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Educational Note Supplement

Guidance for the 2011 Valuation of Insurance Contract Liabilities of Life Insurers

Document 211110

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Guidance for the 2011 Valuation of Insurance Contract Liabilities of Life Insurers

Committee on Life Insurance Financial Reporting

November 2011

Document 211110

Ce document est disponible en français

Members should be familiar with Educational Notes. Educational Notes describe but do not recommend practice in illustrative situations. They do not constitute Standards of Practice and are, therefore, not binding. They are, however, intended to illustrate the application (but not necessarily the only application) of the Standards of Practice, so there should be no conflict between them. They are intended to assist actuaries in applying Standards of Practice in respect of specific matters. Responsibility for the manner of application of Standards of Practice in specific circumstances remains that of the member in the life insurance practice area.

Memorandum

To: Members in the Life Insurance Practice Area

From: Phil Rivard, Chair
Practice Council

Edward Gibson, Chair
Committee on Life Insurance Financial Reporting

Date: November 11, 2011

Subject: **Educational Note Supplement: Guidance for the 2011 Valuation of Insurance Contract Liabilities of Life Insurers**

INTRODUCTION

The purpose of this Educational Note is to provide guidance to actuaries in several areas affecting the valuation of the 2011 year-end insurance contract liabilities of life insurers for Canadian Generally Accepted Accounting Principles (GAAP) purposes. The Educational Note provides an update on recently published experience studies. The guidance in this Educational Note represents a majority view of the members of the Committee on Life Insurance Financial Reporting (hereinafter referred to as CLIFR) on appropriate practice consistent with the Standards of Practice.

In accordance with the Canadian Institute of Actuary's Policy on Due Process for the Approval of Guidance Material Other than Standards of Practice, this Educational Note has been prepared by CLIFR, and has received final approval for distribution by the Practice Council on November 9, 2011. As outlined in subsection 1220 of the Standards of Practice, "*The actuary should be familiar with relevant Educational Notes and other designated educational material.*" That subsection explains further that a "practice which the Educational Notes describe for a situation is not necessarily the only accepted practice for that situation and is not necessarily accepted actuarial practice for a different situation." As well, "Educational Notes are intended to illustrate the application (but not necessarily the only application) of the standards, so there should be no conflict between them."

GUIDANCE TO MEMBERS ON SPECIFIC SITUATIONS

From time to time, CIA members seek advice or guidance from CLIFR. CLIFR strongly encourages such dialogue. CIA members would be assured that it is proper and appropriate for them to consult with the chair or vice-chair of CLIFR.

360 Albert Street, Suite 1740, Ottawa ON K1R 7X7
613.236.8196 613.233.4552
secretariat@actuaries.ca / secretariat@actuaires.ca
actuaries.ca / actuaires.ca

CIA members are reminded that responses provided by CLIFR are intended to assist them in interpreting CIA Standards of Practice, Educational Notes and Rules of Professional Conduct, and in assessing the appropriateness of certain techniques or assumptions. A response from CLIFR does not constitute a formal opinion as to whether the work in question is in compliance with the CIA Standards of Practice. Guidance provided by CLIFR is not binding upon the member.

RECENT GUIDANCE

In July 2011, two documents related to mortality improvement were published.

> Final Standards of Practice: Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350) Relating to Mortality Improvement (211070)
>
> http://www.actuaries.ca/members/publications/2011/211070e_clean.pdf
>
> Memorandum: Final Communication of a Promulgation of Prescribed Mortality Improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350) (211072)
>
> http://www.actuaries.ca/members/publications/2011/211072e.pdf

Any related changes to the Standards of Practice and to prescribed mortality improvement rates are effective October 15, 2011.

The following revisions to the Standards of Practice have been approved in the last 12 months.

> Final Standards of Practice: Changes to the Standards of Practice – General Standards of Practice, Part 1000 (May 2011)
>
> http://www.actuaries.ca/members/publications/2011/211048e_clean.pdf

Recent CLIFR guidance includes the following material.

> Educational Note: Investment Return Assumptions for Non-Fixed Income Assets for Life Insurers (211027) (March 2011)
>
> http://www.actuaries.ca/members/publications/2011/211027e.pdf
>
> Educational Note: Valuation of Gross Policy Liabilities and Reinsurance Recoverables (210086) (December 2010)
>
> http://www.actuaries.ca/members/publications/2010/210086e.pdf
>
> Educational Note: Valuation of Group Life and Health Policy Liabilities (210034) (June 2010)
>
> http://www.actuaries.ca/members/publications/2010/210034e.pdf

For your convenience all of these publications can be found on the CIA website in the Members Site (Organization > Practice Council > Committees and Task Forces > Committee on Life Insurance Financial Reporting). A list of all the current Educational Notes and research papers can be found in appendix B.

In addition, CLIFR expects to publish the following Educational Notes or research papers in the near future.

Revision of the Educational Note on Future Income and Alternative Taxes,

Calibration of Stochastic Interest Rate Models Phase II,

Revision of the (draft) Educational Note on Valuation of Universal Life Insurance Contract Liabilities,

Calibration of Equity Returns for Segregated Fund Valuation,

Reflection of Hedging in Segregated Fund Valuation, and

Calibration of Fixed-Income Returns for Segregated Fund Valuation.

Some guidance provided last year is still appropriate, and has been duplicated in this Educational Note. Other guidance has been modified, either to reflect recent developments or to improve clarity. The topics covered herein are:

PR, EG

1. EXPERIENCE STUDIES *(modified)*

The Research Committee has published the following studies.

Study on Canadian Group Long-Term Disability Termination Experience (1988-1997) (October 2011)

http://www.actuaries.ca/members/publications/2011/211103e.pdf

The October 2011 study is an update of the earlier termination study done by the Group Life and Health Experience Subcommittee of the Research Committee. This study includes data from some additional insurers as well as data for the 1996 and 1997 years. The graduated tables that have been produced reflect the average experience for the 1988–1997 periods and do not include any margins. A number of tables are included, e.g.,

i. Disabled recovery (Québec/Non-Québec, unisex), and

ii. Disabled mortality (Québec/Non-Québec, gender specific).

Mortality Study – Canadian Standard Ordinary Life Experience 2008 to 2009 (August 2011)

http://www.actuaries.ca/members/publications/2011/211067e.pdf

http://www.actuaries.ca/members/publications/2011/211066e.pdf

These annual reports submitted by the Individual Life Experience Subcommittee of the Research Committee detail the inter-company mortality experience for Canadian standard ordinary life insurance policies. These studies reflect the mortality experience of Canadian standard individual ordinary insurance issues studied between the 2008 to 2009 anniversaries respectively. The CIA8692 and CIA9704 mortality tables were used to calculate the expected death claims for males and females and for smoker/non-smoker distinctions separately.

Mortality Study – Special report on the CIA9704 tables (October 2010)

http://www.actuaries.ca/members/publications/2010/210068e.pdf

The special report submitted by the Individual Life Experience Subcommittee of the Research Committee details the inter-company mortality experience for Canadian standard ordinary life insurance policies between 2003 to 2008 anniversaries respectively. The CIA9704 mortality tables were used to calculate the expected death claims for males and females and for smoker/non-smoker distinctions separately.

Construction of CIA9704 Mortality Tables for Canadian Individual Insurance based on data from 1997 to 2004 (May 2010)

http://www.actuaries.ca/members/publications/2010/210028e.pdf

This research paper describes the data and methodology used to construct the CIA9704 mortality tables based on Canadian Individual Insurance data for years 1997 to 2004. The following mortality tables were developed.

i. Aggregate, Select and Ultimate Tables,

ii. Male and Female Tables,

iii. Smokers, Non-smokers and Aggregate Tables, and

iv. Age Nearest and Age Last Birthday Tables.

Canadian Individual Annuitant Mortality Experience Policy Years 2001 to 2004 (March 2009)

http://www.actuaries.ca/members/publications/2009/209024e.pdf

The study reflects the experience of Canadian individual annuities. The policies included in the study are primarily policies in payout status, but in some cases experience during the deferred period has been included provided that the policy has no cash value and the policy cannot be changed.

2. INSURANCE AND ANNUITY MORTALITY *(modified)*

On July 12, 2011 the Actuarial Standards Board published the Final Revised Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350) Relating to Mortality Improvement (211070) and a Final Communication of a Promulgation of Prescribed Mortality Improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350) (211072).

The new approach outlined in these documents incorporates a minimum insurance contract liability basis with respect to the mortality improvement assumption for both insurance and annuity business. The actuary is encouraged to become familiar with the contents of these documents, which have an effective date of October 1, 2011. In particular, the memorandum includes a discussion of issues raised during this process.

In addition, on September 23, 2010 CLIFR published the Mortality Improvement Research Paper (210065) that provides a rationale for the proposed insurance and annuity mortality improvement rates. This paper references the results of a research study commissioned in 2004 by CLIFR in concert with the Society of Actuaries (SOA). The final report of this study is available on the CIA website under CLIFR > Documents > Other Documents or at the link http://www.soa.org/files/pdf/cia-mortality-rpt.pdf.

3. SCENARIO ASSUMPTIONS – INTEREST RATES (*modified slightly*)

The actuary is reminded that according to paragraph 2330.30 of the Standards of Practice,

> "In addition to the prescribed scenarios, which would be common to the calculation of insurance contract liabilities for all insurers, the actuary would also select other scenarios that would be appropriate to the circumstances of the case. If current rates are near or outside the limits of the prescribed ranges defined, then some scenarios would include rates that, in the near term, would be outside the prescribed ranges. The reasonableness of degrees of change of interest rates would be largely dependent on the period of time being considered. Other plausible scenarios would include parallel shifts up and down as well as flattening and steepening of the yield curve. The scenarios would include those in which the premiums for default risk range from 50% to 200% of the actual premiums at the balance sheet date."

Further testing could also be done that would examine a cyclical approach to setting assumptions and margins.

In applying premiums for default risk (spreads) in prescribed scenarios 7 and 8, the actuary may choose to adjust only the underlying risk-free rates, while maintaining the premium for default risk unchanged across these scenarios, since the scenarios examine shock movements to the underlying risk-free rates, without also shocking the spreads.

Derivation of risk-free lower and upper bounds used in the prescribed scenarios is based on moving averages of Canadian risk-free bonds. In the current environment, this approach generates declining lower and upper bounds from one reporting period to the next. For example, based on rates through June 2011 a lower bound of 4.3% is produced. If rates stay at current levels for a period of time, the lower bound will continue to decrease.

Paragraph 2330.09.1 of the Standards of Practice states that in the base scenario the "risk-free interest rates effective after the balance sheet date would be equal to the forward interest rates implied by the equilibrium risk-free market curve at that date, for the first 20 years after the balance sheet date". In order to determine the 20-year forward rates out to year 20, a 40-year equilibrium risk-free curve is required. Risk-free interest rates are generally not observable in the market for very long terms (i.e., beyond 30 years) and are highly influenced by supply and demand toward the end of the observable horizon. It is, therefore, acceptable to retain the risk-free yield curve up to the point, in the long end (typically after 20 years), where the spot rate is at its peak ("the yield curve horizon"). Beyond the yield curve horizon, the actuary would assume a continuation of the last observed spot rate and calculate forward rates consistent with that assumption. An example of the process used to derive forward rates is presented in appendix A.

In December 2009, CLIFR published Calibration of Stochastic Interest Rate Models Phase I, which covers long-term risk-free rates. CLIFR encourages actuaries to review this Educational Note. Work on Phase II, calibration of short- and medium-term risk-free rates and calibration for default risk and asset depreciation, is continuing and expected to be completed in 2012.

In the context of stochastic testing, the Conditional Tail Expectation (CTE), CTE (60) to CTE (80), defines the range of the insurance contract liabilities (paragraph 2320.51 of the Standards of Practice). For products that are supported by investments in long-term risk-free assets, and therefore fit within the Phase I framework, it would be possible to utilize risk-free interest rate models in the valuation that satisfy the calibration criteria, and in that case, CTE (60) to CTE (80) of the stochastic results may be used as long as the resulting liability is greater than that obtained under the base scenario (see paragraph 2330.09.2 of the Standards of Practice).

In the absence of final short- and medium-term risk-free rates, and spread guidance, for a product with insurance contract liabilities that are sensitive to short- and medium-term interest rates, and any other situations that do not fit within the Phase I framework, and for interest rate models that do not satisfy the calibration criteria or that incorporate premiums for default risk, the actuary would perform scenario testing using the nine prescribed scenarios in addition to the testing performed on a stochastic basis, and consider holding insurance contract liabilities at least equal to the result under the worst prescribed scenario. The decision to establish an insurance contract liability that is less than that required under the worst prescribed scenario would be supported by a clearly documented rationale (for example, by being able to demonstrate that the stochastic model satisfies the long-term calibration criteria). In this context, the actuary would ensure that

> the stochastic interest rate model, including any parameters required, is appropriately selected for use in determining insurance contract liabilities for Canadian life insurance financial reporting purposes,
>
> the range of stochastic scenarios encompasses the nine prescribed scenarios,
>
> the model parameters are reviewed to confirm their appropriateness if the insurance contract liabilities required under the worst prescribed scenario are greater than the insurance contract liabilities at CTE (80), and

the insurance contract liability is at least equal to the result under both the base scenario and prescribed scenario 9.

4. FUTURE INCOME AND ALTERNATIVE TAXES AND HARMONIZATION OF SALES TAXES *(modified)*

CLIFR is currently revising the Educational Note on Future Income and Alternative Taxes that was originally published in 2002. The revised version will reflect the introduction of the CICA section 3855 and the related new legislation. The Educational Note will also be expanded to provide additional guidance and examples on calculation methods for the provision for future taxes in the context of the CALM framework.

CLIFR reminds the actuary of the following recent changes in sales taxes.

a. The HST (Harmonized Sales Tax) has been introduced in Ontario, with an effective date of July 1, 2010.

b. The HST introduced in British Columbia on July 1, 2010 has been repealed. The target date for this change is March 31, 2013.

c. Québec has announced modifications in its provincial sales tax rate. The provincial tax rate increased from 7.5% to 8.5% on January 1, 2011 and will increase to 9.5% on January 1, 2012.

d. Nova Scotia has also announced modifications in its provincial sales tax rate. The provincial sales tax rate increased from 13% to 15% on July 1, 2010.

e. Québec announced a temporary increase in compensatory tax on insurance premiums of 0.2% (from 0.35% to 0.55%) starting March 31, 2010 and ending on April 1, 2014.

The actuary would consider the implications of these changes in valuing insurance contract liabilities. Examples include updating expense studies to reflect HST and the valuation of segregated funds where the cost of the guarantees may be increased as a result of lower fund values due to increased fees.

5. INTERNATIONAL FINANCIAL REPORTING STANDARDS (IFRS) (*modified*)

The Standards of Practice do not provide guidance on the calculation method or assumptions for the gross insurance contract liability and the reinsurance recoverables. CLIFR published an Educational Note, Valuation of Gross Policy Liabilities and Reinsurance Recoverables, which describes considerations in the valuation and presentation of these items. Note that the amounts of the net insurance contract liabilities are not expected to change. The Educational Note includes a list of references to other relevant publications.

6. SEGREGATED FUNDS (*modified*)

In 2011, two segregated fund working groups were created and report to CLIFR. The mandate of the first group was to review the calibration criteria for investment returns, and that of the second group was to provide guidance with respect to the modelling of hedging in the valuation.

Calibration

The first working group has reviewed the calibration criteria for equity returns. The existing criteria covering the left tail of equity returns at the one-, five- and 10-year horizons, as well as the mean and volatility of equity returns, have been updated using data up to June 2010. Criteria have been added for the left tail at the 20-year horizon because of the growing popularity of longer-term products. In addition, criteria for the right tail over the one-year horizon have been established to capture the increasing risk caused by ratchet/reset and lock-in features that have become common in the industry. Finally, calibration criteria will now cover more than broad-based Canadian equity indices. Two sets of calibration criteria will be provided: one for broad-based equity indices of non-Asian developed economies and one for small capitalization equity indices. Guidance will be provided for indices that do not fall into these two categories.

The initial communication of the promulgation of these new calibration criteria for equity returns is expected to be published soon. It will be proposed that the calibration criteria would be used for valuations on or after October 15, 2012, and that early implementation in 2012 would be permitted. The final communication of the calibration criteria is expected to be published in the spring/summer of 2012. In addition, a research paper that will provide the rationale for the proposed calibration criteria is expected to be published at the same time as the initial communication.

The calibration working group has also undertaken the development of calibration criteria for returns of fixed-income funds. There is currently no guidance for modelling such funds. The calibration criteria for fixed-income funds are expected to be promulgated in 2012. Finally, the working group is also expected to provide guidance in 2012 on the modelling of future realized volatility in the context where a hedging program is in place.

One aspect of the modelling of investment returns that will not be covered by the calibration working group is the treatment of foreign exchange risk. The calibration criteria are applicable to investment returns in local currency. Therefore, additional considerations are needed to allow for the impact of foreign exchange rates. According to the report of the CIA Task Force on Segregated Fund Investment Guarantees (March 2002), it may be appropriate to have separate parameters for the market index and for the foreign exchange rate, especially when a currency has depreciated or appreciated significantly in the historical period. This trend may not continue in the future, so an explicit currency exchange model may be suitable.

Historically, the value of the U.S. currency relative to the Canadian currency has been negatively correlated with U.S. returns in local currency, which results in a volatility of the S&P 500 that is lower in the Canadian currency than in the local (U.S.) currency. This led some actuaries to consider that a safe approach for calibrating a model for returns of a U.S. fund in Canadian currency is to use historical U.S. returns in local currency without adjustment for foreign exchange risk. There is no theoretical consensus, however, on the existence and the nature of the relationship between stock prices and exchange rates. The actuary is reminded that the negative correlation observed in the past will not necessarily persist in the future, and is encouraged to analyse the impact of the foreign exchange modelling on insurance contract liabilities.

Please see Currency Risk in the Valuation of Policy Liabilities for Life and Health Insurers for more information.

Hedging

The hedging of segregated fund guarantees has become a common practice in the industry. The practice for recognizing hedging in insurance contract liabilities varies greatly across companies. Paragraph 2320.09 of the Standards of Practice states that, "The actuary would usually apply the Canadian asset liability method to policies in groups that reflect the insurer's asset-liability management practice for allocation of assets to liabilities and investment strategy." Paragraph 2330.05 of the Standards of Practice states that, "The investment strategy for each scenario would be consistent with the insurer's current investment policy."

The working group on hedging has prepared an Educational Note that will provide guidance on approximation methods to account for hedging in the insurance contract liabilities, consistent with the above references, and will also provide guidance with respect to reflecting potential hedging weaknesses in insurance contract liabilities. The guidance is felt to be needed to narrow the range of practice and to ensure that risks related to hedging are being reflected appropriately in liabilities. The Educational Note is expected to be published in March 2012, and the actuary would recognize hedging in the calculation of insurance contract liabilities by late 2012.

Where a hedging program is reflected in the valuation of insurance contract liabilities, potential weaknesses in the hedging strategy would be taken into account. Prior to the publication of the education note on hedging, the actuary is referred to section 2.3 of the 2002 report of the Task Force on Segregated Fund Investment Guarantees which provides a list of such risks, reproduced here for convenience.

> Basis risk between the underlying segregated fund assets (typically mutual fund units) and the hedge positions (e.g., stock index futures and options).
>
> Non-normal asset returns ("fat tails") and uncertain future realized volatility. This will be a particular issue if the hedging strategy depends mainly on linear instruments such as futures.
>
> Uncertain future implied volatility. This will be an issue if the hedging strategy depends on future purchases of short-dated options.
>
> Effect of bid-ask spreads and transaction costs.
>
> Finite intervals between portfolio rebalancing.
>
> Uncertain future interest rates.
>
> Uncertain future correlations between different asset classes. This will be a particular issue if guarantees apply on a "family of funds" basis.
>
> Liquidity risk, in that it may not be possible to rebalance quickly in volatile market conditions. However, extreme illiquidity is a risk that would more appropriately be covered by capital as opposed to insurance contract liabilities.

As stated in the 2002 report, even very detailed modelling is unlikely to capture accurately all these potential risks, and PfADs would be established on a conservative basis.

Where a hedging program is in place, the 2007 Educational Note, Consideration in the Valuation of Segregated Fund Products, stated that negative insurance contract liabilities after issue are allowed, but "subject to constraints on the amount of profit capitalized, consistent with an unhedged position". Some companies have interpreted this by allowing insurance contract liabilities to be negative only to the extent that the gain from negative insurance contract

liabilities is offset by cumulative losses from the hedge assets. CLIFR's view is that the following approach, which does not depend on the past performance of hedge assets, is consistent with the aforementioned statement. For a new cohort, the fee income allocated to the guarantee at the time of issue would be adjusted such that the initial liability for the guarantee is equal to or greater than zero. Once established at issue, the adjusted fee income would be kept constant throughout the remaining life of the cohort. In future periods, the fee income allocated to the guarantee would be that established at issue and the liability for the guarantee would be allowed to move freely up or down, without regard to cumulative gains and losses from the hedge assets. A numerical example is provided in section 7.2 of the report of the Task Force on Segregated Fund Liability and Capital Methodologies.

In the case of a company implementing a hedging program for an in-force block of business, the same principle as for new business would apply, i.e., fee income allocated to the guarantee would be such that the liability for the guarantee post hedging is equal to or greater than zero. In future periods, the fee income allocated to the guarantee would be that established at the inception of the hedging program.

APPENDIX A: EXAMPLE OF SCENARIO ASSUMPTIONS – INTEREST RATES

Prescribed Interest Rate Scenarios

Scenario	Description
0	Base Interest Rate Scenario (forward rates based on the current yield curve grading to long term average)
1	Move to 90% of Current by Year 1; to Prescribed Minimums by Year 20
2	Move to 110% of Current by Year 1; to Prescribed Maximums by Year 20
3	Yield Curve Movements In Full Cycles (Up/Down/Up/Down/Up/Down)
4	Yield Curve Movements In Full Cycles (Down/Up/Down/Up/Down/Up)
5	Inversions and Yield Curve Movements In Full Cycles (Up/Down/Up/Down/Up/Down)
6	Inversions and Yield Curve Movements In Full Cycles (Down/Up/Down/Up/Down/Up)
7	Move to 90% of Scenario 0 by Year 1; 90% of Scenario 0 thereafter
8	Move to 110% of Scenario 0 by year 1; 110% of Scenario 0 thereafter
9	Current yield curve persists

Prescribed Ultimate and Minimum Long Rate - Sample Calculation Calculation as of **June 30th, 2011**

SELECTED GOVERNMENT OF CANADA BENCHMARK **LONG-TERM (V122544) SEMI-ANNUAL** BOND YIELDS - PERCENT

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001							5.94	5.67	5.86	5.31	5.59	5.69
2002	5.68	5.69	5.98	5.92	5.78	5.74	5.73	5.58	5.43	5.63	5.58	5.42
2003	5.49	5.46	5.58	5.41	5.12	[illegible]	5.40	5.44	5.23	5.38	5.29	5.20
2004	5.23	5.09	5.04	5.31	[illegible]	5.33	5.29	5.15	5.04	5.00	4.90	4.92
2005	4.74	4.76	4.77	4.59	4.46	4.29	4.31	4.12	4.21	4.37	4.18	4.02
2006	4.20	4.15	4.23	[illegible]	4.50	4.67	4.45	4.20	4.07	4.24	4.02	4.10
2007	4.22	4.09	4.21	[illegible]	4.39	4.56	4.49	4.44	4.50	4.38	4.23	4.18
2008	4.19	4.18	3.96	[illegible]	[illegible]	4.05	4.16	4.01	4.13	4.27	3.94	3.45
2009	3.72	3.69	[illegible]	[illegible]	4.19	3.91	4.05	3.90	3.84	3.96	3.85	4.07
2010	3.96	4.05	[illegible]	[illegible]	3.68	3.65	3.77	3.47	3.33	3.50	3.65	3.54
2011	3.75	3.75	3.72	3.74	3.50	3.53						

	s.a.	a.e.*
120 Month Average - Effective Annual	4.55	4.60
60 Month Average - Effective Annual	3.98	4.02
Average of 2 Averages		4.31

* *Averages taken from annualized form of above rates.*
e.g. Jun 2011 rate = ((1+0.0353/2)^2) -1 = 3.56%.

Rounded To Nearest 0.10 **4.30** **<= Base Scenario 40+ Rate**
90% and Rounded To Nearest 0.10 **3.90** **<= Prescribed Scenario Long Term Minimum**

Par Yields, Spot Rates, Forward Spots, and Forward Par Yields

Define a spot rate z_n as the yield on a zero-coupon bond maturing in n periods.
Given an observed par yield curve p_n, the spot curve z_n is derived recursively:

Formula 1:

$$z_n = \left[\frac{(1+p_n)}{(1-p_n \sum_{k=1}^{n-1} (1+z_k)^{-k})} \right]^{1/n} - 1$$

Define a forward spot F(n,m) as the z_n on a zero purchased m periods from now.
Given a spot curve z_n, the implied Forward spots F(n,m) are derived via the relation:

Formula 2:

$$F(n,m) = \left[\frac{(1+z_{m+n})^{m+n}}{(1+z_m)^m} \right]^{1/n} - 1$$

The corresponding forward par yields FP(n,m) are then derived via the formula

Formula 3:

$$FP(n,m) = \frac{1-(1+F(n,m))^{-n}}{\sum_{k=1}^{n} (1+F(k,m))^{-k}}$$

A sample process is outlined below; sample 1- and 20-year rates are illustrated at right.

Construction of Implied Forward Par Yield Curves - Steps

Step 1: Obtain current par yield curve from an appropriate source (e.g. Bloomberg)

Step 2: Interpolate the par yield curve where yields are not directly available.

Step 3: Derive the equivalent spot rate curve using Formula 1.

Step 4: Determine the year between 20 and 30 at which the spot curve reaches its maximum. Extend this rate out ind

Step 5: Derive the implied forward spots using F ula 2.

Step 6: Determine the equivalent impli forward par yie using Formula 3.

Notes

1. Maximum spot = 3.737% at term = 20. Extend from this point out.
2. For each term, the time-0 forward spot equals the observed spot for that term.
3. For each term, the ultimate forward spot equals the observed "horizon" spot.
4. For each term, only the first 20 forwards are used in the Base Scenario.

Illustration: 1- and 20-yr Terms

all rates annualized

	Observed Rates by Term (June 30, 2011 - Bloomberg)			Implied Forwards by Year: Spots		Implied Forwards by Year: Par Yields	
	Par	Spots	Adj Spot	1-yr	20-yr	1-yr	20-yr
0				1.232%	3.737% [2]	1.232%	3.566%
1	1.232%	1.232%	1.232%	1.970%	3.864%	1.970%	3.736%
2	1.597%	1.600%	1.600%	2.246%	3.953%	2.246%	3.862%
3	1.809%	1.815%	1.815%	2.486%	4.028%	2.486%	3.976%
4	1.973%	1.983%	1.983%	3.918%	4.092%	3.918%	4.078%
5	2.340%	2.367%	2.367%	3.536%	4.082%	3.536%	4.079%
6	2.524%	2.561%	2.561%	3.952%	4.093%	3.952%	4.108%
7	2.708%	2.758%	2.758%	3.988%	4.082%	3.988%	4.107%
8	2.849%	2.911%	2.911%	4.326%	4.069%	4.326%	4.103%
9	2.991%	3.068%	3.068%	4.678%	4.040%	4.678%	4.074%
10	3.132%	3.227%	3.227%	3.713%	3.993%	3.713%	4.018%
11	3.176%	3.271%	3.271%	3.822%	3.994%	3.822%	4.031%
12	3.219%	3.317%	3.317%	3.934%	3.990%	3.934%	4.037%
13	3.262%	3.365%	3.365%	4.050%	3.980%	4.050%	4.034%
14	3.306%	3.413%	3.413%	4.170%	3.964%	4.170%	4.023%
15	3.349%	3.464%	3.464%	4.294%	3.943%	4.294%	4.002%
16	3.393%	3.515%	3.515%	4.422%	3.915%	4.422%	3.972%
17	3.437%	3.568%	3.568%	4.556%	3.880%	4.556%	3.930%
18	3.481%	3.623%	3.623%	4.695%	3.840%	4.695%	3.878%
19	3.523%	3.679%	3.679%	4.841%	3.792%	4.841%	3.814%
20	3.566%	3.737%	3.737%	3.737%	3.737%	3.737%	3.737%
21	3.567%	3.736%	3.737%	3.737%	3.737% [4]	3.737%	3.737% [4]
22	3.568%	3.725%	3.737%	3.737%	3.737%	3.737%	3.737%
23	3.569%	3.719%	3.737%	3.737%	3.737%	3.737%	3.737%
24	3.570%	3.715%	3.737%	3.737%	3.737%	3.737%	3.737%
25	3.571%	3.711%	3.737%	3.737%	3.737%	3.737%	3.737%
26	3.572%	3.707%	3.737%	3.737%	3.737%	3.737%	3.737%
27	3.573%	3.704%	3.737%	3.737%	3.737%	3.737%	3.737%
28	3.574%	3.701%	3.737%	3.737%	3.737%	3.737%	3.737%
29	3.575%	3.698%	3.737%	3.737%	3.737%	3.737%	3.737%
30	3.576%	3.696%	3.737% [1]	3.737%	3.737%	3.737%	3.737%
31	3.576%	3.692%	3.737%	3.737%	3.737% [3]	3.737%	3.737%
32	3.576%	3.689%	3.737%				
33	3.576%	3.685%	3.737%				
34	3.576%	3.682%	3.737%				
35	3.576%	3.679%	3.737%				
36	3.576%	3.676%	3.737%				
37	3.576%	3.674%	3.737%				
38	3.576%	3.671%	3.737%				
39	3.576%	3.669%	3.737%				
40	3.576%	3.666%	3.737%				
41	3.576%	3.664%	3.737%				
42	3.576%	3.662%	3.737%				
43	3.576%	3.660%	3.737%				
44	3.576%	3.658%	3.737%				
45	3.576%	3.656%	3.737%				

20-year Annual Effective Yields to Maturity

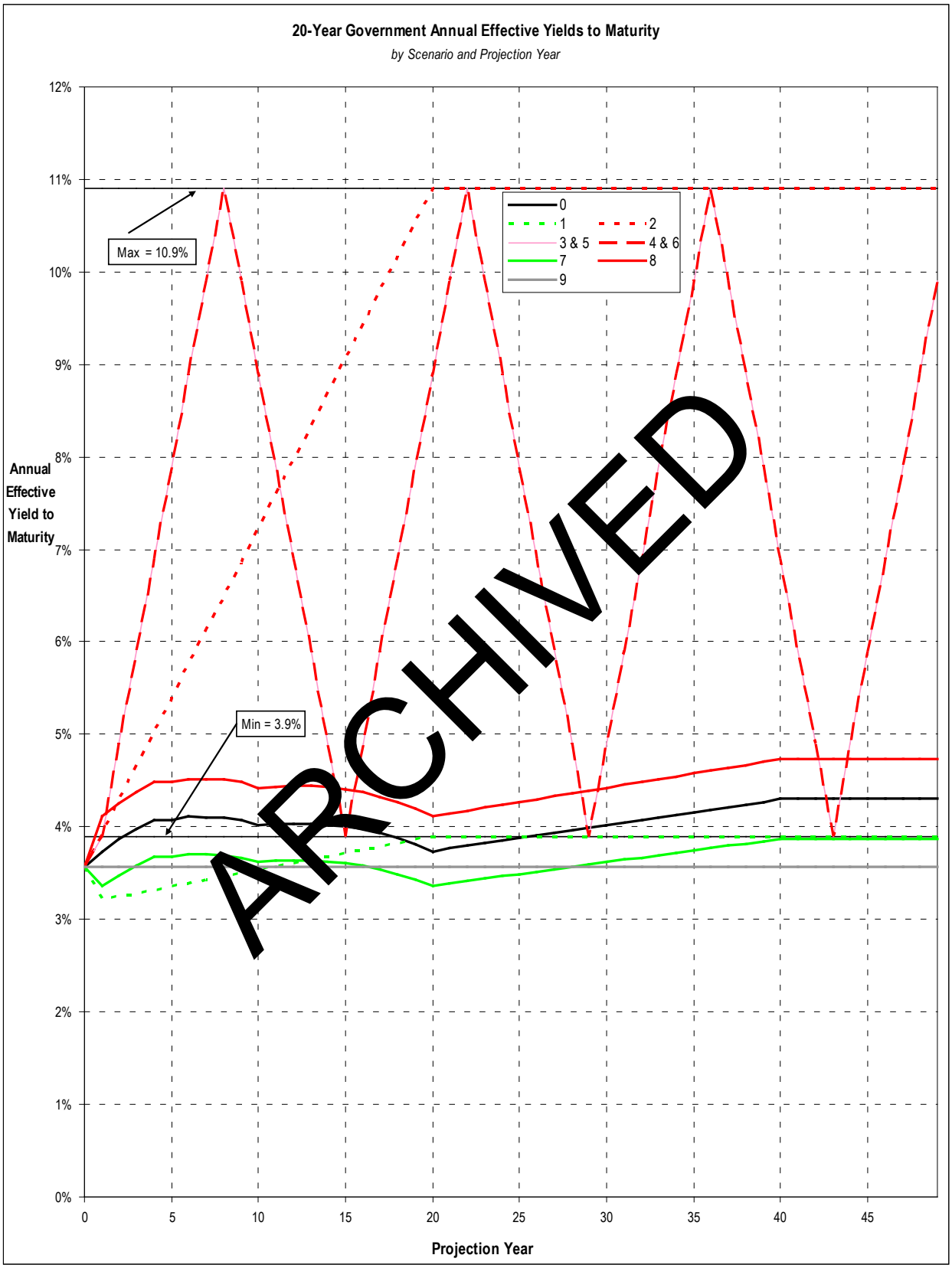
by Scenario and Projection Year

= Observed 20-yr rate @ valuation date
= Implied 20-yr forward par rates
= Smoothly interpolated rates
= Ultimate or nodal rate/spread

Assumptions	a.e.
Observed 20-yr rate @ valn date:	3.566
Ultimate 20 Year Yield Rate:	4.30
Initial Spread:	0.50

Projection	Government Par Yield Curves (annualized)							Gross Spread over Governments					Gross Portfolio Par Yields (annualized)						
Yr (eoy)	0	1	2	4 & 6[1]	7	8	9	0	1-6	7	8	9	0	1	2	3-6	7	8	9
0	3.566	3.566	3.566	3.566	3.566	3.566	3.566	0.50	0.50	0.45	0.55	0.50	4.07	4.07	4.07	4.07	4.02	4.12	4.07
1	3.736	3.21	3.92	3.90	3.36	4.11	3.57	0.50	0.48	0.45	0.55	0.50	4.24	3.68	4.40	4.38	3.81	4.66	4.07
2	3.862	3.25	4.29	4.90	3.48	4.25	3.57	0.50	0.45	0.45	0.55	0.50	4.36	3.70	4.74	5.35	3.93	4.80	4.07
3	3.976	3.28	4.66	5.90	3.58	4.37	3.57	0.50	0.43	0.45	0.55	0.50	4.48	3.71	5.08	6.33	4.03	4.92	4.07
4	4.078	3.32	5.02	6.90	3.67	4.49	3.57	0.50	0.40	0.45	0.55	0.50	4.58	3.72	5.42	7.30	4.12	5.04	4.07
5	4.079	3.35	5.39	7.90	3.67	4.49	3.57	0.50	0.38	0.45	0.55	0.50	4.58	3.73	5.77	8.28	4.12	5.04	4.07
6	4.108	3.39	5.76	8.90	3.70	4.52	3.57	0.50	0.35	0.45	0.55	0.50	4.61	3.74	6.11	9.25	4.15	5.07	4.07
7	4.107	3.43	6.13	9.90	3.70	4.52	3.57	0.50	0.33	0.45	0.55	0.50	4.61	3.75	6.45	10.23	4.15	5.07	4.07
8	4.103	3.46	6.49	10.90	3.69	4.51	3.57	0.50	0.30	0.45	0.55	0.50	4.60	3.76	6.79	11.20	4.14	5.06	4.07
9	4.074	3.50	6.86	9.90	3.67	4.48	3.57	0.50	0.28	0.45	0.55	0.50	4.57	3.78	7.14	10.18	4.12	5.03	4.07
10	4.018	3.54	7.23	8.90	3.62	4.42	3.57	0.50	0.25	0.45	0.55	0.50	4.52	3.79	7.48	9.15	4.07	4.97	4.07
11	4.031	3.57	7.60	7.90	3.63	4.43	3.57	0.50	0.23	0.45	0.55	0.50	4.53	3.80	7.82	8.13	4.08	4.98	4.07
12	4.037	3.61	7.96	6.90	3.63	4.44	3.57	0.50	0.20	0.45	0.55	0.50	[illegible]	3.81	8.16	7.10	4.08	4.99	4.07
13	4.034	3.65	8.33	5.90	3.63	4.44	3.57	0.50	0.18	0.45	0.55	0.50	4.53	[illegible]	8.50	6.08	4.08	4.99	4.07
14	4.023	3.68	8.70	4.90	3.62	4.43	3.57	0.50	0.15	0.45	0.55	0.50	4.52	3.8[illegible]	8.85	5.05	4.07	4.98	4.07
15	4.002	3.72	9.06	3.90	3.60	4.40	3.57	0.50	0.13	0.45	0.55	0.50	4.50	3.8[illegible]	9.19	4.03	4.05	4.95	4.07
16	3.972	3.75	9.43	4.90	3.57	4.37	3.57	0.50	0.10	0.45	0.55	0.50	4.[illegible]	[illegible]85	9.53	5.00	4.02	4.92	4.07
17	3.930	3.79	9.80	5.90	3.54	4.32	3.57	0.50	0.08	0.45	0.[illegible]	0.50	4.43	3.87	9.87	5.98	3.99	4.87	4.07
18	3.878	3.83	10.17	6.90	3.49	4.27	3.57	0.50	0.05	0.45	0.55	0.[illegible]	4.[illegible]8	3.88	10.22	6.95	3.94	4.82	4.07
19	3.814	3.86	10.53	7.90	3.43	4.19	3.57	0.50	0.03	0.45	0.[illegible]5	0.[illegible]0	4.31	3.89	10.56	7.93	3.88	4.74	4.07
20	3.84	3.90	10.90	8.90	3.36	4.11	3.57	0.50	0.00	0.45	0.[illegible]5	0.50	4.24	3.90	10.90	8.90	3.81	4.66	4.07
21	3.86	3.90	10.90	9.90	3.39	4.14	3.57	0.50	0.00	0.[illegible]5	0.[illegible]	0.50	4.27	3.90	10.90	9.90	3.84	4.69	4.07
22	3.88	3.90	10.90	10.90	3.41	4.17	3.57	0.50	0.[illegible]	0.45	0.[illegible]	0.50	4.29	3.90	10.90	10.90	3.86	4.72	4.07
23	3.91	3.90	10.90	9.90	3.44	4.20	3.57	0.5[illegible]	0.00	0.45	0.55	0.50	4.32	3.90	10.90	9.90	3.89	4.75	4.07
24	3.93	3.90	10.90	8.90	3.46	4.23	3.57	0.50	0.[illegible]	0.[illegible]	0.55	0.50	4.35	3.90	10.90	8.90	3.91	4.78	4.07
25	3.95	3.90	10.90	7.90	3.49	4.27	3.57	0.50	0.[illegible]	0.45	0.55	0.50	4.38	3.90	10.90	7.90	3.94	4.82	4.07
26	3.98	3.90	10.90	6.90	3.52	4.30	3.57	0.5[illegible]	0.00	0.45	0.55	0.50	4.41	3.90	10.90	6.90	3.97	4.85	4.07
27	4.00	3.90	10.90	5.90	3.54	4.33	[illegible]	[illegible]0	0.00	0.45	0.55	0.50	4.43	3.90	10.90	5.90	3.99	4.88	4.07
28	4.02	3.90	10.90	4.90	3.57	4.36	3.57	0.50	0.00	0.45	0.55	0.50	4.46	3.90	10.90	4.90	4.02	4.91	4.07
29	4.05	3.90	10.90	3.90	3.59	4.39	3.57	[illegible]50	0.00	0.45	0.55	0.50	4.49	3.90	10.90	3.90	4.04	4.94	4.07
30	4.07	3.90	10.90	4.90	3.62	4.42	3.57	[illegible]50	0.00	0.45	0.55	0.50	4.52	3.90	10.90	4.90	4.07	4.97	4.07
31	4.09	3.90	10.90	5.90	[illegible]	[illegible]5	[illegible]	0.50	0.00	0.45	0.55	0.50	4.55	3.90	10.90	5.90	4.09	5.00	4.07
32	4.11	3.90	10.90	6.90	[illegible]67	4.[illegible]8	3.57	0.50	0.00	0.45	0.55	0.50	4.57	3.90	10.90	6.90	4.12	5.03	4.07
33	4.14	3.90	10.90	7.90	[illegible]69	[illegible]	[illegible]	0.50	0.00	0.45	0.55	0.50	4.60	3.90	10.90	7.90	4.14	5.06	4.07
34	4.16	3.90	10.90	8.90	[illegible]	4.54	3.57	0.50	0.00	0.45	0.55	0.50	4.63	3.90	10.90	8.90	4.17	5.09	4.07
35	4.18	3.90	10.9[illegible]	[illegible]90	3.74	4.58	3.57	0.50	0.00	0.45	0.55	0.50	4.66	3.90	10.90	9.90	4.19	5.13	4.07
36	4.21	3.90	10.90	10.90	[illegible]77	4.61	3.57	0.50	0.00	0.45	0.55	0.50	4.69	3.90	10.90	10.90	4.22	5.16	4.07
37	4.23	3.90	10.90	[illegible]90	3.79	4.64	3.57	0.50	0.00	0.45	0.55	0.50	4.72	3.90	10.90	9.90	4.24	5.19	4.07
38	4.25	3.90	10.90	[illegible]0	3.82	4.67	3.57	0.50	0.00	0.45	0.55	0.50	4.74	3.90	10.90	8.90	4.27	5.22	4.07
39	4.28	3.90	10.90	7.[illegible]	3.84	4.70	3.57	0.50	0.00	0.45	0.55	0.50	4.77	3.90	10.90	7.90	4.29	5.25	4.07
40	4.30	3.90	10.90	6.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	6.90	4.32	5.28	4.07
41	4.30	3.90	10.90	5.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	5.90	4.32	5.28	4.07
42	4.30	3.90	10.90	4.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	4.90	4.32	5.28	4.07
43	4.30	3.90	10.90	3.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	3.90	4.32	5.28	4.07
44	4.30	3.90	10.90	4.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	4.90	4.32	5.28	4.07
45	4.30	3.90	10.90	5.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	5.90	4.32	5.28	4.07
46	4.30	3.90	10.90	6.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	6.90	4.32	5.28	4.07
47	4.30	3.90	10.90	7.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	7.90	4.32	5.28	4.07
48	4.30	3.90	10.90	8.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	8.90	4.32	5.28	4.07
49	4.30	3.90	10.90	9.90	3.87	4.73	3.57	0.50	0.00	0.45	0.55	0.50	4.80	3.90	10.90	9.90	4.32	5.28	4.07

1. Scenarios 3 & 5 are derived similarly - though the initial direction would be toward the maximum. In the above example, the year-1 rate would also be 3.90%.


20-Year Government Annual Effective Yields to Maturity
by Scenario and Projection Year
Annual Effective Yield to Maturity
Projection Year
Max = 10.9%
Min = 3.9%
0
1
2
3 & 5
4 & 6
7
8
9
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
0
5
10
15
20
25
30
35
40
45
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APPENDIX B: CIA GUIDANCE

Document Number	Title	Publication Date
211072	Final Communication of a Promulgation of Prescribed Mortality Improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350)	July 12, 2011
211070	Final Standards – Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350) Relating to Mortality Improvement (clean version)	July 12, 2011
211062	Revised Exposure Draft: Revised Exposure Draft to Revise the Standards of Practice – Dynamic Capital Adequacy Testing – Section 2500	June 8, 2011
211027	Educational Note: Investment Return Assumptions for Non-Fixed Income Assets for Life Insurers	March 1, 2011
211003	Final Communication of a Promulgation of Calibration Criteria for Investment Returns Referenced in the Standards of Practice for the Valuation of Policy Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2360)	January 20, 2011
210088	Research Paper: IFRS Disclosure Requirements for Life Insurers	December 13, 2010
210086	Educational Note: Valuation of Gross Policy Liabilities and Reinsurance Recoverables	December 1, 2010
210065	Research Paper: Mortality Improvement Research Paper	September 23, 2010
210053	Report: Report from the Task Force on Segregated Fund Liability and Capital Methodologies	August 11, 2010
210034	Educational Note: Valuation of Group Life and Health Policy Liabilities	June 4, 2010
209122	Educational Note: Calibration of Stochastic Interest Rate Models	December 3, 2009
209121	Educational Note: Currency Risk in the Valuation of Policy Liabilities for Life and Health Insurers	December 2, 2009
208004	Educational Note: Implications of Proposed Revisions to Income Tax Legislation (July 7, 2007 Department of Finance Proposal)	January 23, 2008
207109	Educational Note: Considerations in the Valuation of Segregated Fund Products	November 22, 2007
207029	Educational Note: Implications of CICA Handbook Section 3855 – Financial Instruments on Future Income and Alternative Taxes: Update to Fall Letter	April 11, 2007
206148	Draft Educational Note: Valuation of Universal Life Policy Liabilities	November 30, 2006
206147	Educational Note: Use of Actuarial Judgment in Setting Assumptions and Margins for Adverse Deviations	November 30, 2006
206134	Educational Note: Best Estimate Assumptions for Expenses	November 8, 2006
206133	Educational Note: Approximations to Canadian Asset Liability Method (CALM)	November 8, 2006
206132	Educational Note: Margins for Adverse Deviations	November 8, 2006

206077	Educational Note: CALM Implications of AcSB Section 3855 Financial Instruments – Recognition and Measurement	June 7, 2006
205111	Educational Note: Valuation of Segregated Fund Investment Guarantees (Revised)	October 26, 2005
203106	Educational Note: Selection of Interest Rate Models	December 2003
203083	Educational Note: Aggregation and Allocation of Policy Liabilities	September 15, 2003
202065	Educational Note: Future Income and Alternative Taxes	December 2002
202037	Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies	July 8, 2002
Document Number	Draft Educational Notes	Publication Date
206148	Draft Educational Note: Valuation of Universal Life Policy Liabilities	November 30, 2006