the stochastic scenario testing process.

Possible Application of the Alternative Amount

Subject to meeting the requisite criteria, the Alternative Amount option may be applied to all inforce life insurance policies in scope. Doing so would result in a C3 amount which is determined by using the current factor-based C3 Risk-Based Capital requirements. The necessary certification, documentation and demonstration associated with the Alternative Amount would be additional requirements not currently necessary under the existing C3 Risk-Based Capital requirements.

The Alternative Amount is intended to enable the actuary to make use of existing models or risk evaluation processes as a substitute to performing the stochastic testing otherwise required under the September 2008 Report proposal.

Alternative Amount Illustration

The following illustration is not intended to be construed as the only method nor the “best” method for developing the Alternative Amount. There may be many possible methods that could be used, depending upon the risks and circumstances of the policies being evaluated and the models and / or risk evaluation processes a company has in place.

One of the models a company will potentially have at its disposal for determining the Alternative Amount is the cashflow-testing analysis model.

Consider a hypothetical block of business for which cashflow testing is performed. The block contains minimum interest guarantees. Surrender charges on the policies include a market value adjustment which protects the company in the event of spike lapses when interest rates rise. The company's investment policy supporting this block of business is to invest in high quality investment grade bonds and is precluded from investing in equities. The company does not cashflow match. The duration of the assets is currently shorter than the duration of the liabilities.

The results of the cashflow testing scenarios are such that the worst result occurs in the scenario where interest rates immediately spike down and remain level at these lower levels thereafter. This result is consistent with the actuary's expectations given the risk profile of the business. No additional reserves are held as a result of cashflow testing, since in the actuary's judgment, this is the only scenario of those tested which produces an adverse result, and the likelihood of this scenario occurring is minimal.

Having ascertained that the primary C3 risk is driven by low interest rate scenarios, one possible way of determining the Alternative Amount would be to generate a stochastic set of interest rate scenarios using the generator supplied by the Academy's Life Capital Adequacy Subcommittee and the yield curve in effect at the valuation date. This set of scenarios is the same set that would have been used for purposes of computing the Stochastic Amount. The scenario with the lowest average return is then selected from this scenario set and the Scenario Amount is determined under this single deterministic scenario. The Scenario Amount becomes the Alternative Amount.

The actuary is confident that the Alternative Amount exceeds a CTE90 amount for the given stochastic scenario set. Should the resultant Alternative Amount be less than or equal to the current factor-based C3 on the block of policies, no further projections are required.

Should the resultant Alternative Amount be more than the current factor-based C3 amount on the block of policies, the actuary may decide that the conservatism in having applied the worst-case scenario is excessive and may decide to perform further analysis to select a scenario or set of scenarios to run which would be consistent with a CTE90 amount.

Alternative Amount and the Stochastic Exclusion Test

The concepts of Alternative Amount and the Stochastic Exclusion Test are consistent in that a block of policies is considered to have no material tail risk by passing the Stochastic Exclusion Test and the C3 amount is then determined using the existing C3 RBC factors.

This result is equivalent to explicitly developing an Alternative Amount calculation where the Alternative Amount calculation turns out to be less than the current factor-based amount. Due to the currently proposed minimum, the Alternative Amount is floored at the current factor-based amount.

Through either of these two methods, a block of low risk policies would have their C3 amount equal to the current factor-based amount, and the focus of the actuary's time and work would be directed to those blocks of policies having material tail risk.

Appendix 1

The following details regarding the proposed Stochastic Exclusion Test are taken from section 10 of the September 2008 Report.

Section 10. Stochastic Exclusion Test

A. Purpose of the Test

1. The Stochastic Exclusion Test identifies those blocks of policies not having material tail risk arising from interest rate movements or equity performance, i.e., not having significant variation in financial results depending upon future economic conditions
2. The Stochastic Exclusion Test constitutes a series of deterministic scenarios which establish a range of results. If the range of results is beyond the specified tolerance for variability then the block of policies are considered to have material tail risk and do not pass the test.
3. The Stochastic Exclusion Test is passed if the Stochastic Exclusion Test Ratio relating to the block of policies tested, determined in accordance section 10B, is less than 4%. Those blocks of policies that pass the test are not considered to have material tail risk for the risks of interest rate movements or equity performance.
4. For blocks of policies which both pass the exclusion test and which meet the reserve adequacy certification requirements of section 10C, the C3 requirement may be determined as the Factor-based Amount as defined in section 10D.
5. Passing the Stochastic Exclusion Test does not preclude the actuary from determining the C3 requirements on a given block of policies in accordance with the Stochastic Amount should the Stochastic Amount relating to such block of policies result in a lower C3 requirement.

B. Stochastic Exclusion Test Ratio

1. For each test scenario described in Section 10F, determine the Test Scenario Amount. The Test Scenario Amount is the amount required to fund the future benefits and expenses.
2. The Test Scenario Amount for any test scenario is determined using a Gross Premium Valuation methodology (present value of net cash flows) with the following assumptions:
 - a. Anticipated experience assumptions;
 - b. Zero working reserve;
 - c. Starting Assets are no less than 98% of the statutory reserve relating to the policies modeled

- d. No recognition of federal income taxes in the cashflows or discount rates;
 - e. Discount rates are the net asset earned rates each period where net asset earned rates are equal to gross asset earned rates less defaults and investment expenses.
3. As a practical measure, the actuary may alternatively use cash flow testing assumptions rather than anticipated experience assumptions in the determination of the Scenario Reserve for those blocks of policies whose reserves are not determined under a principle-based approach.
 4. The Stochastic Exclusion Test ratio is determined as the ratio of
 - a. The excess of the highest Scenario Reserve in each of the test scenarios, over the Scenario Reserve in the Base Scenario; to
 - b. The sum of the Scenario Reserve under the Base Scenario and the present value of future premiums.

C. Reserve Adequacy Certification Requirement

1. For those blocks of policies which pass the exclusion test and which the Qualified Actuary is able to certify that the statutory value on the valuation date of the policies included in the exclusion test are adequate, the C3 requirement may be determined as the Factor-based Amount as defined in section 10D.
2. The adequacy of a given block of policies is to be determined using the same methods and assumptions as applied to the block of policies in performing the annual Asset Adequacy Analysis.
3. The adequacy of a given block of policies is to be determined on a stand-alone basis for that block.
4. Certification and documentation are to be completed in accordance with Section 11.

D. Factor –based Amount

1. The Factor-based Amount is determined as the sum of the following amounts:
 - a. The statutory reserve at the Valuation Date relating to policies which have been tested for exclusion by the Stochastic Exclusion Test ; and
 - b. 0.5% of item (a) above.

E. Stochastic Exclusion Test Timing

1. The exclusion test shall be carried out annually for a given block of policies to continue to qualify for the stochastic testing exclusion, and shall be done within the 12 month period prior to the valuation date. It

would be expected that the timing of the test would be consistent from year to year and that the actuary would document both the current and prior year timing of the exclusion testing as well as rationale for any change in timing.

2. The actuary will certify that no material subsequent event has occurred after the date of the current year testing.

To the extent a material subsequent event has occurred between the date of current year testing and the actual year end, it will be necessary to re-perform the testing subsequent to filing, using actual year-end data. If the actual RBC value exceeds that estimated earlier in the blanks filing by more than 5 percent, or if the actual value triggers regulatory action, a revised filing with the NAIC and the state of domicile is required by June 15; otherwise re-filing is permitted but not required.

3. For purposes of the above, a material subsequent event is one or more circumstances which, if reflected in the exclusion testing would be anticipated to result in a failure of the exclusion test.

F. Stochastic Exclusion Test Scenarios

It is anticipated that the specific interest rate and equity return rate paths underlying each test scenario will be provided by the Academy of Actuaries by means of a return generator and/or Academy supplied scenarios. The scenarios are defined in terms of 90 percentile random shocks in various directions over various periods of time. The sum of the random shocks over n periods has a distribution, and the 90 percent level of that distribution is 1.28 times the square root of n . As an example, to get a 90 percent level shock over 5 years assuming monthly shocks, the sum of the 60 shocks must be 1.28 times the square root of 60. The test scenarios are described below:

1. Scenario 1 – Pop up, high equity

Interest rate shocks that maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 90% level.

For illustration, the pop-up scenario has shocks of

- 1.28 times $(\sqrt{1} - \sqrt{0})$ in period 1;
- 1.28 times $(\sqrt{2} - \sqrt{1})$ in period 2;
- 1.28 times $(\sqrt{3} - \sqrt{2})$ in period 3; and so on.

By the end of period n , the cumulative shock is -1.28 times \sqrt{n} .

2. Scenario 2 – Pop up, low equity

Interest rate shocks that maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 10% level.

3. Scenario 3 – Pop down, high equity

Interest rate shocks that maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 90% level.

4. Scenario 4 – Pop down, low equity

Interest rate shocks that maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns that maintain the cumulative equity return at the 10% level.

5. Scenario 5 – Up/down, high equity

Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns that maintain the cumulative equity return at the 90% level.

6. Scenario 6 – Up/down, low equity

Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns that maintain the cumulative equity return at the 10% level.

7. Scenario 7 – Down/up, high equity

Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns that maintain the cumulative equity return at the 90% level.

8. Scenario 8 – Down/up, low equity

Interest rate shocks that, for each five-year period, are consistently in the same direction. The cumulative shock for each 5-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns that maintain the cumulative equity return at the 10% level.

9. Scenario 9 – Base scenario

All shocks are zero.

10. Scenario 10 – Inverted yield curves

Zero shocks to long term rates and equities. 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.

11. Scenario 11 – Volatile equity returns

Zero shocks to interest rates. Shocks to equity returns that are consistently in the same direction for each two-year period, and then switch directions.

12. Scenario 12 – Deterministic scenario for valuation

Uniform downward shocks each month for 20 years, sufficient to get down to the 80% point on the distribution of 20 year shocks. After 20 years, shocks are at a level that keeps the cumulative shock at the 80% level (or the 20% level, depending on how you look at it).

13. Scenario 13 – Delayed pop up, high equity

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 that maintain the cumulative equity return at the 90% level.

14. Scenario 14 – Delayed pop up, low equity

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 that maintain the cumulative equity return at the 10% level.

15. Scenario 15 – Delayed pop down, high equity

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 that maintain the cumulative equity return at the 90% level.

16. Scenario 16 – Delayed pop down, low equity

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 that maintain the cumulative equity return at the 10% level.

Appendix 2

The following details regarding the proposed Alternative Amount are taken from section 6H of the September 2008 Report.

H. The Alternative Amount

1. Purpose. The purpose of the Alternative Amount is to produce a C3 amount that is adequate to cover the C3 risks related to the product benefits and expense, reflecting future revenue, for those policies for which the stochastic modeling exclusion has been made.
2. Alternative Amount Description. The Alternative Amount for a given set of policies within a Business Segment is to be determined by the actuary. The actuary must be able to demonstrate how he/she came to the conclusion that the Alternative Amount covers adverse experience at a comparable CTE level as the Stochastic Amount which would have been calculated for such policies had the stochastic modeling exclusion not been made. The actuary must be able to demonstrate how the actuary came to the conclusion that the Alternative Amount considers the dynamics of the liability and supporting asset cashflows in response to changes in interest rates and market movements.
3. The appropriate costs and benefits of Derivative Instruments that are currently held by the company in support of the policies falling under the scope of the report shall be included in the projections when determining the Alternative Amount. The Alternative Amount shall take into account the appropriate costs and benefits of Derivative Instruments expected to be held in the future through the execution of that strategy only if the company is following a Clearly Defined Hedging Strategy and the hedging strategy meets the requirements as defined in Section 6.E.9 above.
4. As a minimum requirement, the Alternative Amount may be determined for a set of policies if and only if such policies have been subjected to asset adequacy testing at the valuation date. Asset adequacy testing analysis methods need not be limited to cash flow testing. The actuary should use professional judgment in choosing an appropriate testing method among those currently in use in generally accepted actuarial standards of practice.
5. Furthermore, the Alternative Amount may not be less than the sum of the following amounts:
 - a. The statutory reserve at the Valuation Date relating to such policies;
and

- b. 0.5% of item (a) above in the case of the company submitting an unqualified actuarial opinion based on asset adequacy testing; otherwise 0.75% of item (a) above.

[Note: the intent of the minimum amount is to provide regulator assurance that the C3 requirements for blocks of business for which the Alternative Amount has been determined and not subjected to stochastic scenario analysis are not less than the current factor-based rules. The minimum requirement is viewed by the C3WG as a temporary measure until regulators and industry are comfortable with the process as a minimum requirement would not generally be included in a Principle-based Approach. It is recommended that the minimum requirement be removed after a period of 3 years following the date that the recommendations within this report first become effective.]

If the Alternative Amount is determined on a date that precedes the Valuation Date, then the Alternative Amount shall be adjusted to the Valuation Date.

The actuary shall annually re-evaluate the adequacy of the Alternative Amount. If, as of the end of any calendar year, the actuary determines the Stochastic Amount will materially exceed the Alternative Amount for the group of policies:

- i. The Alternative Amount shall be increased so the Stochastic Amount does not materially exceed the Alternative Amount, or
- ii. The exclusion shall be discontinued and the Stochastic Amount shall be held.

Alternative Amount Demonstration and Analysis. A demonstration supporting the exclusion from stochastic testing must be provided in the initial exclusion year and at least once every three calendar years subsequent to the initial exclusion. Such demonstration may use a series of deterministic scenarios with varying levels of imputed adverse deviations, or other techniques, to impute what confidence level and CTE level is covered, and that the resulting Alternative Amount is consistent with the intended conservatism implicit in the determination of the Stochastic Amount, had the Stochastic Amount been determined. The level of thoroughness required in the demonstration would be greater the more material the C3 risks related to the block, and the higher the level of volatility and unpredictability of the underlying variables (e.g., products with guarantees but investing in stocks would need more testing than a participating whole life product with a 3% guarantee.) Such demonstration must be accompanied by a high level analysis of the products, the associated C3 risks and the potential C3 capital needs of the products under adversity.