

**1989 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

CHANGES IN FINANCIAL REPORTING IN CANADA

MR. BROCK L. STACKHOUSE: Crown Life set up a task force in December 1987 to determine and implement the changes in reserve methods and assumptions that would result from the use of the policy premium method (PPM) and the new reporting standards that were being developed by the Canadian Institute of Actuaries.

Our valuation system for individual business calculates current statutory reserves on a seriatim basis by formula. Control tables with plan and rate book codes and programs with assumptions dictate the parameters used to determine reserves for each policy. This system compares gross and net premiums and calculates deficiency reserves where appropriate.

Adjustments are made for other than annual premium frequency business, appropriations are set up for cash value deficiencies and negative reserves, and a dividend liability is set up for the next full dividend less unearned excess interest.

Although PPM represents a simplification of the reserve formula, many approximations that worked under the current statutory basis required rethinking due to the increased sensitivity and to the new reporting standards. While there has generally been acceptable compliance

VALUATION ACTUARY SYMPOSIUM, 1989

by Crown with the CIA guidelines, the requirements of reflecting all future benefits, dividends, expenses and gross premiums on an explicit basis using sophisticated sets of assumptions presented complex systems and business problems for Crown Life.

PPM implies the use of explicit assumptions including provision for AIDS, provision for adverse deviation (PAD), conformity with all the published valuation technique papers (VTPs), recognition of all others (at the discussion or exposure stage) and the use of consistent practices if specific guidelines are not available.

A number of systems modifications were required to deal with:

- The complexity of determining future gross premiums and assumption changes for adjustable products;
- Explicit valuation for participating business with provision for future dividend scale changes;
- Flexibility and design of lapse and mortality rates for lapse supported, individual renewable term and re-entry business;
- Cash flow for reinsurance business;
- Mortality tables with PAD;
- Dynamic mortality tables for annuity business;

CHANGES IN FINANCIAL REPORTING IN CANADA

- Appropriate lapse margins by issue age; and
- The ability to access benefits, premiums and expenses to the end of the benefit period.

Testing was required to determine the financial implications of front-ending of profit and the removal of the limitation on the deferral of acquisition expenses. We needed to assess the impact of these changes on future earnings through sensitivity testing. We wanted to make sure that evolving experience would not hurt earnings in a major way.

In September 1988, we were advised that the Office of the Superintendent of Financial Institutions (OSFI) would agree in principle with PPM subject to a review of reports due June 30, 1989, which determined the changes in company liabilities and appropriations, addressed concerns about front-ending, and analyzed the total impact and sensitivity of the use of PPM with PAD.

We developed a PC model to do some initial sensitivity testing, then transferred this work to a special file based on 1 percent of our in-force business. We have used this file extensively in the past to estimate reserve changes due to changes in assumptions or methods and have found it to be reliable and cost effective.

VALUATION ACTUARY SYMPOSIUM, 1989

During the early months of 1989, we took a fresh look at the assumptions that would be used with PPM based on the guidelines outlined in the VTPs and the paper on PAD.

In order to assess the impact of assumption changes, we produced PPM reserves using current statutory assumptions on the 1 percent test file. Approximately 30 changes, (a combination of method and assumption changes) were tested and decisions were made as to the appropriate bases to use for PPM with PAD, AIDS and annuity mortality improvement.

PC models were used to do some of the testing to determine:

1. The impact on reserves of future dividend scale changes (Slide 1). We assumed a reduction in the dividend interest rate of 100 basis points in 5 years and a further reduction of 50 basis points in 10 years, with appropriate changes in future dividends. Two dollars per thousand was added to the reserves as a result of this test; and
2. Assumption changes to comply with VTP #2 on the valuation of individual renewable term (Slide 2). We compared reserves based on various levels of mortality trends with those based on selective lapse rates. Our valuation system has been altered to accommodate mortality trend factors but cannot easily cope with

CHANGES IN FINANCIAL REPORTING IN CANADA

SLIDE 1

				Reserves with the Par Transfer		
Plan	Rtbk	Age	Durn	No Div Scale Change	One Div Scale Change	Two Div Scale Change
120	2167	25	20	273.09	275.28	276.10
		35		366.54	368.00	368.51
		45		468.42	469.68	470.05
		55		575.77	576.77	576.92

VALUATION ACTUARY SYMPOSIUM, 1989

SLIDE 2

COMPARISON OF A TREND IN MORTALITY VS. SELECTIVE LAPSES

Plan	Rtbk	Age	Durn	<u>PPM Unit Reserves</u>				
				Trend			Sel. Lapses	
				<u>0.5%</u>	<u>1%</u>	<u>3%</u>	<u>5%</u>	<u>10%</u>
T5R	C80	26	1	(1.75)	(1.71)	(1.52)	(2.47)	(0.60)
			2	(1.60)	(1.54)	(1.25)	(1.90)	0.19
			3	(1.41)	(1.32)	(0.93)	(1.30)	1.03
			4	(1.22)	(1.10)	(0.54)	(0.70)	1.90
			5	(1.04)	(0.88)	(0.11)	(0.12)	2.78
			10	0.08	0.51	0.58	2.38	7.33
			15	0.91	1.88	6.74	4.20	12.39
			20	1.68	3.66	14.03	5.22	17.97
			25	2.47	6.54	28.54	4.95	24.70
		28	1	(1.70)	(1.66)	(1.45)	(2.40)	(0.33)
			2	(1.50)	(1.43)	(1.12)	(1.79)	0.51
			3	(1.28)	(1.19)	(0.75)	(1.20)	1.37
			4	(1.08)	(0.95)	(0.33)	(0.63)	2.23
			5	(0.90)	(0.72)	0.14	(0.10)	3.11
			10	(0.14)	0.36	2.73	1.88	7.40
			15	0.89	2.02	7.67	3.74	12.98
			20	1.43	3.80	16.12	4.12	18.69
			25	2.11	6.98	33.10	2.77	25.33

Assumptions used: Mortality: 70% of CDS79 Male Aggregate

Lapses: 25% (5), 15% t/a

Interest: 9% for 8 years going down to 5% in durn 33

Expenses: \$0.11 per 1,000, 6.25% of GP, \$29 per policy

Inflation: 4%

CHANGES IN FINANCIAL REPORTING IN CANADA

selective lapse rates. This testing suggested a 2 percent upward trend factor for mortality.

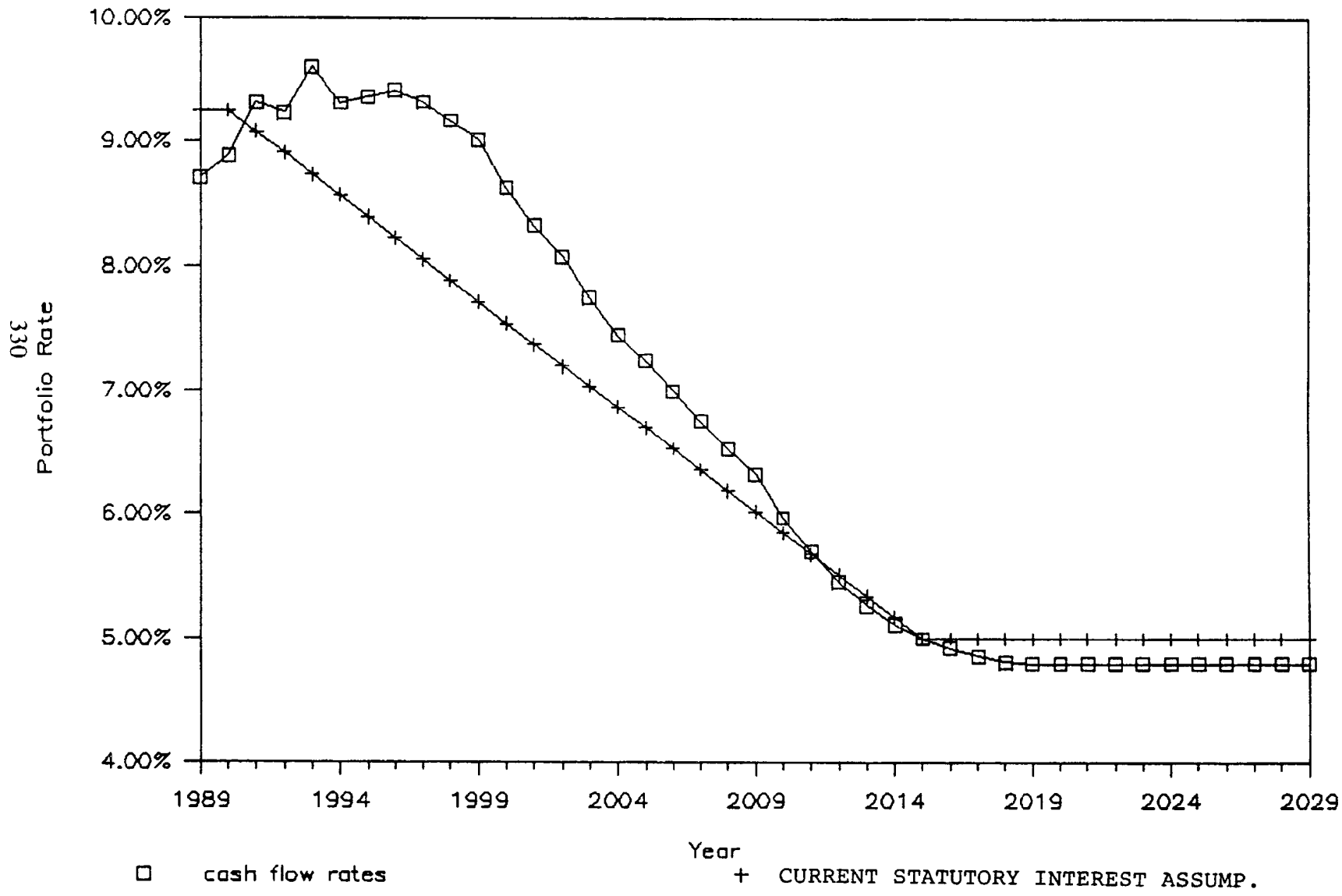
A cash-flow model was used to determine interest rate assumptions for Canadian nonparticipating permanent life following VTP #3 on future cash-flow investment assumptions (Slide 3). The set of rates from this cash-flow analysis were compared with the rates used for this block of business for current statutory reserves. Interest rate changes were not made as a result of this work, but we did conclude that higher interest rates could be justified at early durations and slightly lower rates after duration 25.

A cash-flow model was used to assess the appropriateness of universal life reserves following the principles contained in the paper exposed at the Whistler Meeting last spring. Further testing is required, but our initial assessment is that the reserves currently held (fund less unamortized acquisition expenses) are appropriate.

Last year-end, we did extensive work on estimating AIDS reserves following the guidance notes published at that time (Slide 4). This work was used to develop formulae for calculating AIDS reserves on a seriatim basis for individual life business for which we have a master record. Reserves were determined for reinsurance, nonadjustable and adjustable business by territory. Approximate methods were used to determine factors for territories

SLIDE 3

PPM Interest Assumptions



SLIDE 4

AIDS PROVISION - 1% FILE RESULTS
(excludes Pooled Reinsurance) (millions)

PAR

Area of Residence	Reins. Rec'd Less Reins. Ceded	Not Adjustable			Adjustable					
		Ren. Term	Other	Total	Universal	Dir. Mrktg	Ren. Term	Other	Total	TOTAL
Canada		0.4	1.3	1.7					0.0	1.7
U.S. @ 1.25	-0.2		2.8	2.8					0.0	2.8
U.K.				0.0					0.0	0.0
W.I. (incl. Bah., Berm., S.A., Mexico)		0.2	0.8	1.0					0.0	1.0
Other (incl. Hong Kong)			0.2	0.2					0.0	0.2
331 TOTAL	-0.2	0.6	5.1	5.7	0.0	0.0	0.0	0.0	0.0	5.5

NON PAR

Area of Residence	Reins. Rec'd Less Reins. Ceded	Not Adjustable			Adjustable						
		Ren. Term	Other	Total	Universal	Dir. Mrktg	Ren. Term	Other	Total	TOTAL	
Canada	0.2	1.3	0.9	2.2	0.1	0.1		0.1	0.3	2.7	
U.S. @ 1.25	2.7	1.3	0.2	1.5	6.1		3.8	0.6	10.5	14.7	
U.K.				0.0					0.0	0.0	
W.I. (incl. Bah., Berm., S.A., Mexico)		0.4	0.5	0.9	0.6		0.3	0.3	1.2	2.1	
Other (incl. Hong Kong)				0.0					0.0	0.0	
TOTAL	2.9	3.0	1.6	4.6	6.8	0.1	4.1	1.0	12.0	19.5	25.0

VALUATION ACTUARY SYMPOSIUM, 1989

other than Canada, U.S. and U.K.; reserves for business (i.e., reinsurance received) managed on a pool or bulk basis were estimated by a separate method.

Various methods for projecting mortality for individual and group annuity business were investigated (Slide 5). Approximate reserve strengthening methods have been used for current statutory reporting but are expected to be replaced by a more sophisticated basis (probably based on generation to year 2000, then static) at the time PPM with PAD becomes the statutory reporting basis.

We complied with the special set of reporting standards for the June 30 report except for the use of cash flow for reinsurance and treating investment income tax as an expense rather than as an offset to the interest rates. Conformity is not expected to have much impact on reserves.

Using the June 30 report as the basis for assessing the impact of a change to PPM with PAD, Crown's reserves would decrease 0.6 percent (\$31.7 M), and appropriations would increase 19.9 percent (\$27.7 M) for a net increase in free surplus of 0.7 percent (\$4.1 M) of total liabilities and appropriations.

SUMMARY OF MORTALITY PROJECTIONS
1983 GAM - MALE

MEDIAL RESERVE (\$1200/YR)

	AGE 65: L-10 10% (11) <u>5% (t/a)</u>	AGE 70: L-5 10% (11) <u>5% (t/a)</u>	AGE 75: L-O 10% (10) <u>5% (t/a)</u>	AGE 80: L-O 10% (10) <u>5% (t/a)</u>
<u>MORTALITY</u>				
A) NO PROTECTION	10,145	8,526	6,961	5,723
B) FULL GENERATION	10,521	8,889	7,281	5,962
C) STATIC PROJ'N TO 1995	10,420	8,859	7,326	6,047
D) GENERATION TO 2000, THEN STATIC	10,468	8,865	7,274	5,961
<u>\$CHANGE IN RESERVE</u>				
D1 = B - A	376	363	320	239
D2 = C - A	275	333	365	324
D3 = D - A	323	339	313	238
<u>%CHANGE IN RESERVE</u>				
D1/A	3.71%	4.26%	4.60%	4.18%
D2/A	2.71%	3.91%	5.24%	5.66%
D3/A	3.18%	3.98%	4.50%	4.16%

333

VALUATION ACTUARY SYMPOSIUM, 1989

Crown was one of several companies which agreed to perform sensitivity tests on our individual Canadian nonparticipating business. We were asked to separate the data into three categories: regular term and yearly renewable term, traditional life and endowment, and lapse supported including Term-to-100. For the purposes of this study, adjustable and universal life products were to be excluded. For each category, reserves are shown separately for issues of the last 5 years, 6 to 15 years and more than 15 years.

In order to obtain a true measure of relative sensitivity of the two methods, we were asked to use the same assumptions for the standards case for both methods.

The investigation focused on the effect on reserves of weakening in turn each of the four major actuarial assumptions and the combined effect using:

1. Ninety percent of the original mortality assumption;
2. Increasing interest rates by 100 basis points;
3. Ten percent lower lapse rates at all durations except for lapse supported business for which we were asked to increase the assumption by 10 percent;
4. Ninety percent of future administration expenses; and
5. All of the above.

CHANGES IN FINANCIAL REPORTING IN CANADA

We did make a few alterations in these assumptions.

1. We did not apply the 90 percent mortality factor to the constant in the mortality PAD of K/EX; and
2. In the case of renewable term, our expected mortality assumption included an unfavorable upward trend of 2 percent per annum from issue to comply with VTP #2. Since this trend is not evident in our actual mortality experience, it is not part of the pricing premium assumption, and hence, later duration premiums will not cover the expected claims on a valuation basis. In our June 30 report, we found that the lower lapse assumption was conservative for this product because it increases the probability that the insufficient premiums would be paid. We decided to use the requested reduction in the lapse assumption even though this caused an increase in the reserves.

Our 1 percent file was used for this report, and the results were summarized on a spread sheet (Slide 6). We included ratios of the reserves based on each variation in assumption to the corresponding standard case cell reserves to better reflect relative sensitivity. In order to assess the interdependence of the combined effect, we compared the product of the four ratios with the combined ratio. The difference is described as the compounding effect on the overhead.

SLIDE 6

CROWN LIFE INSURANCE COMPANY - SENSITIVITY ANALYSIS

336

PRODUCT TYPE	Regular Term and YRT			Lapse Supported			Traditional Products			Subtotal	
	POLICY DURATION	1-5	6-15	16+	1-5	6-15	16+	1-5	6-15		16+
<u>1978 Statutory Reserves</u>											
Standard		100.0%	100.0%	100.0%	100.0%			100.0%	100.0%	100.0%	100.0%
Adj. Mortality		64.2%	77.5%	92.9%	88.8%			90.4%	98.0%	98.3%	94.9%
Adj. Interest		88.9%	92.1%	96.7%	71.4%			80.4%	93.7%	94.9%	89.3%
Adj. Lapse		119.1%	111.9%	102.5%	96.9%			100.6%	98.8%	99.5%	99.5%
Adj. Expenses		86.3%	97.2%	98.0%	98.3%			98.4%	99.2%	98.7%	98.6%
All Adj. Combined		56.1%	77.1%	90.0%	59.7%			77.6%	89.6%	91.1%	83.0%
Compounding Effect		2.6%	0.5%	0.2%	0.7%			-5.6%	0.4%	0.5%	0.1%
<u>Policy Premium Reserves</u>											
Standard		100.0%	100.0%	100.0%	100.0%			100.0%	100.0%	100.0%	100.0%
Adj. Mortality		45.7%	47.1%	81.3%	86.3%			176.1%	94.5%	97.9%	91.1%
Adj. Interest		89.3%	89.0%	95.0%	67.3%			171.0%	88.9%	94.4%	85.7%
Adj. Lapse		118.0%	116.8%	103.3%	96.2%			116.9%	97.4%	99.2%	98.6%
Adj. Expenses		84.1%	89.7%	90.7%	97.8%			116.7%	97.1%	98.4%	97.1%
All Adj. Combined		32.5%	39.1%	69.7%	50.1%			277.2%	77.4%	89.7%	72.6%
Compounding Effect		8.0%	4.9%	2.7%	4.5%			133.6%	2.0%	0.7%	2.1%