

**Presentation to the Federal/Provincial Pensions Conference
Actuarial Reports on Public Sector Pension Plans
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Good afternoon. Thank you for inviting me here today to talk about the actuarial reports of the public sector pension plans as at 31 March 2008. These reports have been tabled or will soon be tabled by the President of Treasury Board, the Honourable Vic Toews.

Presentation (Slide 2) The purpose of this presentation is to provide you with a brief overview of how our liabilities materialize, how they are quantified and how they are financed. I will start with the legislative responsibilities of the Chief Actuary, provide a brief overview of the membership of the three public sector pension plans, the assumptions used in the actuarial reports and some valuation results. I will then conclude with issues going forward.

PPRA defines the legislative responsibilities (Slide 3) Each of the three public sector pension plans has its own Act. Each Act requires that, in accordance with the *Public Pensions Reporting Act*, a cost certificate and actuarial valuation report be prepared, filed with the designated Minister and tabled before Parliament. The relevant sections of the *Public Pensions Reporting Act* with regard to the actuary state that the Chief Actuary must conduct actuarial reviews at least every three years.

Cost Certificate (Slide 4) One of the responsibilities of the actuary is to file a cost certificate in respect of each plan. For each plan, the cost certificate is composed of the current service cost, contributions for prior service elections and special payments to cover any deficits. The current service cost of a plan is the annual amount paid into the fund in respect of future benefits accrued during that year of service. The benefits could be termination, disability, survivor or retirement benefits. The actuary must also determine any special payments that the Government must make in respect of plan deficits. These special payments must be calculated over a period not exceeding fifteen years.

Actuarial Liabilities (Slide 5) The actuarial liabilities of the plans must also be calculated using the same assumptions and methodology used to determine the current service cost. The actuarial liability corresponds to the value of all future benefits, discounted using actuarial assumptions including the projected yield on the Account (for pre-April 2000 service) or the expected return on the Fund (for post-March 2000 service). The main use of the liability projections is to determine the Plan's financial status for valuation purposes. A going-concern valuation rather than a solvency valuation is required since it is assumed that the Plans will continue indefinitely.

Financial Status (Slide 6) Once the actuary has measured the actuarial value of plan assets and liabilities, he determines the financial status of the plans. An actuarial surplus or deficit is the actuary's best estimate of the difference between the actuarial value of plan assets and the actuarial liabilities. An actuarial surplus or deficit is a highly variable amount that may change significantly depending on the actuarial assumptions and methods used.

Membership (Slide 8) Currently, there are about 380,000 contributors to the three pension plans and about the same number of beneficiaries. Over the past three years, the average retirement age of a public service member has been 58 with 26 years of service. For RCMP, it has been 54 with 31 years of service. Lastly, the average retirement age for Canadian Forces has been 45 with 25 years of service.

Plan Provisions (Slide 9) Subject to integration with the pensions paid by the CPP and the QPP, the retirement pension is equal to 2% of the highest average annual pensionable earnings over five years, multiplied by the annual number of years of pensionable service not exceeding 35 years. Once in pay, the pension is indexed annually with inflation with the exception that indexation is deferred and paid only when the beneficiary reaches age 60 for the RCMP and Canadian Forces Pension Plan. The indexation could be paid earlier if the member is 55 years old with 30 years of service.

Member Contributions (Slide 10) During the first 35 years of pensionable service, members contribute according to the rates shown in the following table. The increase in member contribution rates decreases the Government's contribution but has no effect on the total cost of the Plan. The objective is to restore the historic 60:40 cost sharing of the pension plans between the Government and Plan members, with the Government assuming the larger share.

Working and retirement life (Slide 11) This slide illustrates the average working and retirement life of a member for each of the three public sector pension plans. On average, members enter the Public Service Pension Plan at age 32, retire at age 58 and receive their pension for 27 years. For the RCMP Pension Plan, members on average enter the plan at age 23, retire at age 54 and receive their pension for 32 years. And, members of the Canadian Forces Pension Plan on average enter at age 20, retire at age 45 and receive their pension for 39 years.

Valuation Assumptions (Slide 13) There are two main categories of assumptions used in the actuarial reports: economic and demographic assumptions. The three key economic assumptions are for inflation, real wage increases and the real rate of return. I will talk briefly about inflation, more about the real rate of return of assets and conclude with current and future life expectancies.

Inflation assumption (slide 14) This chart illustrates the historical inflation rate since 1964. Based on the renewed commitment of the Bank of Canada and the Government to keep inflation between 1% to 3% until 2011, an annual inflation rate of 2.0% has been assumed until 2012. The rate of inflation is then assumed to increase from 2.0% to 2.4% in 2016 and to remain at that level thereafter. Various pension plans assume a long-term rate of inflation between 1.9% and 2.8%. An external peer review panel of actuaries who reviewed the assumptions of the most recent CPP actuarial report indicated that the CPP long-term assumption of 2.5% was within, but towards the high end of, the reasonable range.

Determining the real rate of return (slide 15) In the following slides, I will discuss four factors to consider when determining an assumption for the real rate of return on plan assets: the risk-free interest rate, the equity risk premium, the real rate of return by asset class and the plan's asset mix.

Government of Canada bonds (slide 16) This graph shows the historical, as well as projected, yields, both nominal and real, on long-term Government of Canada marketable bonds since 1996. Over the past 50 years, the average real yield was 3.1% while it was 2.9% over the past 10 years.

To maintain consistencies among all economic assumptions set in our actuarial reports, the risk-free interest rate (in real terms) is the return on the nominal bond minus the inflation assumption. For the first four years, the risk-free real interest rate is 4.4% minus 2.0%, or 2.4%. On a long-term basis, the risk-free real interest rate is 5.2% minus 2.4%, or 2.8%.

On a long-term basis, our assumption for the real return of long-term Government of Canada bonds is lower than that of most forecasters.

Fixed income portfolio (slide 17) The bond portfolio consists of 4 types of bonds: federal, provincial, corporate and real-return. Federal bonds are considered to be the only risk-free bonds in the portfolio. The yields on the other bonds are determined based on historical statistics. It is assumed that provincial and corporate bonds will have spreads of 40 bps and 100 bps, respectively above the risk-free federal long-term rate. Real return bonds, on the other hand, are assumed to have a negative spread of 40 bps. A long-term real rate of return of 3.2% is therefore assumed for the fixed income portfolio.

Equity Risk Premium (slide 18) The equity risk premium is the expected excess return on equity over a long-term fixed income investment, such as risk-free Government of Canada bonds. An annualized equity risk premium was calculated relative to bonds for 17 countries for the 106-year period 1900-2005. The historical worldwide equity risk premium was 4.0%. The Canadian equity risk premium was 4.2% relative to bonds. The authors infer in the study that investors could expect a future premium on the world index of around 3 to 3.5%. Over the 109-year period, the Canadian equity risk premium has dropped to 3.7%

while the drop has been more significant on a worldwide basis at 3.4%. It shows the extent to which dramatic negative returns in 2008 on a worldwide basis have negatively impacted the historical average.

Canadian Equities (slide 19) Over the last 50 years, Canadian equities have earned an average real rate of return of 5.1% with an annual standard deviation of 17%. Over the same period U.S. equities have earned an average rate of return of 5.5% in Canadian dollars. Over the same period, the U.S. equity risk premium has exceeded the Canadian equity risk premium by around 50 basis points at 1.7% compared to 1.2%.

Asset Mix of Peers (Slide 20) Since 2003, peers have decreased their equity holdings in favour of alternative investments such as real estate and infrastructure. The equity component is currently hovering between 40% and 55% while the average fixed income component is about 30% and the real return component is 15 to 30%.

PSPIB Asset Mix (slide 21) As at 31 March 2009, the assets managed by the Public Sector Pension Investment Board (PSPIB) were invested in 53% equity, 26% fixed income securities and 21% real return assets. The short-term asset mix of the Plan is assumed to consist of 55% equity, 25% fixed income securities and 20% real return assets. As the Plan matures and plan members age, and as the Funds grow, it is assumed that the proportion of fixed income securities will slightly increase. The assumed long-term asset mix target is composed of 50% equity, 30% fixed income securities and 20% real return assets.

Real rate of return (slide 22) This slide shows the components of the real rate of return assumption. Each asset class has an associated real rate of return and weight in the portfolio. Real return assets such as real estate and infrastructure are considered to be a hybrid of debt and equity (50/50). Assuming a split of 50% debt and 50% equity, real estate and infrastructure would have an equity risk premium that is 50% of that assumed for pure equity. Thus, the risk premium for real return assets is 1.2% compared to 2.3% for equity. This leads to a long-term real return assumption of 4.0% for this class. This assumption is much lower than historical results for real estate.

In summary, the real return on long-term Canada bonds is 2.4% for the first 4 years of projection and 2.8% for years 2014 and thereafter. The spreads of provincial, corporate and real return bonds are derived from historical correlation with long-term Canada bonds. This leads to an additional 40 basis points for a higher return of 3.2%, and the equity risk premium is set at 2.3%. By multiplying the real rate return of each asset class by its weight and adding the results across all asset classes, the real rate of return of 4.3% for the portfolio is derived. The real rates of return assumptions by asset class are consistent with the assumptions used in the most recent CPP actuarial report.

Real rate of return (slide 23) This chart illustrates the 5-year average real rates of return for private pension plans with diversified portfolios similar to the PSPIB. Overall, plan assets earned an average real rate of return of 4.1% over the 40-year period ending in 2008 compared to 4.8% for the 40-year period ending in 2006. This graph also shows that four consecutive 5-year periods from 1979 to 1998 delivered higher returns than average while the periods before and after delivered disappointing returns.

Life expectancies (slide 24) The life expectancy of plan members is an important factor to take into consideration in evaluating the cost of any pension plan. This slide compares the life expectancies between the three public sector pension plans and the CPP. Members of the public service and CPP contributors have similar life expectancies, while officers of the Canadian Forces and regular members of the RCMP have life expectancies that are approximately 1 to 2 years higher. Life expectancies are expected to increase by about 1 to 1.5 years in 2025.

Current Service Costs and Liabilities (slide 25) The main purpose of the actuarial reports is to show realistic estimates of the projected costs of the plans and the balance sheets of the pension plans as at the valuation date; that is, the actuarial liabilities, the actuarial value of assets and the actuarial surplus or actuarial deficit.

Current Service Cost – PSSA (slide 26) The current service cost for the plan year 2008-2009 of the Public Service Pension Plan is 18.5% of pensionable payroll, slightly higher than the 18.0% of the previous report. For every \$1 plan members contribute to the Plan, the government contributes \$2.03. By 2010-11, it is expected that the government's share will decrease slightly to \$1.92 for every \$1 plan members contribute. The total contributions are therefore \$3.3 billion in plan year 2008-2009.

Evolution of PSSA Liabilities (slide 27) The next slide shows how the total actuarial liabilities are split between the Pension Fund and the Superannuation Account. The Superannuation Account represents the actuarial liabilities for service earned up until April 2000. There is no current service cost credited to the Account while the benefit payments made in respect of service earned before 2000 are debited from the Account. Since 1 April 2000 the contributions to the pension plan have been deposited to the Public Service Pension Fund. These funds are invested in the financial markets by the PSPIB with a view to maximize returns without undue risk of loss.

Tangible assets backing the liabilities invested through PSP Investments could be long-term since the liabilities are heavily weighted towards the actives, thus reducing the assets/liabilities mismatch or, said differently, net cash flows are expected to be positive until 2030. PSP Investments is managing the assets of one of the youngest pension plans in Canada. Thus, the PSPIB is able to utilize more long-term investments than other pension plans since investment income will not be needed to pay benefits for the next 21 years.

The ratio of liabilities of actives to total members in the Pension Fund is currently quite high (84% in 2008) because most members who have made contributions to the Fund have not yet retired. Over time, this ratio will decrease as members age and begin to retire. Currently, the Fund represents only a small proportion of total liabilities; however, this proportion is expected to increase over time as any new members will contribute entirely to the Fund.

Evolution of cash flows (slide 28) This chart shows the evolution of the net cash flows of the three Pension Funds. In 2008, the net cash flow of \$4.1 billion consisted of contributions of \$4.7 billion and \$600 million of benefits paid from the Pension Funds. It is projected that the net cash flows will remain positive until 2030.

Stochastic Analysis (slide 29) The purpose of a stochastic model is to assign a probability distribution to a best-estimate assumption in order to determine the variation that could occur around the assumption and the associated probabilities with that variation.

Historical Inflation (slide 30) Over the last 85 years ending in 2008, the geometric mean of the inflation rate was 3.0% with an annual standard deviation of 4%. What does it mean? The geometric mean implies that an item priced \$1 in 1924 would be worth \$12 some 85 years later. It also means that with no variation from one year to the next, the standard deviation would be 0%. The standard deviation is a mathematical number representing the volatility. It could be calculated over 1 year, 20 years or any number of years. Does the inflation rate follow the normal curve from which we could derive various conclusions about the volatility? The answer is maybe. If the inflation rate follows the normal curve, it would imply that 68% of the observations would fall between minus one standard deviation and plus one standard deviation. In other words, 58 years among 85 years would produce inflation between negative 1% and 7%. It turns out that the blue area covers 76% of the observations or 65 years. With two standard deviations, 95% of the observations should fall between negative 5% and 11%. It turns out that the inflation falls within this range 93% of the time or for 79 years over the 85 observed years (the range between the dotted lines). With that information, we could conclude that the normal curve is a reasonable statistical measure to represent the volatility of the inflation in Canada.

Projected inflation using a stochastic process (slide 31) Using the experience of the last 85 years, ending in 2008, the projected average inflation rate over a 20-year period would be in the range of 1.3% to 4.9 with 95% probability. 10,000 scenarios were generated and produced a median inflation rate of 3.1%. The standard deviation of 0.9% is much smaller than the historical data because it considers 10,000 projections of the *average* inflation rate over 20 years and thus fluctuations in the 20-year average, rather than year-to-year fluctuations. In the actuarial report, the inflation assumption is set at 2.4%. Two sensitivity

tests showing the impacts on the current service cost and liabilities at plus and minus 1% are also performed.

Historical Canadian Real Equity Returns (slide 32) Over the last 71 years ending in 2008, the geometric mean of the Canadian real equity return was 5.8% with an annual standard deviation of 16.5%. What does it mean? It means that if you had invested \$1 in 1938, the same investment would worth \$54.76 in 2008 in real terms. The standard deviation of 16.5% means that the return on equities is much more volatile than the rate of inflation.

Real Rate of Return (Slide 33) The best-estimate long-term real rate of return on the PSPIB investment portfolio is 4.3%. 10,000 scenarios were generated and produced a median real rate of return of 5.6%. Using the experience of the last 71 years, ending in 2008, the projected average real rate of return over a period of 20 years will be in the range 0.7% to 10.5% with 95% probability.

Real Rate of Return (Slide 34) By removing a 10-year period (1973-1982) of high inflation, 10,000 generated scenarios instead produced a median real rate of return of 6.5%. History is telling us that high inflation has a negative impact on investments.

Real Rate of Return (Slide 35) Using the experience of the last 25 years, ending in 2006, which is the most favorable period of recent history (1982-2006), 10,000 generated scenarios produced a median real rate of return of 8.7%. One might argue that on a long term basis, there is a 98% probability of achieving a return higher than the actuarial assumption of 4.3%. In my view, it is not realistic. This graph clearly shows the risk of misusing stochastic processes. Next time you are given stochastic results, take the time to look at the period of observations and the methodology used. Stochastic processes might look good on the surface but we must be careful.

Actuarial Opinion (Slide 37) At the time of preparing these reports, the global economy and financial markets were going through a difficult period. Should the deterioration of financial markets continue, the impact will be reflected in the next actuarial valuation as at 31 March 2011.

Projected Pension Fund Surplus (Slide 38) For the first time ever, we have introduced short term projections in the actuarial reports. Three “what if” scenarios on the projected pension fund surplus are presented at the next valuation date, which is 31 March 2011. According to the third scenario, a rate of return of negative 20% is used followed by our best-estimate assumption of 6%. This scenario produces a deficit of \$6.7 billion.

Investment Policy Impact on Plan Funding (slide 39) This table shows the impact that various asset mixes would have on the current service cost and the funded ratio at the valuation date. Portfolio #1 is invested in long-term Government of Canada Bonds. Portfolio #2 is a marketable bond portfolio consisting of federal, provincial, corporate and real return bonds. These two portfolios produce expected investment returns lower than the current actuarial assumption. Thus, a more risky portfolio is required in order to achieve an average annual real return of 4.3%.

The rest of the portfolios discussed are diversified portfolios that consist of equity, fixed income securities and real return assets, such as real estate and infrastructure. Portfolio #3 and Portfolio #4 are more diversified than the first two portfolios. This diversification increases the real rate of return earned on these portfolios and reduces their volatility compared to the first two portfolios since the three broad asset categories are not perfectly correlated. However, despite an increased real return and lower risk, these portfolios are still not sufficient to maintain the current funded ratio. Thus, an increase in the current service cost would be required with both portfolios. It should be noted the current target portfolio is composed of twelve different asset classes all described in the annual report of the PSPIB. The challenge is to design a portfolio that meets the required rate of return of 4.3% with the lowest volatility over time.

Eliminating Risk in Defined Benefit Plans (slide 40) To completely eliminate investment risk in defined benefit pension plans, the solution is to invest solely in high-quality securities that exhibit guaranteed real returns in excess of the CPI. This could be done but at what cost? In Canada, only the Government of Canada Long-Term Real Return Bond guarantees a risk-free inflation protected return. The yield on this bond was 2.0% over the past twelve months. This is well below the required return on assets of 4.3% that is needed to sustain the plans at the current contribution rate.

By investing solely in risk-free real return bonds, almost all investment risk could be eliminated but at an excessive cost and then at the detriment of current and future active members, who will have to contribute more unless benefits were decreased. If the PSPIB were to switch from the current portfolio of fixed and variable income securities to a portfolio that consists of only long-term Government of Canada real return bonds, the current service cost of the Plan would have to increase substantially in order to maintain the current funding status or benefits would have to be reduced. Neither of these is a desirable option.

Thank you for your attention. I will be pleased to answer any questions you may have.