



AMERICAN ACADEMY *of* ACTUARIES

**Economic Scenario Implementation Work Group  
Frequently Asked Questions (FAQ)  
December 2010**

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The American Academy of Actuaries' Economic Scenario Work Group (ESWG) released an interest rate generator, calibration criteria, and a scenario picking tool in December, 2008. For purposes of this FAQ document, the December 2008 interest rate generator along with any subsequent technical modifications developed by the ESWG, is referred to as the Academy Interest Rate Generator (AIRG). The ESWG developed a 2010 release of the AIRG that is now available. The enhancements made to the AIRG by the ESWG in the 2010 release are summarized in Question 4 below. The new version of the AIRG, Version 7.0.3, is available [here](#).

This FAQ document was developed by the American Academy of Actuaries' Economic Scenario Implementation Work Group (ESIWG) to provide information relevant to the AIRG, with particular emphasis on use for principle-based reserve and capital calculations. This FAQ document is current as of December, 2010.

The Academy's Life Capital Adequacy Subcommittee (LCAS) recommended the AIRG to the NAIC for use in all regulatory calculations, as part of the implementation of principle-based reserve and capital requirements (i.e., PBA).

**1. What is the status of the AIRG? Has it been approved for use in C3P3 and VM-20 reserves?**

VM-20

As of August, 2010, the NAIC has adopted the Standard Valuation Law with further action on hold pending a final version of the Valuation Manual. The VM-20 section of the revised Valuation Manual prescribes the calculation of life reserves and includes a description of the scenario requirements. The most current version of VM-20 has been exposed by LHATF for purposes of conducting an impact study. We anticipate that LHATF will designate the AIRG as the prescribed generator for VM-20. LHATF did not include the use of proprietary generators for stochastic life reserve calculations in the exposure of VM-20.

The 2010 release of the AIRG is being used to develop scenarios for the NAIC study of the impact of the VM-20 on reserves for life insurance products.

### C3P3

The NAIC Life Risk-Based Capital Working Group (LRBCWG) has exposed the Academy's C3 Life and Annuity Capital Work Group's recommendation entitled "RBC C3 Requirements for Life Products," which includes the recommendation to use either the AIRG or proprietary generators whose scenarios satisfy the required calibration criteria.

## **2. Is the AIRG approved for use in C3P1, C3P2, and AG43?**

The ESWG, along with the Academy's Life Capital Adequacy Subcommittee (LCAS), recommended that the AIRG replace the Enhanced C-3 Phase I Interest Rate generator. Some specific elements of the C3P1 calculation and/or instructions will need to be modified before the NAIC can prescribe the use of this new AIRG in regulatory capital calculations.

### C3P1

The AIRG has not yet been approved by the NAIC for use in C3P1 capital calculations. Until further action by the NAIC, C3P1 requires the use of the Enhanced C3 Phase I Interest Rate Generator. The Enhanced C3 Phase I Interest Rate Generator is available at: [http://www.naic.org/committees\\_e\\_capad\\_lrbc\\_c3\\_market.htm](http://www.naic.org/committees_e_capad_lrbc_c3_market.htm).

### C3P2 and AG43

Both C3P2 and AG43 allow companies to generate and use their own scenarios, provided those scenarios meet the calibration criteria. Therefore, equity and interest rate scenarios (including fixed income equity scenarios) can be generated using the AIRG for use in C3P2 and AG43 calculations, as long as the scenarios satisfy the approved calibration criteria. The AIRG fixed income equity scenarios will differ from the pre-packaged scenarios previously generated and available on the Academy's website.

- For AG43, a company can generate scenarios or use the approved pre-packaged scenarios. A company can use any tool to generate scenarios, including the new AIRG. Regardless of the generator used, the equity scenarios must meet the prescribed calibration criteria. The pre-packaged scenarios can be found at <http://www.actuary.org/life/phase2.asp> and are fully documented at [http://www.actuary.org/pdf/life/c3supp\\_march05.pdf](http://www.actuary.org/pdf/life/c3supp_march05.pdf).
- For C3P2, the pre-packaged equity scenarios are the same as those approved for AG43, and can also be found at [http://www.actuary.org/life/phase2\\_2.asp](http://www.actuary.org/life/phase2_2.asp). If generating scenarios, the equity scenarios need to meet the calibration methodology and requirements outlined in Appendix 2 of the LCAS's June 2005 report, [Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products](#).

## **3. Are proprietary generators allowed in regulatory calculations?**

As described above, the NAIC allows the use of proprietary generators for AG43 and C3P2 calculations, as long as the generated scenarios satisfy the calibration criteria adopted by the

NAIC. While the Academy's Life Reserves Work Group recommended the use of proprietary generators for life reserve calculations subject to calibration criteria, LHATF did not include the use of proprietary generators for stochastic life reserve calculations in the exposed version of VM-20. The Academy's C3 Work Group also recommended use of proprietary generators for C3P3 capital calculations. At this time, the Academy's C3 Work Group's recommendation on C3P3 capital requirements has been exposed for comment; the LRBCWG has not yet voted on any aspect of the C3P3 recommendations, including the use of proprietary generators for C3P3.

#### **4. What enhancements were included in the 2010 release of the AIRG?**

The 2010 release of the AIRG is based on the same methodology as the 2008 release and has been updated to be more user-friendly. In particular, the 2010 release:

- Allows the generator to be run with different starting dates.
- Calculates the mean reversion point reflecting the formula approved by LHATF for use in VM-20 calculations. The mean reversion calculation has been programmed, so that it will automatically update based on future changes in interest rates. The mean reversion point is held constant during a calendar year based on January values.
- Produces Stochastic Exclusion Test (SET) scenarios as of a specified date.
- Includes ability to generate spot rates. The generator can save results as either coupon yield curves or as spot rate yield curves, based on user selection. The coupon yield curves are expressed as bond-equivalent yields (i.e., a rate to be compounded every six months) while the spot rates are expressed as annual-effective yields. Since derivation of a spot curve from a bond curve requires values for the coupon bond curve at six-month maturity intervals, the derivation used here is based on linear interpolation between the 10 points on the bond curve that are output from the generator.
- Includes the scenario picker tool developed by the ESWG with the generator and is automatically run whenever 10,000 scenarios are generated. The results are used to pick subsets of less than 10,000 upon request.
- Incorporates the ability to generate either interest rate or equity scenarios within the same workbook. The generator for fixed income fund returns has been integrated with the generator for interest rate scenarios so that fund returns depend on the change in interest rates in the same scenario.
- Includes additional functionality, such as the ability to:
  - more easily view the generated scenarios
  - generate a user-specified number of scenarios
  - output results to a new file format called EconSML (format developed by the Technology Section of the Society of Actuaries as a proposed standard for exchange of scenario files between modeling systems).

**5. Were there any technical changes to the 2010 release of the AIRG?**

The ESWG made a technical modification to the AIRG. The method of yield curve interpolation was changed from an approach based on historical curves, to one using the Nelson-Siegel formula. The impetus for this change was the occurrence of anomalous results when generated yield curves went outside the range of historical observations. Nelson-Siegel parameters were chosen so as to produce results similar to the historical method across a broad range of observed yield curves. Results outside observed ranges were deemed to be reasonable.

The floor on generated interest rates has been changed to 0.01%. The previous floor was formulaic.

**6. Will the ESWG or other Academy Work Groups continue to provide pre-packaged scenarios?**

Pre-packaged scenarios have been generated by Academy Work Groups for various dates in the past and will remain available on the Academy website. However, going-forward, the Academy will no longer publish updated pre-packaged scenarios.

**7. What information on the AIRG is available on the Academy website?**

Information on the AIRG can be found at (<http://www.actuary.org/life/phase3.asp>).

Since early 2009, the Academy website has included the following information with respect to the initial release of the AIRG:

- December 2008 Report from the ESWG that describes the development of the generator and the calibration criteria.
- Interest rate generator with parameters set to develop interest scenarios based on the September 30, 2008 Treasury curve.
- 10,000 pre-packaged interest scenarios developed as of September 30, 2008 and a subset of 1000 scenarios that meet the calibration criteria.
- Scenario picking tool that can be used to pick a subset of scenarios from the 10,000 pre-packaged interest scenarios using a significance measure method (see additional details below). The actuary will need to confirm that subsets produced from the tool satisfy the calibration criteria.
- 16 Stochastic Exclusion Test Scenarios (including both interest and equity rates for these scenarios) developed as of September 30, 2008

In late 2009, the ESWG updated the AIRG parameters to develop interest scenarios based on the September 30, 2009 US Treasury curve. The following information was posted on the Academy website in February 2010:

- 10,000 pre-packaged interest scenarios developed as of September 30, 2009 and a subset of 1,000 scenarios that meet the calibration criteria.
- Scenario picking tool that can be used to pick a subset of scenarios from the 10,000 pre-packaged interest scenario using a significance measure method (see additional details below). The actuary will need to confirm that subsets produced from the tool satisfy the calibration criteria.

- 16 Stochastic Exclusion Test Scenarios (including both interest and equity rates for these scenarios) developed as of September 30, 2009.

In November 2010, the ESWG revised the AIRG and posted the following information to the Academy website:

- 2010 Release of the AIRG
- Release notes for 2010 Release

**8. What documentation is available on the equity scenario generator?**

Information on the Academy’s equity scenario generator is contained on the Academy’s website: <http://actuary.org/life/phase2.asp>

**9. Is the NAIC requiring use of the scenario picking tool?**

No. The NAIC permits the use of scenario reduction techniques for regulatory calculations, but is not requiring the use of any standard techniques or tools for selecting a subset of scenarios to be used in the calculations. The scenario picking tool has been provided as a convenience to Academy members.

**10. In the scenario picking tool, what methods were used to pick the 1,000 scenario subset from the 10,000 scenario set?**

- The significance measure algorithm is described in the following article: Chueh, Yvonne C. M. “Efficient Stochastic Modeling for Large and Consolidated Insurance Business: Interest Rate Sampling Algorithms,” NAAJ, Vol. 6, No. 3, July 2002, pages 88-103 [http://www.soa.org/library/journals/north-american-actuarial-journal/2002/july/naaj0207\\_8.pdf](http://www.soa.org/library/journals/north-american-actuarial-journal/2002/july/naaj0207_8.pdf).
- The algorithm used, called the Significance Method, is described on pages 92-93 of the article. The measure used was:

$$s = \sqrt{\sum_{t=1}^T \left[ \prod_{m=0}^{t-1} \left(1 + \frac{i_m}{2}\right)^{-\frac{2}{12}} \right]^2} = \sqrt{\sum_{t=1}^T \left[ \prod_{m=0}^{t-1} \left(1 + \frac{i_m}{2}\right)^{-\frac{1}{3}} \right]}$$

- Where  $i_m$  is the monthly long rate (i.e., twenty year rate), and the measure is calculated over the entire time period of the scenario.