



Department of Insurance  
Canada

Département des assurances  
Canada

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PUBLIC SERVICE DEATH BENEFIT ACCOUNT

ACTUARIAL REPORT

AS AT DECEMBER 31, 1980

## Public Service Superannuation Act - Part II

### Report on Actuarial Examination of the Public Service Death Benefit Account in the Consolidated Revenue Fund as at December 31, 1980

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Pursuant to section 48 of the Public Service Superannuation Act, we have completed an actuarial examination of the Public Service Death Benefit Account as at December 31, 1980 and have the honour to report thereon.

#### Terms of the Supplementary Death Benefits Plan

##### Participants

Employees and former employees of the Public Service who are eligible for benefits under Part II of the Act are termed "participants". They are divided into elective and non-elective participants.

##### (a) Non-Elective Participants

For purposes of this report "non-elective participants" means all contributors to the Superannuation Account who are employed in the Public Service with the exception of employees of Crown corporations that are excluded by regulation from the operation of Part II of the Act (4518 on Dec 31, 1980) because they have group life insurance plans in operation, and of contributors (2030 on Dec 31, 1980) who had elected not to come under the provisions of Part II of the Act at its inception in 1955.

##### (b) Elective Participants

The term "elective participants" means all participants who have ceased to be employed in the Public Service and have elected to continue as participants under Part II. The right of election is limited to participants who, at the time they cease to be employed in the Public Service, have at least five continuous years of service or have been participants under the plan for at least five continuous years. Election must be made either within one year before cessation of employment or within thirty days afterwards. In the case of a participant not entitled to an immediate annuity on cessation of employment, the death benefit coverage is extended for thirty days after the date of cessation whether or not the participant exercises his right of election. A participant who becomes entitled to an immediate annuity under Part I of the Act upon cessation of employment is deemed to have elected to continue as a participant, but such person may elect to have the amount of benefit reduced to \$500.

Benefits

The basic benefit is equal to the participant's annual rate of salary, if it is a multiple of \$250, and otherwise to the nearest multiple of \$250 above such salary, reduced by 10% of such amount for every year of age in excess of age 60 attained by the participant. The annual rate of salary of an elective participant is defined as his annual rate of pay at the time he ceased to be an employee of the Public Service. The benefit payable on account of a non-elective participant at time of death cannot be less than the greater of \$500 and the multiple of \$250 equal to or next above one-sixth of the participant's annual rate of salary. The benefit payable to an elective participant entitled to an immediate annuity can never be less than \$500 which is the amount of reduced coverage that the participant may elect to retain. Such an election is irrevocable. The Government provides to non-elective participants and elective participants entitled to an immediate annuity paid-up coverage of \$500 on attainment of age 65 or completion of five years of service, if later.

Contributions by Participants

For non-elective and elective participants entitled to an immediate annuity on ceasing to be employed in the Public Service, the rate of contribution is 10 cents per month for each \$250 of benefit coverage. At attainment of age 65 or completion of five years' service, if later, the total contribution is reduced by 20 cents per month in recognition of the fact that \$500 of the benefit becomes paid-up for the remaining lifetime of the participant by means of a single premium credited to the Account by the Government at that time.

For elective participants not entitled to an immediate annuity on ceasing to be employed in the Public Service, the rate of contribution is dependent upon the age of the participant on the thirtieth day immediately following the date on which the participant ceases to be employed. The following schedule shows the applicable rates for quinquennial ages:

<u>Age last Birthday</u>	<u>Annual Contribution per \$1,000 Benefit</u>	<u>Monthly Contribution per \$1,000 Benefit</u>
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

Credits by Government

The Government credits to the Public Service Death Benefit Account one-sixth of the benefits paid on which contributions were being paid by participants who, at the time of death, were employed in the Public Service (other than

by Crown corporations and public boards) or by elective participants entitled to an immediate annuity under Part I of the Act. In addition, the Government credits to the Account, when each participant satisfies the requirements stated previously, an amount representing the single premium for \$500 of benefit coverage for life in respect of which no contributions are required from such participant, calculated on the basis of the Canadian Life Tables 1950-1952 and interest at four percent per annum.

Crown corporations and public boards whose employees are participants contribute at the rate of 2 cents per month for each \$250 of benefit coverage.

The Government also credits to the Account, at the end of each quarter of the fiscal year, an amount representing interest calculated by applying to the balance in the Account at the end of the preceding quarter the same rate of interest that is determined each quarter for the purpose of crediting interest in respect of the Public Service Superannuation Account.

Data

Data for participants employed in the Public Service on December 31, 1980, and for elective participants were provided by the Superannuation Division of Supply and Services Canada. The following schedule shows pertinent statistics (including paid-up coverage) derived from the tabulated data.

Participants as at December 31, 1980

<u>Class</u>	<u>Number</u>	<u>Total Benefit ( '000)</u>	<u>Average Benefit</u>
<u>Non-Elective Participants</u>			
Males	190,553	\$4,178,049	\$21,926
Females	100,739	1,679,129	16,668
<u>Elective Participants</u>			
a) entitled to an immediate annuity under the Act			
Males	51,961	405,553	7,805
Females	14,093	65,144	4,622
b) not entitled to an immediate annuity under the Act			
Males	160	2,010	12,562
Females	42	431	10,264
Total	357,548	\$6,330,316	\$17,705

Valuation Assumptions

1. Interest

Currently the Public Service Death Benefit Account is credited quarterly with interest calculated on the balance in the Account in accordance with Section 29 of the Public Service Death Benefit Regulations. As noted earlier, the rates specified in the regulations are the same as those at which interest credits in respect of the Public Service Superannuation Account are calculated. These rates are based on hypothetical investments in long term government securities similar to those prescribed for purposes of the Canada Pension Plan and they vary from quarter to quarter. The quarterly rates applicable to the balance in the Account during the calendar year 1980 were equivalent to an annual rate of approximately 8.5% per annum.

Although interest plays a minor role in the operation of this Account, it was considered appropriate for purposes of calculating the required actuarial reserves to change the assumed rate from 4% to 6.5% per annum. However, for the purpose of projecting the contingency reserve, interest credits were calculated in accordance with assumed fund yields related to the Public Service Superannuation Account\* as follows:

1981-1990(%): 8.1, 8.6, 8.9, 9.0, 9.1, 9.1, 9.1, 9.0, 8.8, 8.6  
1991-2000(%): 8.5, 8.3, 8.1, 8.0, 7.8, 7.6, 7.4, 7.2, 7.0, 6.7  
after 2000: 6.5%

2. Mortality

(a) Non-Elective Participants

Active contributors under Part I of the Act comprise a group largely identical to that of the non-elective participants under Part II. We have, therefore, adopted rates equal to 110% of the rates assumed for purposes of the Actuarial Report on the Superannuation Account as at December 31, 1980. The latter rates largely reflect the 1978-80 experience. The rates used for purposes of this Report are generally somewhat lower than those used for the preceding report; they are shown in Appendix 1.

(b) Elective participants entitled to an immediate annuity

A large proportion of participants who became entitled to immediate annuities upon ceasing to be employed in the Public Service between January 1, 1955 and July 14, 1960, did not become elective participants. This situation changed largely as the result of the 1960 amendments to the Act.

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\* P.S.S.A. Actuarial Report as at December 31, 1980, page 26

Since July 14, 1960, it has no longer been necessary for a participant who becomes an annuitant to take positive action to retain the death benefit coverage. In fact, the only action such participant may now take is to elect to reduce coverage to \$500.

For mortality purposes, this class of elective participants is divided into two separate groups, depending on whether participants become entitled to an immediate annuity under the Public Service Superannuation Act because of disability or for other reasons.

For elective participants entitled to an immediate annuity for reasons other than disability, the rates used for purposes of this report were those of the 1980-1982 Canada Life Tables.\* These rates are somewhat lower than those used for purposes of the preceding report, but were found to provide an effective margin of about 12% on the basis of the 1978-80 experience. The rates are shown in Appendix 2.

For elective participants entitled to an immediate annuity because of disability, the experience during the period from January 1, 1978 to December 31, 1980 indicated substantially higher rates than used for purposes of the preceding report.

The bases adopted are as follows:

- (i) for participants in respect of whom two or more years have elapsed from date of retirement the rates are based on the 1978-80 experience (excluding the first two years after retirement) of contributors entitled to an immediate annuity under Part I of the Act because of disability;
- (ii) for participants within the first and second year after date of retirement the rates are 250% and 150%, respectively, of the ultimate rates described in (i) above.

The ultimate rates described in (i) above are shown in Appendix 3.

(c) Participants entitled to \$500 paid-up benefit coverage

All participants entitled to the \$500 paid-up benefit coverage at age 65 or over are included in the groups described in (a) and (b) above. For purposes of determining the actuarial reserve in respect of the paid-up benefit the mortality rates used are those of the 1980-82 Canada Life Tables which are illustrated in Appendix 2.

(d) Elective participants who do not become entitled to an immediate annuity on ceasing to be employed in the Public Service

The mortality basis used to compute the actuarial reserve are the same as those described in b(i) above for elective participants entitled to an immediate annuity because of disability in respect of whom two or more years have elapsed from the date of retirement. These rates are shown in Appendix 3.

\* Statistics Canada: Life tables, Canada and provinces 1980-1982

### 3. Other Assumptions

For purposes of long term projections it was assumed that

- (a) the sex, number, age and relative salary distribution of persons becoming participants in each future year will be the same as the average per annum for the persons who became contributors to the Superannuation Account during the period January 1, 1978 to December 31, 1980,
- (b) the probabilities of remaining employed and retiring for participants employed in the Public Service will be the same as the corresponding probabilities assumed for purposes of the examination of the Superannuation Account as at December 31, 1977,
- (c) employed participants will experience mortality in accordance with the bases described in section 2(a) above,
- (d) contributors to the Superannuation Account who cease to be employed with entitlement to an immediate annuity will become elective participants and will experience mortality in accordance with the bases described in section 2(b) above,
- (e) for active participants the average amounts of benefit coverage will be the same as their coverage as at December 31, 1980, or at the date of entry, if later, increased by the promotional salary scale used for purposes of the actuarial report on the Superannuation Account as at December 31, 1980 plus a general (economic) salary increase factor of 5% per year, decreased by 10% for each year of age above 60,
- (f) contributors to the Superannuation Account who cease to be employed without entitlement to an immediate annuity and become elective participants will not be a source of significant gain or loss.

These assumptions are very broad but are believed to produce reasonably safe estimates of the cost of benefit coverage in the long term.

With regard to (f) above, it seems unlikely that more than a very small proportion of contributors who cease to be employed without entitlement to an immediate annuity will become or remain elective participants, because the death benefit coverage is not permanent insurance and has no cash or loan value, contribution rates are not lower than could be obtained by healthy persons from an insurance company, election is not automatic, and contributions are only rarely payable automatically as a deduction from "annuitant" cheques.

COST OF BENEFIT SUBJECT TO UNIFORM  
MONTHLY CONTRIBUTIONS

(a) Current Cost

As described earlier in this report, non-elective participants and elective participants entitled to an immediate annuity on ceasing to be employed in the Public Service contribute to the Public Service Death Benefit Account at a monthly rate of 40 cents per \$1,000 of benefit, regardless of age (except for the 20 cents reduction after age sixty-five in respect of the \$500 of benefit paid-up by the employer).

For these participants the benefit cost expected to be experienced in the few years following December 31, 1980 was estimated by applying the mortality rates described in the preceding section to the benefit coverage of participants of the plan as at December 31, 1980. The results are shown in the following table:

<u>Current Cost per \$1000 Benefit</u>	
<u>Class</u>	<u>Monthly Cost</u>
Non-elective participants	\$0.191
Elective participants entitled to an immediate annuity	\$1.957
Employed and elective participants combined	\$0.317

The above table gives an indication of the current level of the direct monthly benefit cost for employed participants and elective participants entitled to an immediate annuity. There could be indirect costs in the event that benefits provided for elective participants not entitled to an annuity and the \$500 paid-up benefit at age 65 for employed participants and elective participants entitled to an immediate annuity are not operated on a self-supporting basis.

In group insurance contracts, it is normally provided that a member of the group may, upon termination of employment, convert group coverage to an individual life insurance policy from the company at standard premium rates without submitting evidence of insurability. Persons who take advantage of this option often exercise selection against the company and the mortality experience of converted policies is normally unfavourable. Under the Supplementary Death Benefit plan a similar situation exists with respect to elective participants without entitlement to an immediate annuity. However, the relative number of cases is too small to have a measurable effect on the monthly cost noted above.



In view of the foregoing comments, the figures set out in the above table may be accepted as reflecting the total current average monthly cost, which is seen to be about 32 cents per \$1,000 benefit for employed participants and elective participants entitled to an immediate annuity combined. This level of cost is given support by statistics included in the published annual reports on the administration of the Public Service Superannuation Act for the six years ending March 31, 1983 which indicate current average monthly claim payments per \$1,000 benefit of between 28.8 cents and 32.5 cents.

Since monthly contributions from participants together with Government credits currently represent about 45 cents per \$1,000 benefit for these two classes of participants, there continues to be an excess of current contribution income over benefit outgo. This excess has been the main reason for the accumulation of a substantial contingency reserve which will be discussed further in connection with the balance sheet.

(b) Long Term Cost

Long term benefit costs were estimated according to the valuation bases noted previously and are shown in the following table:

<u>Long Term Cost (monthly) per \$1000 Benefit</u>				
<u>Class</u>	<u>1995</u>	<u>2010</u>	<u>2025</u>	<u>Ultimate</u>
Non-elective participants	\$0.187	\$0.210	\$0.203	\$0.203
Elective participants entitled to an immediate annuity	2.156	2.050	2.010	2.009
Elective and non-elective participants combined	0.339	0.411	0.401	0.401

The ultimate distribution of non-elective participants is weighted more heavily at the older ages than the current population and the monthly cost per \$1000 benefit is expected to increase approximately 10% for males and 32% for females. At the same time, however, there is a significant increase in the proportion of non-elective coverage on female lives, from a 29% level in 1980 to an ultimate level of 37%. These two factors combined result in an increase of approximately 6% in the combined monthly cost for non-elective participants from the current (1980) to the ultimate level.

The estimated ultimate monthly cost for elective participants entitled to an immediate annuity is approximately 3% greater than the estimate of the current (1980) monthly cost. This increase is primarily the net result of an increase in the proportion of elective coverage on disabled lives, from a 15% level in 1980 to an ultimate level of 29%, and an increase in the proportion of elective coverage on female lives, from a 14% level in 1980 to an ultimate level of 36%.

The estimated ultimate monthly cost for non-elective and elective participants combined is expected to increase by 26% compared to the estimate of the current (1980) monthly cost. This change is the net result of

- (i) the distribution of coverage weighted at higher ages resulting in an increase in monthly costs of approximately 9%;
- (ii) the increase in the proportion of total coverage on elective participants, from 7% in 1980 to 11% ultimately, resulting in an increase of approximately 29%; and
- (iii) the increase in the proportion of total coverage on female lives, from 27% in 1980 to 37% ultimately, resulting in a decrease of approximately 10%.

For purposes of the preceding report, the ultimate monthly cost per \$1000 benefit for non-elective and elective participants combined was estimated to be \$0.450. A reconciliation of the difference is provided in the following table:

Reconciliation of 1977 and 1980 Report Estimates  
of Ultimate Monthly Costs

1977 Report Estimate of Ultimate Monthly Cost	\$0.450
Changes in Assumed Mortality Rates	-0.068
Changes in Assumed Salary Increases	+0.013
Changes in Assumed New Entrants	-0.014
Changes in Methodology	+0.020
1980 Report Estimate of Ultimate Monthly Cost	\$0.401

Balance Sheet and Contingency Reserve Projections

The following balance sheet shows the state of the Public Service Death Benefit Account as at December 31, 1980.

Assets

Balance of Account	\$106,833,000
Contributions due from Government	<u>1,627,000</u>
Total Assets	108,460,000

Liabilities

Actuarial present value of \$500 paid-up benefit for participants above age 64 who are employed in the Public Service or entitled to an immediate annuity	11,653,000
Actuarial liability for elective participants not entitled to an immediate annuity	461,000
Reserve for claims incurred but unreported or reported but not paid	<u>4,241,000</u>
Total Liabilities	16,355,000
Contingency Reserve	<u>92,105,000</u>
Total Liabilities and Contingency Reserve	108,460,000

The contingency reserve of \$92,105,000 shown in the above statement is equal to about 3.8 times the benefits payable from the Account in 1981. For the existing plan, this reserve is expected to grow indefinitely and is more than adequate to offset adverse disability and mortality fluctuations. The following table illustrates the expected contingency reserve based on several financing assumptions.

<u>Assumed Monthly Contribution per \$1000 Benefit</u>	<u>Projected Ratio of Contingency Reserve to Annual Benefit Payments in Following Year</u>			
	<u>1995</u>	<u>2010</u>	<u>2025</u>	<u>2040</u>
\$ 0.40*	11.51	14.48	21.29	29.06
0.32*	7.52	7.54	8.98	10.58
0.36**	6.74	5.91	5.70	5.44

\* rate paid by participants; in addition, government credits to the Account assumed equal to one-sixth of benefits paid subject to standard contributions

\*\* assumed to equal total from participants and government combined

Summary and Conclusions

The total benefit coverage for all participants as at December 31, 1980 was approximately \$6.33 billion.

The current average cost for elective and non-elective participants is estimated to be approximately \$0.32 per month per \$1,000 benefit.

Based on the assumptions previously described, the average monthly cost per \$1,000 benefit is expected to increase gradually to a level of approximately \$0.41 by 2010 and thereafter to decrease gradually over a period of 15 years to a level of approximately \$0.40. Costs are expected to remain stable thereafter. These changes in estimated costs arise primarily from increases in the proportion of total coverage attributable to elective and female participants.

The contingency reserve in the Public Service Death Benefit Account was \$92,105,000 as at December 31, 1980, or about 3.8 times the amount of benefits payable from the Account in 1981. Without any change in the benefits and financing provisions of the Plan, the income excluding interest credits is expected to exceed charges in all future years. This excess together with the interest credits would result in an ever increasing contingency reserve, expressed either as a dollar amount or as a multiple of the annual expected benefits payable from the Account, and would be substantially more than adequate to offset adverse experience fluctuations.

Respectfully submitted,



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APPENDIX 1

Rates of Mortality for Employed Participants

<u>Age</u>	<u>Males</u>	<u>Females</u>
20	.0004	.0002
25	.0006	.0003
30	.0007	.0004
35	.0008	.0006
40	.0013	.0008
41	.0015	.0009
42	.0018	.0010
43	.0020	.0010
44	.0022	.0011
45	.0024	.0012
46	.0028	.0013
47	.0031	.0014
48	.0034	.0015
49	.0037	.0017
50	.0041	.0018
51	.0045	.0019
52	.0050	.0021
53	.0054	.0022
54	.0059	.0024
55	.0064	.0026
56	.0069	.0029
57	.0075	.0031
58	.0081	.0034
59	.0087	.0037
60	.0094	.0041
61	.0099	.0044
62	.0106	.0047
63	.0112	.0052
64	.0119	.0056
65	.0127	.0061
66	.0133	.0066
67	.0141	.0070
68	.0147	.0076
69	.0155	.0083
70	.0162	.0089

APPENDIX 2

Rates of Mortality for elective  
participants entitled to an immediate  
annuity for reasons other than disability

<u>Age</u>	<u>Males</u>	<u>Females</u>
50	.0063	.0034
51	.0070	.0037
52	.0077	.0041
53	.0085	.0044
54	.0093	.0048
55	.0103	.0053
56	.0113	.0057
57	.0124	.0063
58	.0136	.0068
59	.0149	.0074
60	.0163	.0080
61	.0178	.0087
62	.0195	.0096
63	.0214	.0105
64	.0234	.0115
65	.0255	.0126
66	.0279	.0138
67	.0305	.0151
68	.0332	.0166
69	.0360	.0181
70	.0391	.0198
71	.0424	.0218
72	.0462	.0240
73	.0503	.0265
74	.0546	.0291
75	.0593	.0321
76	.0644	.0354
77	.0700	.0394
78	.0761	.0438
79	.0825	.0487
80	.0894	.0540
81	.0969	.0599
82	.1048	.0666
83	.1134	.0738
84	.1224	.0816
85	.1320	.0900
86	.1422	.0991
87	.1532	.1091
88	.1647	.1198
89	.1767	.1313
90	.1898	.1435

APPENDIX 3

Rates of Mortality for elective Participants who are  
 (a) in receipt of an immediate annuity for at least two years  
 because of disability, or  
 (b) not entitled to an immediate annuity

<u>Age</u>	<u>Males</u>	<u>Females</u>
25	.0354	.0149
30	.0359	.0151
35	.0364	.0154
40	.0371	.0157
45	.0381	.0163
50	.0391	.0172
55	.0412	.0189
60	.0475	.0218
65	.0650	.0266
66	.0707	.0278
67	.0776	.0292
68	.0857	.0307
69	.0944	.0324
70	.1043	.0342
71	.1149	.0361
72	.1265	.0385
73	.1393	.0412
74	.1528	.0438
75	.1671	.0469
76	.1822	.0505
77	.1979	.0544
78	.2146	.0588
79	.2328	.0635
80	.2521	.0694
81	.2723	.0760
82	.2935	.0837
83	.3167	.0923
84	.3404	.1017
85	.3667	.1121
86	.3949	.1234
87	.4243	.1364
88	.4555	.1506
89	.4910	.1662
90	.5314	.1832