## ACTUARIAL REPORT

## on the <br> Public Service Death Benefit account

as at 31 March 2011

## Office of the Chief Actuary

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The Honourable Tony Clement, P.C., M.P.
President of the Treasury Board
Ottawa, Canada
KiA 0R5

Dear Minister:
Pursuant to Section 59 of the Public Service Superannuation Act, I am pleased to submit the report on the actuarial review as at 31 March 2011 of the Public Service Death Benefit Account established under Part II of this Act.

Yours sincerely,

Gean. Claude ménud
Jean-Claude Ménard, F.S.A., F.C.I.A.
Chief Actuary
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## I. Executive Summary

This actuarial report on the Public Service Death Benefit Account was made pursuant to Section 59 of the Public Service Superannuation Act (PSSA) which states that "A valuation report on the state of the Public Service Death Benefit Account shall be prepared ... in accordance with the Public Pensions Reporting Act and as if the supplementary death benefit plan established by this Part were a pension plan established under an Act referred to in subsection 3(1) of that Act".
This actuarial valuation is as at 31 March 2011 and is in respect of death benefits and contributions defined by Part II of the PSSA.

The previous actuarial report was made as at 31 March 2008. The date of the next periodic review is scheduled to occur no later than 31 March 2014.

## A. Purpose of this Actuarial Report

The purpose of this actuarial valuation is to determine the state of the Public Service Death Benefit (PSDB) Account as well as to assist the President of the Treasury Board in making informed decisions regarding the financing of the government's death benefit obligation. This is achieved by providing a best-estimate long-term projection of the account based on the projected contributions and interest credited to the account and projected death benefits debited from the account.

## B. Valuation Basis

This valuation report is based on the supplementary death benefit plan provisions enacted by legislation, summarized in Appendix 1. There have been no changes to the plan provisions since the last actuarial valuation report.
The financial data on which this valuation is based is the PSDB Account established to track contributions and benefits under the SDB plan provisions. The account data is summarized in Appendix 2. The membership data is summarized in Appendix 3.

The valuation was prepared using accepted actuarial practices, methods and assumptions which are summarized in Appendices 4 to 6.
All actuarial assumptions used in this report are best-estimate assumptions. They are individually reasonable for the purposes of the valuation at the date of this report.

Actuarial assumptions used in the previous report were revised based on economic trends and demographic experience. A complete description of the assumptions is shown in Appendices 5 and 6.
Death benefits are paid from the Consolidated Revenue Fund and charged against the PSDB Account. Contributions by employees, Crown corporations and Government are credited to the PSDB Account. Based on the balance of the PSDB Account, interest credits are calculated in such manner and at such rates and credited at such times as the PSDB Regulations provide. Therefore, the recent deterioration in financial markets has no impact on the PSDB Account except insofar as long-term Government of Canada bond yields influence the interest credited by regulation.

Public Service Death Benefit Account
as at 31 March 2011

## C. Main Findings

As at 31 March 2011, the plan has an actuarial excess of $\$ 2,407$ million resulting from the difference between the PSDB Account balance available for benefits of \$2,961 million and the liabilities of $\$ 554$ million.

The actuarial excess is projected to reach $\$ 5,332$ million at the end of plan year ${ }^{1} 2036$. Figure 1 shows the ratio of projected actuarial excess at the end of the plan year to annual benefit payments projected for the following plan year. This ratio is expected to remain stable at around the current level of 14.7 throughout the projection period.

Figure 1 Projected Ratio of Actuarial Excess to Annual Benefit Payments
(Actuarial excess is measured at the end of the plan year and annual payments are those of the following plan year.)


[^0]
## II. Financial Position of the Plan

## A. Balance Sheet

The following balance sheet as at 31 March 2011 was prepared using the PSDB Account balance available for benefits described in Appendix 2, the data described in Appendix 3, the methodology described in Appendix 4, and the assumptions described in Appendices 5 and 6. The results of the previous valuation are also shown for comparison purposes.

Table 1 Balance Sheet (\$ millions)

## As At 31 March 2011 As At 31 March 2008

## Account balance available for benefits

2,961
2,570

## Liabilities

Paid-up Death Benefit ${ }^{1} \quad 529480$
IBNR $^{2} \quad \underline{25} \underline{23}$
Total Liabilities 554503

Actuarial Excess
2,407
2,067

## B. Financial Position

At 31 March 2011 the actuarial excess totals $\$ 2,407$ million, being 14.7 times the total amount of basic benefits projected for plan year 2012. By comparison, the actuarial excess as at 31 March 2008 under the previous report was $\$ 2,067$ million, which was 12.0 times the amount of basic benefits projected for plan year 2009.

As shown in Appendix 2 and explained in Section IV, the projected contributions to the plan are less than the projected benefits for all future plan years. However, total income exceeds total expenditures in every year of the projection period because interest earnings more than offset the excess of benefits over contributions.

## C. Sensitivity of Valuation Results to Variations in Key Assumptions

The following supplementary estimates indicate the degree to which the valuation results depend on some of the key assumptions. These resulting differences can also serve as a basis for approximating the effect of other numerical variations in a key assumption, to the extent that such effects are indeed linear.

[^1]
## 1. Projected Interest Yields

As a measure of sensitivity, an increment of one and a half percentage point in the projected yields would increase the actuarial excess projected at the end of plan year 2036 from $\$ 5,332$ million to $\$ 8,898$ million, an increase of $67 \%$.
On the opposite side, a decrease of one and a half percentage point in the projected yields would decrease the actuarial excess projected at the end of plan year 2036 from $\$ 5,332$ million to $\$ 2,766$ million, a decrease of $48 \%$.

## 2. Mortality

If the assumed improvements in longevity after the 2012 plan year were disregarded, then the monthly benefit cost rate ${ }^{1}$ of 17.6 cents projected for plan year 2036 would climb to 23.6 cents, an increase of $34 \%$. The actuarial excess projected at the end of plan year 2036 would decrease by $31 \%$ from $\$ 5,332$ million to $\$ 3,700$ million.

However, if the assumed improvements in longevity were kept at the level of plan year 2012, resulting in greater improvements in longevity than those assumed in table 25 , then the monthly benefit cost rate of 17.6 cents projected for 2036 would decline to 15.2 cents, a decrease of $14 \%$. The actuarial excess projected at the end of plan year 2036 would climb by $8 \%$ from $\$ 5,332$ million to $\$ 5,773$ million.

## 3. Non-elective population growth rate

If the assumed percentage increase in the non-elective population in each plan year were double the current assumption, then the projected population would be relatively younger. The monthly cost projected for plan year 2036 would decrease by $6.2 \%$ from 17.6 to 16.5 cents. The actuarial excess projected at the end of plan year 2036 would climb by $4.9 \%$ from $\$ 5,332$ million to $\$ 5,593$ million.
If the assumed percentage increase in the non-elective population were set to $0 \%$, then the projected population would be relatively older. The monthly cost projected for plan year 2036 would increase by $5.1 \%$ from 17.6 to 18.5 cents. The actuarial excess projected at the end of plan year 2036 would decrease by $1.1 \%$ from $\$ 5,332$ million to $\$ 5,271$ million.

[^2]
## III. Reconciliation of Results with Previous Report

Table 2 illustrates the impact of the updated assumptions, intervaluation economic experience, population changes and changes in mortality assumption methodology since the last valuation report as at 31 March 2008. The projected monthly cost for plan year 2036 fell 4.2 cents from 21.8 cents as at 31 March 2008 to 17.6 cents as at 31 March 2011. The primary source of this decrease was the new mortality assumption methodology based on the amount of coverage instead of the number of individuals at time of death as established for the Public Service pension plan and the new mortality improvement assumptions.

For the same reason as described above, the projected ratio of actuarial excess at the end of plan year 2036 to benefit payments in plan year 2037 increased by $86.3 \%$ from 7.5 to 14 .

## Table 2 Reconciliation of Projected Results

|  | Monthly Cost <br> Per \$1000 of <br> Term Insurance <br> in Specified <br> Projection Year <br> (Cents) | Year End <br> Actuarial Excess <br> in the Year After the <br> Specified Projection <br> Year <br> (Ratio) |
| :--- | :---: | :---: |
| Projection Year 2033 |  |  |
| Projection as at 31 March 2008 | $\mathbf{2 2 . 1}$ | $\mathbf{7 . 9}$ |
| Projection Year 2036 | $\mathbf{2 1 . 8}$ | $\mathbf{7 . 5}$ |
| Projection as at 31 March 2008 | 0.3 | $(0.1)$ |
| Change in methodology | 0.2 | 0.0 |
| New population and intervaluation account experience | $(0.1)$ | 0.7 |
| Change in assumed rate of salary increase <br> (both economic and seniority/promotional) <br> Change in projected yields | 0.0 | $(1.2)$ |
| Change in assumed mortality rates (pension plan) | $(1.1)$ | 1.6 |
| Change in assumed mortality rates (SDB plan) | $(2.9)$ | 4.6 |
| Change in longevity improvement factors | $(0.8)$ | 1.2 |
| Change in all other assumptions | $\underline{0.2}$ | $(0.3)$ |
| Projection as at 31 March 2011 | $\mathbf{1 7 . 6}$ | $\mathbf{1 4 . 0}$ |

## IV. Legislated Contribution Rates

The aggregate amount of death benefit payments projected for plan year 2012 is $\$ 163.4$ million, which is made up of $\$ 122.8$ million in respect of the term insurance and $\$ 40.6$ million in respect of the paid-up insurance. In this report, term insurance means the basic coverage (two times salary) less the $10 \%$ per year reduction applicable from age 66 and less the $\$ 10,000$ paid-up insurance applicable from age 65.

## A. Paid-Up Insurance

For plan year 2012, the estimated single premiums at age 65 for each $\$ 10,000$ of paid-up insured benefit are $\$ 4,023$ and $\$ 3,691$ for males and females, respectively. The corresponding legislated contribution rates for each $\$ 10,000$ of paid-up insured benefits are $\$ 310$ and $\$ 291$, respectively.
The assumed improvements in longevity cause the projected single premium for the paid-up death benefit to decrease over time. However, the projected ultimate yield of $5.00 \%$ is lower than the yield of $6.00 \%$ projected for plan year 2012. This has the effect of gradually increasing the projected single premium over the years.

The net effect of longevity improvements and decreasing projected yields is to decrease the projected single premiums at age 65 for each $\$ 10,000$ of paid-up insured benefit. A male participant's projected single premium decreases from \$4,023 for plan year 2012 to $\$ 3,930$ for plan year 2036; for a female participant the decrease is from $\$ 3,691$ to \$3,621.

## B. Term Insurance

The total amount of term insurance proceeds projected to be payable during plan year 2012 is $\$ 122.8$ million. Given that the total amount of term insurance projected to be in force for plan year 2012 is $\$ 53,976$ million, the benefit cost rate projected for plan year 2012 is 19 cents per month per $\$ 1,000$ of term insurance.

Non-elective participants and elective participants in receipt of an immediate annuity or an annual allowance are required to contribute monthly 15 cents per $\$ 1,000$ of term insurance. As a minimum, the Government contribution credited monthly to the PSDB Account is equal to one-twelfth of the total amount of term insurance proceeds payable during the month. For plan year 2012, the Government's monthly contribution is estimated at 1.6 cents per $\$ 1,000$ of term insurance.

The total amount credited to the PSDB Account resulting from participants and government contributions in plan year 2012 is therefore 16.6 cents ( 15 cents plus 1.6 cents) per month per $\$ 1,000$ of term insurance, i.e. significantly less than the estimated monthly cost of 19 cents per \$1,000 of term insurance for plan year 2012.

Figure 2 Projected Monthly Cost (cents per $\$ 1,000$ of term insurance)


As shown in Figure 2, the monthly cost per $\$ 1,000$ of term insurance is projected to increase from 19 cents to 20.1 cents by plan year 2016. Thereafter, the monthly cost is projected to decrease gradually to 17.6 cents by plan year 2036. In comparison, the combined contribution rate in 2036 is projected to be 16.5 cents ( 15 cents for participants plus one-twelfth of 17.6 cents for Government).
The following table illustrates the projected monthly costs per \$1,000 of term insurance for selected plan year and participant type.

Table 3 Projected Monthly Cost
(cents per $\$ 1,000$ of term insurance)

| Participants | 2012 | 2016 | 2021 | 2026 | 2031 | 2036 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Non-elective | 10.4 | 10.6 | 10.3 | 10.1 | 9.9 | 9.4 |
| Elective | 54.3 | 53.0 | 52.0 | 50.2 | 48.7 | 45.5 |
| All | 19.0 | 20.1 | 19.7 | 18.8 | 18.2 | 17.6 |

For non-elective participants, the monthly cost projected for plan year 2036 is $90 \%$ of the monthly cost estimated for plan year 2012. This results mainly from the following two factors:

- There is a reduction in cost due to the assumed lower mortality for plan year 2036 in accordance with the longevity improvement factors shown in table 25 applied to the current mortality rates shown in table 20.
- The distribution of non-elective participants in the plan year 2036 is weighted more heavily at the older ages than currently. This has the effect of increasing costs. However, this increase is more than offset by the effect of the assumed mortality improvements.

In respect of elective participants in receipt of an immediate annuity or an annual allowance, the monthly benefit cost rate projected for plan year 2036 is $84 \%$ of the monthly cost projected for plan year 2012. This decrease is mostly the result of the assumed mortality improvements.
For all plan participants in aggregate, the monthly cost projected for plan year 2036 is $93 \%$ of the monthly cost projected for plan year 2012.

## V. Actuarial Opinion

In our opinion, considering that this report was prepared pursuant to the Public Pensions Reporting Act per Section 59 of the Public Service Superannuation Act,

- the valuation input data on which the valuation is based are sufficient and reliable for the purposes of the valuation;
- the assumptions that have been used are, individually and in aggregate, appropriate for the purposes of the valuation;
- the methods employed are appropriate for the purposes of the valuation; and
- this report has been prepared, and our opinions given, in accordance with accepted actuarial practice in Canada.

In particular, this report was prepared in accordance with the Standards of Practice (Standards of Practice - General Standards) published by the Canadian Institute of Actuaries.
To the best of our knowledge, after discussion with the Public Works Government Services Canada and Treasury Board of Canada Secretariat, there were no other subsequent events between the valuation date and the date of this report that would have a material impact on the results of this valuation.


Daniel Hébert, F.C.I.A., F.S.A.
Senior Actuary
Office of the Chief Actuary


Ottawa, Canada
25 May 2012

## Appendix 1 - Summary of Plan Provisions

Following is a summary description of the main provisions of the Supplementary Death Benefit plan established for public servants under Part II - Supplementary Death Benefits of the Public Service Superannuation Act (PSSA). This plan supplements benefits payable under the pension plan by providing a lump sum benefit upon the death of a plan participant.

## A. Plan Participants

## 1. Non-Elective Participants

The term Non-elective participant means all contributors to the pension plan established under the PSSA who are employed in the Public Service except employees of Crown corporations covered under other group life insurance plans.

## 2. Elective Participants

The term Elective participant means all participants who have ceased to be employed in the Public Service following disability or retirement and have opted for continuing their coverage under the Supplementary Death Benefit plan. Such right is limited to participants who, at the time they ceased to be employed in the Public Service, have completed at least two years of continuous service in the Public Service or two years of membership in the Supplementary Death Benefit plan.
A non-elective participant who ceases employment and becomes entitled to a PSSA immediate annuity or annual allowance automatically becomes an elective participant. During the first 30 days as an elective participant, an individual has the right to opt out of the plan, effective on the $31^{\text {st }}$ day.

## B. Contributions

1. Non-Elective Participants, and Elective Participants in Receipt of an Immediate Annuity or an Annual Allowance
For non-elective participants as well as elective participants in receipt of an immediate annuity (disability or retirement) or an annual allowance, the rate of contribution is 15 cents per month for each $\$ 1,000$ of death benefit. When these participants attain age 65 (or complete two years of service, if later), their contribution is reduced by $\$ 1.50$ per month in recognition of the fact that $\$ 10,000$ of basic benefit becomes paid-up (by the Government) for the remaining lifetime of the participant.

## 2. Elective Participants Entitled to a Deferred Annuity

For elective participants entitled to a deferred annuity, the contribution rate varies in accordance with the attained age of the participant, and the corresponding contributions become chargeable on the 30th day immediately following cessation of employment.

The contribution rates for selected ages are shown in the following table:
Table 4 Contribution per \$2,000 of Death Benefit

| Age Last Birthday | Annual | Monthly |
| :---: | :---: | :---: |
| 25 | $\$ 9.70$ | $\$ 0.82$ |
| 30 | 11.42 | 0.97 |
| 35 | 13.58 | 1.15 |
| 40 | 16.29 | 1.39 |
| 45 | 19.72 | 1.67 |
| 50 | 24.11 | 2.05 |
| 55 | 29.80 | 2.53 |
| 60 | 37.65 | 3.20 |

## 3. Government

The Government credits monthly to the PSDB Account an amount equal to one-twelfth of the total amount of death benefits paid in the month.

Crown corporations and public boards whose employees are participants contribute at the rate of four cents per month for each $\$ 1000$ of death benefit.
When a participant, other than one entitled to a deferred annuity, reaches age 65 (or completes two years of service, if later), the Government credits to the PSDB Account a single premium for the individual $\$ 10,000$ paid-up portion of basic benefit in respect of which contributions are no longer required from the participant.
The legislated amount of single premium for each such $\$ 10,000$ paid-up portion of basic benefit is shown in the following table and corresponds to one-twentieth of $\$ 10,000$ times the single premium rate for each dollar of death benefit, computed on the basis of the Life Tables, Canada, 1950-1952 and interest at 4\% per annum.

Table 5 Legislated Single Premium per \$10,000 of Basic Benefit

| Age Last Birthday | Male | Female |
| :---: | :---: | :---: |
| 65 | $\$ 310$ | $\$ 291$ |
| 66 | 316 | 298 |
| 67 | 323 | 306 |
| 68 | 329 | 313 |
| 69 | 336 | 320 |
| 70 | 343 | 328 |
| 71 | 349 | 335 |
| 72 | 356 | 342 |
| 73 | 362 | 349 |
| 74 | 369 | 356 |
| 75 | 375 | 363 |

Under the statutes, if for whatever reason the PSDB Account were to become exhausted, the Government would then credit special contributions to the Account in an amount at least equal to the basic benefits then due but not paid by reason of such cash shortfall.

## C. Amount of Basic Benefit

Subject to the applicable reductions described below, the lump sum benefit payable upon the death of a participant is equal to twice the participant's current salary, the result being rounded to the next higher multiple of $\$ 1,000$ if not already equal to such a multiple. For this purpose, the current salary of an elective participant is defined as the annual rate of pay at the time of cessation of employment in the Public Service.
The amount of basic benefit described above is reduced by $10 \%$ a year starting at age 66 until it would normally vanish at age 75. However, the amount of basic benefit cannot at any time be reduced below a basic floor value of $\$ 10,000$ subject to the following exceptions:

- For those elective participants who had, upon cessation of employment prior to 5 October 1992, made an election to reduce their basic benefit to \$500 and further had made a second election, within one year thereafter, to keep their basic benefit at $\$ 500$, the floor value is $\$ 500$ instead of $\$ 10,000$. Such election is irrevocable.
- For non-elective participants, the amount of basic benefit cannot be reduced below the multiple of $\$ 1,000$ equal to or next above one-third of the participant's annual salary, even if the resulting amount is higher than $\$ 10,000$.
- All participants aged between 61 and 70 prior to 1 October 1999 may elect to retain the $10 \%$ a year reduction schedule starting at age 61 .
- For elective participants entitled to a deferred annuity there is no coverage past age 75.

Upon ceasing to be employed in the Public Service, elective participants in receipt of an immediate annuity or in receipt of an annual allowance under the PSSA may opt to reduce their amount of basic benefit to $\$ 10,000$.

## Appendix 2 - PSDB Account Balance Available for Benefits



## A. Public Service Death Benefit Account

The plan is entirely financed through the PSDB Account, which forms part of the Accounts of Canada. The PSDB Account consists of notional assets. No formal debt instrument has been issued to the Account by the government in recognition of the amounts therein. The PSDB Account is:

- credited with all contributions made by participants, Crown corporations and the Government;
- credited with interest earnings every three months on the basis of the actual average yield for the same period on the combined Superannuation Accounts of the Public Service, Canadian Forces and Royal Canadian Mounted Police pension plans. These accounts generate interest earnings as though net cash flows were invested quarterly in 20-year Government of Canada bonds issued at prescribed interest rates and held to maturity; and
- debited with basic benefit payments when they become due.

Table 6 shows the reconciliation of the balance of the PSDB Account from the last valuation date to the current valuation date. Since the last valuation, the PSDB Account balance has grown by $\$ 391$ million (i.e. a 15\% increase) to reach \$2,961 million as at 31 March 2011. The net growth in the Account balance is to a large extent the result of interest credits made.
Table 6 Public Service Death Benefit Account (\$ millions)

| Plan Year | $\mathbf{2 0 0 9}$ | $\mathbf{2 0 1 0}$ | $\mathbf{2 0 1 1}$ | $\mathbf{2 0 0 9 - 2 0 1 1}$ |
| :--- | ---: | ---: | ---: | ---: |
| Opening balance | 2,570 | 2,702 | 2,829 | 2,570 |
| INCOME |  |  |  |  |
| $\quad$ Employee contributions | 81 | 88 | 93 | 262 |
| $\quad$ Employer contributions |  |  |  |  |
| $\quad$ - Term insurance | 10 | 11 | 11 | 32 |
| $\quad$ - Paid-up insurance | 2 | 2 | 2 | 6 |
| $\quad$ Interest earnings | $\underline{179}$ | $\underline{180}$ | $\underline{182}$ | $\underline{541}$ |
| Subtotal |  | 281 | 288 | 841 |
| EXPENDITURES |  |  |  |  |
| $\quad$ Death benefit claims | 102 | 114 | 120 | 336 |
| $\quad$ - Term insurance | $\underline{38}$ | $\underline{40}$ | $\underline{36}$ | $\underline{114}$ |
| $\quad$ Paid-up insurance | 140 | 154 | 156 | 450 |
| Subtotal | 2,702 | 2,829 | 2,961 | 2,961 |
| Closing balance |  |  |  |  |

B. Rates of Interest

The following rates of interest on the PSDB Account by plan year were calculated using the foregoing entries.
Table 7 Rates of Interest

| Plan Year | Interest |
| :---: | :---: |
| 2009 | $7.09 \%$ |
| 2010 | $6.79 \%$ |
| 2011 | $6.55 \%$ |

C. Sources of the PSBD Account Available for Benefits

The Account entries shown previously were taken from the Accounts of Canada.

## D. Account Projection

The following table shows a projection of the PSDB Account over 25 years commencing 1 April 2011.

Table 8 Account Projection
(\$ millions)

| Plan Year | Balance Sheet at the End of Plan Year |  |  | Ratio of Projected Actuarial Excess at the End of the Plan Year to Annual Benefit Payments Projected for the following Plan Year |
| :---: | :---: | :---: | :---: | :---: |
|  | Account | Liabilities | Actuarial Excess |  |
| 2011 | 2,961 | 554 | 2,407 | 14.7 |
| 2012 | 3,085 | 579 | 2,507 | 14.8 |
| 2013 | 3,206 | 605 | 2,600 | 14.9 |
| 2014 | 3,324 | 632 | 2,692 | 14.9 |
| 2015 | 3,440 | 659 | 2,781 | 14.9 |
| 2016 | 3,552 | 687 | 2,865 | 14.9 |
| 2017 | 3,662 | 715 | 2,947 | 14.8 |
| 2018 | 3,773 | 745 | 3,028 | 14.7 |
| 2019 | 3,885 | 775 | 3,109 | 14.7 |
| 2020 | 3,997 | 806 | 3,191 | 14.6 |
| 2021 | 4,114 | 836 | 3,277 | 14.5 |
| 2022 | 4,232 | 866 | 3,365 | 14.5 |
| 2023 | 4,354 | 897 | 3,457 | 14.4 |
| 2024 | 4,482 | 928 | 3,555 | 14.3 |
| 2025 | 4,611 | 958 | 3,653 | 14.2 |
| 2026 | 4,744 | 987 | 3,757 | 14.1 |
| 2027 | 4,887 | 1,016 | 3,871 | 14.1 |
| 2028 | 5,035 | 1,044 | 3,990 | 14.0 |
| 2029 | 5,188 | 1,071 | 4,117 | 13.9 |
| 2030 | 5,352 | 1,098 | 4,253 | 13.9 |
| 2031 | 5,521 | 1,122 | 4,399 | 13.8 |
| 2032 | 5,707 | 1,145 | 4,562 | 13.8 |
| 2033 | 5,901 | 1,166 | 4,735 | 13.8 |
| 2034 | 6,109 | 1,188 | 4,921 | 13.9 |
| 2035 | 6,331 | 1,210 | 5,121 | 13.9 |
| 2036 | 6,563 | 1,231 | 5,332 | 14.0 |

## ACTUARIAL REPORT

Public Service Death Benefit Account
as at 31 March 2011

## E. Income and Expenditure Projection

The following table shows a projection of the income and expenditure which served as the basis of the projection of the PSDB Account over 25 years commencing with plan year 2012.
Table 9 Income and Expenditure Projection
(\$ millions)

| Plan <br> Year | Contributions |  |  |  | Benefit Payments |  |  | Interest Credits | Net Credits |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Participants | Government ${ }^{1}$ |  | Total |  |  |  |  |  |
|  |  | Term | Paid-Up |  | Term | Paid-Up | Total |  |  |
| 2012 | 97 | 12.0 | 2.7 | 112 | 123 | 41 | 163 | 176 | 124 |
| 2013 | 100 | 12.6 | 2.8 | 115 | 128 | 41 | 169 | 174 | 120 |
| 2014 | 103 | 13.1 | 2.8 | 118 | 134 | 41 | 175 | 175 | 118 |
| 2015 | 105 | 13.7 | 2.8 | 122 | 139 | 42 | 181 | 175 | 116 |
| 2016 | 108 | 14.2 | 2.9 | 125 | 144 | 42 | 186 | 174 | 112 |
| 2017 | 113 | 14.8 | 3.0 | 130 | 150 | 42 | 193 | 172 | 110 |
| 2018 | 117 | 15.4 | 3.1 | 136 | 156 | 43 | 199 | 174 | 111 |
| 2019 | 122 | 16.1 | 3.2 | 141 | 162 | 43 | 205 | 176 | 112 |
| 2020 | 127 | 16.7 | 3.2 | 147 | 168 | 44 | 212 | 177 | 112 |
| 2021 | 133 | 17.4 | 3.2 | 153 | 174 | 45 | 219 | 182 | 117 |
| 2022 | 139 | 18.1 | 3.2 | 160 | 180 | 45 | 226 | 184 | 118 |
| 2023 | 145 | 18.7 | 3.2 | 167 | 186 | 46 | 233 | 189 | 123 |
| 2024 | 151 | 19.5 | 3.2 | 174 | 193 | 48 | 240 | 194 | 128 |
| 2025 | 158 | 20.2 | 3.3 | 181 | 200 | 49 | 248 | 196 | 128 |
| 2026 | 165 | 21.0 | 3.3 | 189 | 207 | 50 | 257 | 201 | 133 |
| 2027 | 172 | 21.8 | 3.2 | 197 | 214 | 52 | 266 | 212 | 143 |
| 2028 | 179 | 22.6 | 3.2 | 205 | 222 | 54 | 275 | 218 | 148 |
| 2029 | 187 | 23.4 | 3.2 | 213 | 230 | 55 | 285 | 225 | 153 |
| 2030 | 195 | 24.3 | 3.2 | 222 | 238 | 57 | 295 | 237 | 164 |
| 2031 | 203 | 25.3 | 3.0 | 231 | 247 | 60 | 306 | 244 | 169 |
| 2032 | 212 | 26.3 | 2.9 | 241 | 256 | 62 | 318 | 263 | 186 |
| 2033 | 221 | 27.3 | 2.9 | 251 | 265 | 64 | 330 | 272 | 194 |
| 2034 | 231 | 28.3 | 3.0 | 262 | 275 | 67 | 342 | 287 | 208 |
| 2035 | 241 | 29.5 | 3.0 | 274 | 286 | 69 | 355 | 303 | 222 |
| 2036 | 252 | 30.6 | 3.1 | 286 | 296 | 72 | 368 | 314 | 232 |

[^3]
## Appendix 3 - Participant Data

## A. Source of Participant Data

As a consequence of the Pension Modernization project, the structure of the data provided to the Office of the Superintendent of Financial Institutions (OSFI) has changed. Previously, the Compensation Systems Branch of Department of Public Works and Government Services Canada (PWGSC) was responsible for summarizing all relevant data into a single file. Beginning with the previous valuation report, the Compensation Systems Branch simply provides OSFI with multiple files reflecting the raw data as it exists in their system.

Subsequently, OSFI validates and corrects the data before transforming it into a structure amenable to analysis, interpretation, and valuation.
The data provided contains all required information in respect of contributors, pensioners and survivors. In particular, the data shows the historical progression of members during the period from 31 March 2008 to 31 March 2011 as required for reconciliation and experience studies.

## B. Participant Data Summary

Tables 10 to 12 on the following pages show the detailed participant data upon which this valuation is based. Comparisons are made with the population used in the previous actuarial report as at 31 March 2008.

Public Service Death Benefit Account
as at 31 March 2011
Table 10 Non-Elective Participants ${ }^{1}$
As at 31 March 2011

| Age ${ }^{2}$ | Number |  |  | Basic Benefits (\$ thousands) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Male | Female | Total | Male | Female | Total |
| 15-19 | 58 | 55 | 113 | 3,294 | 3,347 | 6,641 |
| 20-24 | 2,889 | 4,275 | 7,164 | 277,926 | 407,552 | 685,478 |
| 25-29 | 11,233 | 16,098 | 27,331 | 1,306,301 | 1,838,374 | 3,144,675 |
| 30-34 | 16,216 | 23,513 | 39,729 | 2,158,606 | 3,001,662 | 5,160,268 |
| 35-39 | 17,660 | 24,040 | 41,700 | 2,541,266 | 3,265,295 | 5,806,561 |
| 40-44 | 18,366 | 24,034 | 42,400 | 2,772,567 | 3,308,050 | 6,080,617 |
| 45-49 | 22,521 | 28,402 | 50,923 | 3,448,722 | 3,881,808 | 7,330,530 |
| 50-54 | 23,839 | 29,401 | 53,240 | 3,727,141 | 4,009,640 | 7,736,780 |
| 55-59 | 17,230 | 17,887 | 35,117 | 2,733,579 | 2,394,942 | 5,128,521 |
| 60-64 | 7,635 | 6,673 | 14,308 | 1,215,727 | 858,399 | 2,074,126 |
| 65-69 | 1,829 | 1,243 | 3,072 | 302,697 | 155,641 | 458,338 |
| 70-74 | 147 | $\underline{93}$ | $\underline{240}$ | 26,118 | 10,626 | 36,744 |
| Total | 139,623 | 175,714 | 315,337 | 20,513,944 | 23,135,335 | 43,649,279 |


| As at 31 March 2008 | Average | Male | Female | Total |
| :--- | ---: | :---: | :---: | :---: |
|  | Age $^{2}$ | 45.5 | 43.4 | 44.4 |
|  | 13.9 | 12.5 | 13.1 |  |
|  | Basic Benefit (\$) | 136,954 | 121,135 | 128,142 |
|  |  |  |  |  |
| As at 31 March 2011 |  |  |  |  |
|  | Age $^{2}$ | 45.3 | 43.5 | 44.4 |
|  | Service $^{2}$ | 13.1 | 12.2 | 12.6 |
|  | Basic Benefit $(\$)$ | 146,924 | 131,665 | 138,421 |

[^4]Table 11 Elective Participants in Receipt of a Disability Pension
As at 31 March 2011

| Age ${ }^{1}$ | Number |  |  | Basic Benefits (\$ thousands) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Male | Female | Total | Male | Female | Total |
| 30-34 | 8 | 14 | 22 | 834 | 1,372 | 2,206 |
| 35-39 | 10 | 66 | 76 | 1,236 | 6,776 | 8,012 |
| 40-44 | 50 | 179 | 229 | 5,709 | 18,489 | 24,198 |
| 45-49 | 162 | 455 | 617 | 17,096 | 43,399 | 60,495 |
| 50-54 | 470 | 1,039 | 1,509 | 48,094 | 99,141 | 147,235 |
| 55-59 | 898 | 1,442 | 2,340 | 89,367 | 132,346 | 221,713 |
| 60-64 | 1,094 | 1,276 | 2,370 | 99,543 | 106,300 | 205,843 |
| 65-69 | 786 | 740 | 1,526 | 51,374 | 42,685 | 94,059 |
| 70-74 | 774 | 678 | 1,452 | 16,972 | 13,099 | 30,071 |
| 75-79 | 625 | 475 | 1,100 | 6,250 | 4,750 | 11,000 |
| 80-84 | 375 | 270 | 645 | 3,750 | 2,700 | 6,450 |
| 85-89 | 257 | 173 | 430 | 2,570 | 1,730 | 4,300 |
| 90-94 | 66 | 55 | 121 | 660 | 550 | 1,210 |
| 95-99 | 4 | 15 | 19 | 40 | 150 | 190 |
| 100-104 | $\underline{3}$ | $\underline{0}$ | $\underline{3}$ | $\underline{30}$ | $\underline{0}$ | $\underline{30}$ |
| Total | 5,582 | 6,877 | 12,459 | 343,526 | 473,488 | 817,013 |


| As at 31 March 2008 | Average | Male | Female | $\frac{\text { Total }}{}$ | Age $^{1}$ |
| :--- | :---: | :---: | :---: | :---: | :---: |


| As at 31 March 2011 | Age $^{1}$ | 60.0 | 57.0 | 58.3 |
| :--- | ---: | :---: | :---: | :---: |
|  | Basic Benefit (\$) | 61,542 | 68,851 | 65,576 |

[^5]Public Service Death Benefit Account
as at 31 March 2011
Table 12 Elective Retired Participants ${ }^{1}$
(In Receipt of an Immediate Annuity or an Annual Allowance)
As at 31 March 2011

| Age ${ }^{2}$ | Number |  |  | Basic Benefits <br> (\$ thousands) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Male | Female | Total | Male | Female | Total |
| 50-54 | 469 | 677 | 1,146 | 68,399 | 87,559 | 155,958 |
| 55-59 | 7,869 | 8,603 | 16,472 | 1,218,459 | 1,142,267 | 2,360,726 |
| 60-64 | 17,447 | 13,117 | 30,564 | 2,537,777 | 1,538,341 | 4,076,119 |
| 65-69 | 16,470 | 9,428 | 25,898 | 1,678,487 | 745,254 | 2,423,741 |
| 70-74 | 11,656 | 5,813 | 17,469 | 419,789 | 157,486 | 577,275 |
| 75-79 | 10,237 | 4,272 | 14,509 | 102,370 | 42,720 | 145,090 |
| 80-84 | 8,706 | 3,646 | 12,352 | 87,060 | 36,460 | 123,520 |
| 85-89 | 6,739 | 3,031 | 9,770 | 67,390 | 30,310 | 97,700 |
| 90-94 | 2,599 | 1,361 | 3,960 | 25,990 | 13,610 | 39,600 |
| 95-99 | 421 | 344 | 765 | 4,210 | 3,440 | 7,650 |
| 100-104 | 30 | 48 | 78 | 300 | 480 | 780 |
| 105-109 | $\underline{0}$ | 4 | $\underline{4}$ | $\underline{0}$ | 40 | $\underline{40}$ |
| Total | 82,643 | 50,344 | 132,987 | 6,210,232 | 3,797,968 | 10,008,200 |


| As at 31 March 2008 | Average | $\underline{\text { Male }}$ | $\underline{\text { Female }}$ | $\underline{\text { Total }}$ |
| :--- | :---: | :---: | :---: | :---: |
|  | Age $^{2}$ | 63.6 | 62.3 | 63.2 |
|  | Basic Benefit (\$) | 66,571 | 63,098 | 65,378 |

As at 31 March 2011

| Age $^{2}$ | 63.9 |
| ---: | :---: |
| Basic Benefit (\$) | 75,145 |

62.3
75,440
63.3

75,257

[^6]
## Appendix 4 - Methodology

## A. PSDB Account available for benefits

The account available for benefits of the plan consists essentially of the recorded balance in the PSDB Account, which forms part of the Accounts of Canada. The account is considered notional assets, meaning that no debt instrument has been issues to the PSDB Account by the government in recognition of the amounts therein. These assets are shown at the book value of the underlying notional bond portfolio described in Appendix 2.
The PSDB Account balance corresponds to the cumulative historical excess of contributions and interest credits over basic benefit payments. The PSDB Account available for benefits is accordingly projected to the end of a given plan year by adding to the PSDB Account at the beginning of that plan year the net income (i.e. the excess of contributions and interest credits over benefits) projected as described below for that plan year. Administration expenses are ignored because they are not charged to the PSDB Account.

## B. Contributions

## 1. Participants

Participants' annual contributions are projected for a given plan year by multiplying

- the legislated annual contribution rate of $\$ 1.80$ per $\$ 1,000$ of coverage (equivalent to the monthly rate of 15 cents per $\$ 1,000$ of coverage)
by
- the aggregate of two times the salaries of participants projected for that plan year on an open-group basis, less
- the $10 \%$ a year reduction from age 66 if applicable, and
- the $\$ 10,000$ paid-up coverage after age 65 , if applicable.

Non-elective participants’ salaries are projected for a given plan year using the assumed rates of increase described in Appendix 5 and by the assumed seniority and promotional salary increases described in table 14. Elective participants’ salaries are frozen at time of retirement or disability and are not subject to further increases.

## 2. Government

The Government's annual contribution is projected for a given plan year as the sum of:

- one-twelfth of the amount of term insurance death benefits projected to be paid during that plan year, and
- the legislated single premiums in respect of relevant participants 65 years of age (or participants completing two years of service, if older).


## 3. Crown Corporations and Public Boards

Crown corporations’ and public boards’ annual contributions are projected for a given plan year by multiplying

- the legislated annual contribution rate of $\$ 0.48$ per $\$ 1,000$ of coverage (equivalent to the monthly rate of 4 cents per $\$ 1,000$ of coverage)
by
- the aggregate of two times the salaries of each participant who is employed by the Crown corporation or public board projected for that plan year on an open-group basis,
less
- the $10 \%$ a year reduction from age 66 if applicable, and
- the $\$ 10,000$ paid-up coverage after age 65, if applicable.


## C. Discount Rates

The rates used to calculate the present value of actuarial liabilities in respect of paid-up death benefits are the same as the yields described and shown in Appendix 5.
D. Interest Credits

Annual interest credits are projected for a given plan year as the product of the yield projected for that plan year (Appendix 5) and the projected average PSDB Account balance in that plan year.

## E. Treatment of Correctional Service Canada (CSC) Elective Employees

For simplification, all employees of CSC have been treated as Operational service employees. As at 31 March 2011, approximately 12,000 employees of CSC were reported as operational as compared to approximately 500 non-operational employees. Considering non-operational employees as operational employees has a negligible impact on the results of the valuation.

## F. Basic Benefit Payments

The total amount of basic benefits (term and paid-up insurance) for a given plan year is projected as the total amount of insurance in force during that plan year multiplied by the mortality rates assumed to apply during that plan year. The amount of basic benefit in force depends on the salary projected to time of death. Salaries are projected for this purpose using the assumed rates of increase in salaries and the number of participants projected on an open-group basis as described in Appendix 6.

## G. Liabilities

## 1. Paid-up Reserve

At the end of a given plan year, the liabilities associated with the individual $\$ 10,000$ paid-up death benefit in force correspond to the amount which, together with interest at the projected yields, is sufficient to pay for each individual $\$ 10,000$ paid-up death benefit projected payable on the basis of the assumed mortality rates.

## 2. IBNR and Pending Claims Reserves

On the basis of the plan's experience, the reserve at the end of a given plan year for claims incurred but not reported (IBNR), and for pending claims is set equal to one-sixth of the projected annual death benefits paid on average during the six previous plan years.

## 3. Extension of Coverage

Due to the negligible financial impact of the 30-day extension of the basic benefit upon termination of coverage and to the nature of basic benefit paid for on a monthly basis, no explicit liability was calculated in respect of that basic benefit provision.

## Appendix 5 - Economic Assumptions

The following economic assumptions are required for valuation purposes:

## A. Increases in Average Earnings

Salary increases consist of a combination of inflation, productivity growth (i.e. real ${ }^{1}$ increase in average employment earnings in excess of inflation) and seniority and promotional increase. Seniority and promotion is strongly service-based and is therefore considered to be a demographic assumption rather than an economic assumption.
The assumed increase in average earnings ${ }^{2}$ was $1.75 \%, 1.5 \%$ and $2.0 \%$ for plan years 2012, 2013 and 2014, respectively, based on recently approved contracts which apply to the majority of non-elective participants. The assumed increase in average earnings ${ }^{2}$ for plan years 2015+ was calculated as the sum of assumed inflation and assumed productivity growth.
Price increases, as measured by changes in the Consumer Price Index, tend to fluctuate from year to year. Based on the renewed commitment of the Bank of Canada and the Government to keep inflation between $1 \%$ and $3 \%$ until the end of 2016, a rate of price increase of $2.0 \%$ is assumed for plan years 2012 to 2017, steadily increasing to $2.3 \%$ for plan year 2021. The ultimate rate of $2.3 \%$ is $0.1 \%$ lower than the assumed rate in the previous valuation.
An ultimate real-wage differential of $1.2 \%$ is assumed to be reached in plan year 2022. The ultimate real-wage differential assumption combined with the ultimate price increase assumption results in an assumed annual increase in nominal wages of $3.5 \%$ in 2022 and thereafter.

The resulting assumed increases in average earnings ${ }^{2}$ are shown in table 13.
B. Projected Yields on PSDB Account

These yields are required for the long-term projection of the actuarial Account value available for benefits, liabilities and excess or deficit. The projected yields on the PSDB Account are the projected annual yields on the combined book value of the Superannuation Accounts of the Public Service, Canadian Forces, and the Royal Canadian Mounted Police pension plans.

[^7]Table 13 Summary of Economic Assumptions
(percentage)

| Plan Year | Average Salary Increase ${ }^{1}$ of <br> Non-Elective Participants | Projected Yield |
| :---: | :---: | :---: |
| 2012 | 1.75 | 6.00 |
| 2013 | 1.50 | 5.70 |
| 2014 | 2.00 | 5.50 |
| 2015 | 2.60 | 5.30 |
| 2016 | 2.70 | 5.10 |
| 2017 | 2.80 | 4.90 |
| 2018 | 2.90 | 4.80 |
| 2019 | 3.00 | 4.70 |
| 2020 | 3.20 | 4.60 |
| 2021 | 3.40 | 4.60 |
| 2022 | 3.50 | 4.50 |
| 2023 | 3.50 | 4.50 |
| 2024 | 3.50 | 4.50 |
| 2025 | 3.50 | 4.40 |
| 2026 | 3.50 | 4.40 |
| 2027 | 3.50 | 4.50 |
| 2028 | 3.50 | 4.50 |
| 2029 | 3.50 | 4.50 |
| 2030 | 3.50 | 4.60 |
| 2031 | 3.50 | 4.60 |
| 2032 | 3.50 | 4.80 |
| 2033 | 3.50 | 4.80 |
| 2034 | 3.50 | 4.90 |
| 2035 | 3.50 | 5.00 |
| 2036 | 3.50 | 5.00 |
| $2037+$ | 3.50 | 5.00 |
|  |  |  |

[^8]
## Appendix 6 - Demographic and Other Assumptions

All contributors to the Public Service pension plan are covered by a supplementary death benefit as defined under Part II of the PSSA. Hence, given the size of the population subject to the PSSA, except where otherwise noted, all demographic assumptions were determined using the Public Service pension plan's own experience, as was done in the past. Where applicable, assumptions used in the previous valuation were updated to reflect the intervaluation experience.

## A. Demographic Assumptions

## 1. Seniority and Promotional Salary Increases

Seniority means length of service within a classification and promotion means moving to a higher paid classification.

The experience of the last three years compares closely to the assumptions reported in the last valuation report. Partial credibility was given to the experience from 1 April 2009 to 31 March 2011. For males with 0-8 years of service and 9-30 years of service the assumption is on average $3 \%$ higher and $3 \%$ lower respectively than the rates shown in the previous valuation report. For females in the same service range, the assumption was on average $5 \%$ higher and $1.5 \%$ lower respectively than the rates shown in the previous valuation report.

Table 14 Sample of Assumed Seniority and Promotional Salary Increases (Percentage of annual earnings)

| Completed Years of <br> Pensionable Service | Male | Female |
| :---: | :---: | :---: |
| 0 | 5.2 | 5.5 |
| 1 | 4.7 | 4.9 |
| 2 | 4.2 | 4.3 |
| 3 | 3.9 | 3.9 |
| 4 | 3.5 | 3.5 |
| 5 | 3.2 | 3.2 |
| 6 | 2.9 | 2.9 |
| 7 | 2.7 | 2.7 |
| 8 | 2.5 | 2.4 |
| 9 | 2.3 | 2.3 |
| 10 | 2.1 | 2.1 |
| 15 | 1.6 | 1.7 |
| 20 | 1.2 | 1.4 |
| 25 | 1.0 | 1.3 |
| 30 | 0.8 | 1.1 |

## 2. New Participants

It was assumed that the distribution of new participants by age and sex would be the same as that of participants with less than one year of service at the valuation date. The assumed percentage increases for each plan year are shown in the following table:

Table 15 Assumed Annual Increases in Number of Non-Elective Participants

| Plan year | Percentage |
| :---: | :---: |
| 2012 | -1.0 |
| 2013 | -1.5 |
| 2014 | -1.5 |
| 2015 | -2.5 |
| $2016+$ | 0.8 |

The initial salary of new members in a given age-sex cell in plan year 2012 is assumed to be the same as the corresponding experience in plan year 2011 with an economic salary increase for plan year 2012. Initial salary is assumed to increase in future years in accordance with the assumption for average earnings increases.

## 3. Pensionable Retirement

The assumed rates of pensionable retirement were revised to reflect the intervaluation experience. Overall, Public Service contributors have delayed their retirement when given the option of an annual allowance, but a higher number of contributors chose to retire when the immediate annuity became available below the age of 60. Members between the ages of 60 and 65 also delayed their retirement, again maybe because of the economic downturn and uncertainty.

The rates assumed for the main group of contributors were reduced by an average of 2\% for the age and service combination that would provide for an annual allowance below 60 , and increased by an average of $10 \%$ for the age/service combination that would provide for an immediate annuity. Retirement rates between the ages of 60 and 65 were reduced by an average of $14 \%$.

The pensionable retirement rates for the operational service group were also changed to give partial credibility to the intervaluation experience

The following tables provide sample rates of pensionable retirement.
Table 16 Sample of Assumed Rates of Retirement - Main Group - Male (Per 1,000 individuals)

|  | Completed Years of Pensionable Service |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | :---: | :---: | :---: | ---: |
| Age | 1 | 2 | 10 | 20 | 29 | 30 | 35 |
| 50 | 50 | 42 | 13 | 7 | 9 | 12 | 52 |
| 55 | 74 | 65 | 23 | 21 | 233 | 182 | 478 |
| 60 | 122 | 117 | 98 | 131 | 247 | 217 | 409 |
| 65 | 235 | 212 | 244 | 247 | 287 | 279 | 405 |
| 70 | 435 | 344 | 327 | 583 | 318 | 600 | 386 |

Table 17 Sample of Assumed Rates of Retirement - Main Group - Female (Per 1,000 individuals)

|  | Completed Years of Pensionable Service |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Age | 1 | 2 | 10 | 20 | 29 | 30 | 35 |
| 50 | 52 | 54 | 15 | 11 | 13 | 16 | 20 |
| 55 | 89 | 84 | 32 | 39 | 283 | 223 | 400 |
| 60 | 105 | 106 | 134 | 199 | 281 | 254 | 318 |
| 65 | 207 | 212 | 282 | 312 | 370 | 325 | 306 |
| 70 | 299 | 307 | 268 | 347 | 299 | 244 | 282 |

Table 18 Sample of Assumed Rates of Retirement - Operational Service Group (Per 1,000 individuals)

|  | Completed Years of Pensionable Service |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Age | 1 | 2 | 10 | 19 | 20 | 30 | 35 |
| $34-47$ | 0 | 0 | 0 | 4 | 4 | 70 | 0 |
| 48 | 0 | 0 | 0 | 10 | 5 | 112 | 0 |
| 50 | 43 | 34 | 12 | 11 | 12 | 147 | 85 |
| 55 | 124 | 95 | 41 | 41 | 38 | 227 | 559 |
| 60 | 114 | 112 | 116 | 163 | 165 | 236 | 364 |
| 65 | 221 | 212 | 263 | 283 | 280 | 302 | 356 |

## 4. Disability Retirement

The disability incidence rate assumptions were revised to reflect the intervaluation experience. The assumed disability incidence rates for males were on average $5 \%$ lower than in the previous valuation. The assumed disability incidence rates for females were on average $7 \%$ higher than in the previous valuation

Table 19 Sample of Assumed Rates of Pensionable Disability
(Per 1,000 individuals)

| Age | Male | Female |
| :---: | :---: | :---: |
| 25 | 0.15 | 0.05 |
| 35 | 0.19 | 0.66 |
| 45 | 1.19 | 2.18 |
| 55 | 3.86 | 5.91 |
| 58 | 5.21 | 8.53 |

## 5. Withdrawal

Withdrawal means ceasing to be employed for reasons other than death or retirement with an immediate annuity or an annual allowance.

In all previous actuarial reports, the withdrawal assumptions had been set on the basis of pensionable service accrued at time of departure. A review of the experience of the last ten years has shown that our actuarial model would benefit from introducing a withdrawal assumption based on both age and service as opposed to only service.

In order to develop the new assumption based on age and service so that it would be considered appropriate given the pre- and post-2008 economic conditions, the experience of the population subject to the PSSA over the last eight years was used. Overall, the withdrawal rates based on age and service are in line with the previous service based assumptions if only service is considered. However, the rates are substantially different when age is factored into the equation. For example, the assumption for males based on a service last of zero is around 203 per 1,000 individuals as compared to 207 per 1,000 individuals assumed in the previous actuarial valuation. As shown in table 20, the service zero rates vary significantly by age.
The following tables provide a sample of assumed rates of withdrawal.
Table 20 Sample of Assumed Rates of Withdrawal - Main Group - Male (Per 1,000 individuals)

|  | Completed Years of Pensionable Service |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Age | 0 | 1 | 5 | 10 | 20 | 25 | 30 |
| 20 | 305 | 299 | 35 | 0 | 0 | 0 | 0 |
| 25 | 124 | 108 | 28 | 20 | 0 | 0 | 0 |
| 30 | 99 | 82 | 27 | 12 | 0 | 0 | 0 |
| 35 | 88 | 74 | 23 | 12 | 6 | 0 | 0 |
| 40 | 82 | 69 | 23 | 14 | 6 | 7 | 0 |
| 45 | 84 | 68 | 17 | 13 | 5 | 4 | 2 |
| 48 | 93 | 72 | 17 | 14 | 7 | 4 | 5 |
| 50 | 125 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 21 Sample of Assumed Rates of Withdrawal - Main Group - Female (Per 1,000 individuals)

|  | Completed Years of Pensionable Service |  |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Age | 0 | 1 | 5 | 10 | 20 | 25 | 30 |
| 20 | 290 | 283 | 45 | 0 | 0 | 0 | 0 |
| 25 | 113 | 97 | 22 | 15 | 0 | 0 | 0 |
| 30 | 98 | 80 | 19 | 7 | 0 | 0 | 0 |
| 35 | 94 | 76 | 21 | 12 | 5 | 0 | 0 |
| 40 | 96 | 79 | 23 | 15 | 7 | 9 | 0 |
| 45 | 111 | 87 | 22 | 14 | 6 | 4 | 4 |
| 48 | 128 | 99 | 24 | 17 | 9 | 8 | 4 |
| 50 | 159 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 22 Sample of Assumed Rates of Withdrawal - Operational Group
(Per 1,000 individuals)

|  | Completed Years of Pensionable Service |  |  |  |  |  |
| :---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Age | 0 | 1 | 5 | 10 | 15 | 18 |
| 20 | 90 | 76 | 23 | 0 | 0 | 0 |
| 25 | 39 | 34 | 8 | 23 | 0 | 0 |
| 30 | 36 | 30 | 16 | 16 | 11 | 0 |
| 35 | 40 | 31 | 12 | 10 | 6 | 6 |
| 40 | 57 | 53 | 15 | 10 | 4 | 4 |
| 45 | 68 | 57 | 67 | 15 | 5 | 5 |
| 48 | 51 | 48 | 37 | 31 | 4 | 3 |
| 50 | 45 | 0 | 0 | 0 | 0 | 0 |
| 55 | 117 | 0 | 0 | 0 | 0 | 0 |
| 60 | 82 | 0 | 0 | 0 | 0 | 0 |

## 6. Elective Participants Entitled to a Deferred Annuity

Due to their negligible impact on costs and liabilities, actual and future deferred annuitants are not taken into consideration for the purpose of this valuation.

## 7. Mortality

The mortality rate assumption as applied to the Public Service pension plan was created by giving partial credibility to projected mortality rates from the previous actuarial report on the pension plan, and partial credibility to the intervaluation experience.
For the mortality rates of the pension plan as applied to the non-elective participants and elective participants who retired normally, these new base year mortality rates are lower at most ages. In particular, at ages 30-40, the assumed mortality rates declined by an average of $15 \%$ for males and $5 \%$ for females. For ages $65-75$, the assumed mortality rates declined by an average of $14 \%$ for males and $7 \%$ for females.

The assumed mortality rates for elective participants who retired on disability was lowered at almost all ages. Between the ages of 30 and 80, the assumed mortality rates were lowered by an average of $8 \%$ for males and $6 \%$ for females.
As was done in all previous actuarial reports on the Public Service Death Benefit Account, the resulting pension plan mortality assumption rates were applied to the elective and non-electives participants:

## Table 23 Sample of Assumed Rates of Mortality - Pension Plan

(Per 1,000 individuals)
Plan Year 2012

|  | Non-Elective Participants and Elective <br> Participants who Retired Normally <br> Male |  | Elective Participants who <br> Retired on Disability |  |
| ---: | ---: | ---: | ---: | :---: |
| Age | 0.5 | Female | Male | Female |
| 30 | 0.7 | 0.3 | 7.1 | 6.0 |
| 40 | 1.9 | 0.4 | 12.5 | 7.0 |
| 50 | 5.6 | 1.3 | 15.5 | 9.0 |
| 60 | 17.5 | 4.1 | 22.9 | 13.9 |
| 70 | 56.0 | 37.4 | 41.3 | 24.0 |
| 80 | 160.2 | 120.1 | 90.3 | 63.3 |
| 90 | 345.1 | 304.1 | 196.9 | 168.1 |
| 100 | 500.0 | 500.0 | 468.1 | 455.9 |
| 110 |  |  | 500.0 | 500.0 |

However, when the new mortality rates were introduced in the actuarial module for the projection of the SDB Account balance, it became apparent that the projected death benefit payments exceeded the actual death benefit payments of the last three years by a margin of at least $30 \%$. This situation has been the case in previous SDB actuarial reports, but the discrepancy between the observed and expected death benefit payments was not as large.
Many actuarial mortality studies have shown that there is a direct correlation between the earnings level of an individual and the incidence of mortality. That is, the higher the level of earnings, the lower the mortality incidence rate. The coverage level of a participant in the SDB plan is a function of his/her salary and, since the number of participants in the SDB plan is large enough, a study of mortality as a function of coverage was conducted over the period of plan years 2007 to 2011.
By observing the same number of deaths as under the Public Service pension plan, but taking into account the level of coverage by age, the overall mortality for plan year 2012 as shown in table 23 were reduced for ages 20 to 75 by $21 \%$ and $6 \%$ respectively for male and female participants. A sample of the new mortality rates as applied to the SDB plan is shown in table 24.

Table 24 Sample of Assumed Rates of Mortality - SDB Plan
(Per 1,000 individuals)
Plan Year 2012

|  | Non-Elective Participants and Elective <br> Participants who Retired Normally <br> Male |  | Elective Participants who <br> Retired on Disability |  |
| ---: | :---: | :---: | :---: | :---: |
| Age | 0.3 | Female | Male | Female |
| 30 | 0.5 | 0.1 | 7.1 | 6.0 |
| 40 | 1.8 | 0.3 | 12.5 | 7.0 |
| 50 | 4.3 | 1.3 | 15.5 | 9.0 |
| 60 | 14.4 | 11.3 | 22.9 | 13.9 |
| 70 | 53.4 | 36.7 | 41.3 | 24.0 |
| 80 | 160.5 | 117.1 | 90.3 | 63.3 |
| 90 | 351.0 | 315.0 | 196.9 | 168.1 |
| 100 | 500.0 | 500.0 | 468.1 | 455.9 |
| 110 |  |  | 500.0 | 500.0 |

As shown in the $25^{\text {th }}$ Actuarial Report on the Canada Pension Plan, life expectancy in Canada has been increasing constantly over the years. This trend is also observed in the population subject to the PSSA, as supported by analysis of past mortality experience. Mortality rates are reduced in the future in accordance with the same longevity improvement assumption used in the $25^{\text {th }}$ Actuarial Report on the Canada Pension Plan. For both males and females, the improvement factors are higher than those used in the previous valuation except at advanced ages. Factors shown in the $25^{\text {th }}$ Actuarial Report of the Canada Pension Plan are based on calendar years. These factors have been interpolated to obtain plan year longevity improvement factors.
The ultimate longevity improvement factors for plan years 2031 and thereafter were established by analysing the trend by age and sex of the Canadian experience over the period 1921 to 2006. Improvement factors for plan year 2012 are assumed to be those experienced on average over the 15-year period from 1991 to 2006. After plan year 2012, the factors are assumed to reduce gradually to their ultimate level by plan year 2031.

A sample of assumed longevity improvement factors is shown in the following table.
Table 25 Sample of Assumed Longevity Improvement Factors (applicable at the end of the plan year)

|  |  |  |  |  | Initial and Ultimate Plan Year Mortality Reductions (\%) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Male |  |  | Female |  |  |  |
|  | 2012 | $2031+$ |  | 2012 | $2031+$ |  |  |
| 30 | 2.77 | 0.80 |  | 1.55 | 0.80 |  |  |
| 40 | 2.11 | 0.80 |  | 1.32 | 0.80 |  |  |
| 50 | 1.83 | 0.80 |  | 1.26 | 0.80 |  |  |
| 60 | 2.30 | 0.80 |  | 1.37 | 0.80 |  |  |
| 70 | 2.49 | 0.80 |  | 1.46 | 0.80 |  |  |
| 80 | 2.01 | 0.70 |  | 1.45 | 0.70 |  |  |
| 90 | 1.15 | 0.44 |  | 0.68 | 0.44 |  |  |
| 100 | 0.35 | 0.30 |  | 0.11 | 0.30 |  |  |
| $110+$ | 0.02 | 0.30 |  | 0.02 | 0.30 |  |  |

Public Service Death Benefit Account
as at 31 March 2011

## 8. Election Proportions

The following table provides a sample of the assumed rates of non-elective participants who opt to continue coverage under the plan at retirement.

Table 26 Election Proportions
(Non-elective participants choosing to become elective participants at retirement)

|  | Pensionable Retirement ${ }^{2}$ |  | Disability Retirement |  |
| :---: | :---: | :---: | :---: | :---: |
| Age $^{1}$ | Male | Female | Male | Female |
| $15-43$ | 0.00 | 0.00 | 1.00 | 1.00 |
| 44 | 0.12 | 0.13 | 1.00 | 1.00 |
| 45 | 0.20 | 0.17 | 1.00 | 1.00 |
| 46 | 0.27 | 0.21 | 1.00 | 1.00 |
| 47 | 0.34 | 0.25 | 1.00 | 1.00 |
| 48 | 0.41 | 0.31 | 1.00 | 1.00 |
| 49 | 0.48 | 0.37 | 1.00 | 1.00 |
| 50 | 0.55 | 0.45 | 1.00 | 1.00 |
| 51 | 0.63 | 0.53 | 1.00 | 1.00 |
| 52 | 0.70 | 0.62 | 1.00 | 1.00 |
| 53 | 0.77 | 0.71 | 1.00 | 1.00 |
| 54 | 0.83 | 0.79 | 1.00 | 1.00 |
| 55 | 0.88 | 0.86 | 1.00 | 1.00 |
| 56 | 0.91 | 0.90 | 1.00 | 1.00 |
| 57 | 0.93 | 0.91 | 1.00 | 1.00 |
| 58 | 0.93 | 0.92 | 1.00 | 1.00 |
| 59 | 0.94 | 0.93 | 1.00 | 1.00 |
| 60 | 0.94 | 0.93 | 1.00 | 1.00 |
| 61 | 0.94 | 0.94 | 1.00 | 1.00 |
| 62 | 0.94 | 0.94 | 1.00 | 1.00 |
| 63 | 0.94 | 0.94 | 1.00 | 1.00 |
| 64 | 0.94 | 0.94 | 1.00 | 1.00 |
| 65 | 0.94 | 0.95 | 1.00 | 1.00 |
| 66 | 0.94 | 0.95 | 1.00 | 1.00 |
| 67 | 0.95 | 0.95 | 1.00 | 1.00 |
| 68 | 0.95 | 0.96 | 1.00 | 1.00 |
| 69 | 0.95 | 1.00 | 1.00 | 1.00 |
| $70+$ | 1.00 |  |  |  |
|  |  |  |  |  |

[^9]
## B. Other Assumptions

## 1. Option to Reduce Coverage to $\mathbf{\$ 1 0 , 0 0 0}$

The valuation data indicates that the proportion of elective participants opting to reduce their basic benefit to $\$ 10,000$ is negligible. Accordingly, no elective participants were assumed to make such an option.

## 2. Option to Continue the Annual 10\% Reduction from age 61

Bill C-78 introduced this option to participants effective 1 October 1999. Election of this option by participants would have a positive effect on the plan's actuarial excess. The valuation data indicates that approximately $1.5 \%$ of participants have opted to continue their $10 \%$ annual reduction from age 61 instead of age 66. Accordingly, no participants were assumed to make such an election.

## 3. Administrative Expenses

In the projection of the PSDB Account, no assumption was made regarding the expenses incurred for the administration of the plan. These expenses, which are not debited to the PSDB Account, are commingled with all other Government charges.

## Appendix 7 - Acknowledgements

The Superannuation Directorate of the Department of Public Works and Government Services Canada provided the data on plan members.
The following individuals were instrumental in the preparation of this report:

Kimberley Burt
Alice Chiu, A.S.A.
Chris Dieterle, F.S.A, F.C.I.A
Lyse Lacourse


[^0]:    ${ }^{1}$ Any reference to a given plan year in this report should be taken as the 12 -month period ending 31 March of the given year

[^1]:    1 The $\$ 10,000$ portion of the basic benefit for which monthly contributions are no longer required from either the participant or the Government. See Appendix 4 - G. 1
    ${ }^{2}$ Incurred But Not Reported claims. See Appendix 4 - G. 2

[^2]:    1 The expression monthly benefit cost rate is defined as the ratio of the total expected monthly term insurance payments over the total amount of expected monthly term insurance benefit coverage, where coverage is expressed per thousand dollars. In this report, term insurance benefit means the basic benefit excluding the $\$ 10,000$ paid-up death benefit applicable from age 65.

[^3]:    1 Government term contributions include the four cents per month per $\$ 1,000$ contribution made by participating Crown companies and public boards.

[^4]:    1 Includes Correctional Services Canada employees and members from participating Crown companies and public boards.
    ${ }^{2}$ Expressed in completed years calculated at the beginning of the plan year. Averages are calculated on a dollar-weighted basis.

[^5]:    1 Expressed in completed years calculated at the beginning of the plan year. Averages are calculated on a dollar-weighted basis.

[^6]:    1 Participants entitled to a deferred annuity were not taken into account for valuation purposes. Their impact is considered negligible.
    2 Expressed in completed years calculated at the beginning of the plan year. Averages are calculated on a dollar-weighted basis.

[^7]:    1 The real rates in this report are differentials, i.e. the difference between the effective annual rate and the inflation rate.
    2 Exclusive of seniority and promotional increases.

[^8]:    1 Exclusive of seniority and promotional increases.

[^9]:    1 Expressed in completed years calculated at the beginning of the plan year.
    ${ }^{2}$ A pensionable retirement is a retirement resulting in either an immediate annuity for reasons other than disability or an annual allowance.

