



AMERICAN ACADEMY *of* ACTUARIES

**Summary of C3 Phase II Survey Results from the American Academy of Actuaries’
Life Capital Adequacy Subcommittee**

**Presented to the National Association of Insurance Commissioners’
Life Risk Based Capital Work Group**

Washington, DC – June 2006

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C-3 Phase II Survey Results Summary

Below is a summary of the results obtained from the C3 Phase II survey conducted by the American Academy of Actuaries' Life Capital Adequacy Subcommittee. There were a total of 70 surveys returned, which represents a very high percentage of insurers writing variable annuities. For many of the survey questions there were a total of 70 answers, but for some questions there were fewer than 70 answers provided and on others, multiple answers were provided by some respondents. Also, there were some questions that were apparently not written clearly enough, so some of the respondents interpreted the question differently than intended. Therefore some of the answers may not be to the question as originally intended.

Summarized results are provided **in bold** following the same format as the survey questions. In some cases, categories of answers are identified by phrases contained within quotation marks. However, these are not direct quotes from survey responses as no direct quoting from any response has been included in this summary.

Method & General

1) Did you find the following resources helpful? (check all that apply)

Practice Note available at http://www.actuary.org/pdf/practnotes/life_va05.pdf **66**

The NAIC Q&A document available through a link at http://www.naic.org/committees_e_capad_lrbc_c3_market.htm **60**

The session recordings at http://www.actuary.org/life/phase2_session.asp **6**

2) Did you determine TAR (whether using a stochastic model or using the Alternative Methodology) based on (check one):

Year-end inforce? **59**

An earlier inforce? **11**

What was the date of the inforce (e.g., 9/30)? **September 30 for 6 and November 30 for 5.**

What method did you use to estimate the impact of using year-end inforce?

<u>Response</u>	<u>Number</u>
None	2
Projection of Inforce	5
Proportional to Reserve or Cash Value	2
NAR decreased	1

3) Did you utilize the option to smooth results? Y-**41** N-**25**

a) If yes, by what percentage did TAR change? **40 total answers were provided ranging from -23% to positive 80%.**

Of these, 36 were between -4% and 4% with an average negative value of -1.21% and an average non-negative value of .70%.

27 of these 36 were between -1% and 1%, with an average negative value of -.36% and an average non-negative value of .33%.

b) If no, what was the reason for not smoothing?

Reflection of hedging in determining TAR 2

Other (please specify) 21

Specified answers included the following:

<u>Response</u>	<u>Number</u>
Small market risk	12
Not hedging	2
Smoothing increased RBC	1
Other reasons	6

4) What aspects of compliance with the C-3 Phase II requirements were most difficult in terms of the amount of work required (check all that apply and/or indicate any item not listed):

Creating equity and/or interest rate scenarios 9

Creating documentation 21

Determination of assumptions 30

Interpreting LR023 instructions 53

Creation of the model population 12

Interpreting AAA June 2005 Report 44

Obtaining sufficient computer resources 35

Understanding and complying with the Standard Scenario requirements 41

Reflecting a Clearly Defined Hedging Strategy in modeling 9

5) Does your company plan to incorporate C3 Phase II methodology in internal business practices (e.g. determination of capital requirements, allocation of capital between lines of business, pricing process)? Y-50 N-20

6) Did you determine TAR (before comparison with the Standard Scenario) using (check one)

Stochastic scenarios 53

The Alternative Methodology? 17

7) Would you have used the Alternative Methodology except that (check all that apply)

Your business contained guaranteed living benefits? 16

You needed to take credit for hedging and that is not permitted under the Alternative Methodology? 5

If you used the Alternative Methodology (AM), please answer only the questions under that caption as no other questions apply to you.

Alternative Methodology

8) Did you use the AM for

All your business? 16

Just a part of it? 3

9) For what reason(s) did you choose to utilize the AM (select all that apply)

It was simpler than running stochastic scenarios. **16**

Because one cannot use the AM after having used the stochastic scenario method, it was deemed worthwhile to try it before employing the stochastic scenario method. **8**

Other: **7**;

Specified answers included the following:

<u>Response</u>	<u>Number</u>
No guaranteed living benefits	1
Limited resources	1
Transition rules limited impact of any overstatement	1
Payout annuities tough to model	1
Avoid Standard Scenario with 100% MGDB table	2

10) Did you apply the AM factors on a seriatim basis and using 100% mortality (to qualify to not calculate the Standard Scenario)? Y-**17** N-**1**

11) In creating the capability to apply the AM, did you (check one)

Start with the Excel workbooks made available by the AAA **6**

Directly create a separate spreadsheet or program. **12** If so, did you use the dll (used by the Excel Add-In Factor Lookup Tool) provided by the Academy for looking up and interpolating the AM factors? Y-**12** N-**0**

12) Did you modify the AM factors as allowed under the requirements? Y-**2** N-**15**. If “yes”, what did the adjustments reflect?

<u>Response</u>	<u>Number</u>
Modified for benefits not reflected in factors but didn’t use	1
Needed for reinsurance of a benefit not reflected in the factors but simply used ROP factors	1

Results

13) What was the ratio of your CTE 90 TAR (after reduction for TAR related to interest rate risk if both interest rate risk and market risk were determined in the same model) to that derived from the Standard Scenario? **Average value was .978**

a) If this ratio was less than one, do you have insights into what caused the Standard Scenario to be larger than CTE 90 (e.g. no dynamic hedging allowed, assumed drop and recovery rates, required use of 100% of the 1994 GMDB Table, etc.)? **Some respondents listed multiple reasons, but taking all into account, they can be summarized as in the table below:**

<u>Response</u>	<u>Number</u>	<u>Response</u>	<u>Number</u>
Higher Mortality	3	Limits on Revenues	1
Lapse Rates	11	Drop & Recovery	1
Annuitization Assumptions	6	No Dynamic Hedging	1
5% Rollup GMIB	1	Revenue Sharing	2
Rollup GMDB	2	ITM Definition	2
Reinsurance as Aggregate	1	No	1

14) For what percentage of scenarios was the resulting TAR greater than the Working Reserve? **One respondent reporting for more than one company indicated a range from 0% to 90 % instead of a single value.**

Other responses were single values and fell in ranges as follows:

<u>Respondents reporting in range</u>	<u>Average</u>	<u>Number</u>
0%	0%	8
> 0% and < 2%	.9%	15
≥ 2% and < 10%	4.8%	5
>10% and < 90%	32.7%	8
≥90%	98.3%	5

15) Was there a predominate value for the projection duration at which the greatest present value of accumulated deficiency occurred in the stochastic projections? (Check all that apply)

End of year 1? **17**

End of the surrender charge period? **5**

Last year of the projection? **12**

Year when GMAB or GMIB reaches the end of the waiting period for election? **6**

Other (please describe) **17**

Of these, 10 respondents reported the greatest present value of deficiency as occurring at the start of projections with various other responses from the other respondents.

16) By what percentage, if any, (using “-” for decrease and “+” for increase) did the hedging adjustment change your pre-hedged results?

a) For TAR based on stochastic modeling of market risk (i.e. sum of the starting assets and GPV of accumulated deficiency, but without provision for interest rate risk)? **There were 8 respondents to this question, 4 with negative percentages ranging from -.02% to -7%, 2 reporting 0% and two reporting between 0% and 1%.**

b) For TAR based on the Standard Scenario (sum of the aggregate Working Reserve and the negative of the Accumulated Net Revenue)? **There were 7 respondents to this question, 4 with negative percentages ranging from -.003% to -4.38%, 2 reporting 0% and one reporting 1%.**

17) Was the TAR (before the tax adjustment, if any, but after any smoothing and transition) used for calculation of RBC:

Greater than the actual statutory reserve? **28**

Less than the actual statutory reserve? **30**

18) Can you estimate the change that C-3 Phase II had in the overall RBC requirement for the Variable Annuity line of business at your company? (check one)

Increased by ____% **16**

The percentages reported ranged broadly from .5% to 9999% with little pattern to report here.

Decreased by ____% **16**

The percentages ranged from 0% to 100%, with 8 less than 10%, 3 from 10%-20%, and 3 between 20% and 100% and 2 not specifying a percentage.

Stayed the same **15**

Unable to estimate the change **7**

19) Do you have any suggested changes to the methodology? **There were 57 total suggestions, counting multiple ones from each respondent. The ones having the highest frequency are shown in the table below:**

<u>Response</u>	<u>Number</u>
Eliminate or simplify the SS	16
No	8
Correct or modify smoothing and/or transition rules	7
Improve/correct the LR024 instructions	7
Apply tax adjustment to CTE90 & SS before comparing	5
Too much work for an immaterial and predictable result.	3

20) Did you discover any elements of the methodology that produced inappropriate results (please specify)? **There were a total of 31 responses to this question, with many of the responses either referencing the answer to the previous question or reiterating what had already been stated. The Standard Scenario, with 10 responses and “No” with 11 responses made up a majority of the answers.**

Scenarios

21) For scenarios, did you (check one)

Use the AAA equity, bond and interest scenarios? 27

Use the AAA equity and bond scenarios combined with forward rates derived from the swap curve? 13

Use the AAA equity and bond scenarios together with interest rates generated by a separate model? 1

Generate your own equity and bond scenarios by complying with calibration criteria together with forward rates? 7

Generate your own equity, bond and interest scenarios in an integrated model? 3

Other approach (please describe)? 2 Both respondents reported using the AAA equity and bond scenarios with a constant earned rate on GA assets.

22) If you used the AAA scenarios, did you base your CTE 90 results on (check one)

The March 2005 scenarios? 30

The enhanced December 2005 scenarios? 13

23) How many stochastic scenarios were utilized in the projections used to calculate TAR based on CTE 90? Average number was 947

24) What methods or techniques were used to map funds to proxies where a fund proxy may be an index, a linear combination of indices, a pre-packaged scenario, a linear combination of pre-packaged scenarios or a linear combination of indices and pre-packaged scenarios? The 51 responses to this question can be categorized into the four categories appearing in the table below, together with the number of responses of each type. The prototypical methodology reported for the Quantitative response was “regression analysis”, while the corresponding method for Qualitative was “review prospectus”.

<u>Response</u>	<u>No</u>
Quantitative analysis (e.g. Regression Analysis)	19
Unknown	21
AG 34 rules	2
Qualitative analysis (e.g. Analyze fund write-ups in prospectus)	5
Quantitative & Qualitative	4

25) What rate(s) was used to discount the accumulated surplus/deficiency within each scenario (e.g., one-year after-tax Treasuries)? There were 50 responses to this question with the responses summarized below:

<u>Response</u>	<u>Number</u>
1-Yr. After Tax Treasuries	18
After-tax swap curve	6
Swap curve	7
Portfolio Yield	6
Modified swap curve	5
LIBOR	2
Other	6

Modeling (please skip this section if you utilized the Alternative Methodology)

26) Did you

Project on a seriatim basis **12**

Compress contracts into model cells? **41**

How many model cells were in the population? **There were 38 responses to this question, with results ranging from a low of 20 to 30 cells to a high of 171,000. The following table summarizes the results:**

<u>Range of # of Model Cells</u>		<u>Number of</u>	<u>Average</u>
<u>Low</u>	<u>High</u>	<u>Respondents</u>	<u>Number of</u>
			<u>Cells</u>
-	999	5	391
1,000	1,999	4	1,413
2,000	4,999	5	3,208
5,000	9,999	5	8,039
10,000	19,999	7	13,660
20,000	99,999	10	52,601
100,000	171,000	2	162,000

27) For how many future projection years did you run your stochastic model? **There were 53 respondents to this question as shown in the following table:**

<u>Projection Years</u>	<u>Respondents</u>
20 Years	13
21 Years	2
25 Years	3
30 Years	35

28) What tests of model fit, other than that required under the Standard Scenario, did you utilize, if any (check all that apply)?

Projected all or a portion of the business on a seriatim basis for a scenario to compare to the results to that obtained from the model for that scenario? 23

Other 10

29) Did you reflect a Clearly Defined Hedging Strategy (CDHS) in the CTE 90 results? Y-13 N-39

a) If yes, check all that apply:

Incorporated the CDHS directly into the scenarios used to calculate CTE 90. 8

The effect was determined through separate projections and reflected as an adjustment to the CTE 90 scenarios or results. 5 Did you use the same number of scenarios as for the “before hedging” modeling? Y-4 N-1

30) Computers used for stochastic projections:

a) What is the approximate number of computers that were utilized simultaneously to run the stochastic projections? **This question should have asked how many processors were used instead of the number of computers because many respondents indicated they used dual-processor servers. For respondents not indicating the use of dual-processor computers, it was assumed in summarizing the results that their computers were all single processor and the results tabulated in terms of number of processors.**

b)

<u>Processors</u>		<u>Number of Respondents</u>	<u>Average Number of CPUs</u>
<u>Low</u>	<u>High</u>		
0	1	7	1.0
2	5	4	2.8
6	10	8	8.9
11	20	8	16.4
21	30	5	26.4
31	50	7	36.9
51	100	11	80.9
101	200	2	200.0
201	500	1	500.0

c) What was the elapsed time to complete a set of stochastic scenarios? **There were 53 respondents to this question, with answers ranging from a low of .25 hours to a high of 240 hours.**

<u>Elapsed Time in Hours</u>		<u>Number of Respondents</u>	<u>Average Number of Hours</u>
<u>Low</u>	<u>High</u>		
0	12	23	6.8
13	24	12	19.8
25	48	8	43.5
49	60	2	60.0
61	72	2	72.0
73	120	5	104.4
240	240	1	240.0

d) What other data processing methods did you employ to generate your results? (Check all that apply.)

Distributed Processing 28

Grid Computing 20

Other (please specify) : 3 **There was no particular pattern to the three responses.**

31) How was reinsurance that has requirements for minimum premiums or maximum benefits reflected in modeling? **There were 44 responses to this question with the two highest responses being 21 “N/A” and 18 “Explicitly modeled”.**

32) To reflect tax reserves, did you

Directly model tax reserves? 12

Apply the approximate adjustment to TAR based on the “duration to worst”? 30

Other (please describe) 11 **No pattern of answers was observed that was meaningful.**

Assumptions

33) How did you accommodate creating Prudent Best Estimate assumptions (both base assumptions and dynamic assumptions) for which you have no experience data?

Base Assumptions

Dynamic Assumptions or Modifiers

Used pricing assumptions? 19

Used pricing assumptions? 26

Created a baseline assumption and did sensitivity testing? 31

Created a baseline assumption and did sensitivity testing? 25

Other method? Please describe: **19 Most answers involved sensitivity testing using Cash Flow Testing, reliance on pricing assumptions, experience studies.**

Other method? Please describe: **12 Most answers involved using judgment, weighting toward rational contractholder behavior, industry assumptions, and sensitivity testing using Cash Flow Testing.**

34) Did you reflect Revenue Sharing in your stochastic projections? Y-36 N-19

35) Did you perform a mortality study? Y-29 N-27

a) If yes, how credible was your data? **Responses varied a great deal and ranged from no or low levels of credibility to 100%.**

b) What percentage of the 1994 GMDB table was your assumed mortality (if a varying percentage applies or is different by gender, please give additional information)?

<u>Response</u>	<u>Number</u>
A flat percentage of the 1994 table, varying from 60% to 100% (averaging 85.9%)	31
Percentage varying by issue age	2
Expressing mortality as percentages of the A2000 table	6
Respondents reporting an answer of N/A	2

36) Did you perform a lapse study? Y-39 N-17.

If yes, how credible was your data? Responses varied a great deal, but there generally seemed to be higher levels of credibility than for mortality assumptions.

37) How many plus segments and minus segments were included in your stochastic scenario projections?
Plus: There were 42 responses ranging from 0 to 1,022 with 32 of these reporting a single plus segment.

Minus: There were 34 responses ranging from 0 to 1,022 with 15 of these reporting a no minus segments, and 11 reporting one minus segment.

38) Did you incorporate dynamic assumptions for contractholder behavior into your stochastic models? (check all that apply):

For lapses? 49

For utilization of benefits? 35

Other (please specify): 5 Fund transfers, partial withdrawals, inflation

39) Which assumption did you find the most difficult to determine for the C-3 Phase II projections? There were 45 total responses (more than one per respondent) with the following noted most frequently:

<u>Response</u>	<u>Number</u>
Dynamic Assumptions	12
Lapse Rates	8
Living Benefit Utilization	8
Dynamic Lapse Rates	4
Fund Mapping	4

40) Did you perform any sensitivity testing? Y-54 N-2

a) If yes, what was tested? (mortality, lapses etc.) There were 187 total assumptions that were listed as sensitivity tested. The more frequently listed assumptions are shown below:

<u>Assumption</u>	<u># Respondents</u>	<u>Assumption</u>	<u># Respondents</u>
Mortality	41	Inforce grouping	6
Lapse	33	Hedging	5
Expenses	14	Margins	5
Revenue sharing	10	Plus/minus segments	5
Premium	9	Partial withdrawal	4
DCA accounts	6		

b) If yes, did any of the sensitivity testing change results materially? Y-18 N-34

c) If yes, was your sensitivity testing done on all scenarios or a subset, such as just on the worst scenarios from the base run? **There were 45 responses:**

<u>Response</u>	<u>Number</u>
“All”	19
“The scenario replicating the CTE90 value”	5
“Subset”	10
“Worst X% scenarios”	7
Listing a specific number of scenarios	4

Market Risk and Interest Rate Risk

41) Did you model Market Risk (i.e. equity scenarios) and Interest Rate Risk

a) Within the same set of projections? Y-24 N-31

b) If Interest Rate Risk was determined separately from Market Risk, was it determined

Using Phase I modeling? 12

By applying the RBC factors? 18

Other (please describe)? **7: 4 respondents reporting doing full asset adequacy.**

42) How did you reflect both Market Risk and Interest Rate Risk in the RBC calculation? (check one)

Both Market Risk and Interest Rate Risk were stochastically modeled in a single set of stochastic projections. 20

Market Risk and Interest Rate Risk were each modeled but in separate models. 12

Market Risk was stochastically modeled but Interest Rate Risk was reflected in RBC using the factors supplied for this purpose. 17

Other (please explain). 7

Explanation:

<u>Response</u>	<u>Number</u>
“Full market and interest rate risk derived through stochastic scenarios with market risk derived by subtracting an amount derived using factors”	1
“Similar to this last approach but the Standard Scenario turned out to be larger”	1
“Performed using method (c) from Appendix VI”	1

43) If Interest Rate Risk was determined separately from Market Risk

a) Did you assume the full interest crediting spread in both determinations? Y-20 N-6. If no, how did you split the assumed interest crediting spread between market risk and interest rate risk? **Three respondents reported using no spread in Phase II; One respondent split the spread between Phase I and Phase II.**

b) Did you reflect any guaranteed minimum crediting rate in the Market Risk projections? Y-27 N-3