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Educational Note

Guidance for the 2012 Valuation of Insurance Contract Liabilities and Dynamic Capital Adequacy Testing for Property and Casualty Insurers

Document 212101

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Guidance for the 2012 Valuation of Insurance Contract Liabilities and Dynamic Capital Adequacy Testing for Property and Casualty Insurers

Committee on Property and Casualty Insurance Financial Reporting

November 2012

Document 212101

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 property and casualty insurance practice area.

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Memorandum

To: Members in the Property and Casualty Insurance Practice Area

From: Phil Rivard, Chair
Practice Council

Isabelle Périgny, Chair
Committee on Property and Casualty Insurance Financial Reporting

Date: November 29, 2012

Subject: **Educational Note: Guidance for the 2012 Valuation of Insurance Contract Liabilities and Dynamic Capital Adequacy Testing for Property and Casualty Insurers**

In accordance with the Canadian Institute of Actuaries' Policy on Due Process for the Approval of Guidance Material Other than Standards of Practice, this educational note has been prepared by the Committee on Property and Casualty Insurance Financial Reporting, and has received final approval for distribution by the Practice Council on November 22, 2012.

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."

If you have any questions or comments regarding this educational note, please contact Isabelle Périgny at her CIA Online Directory address, isabelle.perigny@lacapitale.com

PR, IP

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

INTRODUCTION

The Committee on Property and Casualty Insurance Financial Reporting (PCFRC) of the Canadian Institute of Actuaries (CIA) prepared this educational note to provide guidance to actuaries in several areas affecting the valuation of insurance contract liabilities and dynamic capital adequacy testing (DCAT) reporting for property and casualty (P&C) insurers. This educational note reviews relevant standards of practice and educational notes and discusses current issues affecting the work of the Appointed Actuary (AA). Links to all the CIA documents referenced in this educational note are provided in appendix A. Links to relevant documents from the Office of the Superintendent of Financial Institutions (OSFI) and the l'Autorité des marchés financiers (AMF) are also included in appendix A.

STANDARDS OF PRACTICE

While all of the Rules of Professional Conduct and Standards of Practice are important, your attention is directed to the following that are particularly relevant for AAs:

- Subsection 1340 – Materiality;
- Section 1500 – The Work;
- Section 1600 – Another Person's Work;
- Section 1700 – Assumptions;
- Section 1800 – Reporting;
- Section 2100 – Insurance Contract Valuation: All Insurance;
- Section 2200 – Insurance Contract Valuation: Property & Casualty Insurance;
- Section 2400 – The Appointed Actuary; and
- Section 2500 – Dynamic Capital Adequacy Testing.

The standards of practice for Recognizing Events in Work were revised September 2011. Revisions were made to section 1500 – The Work (specifically subsections 1515 and 1520) and section 1800 – Reporting. In response to these changes in the Standards of Practice, the PCFRC has modified the October 2008 draft educational note titled Subsequent Events. The final educational note was issued in the fall of 2012. Note that the decision tree contained within the subsection 1515 of the Standards of Practice differs from that contained in the 2008 draft educational note on subsequent events.

The Actuarial Standards Board published final standards of practice on dynamic capital adequacy testing (section 2500) in November 2011. The intent of the revision was to ensure consistency with OSFI's Guideline E-18 Stress Testing as well as changes arising from the adoption of International Financial Reporting Standards (IFRS). The following areas are among the key changes in the Standards of Practice:

- The definition of satisfactory financial condition was streamlined;
- A section entitled "Data, methods and assumptions" was added, giving more guidance on the use of up-to-date data and recognition of actual events;
- A section on "corrective management actions" was added, clarifying that potential corrective management actions need to be identified for each of the plausible adverse scenarios that would result in a threat to satisfactory financial condition; and

- The wording of the AA's opinion was revised.

Note that the risk categories were not modified as was initially contemplated in the exposure draft of the Standards of Practice published in July 2010.

Materiality

As stated in the Standards of Practice, "materiality pervades virtually all work" (see paragraph 1340.02). The AA would communicate with the external auditor regarding materiality in accordance with the CIA/CICA Joint Policy Statement (subsection 1630).

The AA-selected materiality threshold for the valuation of insurance contract liabilities would generally not be greater than the external auditors selected materiality threshold. The AA-selected materiality for the DCAT analysis would generally be greater than the materiality selected for the valuation of policy liabilities. For further information on materiality, the AA is referred to the CIA report on materiality (2007) found in appendix A.

Use of Another Person's Work

Section 1600 of the Standards of Practice discusses considerations when using another person's work. Paragraph 1610.07 notes that "the actuary may use and take responsibility for another person's work given confidence that such actions are justified." However, as indicated in paragraph 1610.08, "failing such confidence, the actuary would not take responsibility for the other person's work." In this situation, the AA may still use another person's work, but, as stated in paragraph 1610.12 "if the actuary uses but does not take responsibility for another person's work, then the actuary would nevertheless examine the other person's work for evident shortcomings and would either report the results of such examination or avoid use of the work."

A particularly relevant example for AAs for year-end 2012 is the use of industry benchmarks related to Ontario automobile reforms. Similarly, the use of industry benchmark trend factors is another example. When using benchmarks developed by a third party, the AAs would consider the professional requirements set out in section 1600.

EDUCATIONAL NOTES AND OTHER CIA PUBLICATIONS

To assist AAs in their fiscal year-end valuation or DCAT work, the following educational notes and documents are valuable sources of information:

- Research paper: Disclosure Requirements IFRS 4 – Insurance Contracts for P&C Insurers (October 2010);
- Educational note: Margins for Adverse Deviations for P&C Insurance (December 2009);
- Educational note: Classification of Contracts under International Financial Reporting Standards (June 2009);
- Educational note: Subsequent Events (final September 2012 replacing draft of October 2008);
- Educational note: Dynamic Capital Adequacy Testing (November 2007);
- Report of the CIA Task Force on Materiality (October 2007);
- Report of the CIA Task Force on the Appropriate Treatment of Reinsurance (October 2007);
- Educational note: Discounting (November 2010);

- Educational note: Consideration of Future Income Taxes in the Valuation of Policy Liabilities (July 2005);
- Educational note: Valuation of Policy Liabilities P&C Insurance Considerations Regarding Claim Liabilities and Premium Liabilities (June 2003); and
- Minor amendment to educational note: Evaluation of the Runoff of P&C Claims Liabilities when the Liabilities are Discounted in Accordance with Accepted Actuarial Practice (June 2011).

REGULATORY GUIDANCE

We remind AAs to refer to updated communication from provincial and/or federal insurance regulators regarding insurance contract liabilities valuation and DCAT reporting.

OSFI Requirements

1. OSFI Annual Memorandum for Actuarial Reports on P&C Business

OSFI issues a memorandum for the AA on an annual basis. AAs would consult this memorandum for complete instructions from OSFI.

2. Minimum Capital Test and Branch Adequacy of Assets Test

Effective January 1st, 2012, significant changes were introduced to the Minimum Capital Test (MCT) guideline. Key changes from that date include, but are not limited to:

- Requirement for an audit opinion on the MCT;
- Introduction of greater granularity to credit risk factors for invested assets based on credit rating and terms to maturity;
- Removal of the capital requirement on the provision for adverse deviations (PfAD) portion of the carried unpaid claim provision;
- Introduction of a capital factor on collateral held as security for unregistered reinsurance;
- Removal of the capital factor on registered affiliated reinsurance;
- Requirements for self-insured retentions; and
- Introduction of interest rate risk capital requirement.

In addition, in order to simplify the use and maintenance of the MCT and Branch Adequacy of Assets Test (BAAT) guidelines, OSFI prepared one guideline, to be referred to as the MCT guideline. The MCT guideline combines the MCT and BAAT guidelines.

AAs are expected to provide calculations or guidance to the preparers and reviewers (such as external auditors) of the financial statements on at least two elements of the revised MCT calculation:

- AAs are expected to provide the PfADs by line of business such that they can be removed from the carried unpaid claims provision for the purpose of calculating the capital requirement for unpaid claims;
- In the calculation of the interest rate risk margin, an interest rate shock factor is applied to the fair value of interest rate sensitive assets and liabilities and their duration. AAs are expected to be involved in the calculation of the duration of liabilities (and possibly of

assets). Appendix B presents considerations and examples to help AAs in calculating durations.

Draft changes to the calculation of MCT for 2013 were published in June 2012. The majority of the most recent changes are housekeeping. Key changes in 2013 include, but are not limited to:

- Interest rate shock factor will increase from 0.50 percent to 0.75 percent; and
- Adjustments to capital available and required due to changes in the accounting treatment of defined benefit pension plans as a result of amendments to IAS 19 Employee Benefits.

AAs would be expected to incorporate these changes into their DCAT analyses or, if not practical, comment on the impact.

Further changes to OSFI Guideline B-9 Earthquake Exposure Sound Practices and capital rules are expected to become effective January 1, 2014. The actuary would consider publicly available information (i.e., from the OSFI website). When the changes could be material for the company, the actuary would consider reporting on the impact in the DCAT report. The actuary would make it clear which versions and/or assumptions have been used/made in preparing the report.

3. Stress Testing

OSFI Guideline E-18 Stress Testing states that, from time to time, OSFI may ask institutions to carry out standardized scenario tests to assess system-wide vulnerabilities. A specific standardized test, focused on earthquake scenarios, was requested from approximately 50 institutions with a deadline of June 30, 2012. Institutions that were not specifically required by OSFI to complete the earthquake stress test were requested to consider the assumptions and scenarios and only provide results for the most severe scenario listed, if appropriate, in their next DCAT report as an illustrative scenario. If these institutions do not believe that an earthquake scenario is appropriate for their institution, they are requested to provide information to support such a position.

Under the required 2012 stress test, institutions are to perform a three-year financial projection of the scenario on an enterprise-wide basis, using the 2011 year-end as the start of the projection period, and projecting through years 2012 to 2014. The institution should use the DCAT base projection for this purpose and extend to year 2014 assuming business as usual. The financial projection is to be performed both with and without the incorporation of corrective management action.

The actuary is reminded that the company's performance in previous stress tests can be a useful consideration for the actuary when designing/selecting current year company-specific scenarios.

4. Guideline A-4 Internal Target Capital Ratio for Insurance Companies

In June 2011, OSFI published Guideline A-4 Internal Target Capital Ratio for Insurance Companies, which sets out OSFI's expectations with respect to the setting of insurer-specific target capital ratios and how such targets relate to the assessment of capital adequacy within the context of OSFI's supervisory framework. Guideline A-4 outlines possible approaches an insurer could use to determine an internal capital target ratio. The guideline also notes that analysis supporting the setting and maintaining of an insurer's internal target capital ratio is to be clearly and formally documented, updated at least annually, and discussed with the insurer's board of directors or chief agent. OSFI expected that insurance companies would be compliant with

Guideline A-4 on or before June 2012. The AA would generally be involved with and understand the company's process and assumptions used to select the target capital ratio.

5. Consolidated Financial Reporting

With consolidation for capital purposes, OSFI began requiring consolidated financial reporting for P&C regulatory returns as of year-end 2011. Consolidated returns include the financial results of the parent company and all subsidiaries that carry on business that the parent could carry on directly pursuant to the Insurance Companies Act. OSFI anticipates that most AAs will continue to prepare non-consolidated AARs; however, additional exhibits and commentary are required that reconcile the information within the subsidiary AARs to the consolidated opinion.

AMF Requirements

The AMF issues specific guidelines to AAs of Québec-regulated insurers for both the valuation of contract liabilities and DCAT. The AA would consult these memorandums for the complete instructions from the AMF.

The AMF guideline regarding the mandatory insurance contract liabilities report is updated annually, usually in November, and covers regulatory requirements and the report's expected content and prescribed layout. The AMF guideline also mandates prescribed exhibits for reporting results of the AA's valuation of insurance contract liabilities. Prescribed exhibits include the unpaid claims and loss ratio exhibits for which specific instructions are available. AAs who wish to opt for the filing of a simplified database would refer to the AMF guideline.

The AMF also publishes a guideline for the preparation of the report on the insurer's financial condition (DCAT report). This guideline is updated annually, usually in March, and covers the same general aspects as the guideline on the valuation of insurance contract liabilities. When completing the DCAT report, AAs are advised to be aware of the latest developments in the calculation of the MCT ratio. The AMF requires the AA to disclose the insurer's target capital ratio and discuss the assumptions and calculations underlying the choice of the target.

In June 2012, the AMF published a revised version of its guideline on capital adequacy requirements (MCT Guideline). Including the new page layout, the key changes are the same as those outlined by OSFI except for the audit opinion on the MCT that is not required for the moment.

The AMF is expected to publish a draft MCT Guideline in the fall of 2012 for consultation; AAs would be expected to be familiar with this guideline. The guideline is expected to be published in final form by year-end 2012 with an effective date of January 1, 2013. Expected changes are mainly the same as those made by OSFI, with some textual differences.

AAs are expected to consider these changes and incorporate them, where applicable, in their 2013 DCAT analyses.

AUTO REFORMS

Ontario

At year-end 2012, the AA would be expected to consider the effect of the Ontario auto reforms effective September 1, 2010, on the valuation of insurance contract liabilities. While all Ontario drivers are now under the new standard policy, the claims experience is still not sufficiently mature to determine the effectiveness of the new product and regulations.

In evaluating the effects of the reforms on an insurer's book of Ontario automobile business, the AA may consider the:

- Number of claims in mediation;
- Potential effect of any Financial Services Commission of Ontario (FSCO) mediation backlog and the potential effect of arbitration decisions;
- August 2012 court decision which allows the plaintiff to proceed to arbitration if the prescribed time of 60 days for mediation has expired.
- Percentage of minor injury claims and how the development of these claims differs from moderate and catastrophic claims;
- Effect of potential changes to the catastrophic impairment definition in relation to the ability to combine the physical and the psychological components in order to meet the 55 percent Catastrophic Whole Person Impairment (WPI) rating.
- Effect of potential increased bodily injury frequency (from earlier notices of claim and/or increased late reporting of claims) on development patterns; and
- Effect of any changes in claim reserving and settlement processes.

These considerations may affect the AA's analysis of both claim and premium liabilities.

AAs would also consider the expected effects in future claim costs resulting from the Ontario auto reforms in their DCAT analyses.

Information on the new Statutory Accident Benefits Schedule (SABS) and transition rules is available on the FSCO website.

Other Jurisdictions

On November 9, 2011, the Nova Scotia government introduced reforms to its automobile insurance regulations. The key aspects of the reforms contained:

- Enhanced no-fault mandatory medical-rehabilitation (med-rehab) limits of up to $50,000 from the previous limit of $25,000;
- Direct compensation (DC) for property damage;
- New minor injury treatment protocol based on Alberta's current model; and
- Optional tort product for minor injuries.

The reforms are to be implemented in two phases. The first phase was effective April 1, 2012, and included the enhanced med-rehab benefits. The second phase will be effective April 1, 2013, and will include the DC framework, the new minor injury treatment protocol, and was to include the optional tort product. On July 30, 2012, the Nova Scotia Utility and Review Board (UARB) recommended to the Nova Scotia government that it delay introducing the optional full tort (OFT) product. The decision to delay the introduction of an OFT product now rests with the Nova Scotia Minister of Transportation and Infrastructure Renewal.

The AA would be expected to consider the effect of these changes on the valuation of insurance contract liabilities at year-end 2012 and the potential effect on the DCAT analysis.

In January 2011, the Auto Insurance Working Group was established in New Brunswick. On June 28, 2012, the provincial government announced the cap on non-pecuniary damage for a minor injury would be increased to $7,500 from $2,500 and that it would be indexed annually to

the Consumer Price Index. Changes are also expected in the definition of minor injuries. The AA would consider the effect of these changes on the valuation of insurance contract liabilities and the DCAT analysis.

CURRENT JUDICIAL, LEGISLATIVE AND POLITICAL EVENTS

The AA would consider the potential effect of recent court decisions, judicial events and political events that may be relevant to the valuation of insurance contract liabilities. Recent examples of such events include:

- The Ontario Court of Appeal decision in the Pastore v. Aviva case which may affect the determination of catastrophic impairment for accident benefits in Ontario;
- Prorogation of the Ontario legislature which may delay some Ontario automobile insurance reform measures; and
- A recent development in the class action suit against insurers related to the 1998 Quebec ice storm.

HARMONIZED SALES TAX AND PROVINCIAL SALES TAX

The AA would consider the effect of recent changes in taxes, both the harmonized sales tax (HST) and provincial sales tax (PST), to the extent material in both the valuation of insurance contract liabilities and the DCAT analysis. The AA would need to understand how taxes are reflected in the data underlying the valuation of insurance contract liabilities (paid claims and case reserves).

Examples of recent changes in tax include but are not limited to:

- Effective April 1, 2013, the Prince Edward Island PST will be harmonized with the federal goods and services tax (GST) to become the HST.
- Effective January 1, 2013, the Québec sales tax (QST) will be harmonized with the GST.
- The British Columbia provincial government conducted a referendum on whether to keep the HST or to reinstate PST and GST. The result of the August 2011 referendum was to reinstate the PST and GST. The proposed date to reinstate the PST and GST is April 1, 2013.

INTERNATIONAL FINANCIAL REPORTING STANDARDS

International Financial Reporting Standard 4 (IFRS 4), which was adopted in Canada on January 1, 2011, and applies to insurance contracts, is an interim standard that allows insurers to mostly retain their current accounting policies for those contracts that meet the definition of insurance (Phase I).

Many AAs are taking an active role assisting companies with the extensive disclosure requirements of IFRS 4. The CIA published a research paper, Disclosure Requirements IFRS 4 – Insurance Contracts for P&C Insurers, to assist actuaries who will be working with insurers in the information-gathering process and drafting of disclosure notes. The research paper identifies the disclosures that are relevant to P&C insurers, analyzes the considerations of the disclosure requirements and provides guidance for disclosure.

Phase II of IFRS 4 is intended to result in a single international standard for all insurance contracts. In July 2010, the International Accounting Standards Board (IASB) published the

exposure draft Insurance Contracts for comments (see links in appendix A for further information). The exposure draft introduced substantial changes in the measurement of insurance contract liabilities and the presentation of the financial statements. The IASB is deliberating on numerous issues raised in responses to the exposure draft. The date for the adoption of Phase II is not yet finalized but is not anticipated to be before 2014.

GUIDANCE TO MEMBERS ON SPECIFIC SITUATIONS

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

CIA members are reminded that responses provided by the PCFRC 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 the PCFRC does not constitute a formal opinion as to whether the work in question is in compliance with the CIA Standards of Practice and the Rules of Professional Conduct. Guidance provided by the PCFRC is not binding upon the member.

APPENDIX A

Here is a list of the CIA documents referenced in this educational note:

Rules of Professional Conduct

Standards of Practice

Final Standards – Dynamic Capital Adequacy Testing – Section 2500 (November 2011)

Final Standards – Recognizing Events in Work – Section 1500 (September 2011)

Research paper: Disclosure Requirements IFRS 4 – Insurance Contracts for P&C Insurers (October 2010)

Educational note: Margins for Adverse Deviations for Property and Casualty Insurance (December 2009)

Educational note: Classification of Contracts under International Financial Reporting Standards (June 2009)

Educational note: Subsequent Events (September 2012)

Educational note: Dynamic Capital Adequacy Testing (November 2007)

Task force report: Materiality (October 2007)

Task force report: Appropriate Treatment of Reinsurance (October 2007)

Educational note: Discounting (November 2010)

Educational note: Consideration of Future Income Taxes in the Valuation of Policy Liabilities (July 2005)

Educational note: Valuation of Policy Liabilities P&C Insurance Considerations Regarding Claim Liabilities and Premium Liabilities (June 2003)

Educational note: Evaluation of the Runoff of P&C Claims Liabilities when the Liabilities are Discounted in Accordance with Accepted Actuarial Practice (June 2011)

Educational note: Accounting for Reinsurance Contracts under International Financial Reporting Standards (December 2009)

APPENDIX B

In the calculation of the interest rate risk margin, an interest rate shock factor is applied to the fair value of interest rate sensitive assets and liabilities and their duration. AAs are expected to be involved in the calculation of the duration of liabilities and possibly of assets.

Introduction

Instructions on the calculation of the interest rate risk margin are provided in chapter 5 of OSFI's Minimum Capital Test Guideline (or the AMF's equivalent guideline). The key points for the calculation of the duration are:

- AAs may use either the modified duration or the effective duration to calculate the duration of assets and liabilities. However, the same duration methodology should apply to all assets and liabilities under consideration. Moreover, the same methodology is to be used consistently from year to year
- Effective duration is the preferred measure when interest rate changes may change the expected cash flows.
- The portfolio duration can be obtained by calculating the weighted average of the duration for the assets or liabilities in the portfolio.
- The formulas for calculating the durations are:

$$\text{Macaulay Duration} = \frac{1 \cdot \text{PVCF}_1 + 2 \cdot \text{PVCF}_2 + \ldots + n \cdot \text{PVCF}_n}{k \cdot \text{Market Value}}$$

Note: the Macaulay duration is an intermediate step in the calculation of the modified duration and is *not* a measure of duration accepted by the regulator.

$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{(1+\text{yield}/k)}$$

Where:

k	=	number of periods, or payments, per year (e.g., k = 2 for semi-annual payments and k = 12 for monthly payments)
n	=	number of periods until maturity (i.e. number of years to maturity times k)
yield	=	market value yield to maturity of the cash flows
PVCF_t	=	present value of the cash flow in period t discounted at the yield to maturity

$$\text{Effective duration} = \frac{\text{Fair value if yields decline} - \text{Fair value if yields rise}}{2 \cdot (\text{initial price}) \cdot (\text{change in yield in decimal notation})}$$

$$= \frac{V_- - V_+}{2 \cdot V_0 \cdot \Delta y}$$

Where:

Δy	=	change in yield in decimal
V_0	=	initial fair value
V_-	=	fair value if yields decline by Δy
V_+	=	fair value if yields increase by Δy

Assets

AAs may be asked to calculate the duration of the interest rate-sensitive assets in the insurer's portfolio. Generally, the main classes of assets for most insurers are bonds and preferred shares. An example of the calculation for bonds is presented in this appendix.

In some cases, the insurer's investment specialists would provide the duration of assets. The AA would review the information for reasonableness and identify which duration formula was used to ensure consistency between assets and liabilities.

Claim and Premium Liabilities

When evaluating the duration of the claim and premium liabilities, AAs would consider the following:

- The duration calculation would be consistent with the discounting calculation.
- The duration may be calculated by line of business using the payout patterns used for discounting. The line of business durations would then be weighted to derive the total claim liabilities duration.
- Alternatively, the future payouts may be evaluated for all lines of business and the duration of the combined payout calculated on this aggregated payout.
- When the change in interest rate is small, the modified duration and effective duration are the same or approximately the same. Therefore, the effective duration can be used to assess the reasonableness of the calculation of the modified duration, or even as a proxy for modified duration if appropriate.
- For premium liabilities, the following additional considerations apply:
  - The cash flow would be discounted to the future accident date; and
  - The average accident date and estimated cash flows vary with policy term.
- The duration calculations would be net of reinsurance and net of salvage and subrogation.

The following examples are provided to help AAs in calculating durations for the purpose of the interest rate risk margin. They are intended to be illustrative, rather than prescriptive, and in accordance with OSFI and AMF guidelines.

Asset Duration

Year-end Information

Description	Bond #1	Bond #2	Bond #3
Maturity Date	2012-12-31	2013-06-30	2014-06-30
Rate	2,50%	6,60%	4,65%
Coupon # (k)	2	2	2
Par value	1 250	1 875	1 125
Market value	1 265	2 010	1 140
Coupon $	16	62	26
$i_{(2)}$	0,64%	0,86%	2,04%
Yield = $i_{(2)}$ * 2	1,29%	1,72%	4,08%

Step 1: Future payment for assets

	Cash flows		
Year	Bond #1	Bond #2	Bond #3
2012,5	16	62	26
2013,0	1 266	62	26
2013,5	-	1 937	26
2014,0	-	-	26
2014,5	-	-	1 151

Step 2: Calculation of duration for assets

Change in yield = 0,10%

	Year (1)	Lag (2)	Cash Flows (3)	PV factor (4)	Discounted Cash Flows (5)	Lag * Discounted Cash Flows (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Cash fl. w/ Δy Decrease in yield (11)	Discounted Cash fl. w/ Δy Increase in yield (12)
Bond #1	2012,5	0,5	16	0,9968	16			0,9963	16	16
Yield =	2013,0	1,0	1 266	0,9936	1 258		0,99	0,9926	1 259	1 256
1,29%	2013,5	1,5	-	0,9904	-	-	0,9919	0,9889	-	-
	2014,0	2,0	-	0,9872	-		0,9902	0,9853	-	-
	2014,5	2,5	-	0,9841	-		0,9885	0,9816	-	-
	Total				1 273	1 265			1 274	1 272
					(7) Macaulay duration	0,994		(13) Effective duration		**0,988**
					(8) Modified du	**0,988**				

Change in yield = 0,10%

	Year (1)	Lag (2)	Cash Flows (3)	PV factor (4)	Discounted Cash Flows (5)	Lag * Discounted Cash Flows (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Cash fl. w/ Δy Decrease in yield (11)	Discounted Cash fl. w/ Δy Increase in yield (12)
Bond #2	2012,5	0,5	62	0,9957	62	31	0,9962	0,9952	62	62
Yield =	2013,0	1,0	62	0,9915	61	61	0,9925	0,9905	61	61
1,72%	2013,5	1,5	1 937	0,9873	1 912	2 868	0,9887	0,9858	1 915	1 909
	2014,0	2,0	-	0,9830	-	-	0,9850	0,9811	-	-
	2014,5	2,5	-	0,9789	-	-	0,9813	0,9764	-	-
	Total				2 035	2 960			2 038	2 032
					(7) Macaulay duration	1,455		(13) Effective duration		**1,442**
					(8) Modified duration	**1,442**				

Change in yield = 0,10%

	Year (1)	Lag (2)	Cash Flows (3)	PV factor (4)	Discounted Cash Flows (5)	Lag * Discounted Cash Flows (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Cash fl. w/ Δy Decrease in yield (11)	Discounted Cash fl. w/ Δy Increase in yield (12)
Bond #3	2012,5	0,5	26	0,9899	26	13	0,9904	0,9895	26	26
Yield =	2013,0	1,0	26	0,9800	26	26	0,9810	0,9790	26	26
4,08%	2013,5	1,5	26	0,9701	25	38	0,9716	0,9687	25	25
	2014,0	2,0	26	0,9604	25	50	0,9623	0,9585	25	25
	2014,5	2,5	1 151	0,9507	1 094	2 736	0,9531	0,9484	1 097	1 092
	Total				1 196	2 863			1 199	1 194
					(7) Macaulay duration	2,393		(13) Effective duration		**2,345**
					(8) Modified duration	**2,345**				

(4) PV factor = 1 / (1 + yield/k) ^ lag
(5) Discounted payment = (3) * (4)
(6) Lag * Discounted cash flows = (2) * (5)
(7) Macaulay duration = Sum of (6) / Sum of (5)
(8) Modified duration = (7) / (1 + yield/k)

(9) Δy Decrease in yield = 1 / (1 + yield/k - change in yield) ^ lag
(10) Δy Increase in yield = 1 / (1 + yield/k + change in yield) ^ lag
(11) Discounted cash flows w/ Δy Decrease in yield = (3) * (9)
(12) Discounted cash flows w/ Δy Increase in yield = (3) * (10)
(13) Effective duration = (sum(11) - sum(12)) / (2 * change in yield * sum(5))

Step 3: Weighted Duration of Assets

	Market Value	Modified Duration	Effective Duration
Asset #1	1 265	0,988	0,988
Asset #2	2 010	1,442	1,442
Asset #3	1 140	2,345	2,345
Total	4 415	**1,545**	**1,545**

Claims Liabilities and Premium Liabilities Duration

Year-end Information

Unpaid as at December 31, 2011

Accident Year	Property	Liability
2007	-	32
2008	-	86
2009	-	127
2010	16	186
2011	137	258

Payment Pattern

Age	Property	Liability
12	80%	35%
24	95%	68%
36	100%	80%
48	100%	85%
60	100%	90%
72	100%	95%
84	100%	99%
96	100%	100%

Yield = 1.75%
Unearned Premium Reserve (UPR) for Property = 550
UPR for Liability = 380
Maintenance Expense % = 3.5%

Expected Loss Ratio for Property (ELR) = 65%
ELR for Liability = 80%

Step 1: Future payment for claims liabilities

Property

		Paid in						
Accident Year	Unpaid	2012	2013	2014	2015	2016	2017	2018
2007	-							
2008	-							
2009	-							
2010	16	16	-	-	-	-	-	
2011	137	103	34	-	-	-	-	-
Total	153	119	34	-	-	-	-	-

payout for AY 2011 @ 2012 = 137 / (1-80%) * (95% - 80%)
payout for AY 2011 @ 2013 = 137 / (1-80%) * (100% - 95%)
payout for AY 2010 @ 2012 = 16 / (1-95%) * (100% - 95%)

Liability

		Paid in						
Accident Year	Unpaid	2012	2013	2014	2015	2016	2017	2018
2007	32	[illegible]	13	3				
2008	86	29	29	23	6			
2009	127	32	32	32	25	6		
2010	186	[illegible]	29	29	29	23	6	
2011	258	131	48	20	20	20	16	4
Total	689	277	150	107	80	49	22	4

payout for AY 2011 @ 2012 = 258 / (1-35%) * (68% - 35%)
payout for AY 2011 @ 2013 = 258 / (1-35%) * (80% - 68%)
payout for AY 2010 @ 2012 = 186 / (1-68%) * (80% - 68%)
etc.

Claims Liabilities and Premium Liabilities Duration

Step 2: Calculation of duration for claims liabilities

Property

Yield 1,75% Change in yield 0,10%

Year (1)	Lag (2)	Payment (3)	PV factor (4)	Discounted Payment (5)	Lag * Discounted Payment (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Payment w/ Δy Decrease in yield (11)	Discounted Payment w/ Δy Increase in yield (12)
2012	0,5	119	0,9914	118	59	0,9919	0,9909	118	118
2013	1,5	34	0,9743	33	50	0,9758	0,9729	33	33
2014	2,5	-	0,9576	-	-	0,9599	0,9552	-	-
2015	3,5	-	0,9411	-	-	0,9443	0,9379	-	-
2016	4,5	-	0,9249	-	-	0,9290	0,9208	-	-
2017	5,5	-	0,9090	-	-	0,9139	0,9041	-	-
2018	6,5	-	0,8934	-	-	0,8991	0,8877	-	-
Total		153		151	109			151	151
			(7) Macaulay duration		0,721		(13) Effective duration		**0,708**
			(8) Modified duration		**0,708**				

Liability

Yield 1,75% Change in yield 0,10%

Year (1)	Lag (2)	Payment (3)	PV factor (4)	Discounted Payment (5)	Lag * Discounted Payment (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Payment w/ Δy Decrease in yield (11)	Discounted Payment w/ Δy Increase in yield (12)
2012	0,5	277	0,9914	275	137	0,9919	0,9909	275	275
2013	1,5	150	0,9743	146	219	0,9758	0,9729	146	146
2014	2,5	107	0,9576	102	256	0,9599	0,9552	103	102
2015	3,5	80	0,9411	75	264	0,9443	0,9379	76	75
2016	4,5	49	0,9249	46	206	0,9290	0,9208	46	46
2017	5,5	22	0,9090	20	108	0,9139	0,9041	20	20
2018	6,5	4	0,8934	4	23	0,8991	0,8877	4	4
Total		689		667	1 213			669	666
			(7) Macaulay duration		1,818		(13) Effective duration		**1,786**
			(8) Modified duration		**1,786**				

(4) PV factor = 1 / (1 + yield) ^ lag
(5) Discounted payment = (3) * (4)
(6) Lag * Discounted payment = (2) * (5)
(7) Macaulay duration = Sum of (6) / Sum of (5)
(8) Modified duration = (7) / (1 + yield)

(9) Δy Decrease in yield = 1 / (1 + yield - change in yield) ^ lag
(10) Δy Increase in yield = 1 / (1 + yield + change in yield) ^ lag
(11) Discounted payment w/ Δy Decrease in yield = (3) * (9)
(12) Discounted payment w/ Δy Increase in yield = (3) * (10)
(13) Effective duration = (sum(11) - sum(12)) / (2 * change in yield * sum(5))

Step 2a: Average duration for claims liabilities

	PV of Unpaid Claims	PFAD	APV of Unpaid Claims	Modified Duration	Effective Duration
Property	151	5	156	0,708	0,708
Liability	667	115	782	1,786	1,786
Total	818	120	938	1,607	1,607

Claims Liabilities and Premium Liabilities Duration

Step 3: Future payment for premium liabilities

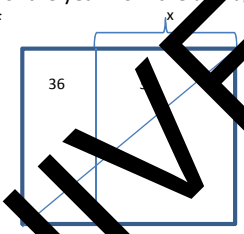
Expected Loss for Property = 550 * 65% 358
Expected Loss for Liability = 380 * 80% 304

Age	Average age for AY	Average age for PY[1]	Property Payment Pattern	Interpolated Payment Pattern for Property	Liability Payment Pattern	Interpolated Payment Pattern for Liability
12	0,5	0,7071	80%	83%	35%	42%
24	1,5	1,7071	95%	96%	68%	70%
36	2,5	2,7071	100%	100%	80%	81%
48	3,5	3,7071	100%	100%	85%	86%
60	4,5	4,7071	100%	100%	90%	91%
72	5,5	5,7071	100%	100%	95%	96%
84	6,5	6,7071	100%	100%	99%	99%
96	7,5	7,7071	100%	100%	100%	100%

[1] Assume that they are all 12-month policy with equal earning

To introduce lag, one possible method is as follows:

To calculate the average age for PY, assume x to be the time to end of the year from the average age of the UPR
The average age is the time that would split the UPR triangle to half
The area of the triangle is 72 (12 * 12 / 2)
To solve x, x^2/2 = 36
Thus x = 8.485 months, which is 0.7071 years



	Loss	Paid in 2012	2013	2014	2015	2016	2017	2018	2019
Property	358	297	46	14	-	-	-	-	-
Liability	304	127	87	32	15	15	15	10	2
Maintenance	33	33	-	-	-	-	-	-	-
Total	694	457	133	46	15	15	15	10	2

Maintenance Expense is 3.5% of the sum of the UPR and it should be paid during the time the UPR is being earned

Step 4: Calculation of duration for premium liabilities

Property

Yield 1,75% Change in yield 0,10%

Year (1)	Lag (2)	Payment (3)	PV factor (4)	Discounted Payment (5)	Lag * Discounted Payment (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Payment w/ Δy Decrease in yield (11)	Discounted Payment w/ Δy Increase in yield (12)
2012	0,2929	297	0,9949	296	87	0,9952	0,9946	296	296
2013	1,2929	46	0,9778	45	58	0,9791	0,9766	45	45
2014	2,2929	14	0,9610	14	31	0,9632	0,9588	14	14
2015	3,2929	-	0,9445	-	-	0,9475	0,9414	-	-
2016	4,2929	-	0,9282	-	-	0,9322	0,9243	-	-
2017	5,2929	-	0,9123	-	-	0,9170	0,9075	-	-
2018	6,2929	-	0,8966	-	-	0,9021	0,8910	-	-
2019	7,2929	-	0,8812	-	-	0,8875	0,8749	-	-
Total				354	176			355	354
			(7) Macaulay duration		0,497		(13) Effective duration		**0,489**
			(8) Modified duration		**0,489**				

Claims Liabilities and Premium Liabilities Duration

Liability

Yield 1,75% Change in yield 0,10%

Year (1)	Lag (2)	Payment (3)	PV factor (4)	Discounted Payment (5)	Lag * Discounted Payment (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Payment w/ Δy Decrease in yield (11)	Discounted Payment w/ Δy Increase in yield (12)
2012	0,2929	127	0,9949	127	37	0,9952	0,9946	127	126
2013	1,2929	87	0,9778	85	110	0,9791	0,9766	85	85
2014	2,2929	32	0,9610	31	71	0,9632	0,9588	31	31
2015	3,2929	15	0,9445	14	47	0,9475	0,9414	14	14
2016	4,2929	15	0,9282	14	61	0,9322	0,9243	14	14
2017	5,2929	15	0,9123	13	70	0,9170	0,9075	13	13
2018	6,2929	10	0,8966	9	58	0,9021	0,8910	9	9
2019	7,2929	2	0,8812	2	15	0,8875	0,8749	2	2
Total				296	469			296	295
			(7) Macaulay duration		1,588		(13) Effective duration		**1,561**
			(8) Modified duration		**1,561**				

Maintenance expenses

Yield 1,75% Change in yield 0,10%

Year (1)	Lag (2)	Payment (3)	PV factor (4)	Discounted Payment (5)	Lag * Discounted Payment (6)	Δy Decrease in yield (9)	Δy Increase in yield (10)	Discounted Payment w/ Δy Decrease in yield (11)	Discounted Payment w/ Δy Increase in yield (12)
2012	0,2929	33	0,9949	33	10	0,9952	0,9946	32	32
2013	1,2929	-	0,9778	-	-	0,9791	0,9766	-	-
2014	2,2929	-	0,9610	-	-	0,9632	0,9588	-	-
2015	3,2929	-	0,9445	-	-	0,9475	0,9414	-	-
2016	4,2929	-	0,9282	-	-	0,9322	0,9243	-	-
2017	5,2929	-	0,9123	-	-	0,9170	0,9075	-	-
2018	6,2929	-	0,8966	-	-	0,9021	0,8910	-	-
2019	7,2929	-	0,8812	-	-	0,8875	0,8749	-	-
Total				32	9			32	32
			(7) Macaulay duration		0,293		(13) Effective duration		**0,288**
			(8) Modified duration		**0,288**				

(4) PV factor = 1 / (1 + yield) ^ lag
(5) Discounted payment = (3) * (4)
(6) Lag * Discounted payment = (2) * (5)
(7) Macaulay duration = Sum of (6) / Sum of (5)
(8) Modified duration = (7) / (1 + yield)

(9) Δy Decrease in yield = 1 / (1 + yield - change in yield) ^ lag
(10) Δy Increase in yield = 1 / (1 + yield + change in yield) ^ lag
(11) Discounted payment w/ Δy Decrease in yield = (3) * (9)
(12) Discounted payment w/ Δy Increase in yield = (3) * (10)
(13) Effective duration = (sum(11) - sum(12)) / (2 * change in yield * sum(5))

Step 4a: Average duration for premium liabilities

	PV of Premium Liabilities	PFAD	APV of Premiun Liabilities	Modified Duration	Effective Duration
Property	354	12	366	0,489	0,489
Liability	296	51	347	1,561	1,561
Maintenance	32	-	32	0,288	0,288
Total	682	63	745	**0,979**	**0,979**

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XYZ Company
Insurer

Appendix 5-A: Worksheet – Capital Required: Interest Rate Risk
MCT Guideline - Chapter 5 - Appendix 5A

Commencing January 1, 2012 the Δy interest rate shock factor is 0.50% (Δy = 0.005). Effective January 1, 2013 the Δy interest rate shock factor is 0.75% (Δy = 0.0075).

					Interest rate shock factor 0,00500		(0,00500)
	Fair Value (01)	**Modified or Effective Duration** (02)		Dollar Fair Value Change ($000) (03)=(01)x(02)xΔy		Dollar Fair Value Change ($000) (04)=(01)x(02)x(-Δy)
Interest Sensitive Assets						
Term Deposits				0		0
Bonds and Debentures	4 415	1,5451		34		(34)
Commercial Paper				0		0
Loans				0		0
Mortgages				0		0
MBS and ABS				0		0
Preferred Shares				0		0
Other				0		0
Total			**A**	34	**A**	(34)
Interest Sensitive Liabilities						
Net unpaid claims and adjustment expenses	938	1,60		8		(8)
Net premium liabilities	745	0 85		4		(4)
Total	1 684		**B**	12	**B**	(12)
Allowable interest rate derivatives	**Notional Value** (01)	**Effective Duration** (02)		Dollar Fair Value Change (Δy) (03)		Dollar Fair Value Change (-Δy) (04)
Long Positions						
Short Positions						
Total			**C**	0	**C**	0
Capital Requirement for Δy shock increase *D=Maximum (0,A-B+C)*			**D**	**22**		
Capital Requirement for -Δy shock decrease *E=Maximum (0,A-B+C)*					**E**	**0**
Interest Rate Risk Margin *F= Maximum (D,E)*			**F**			**22**

where Δy = interest rate shock factor