



Office of the Superintendent
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PUBLIC SERVICE DEATH BENEFIT ACCOUNT

ACTUARIAL REPORT

AS AT DECEMBER 31, 1983

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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, 1983

I. Summary

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, 1983. At that date, the total benefit coverage for all participants was approximately \$9.18 billion.

The current cost for employed and elective* participants is estimated to be approximately \$0.29 per month per \$1,000 benefit. The government contributes one-sixth of this cost or about \$0.05 per month, while participants are required by statute to contribute \$0.40 per month.

Based on the assumptions described in Appendix 1, the 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 \$0.37. 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 \$185 million as at December 31, 1983, or about 5.4 times the amount of benefits payable from the Account in 1984. Without any change in the benefit and contribution 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, whether expressed as a dollar amount or as a multiple of the annual expected benefits payable from the Account. It would continue to be considered an excessive provision for adverse experience fluctuations.

Section II of this report presents a summary of the membership data. Section III sets out the estimated monthly cost of benefits subject to uniform contributions, both currently and in the long term. Section IV presents the balance sheet for the Account as at December 31, 1983 as well as some contingency reserve projections. Section V contains the actuarial opinion as regards the data, the actuarial assumptions and the actuarial method upon which the report is based. The actuarial assumptions entering into the calculations are described in Appendix 1 and a summary of the plan is provided in Appendix 3.

* See Appendix 3 for definitions.

II. Data

Data for participants employed in the Public Service and for elective participants as at December 31, 1983 were provided by the Department of Supply and Services in conjunction with data for the examination of the Public Service Superannuation Account at that date. The following schedule shows pertinent statistics (including paid-up coverage) derived from the tabulated data.

Participants as at December 31, 1983

<u>Class</u>	<u>Total Number</u>	<u>Total Benefit</u> (in thousands)	<u>Average Benefit</u>
<u>Employed Participants</u>			
Males	192,311	\$5,927,925	\$30,825
Females	112,419	2,668,125	23,734
<u>Elective Participants</u>			
a) entitled to an immediate annuity under the Act			
Males	58,462	496,997	8,501
Females	16,468	84,360	5,123
b) not entitled to an immediate annuity under the Act			
Males	215	2,234	10,389
Females	72	604	8,390
<u>Total</u>	379,947	\$9,180,245	\$24,162

III. Cost of Benefit subject to Uniform Monthly Contributions

(a) Current Cost

As described in Appendix 3, employed 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, 1983 was estimated by applying the mortality rates described in Appendix 1 to the benefit coverage of participants of the plan as at December 31, 1983. The results are shown in the following table:

Current Cost per \$1000 Benefit

<u>Class</u>	<u>Monthly Cost</u>
Employed participants	\$0.188
Elective participants entitled to an immediate annuity	\$1.879
Employed and elective participants combined	\$0.291

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. In the event that benefits 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, there could be indirect costs.

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 among holders 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 29 cents per \$1,000 benefit when employed participants are combined with elective participants entitled to an immediate annuity. This level of cost is supported by statistics included in recent published annual reports on the administration of the Public Service Superannuation Act for the six years ending March 31, 1987. These indicate recent average monthly claim payments per \$1,000 benefit coverage of between 25.3 cents and 29.4 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 what must now be regarded as a very large contingency reserve, a matter discussed further in connection with the balance sheet in Section IV.

(b) Long-Term Cost

Long-term benefit costs were estimated on the basis of the assumptions described in Appendix 1. They are shown in the following table:

Long-Term Cost (monthly) per \$1000 Benefit

<u>Class</u>	<u>1995</u>	<u>2010</u>	<u>2025</u>	<u>Ultimate</u>
Employed participants	\$0.203	\$0.242	\$0.218	\$0.227
Elective participants entitled to an immediate annuity	\$1.957	\$1.852	\$1.839	\$1.851
Employed and elective participants combined	\$0.320	\$0.406	\$0.372	\$0.384

The ultimate distribution of employed 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 20% for males and 48% for females. At the same time, however, there is a reduction in the proportion of employed participants' coverage attributable to males, from 65% in 1983 to an ultimate level of 59%, and an increase in the proportion of employed participants' coverage attributable to females from 29% in 1983 to an ultimate level of 32%. These two factors combined result in an increase of approximately 21% in the combined monthly cost for employed participants from the current (1983) level to the ultimate level.

The estimated ultimate monthly cost for elective participants entitled to an immediate annuity is virtually identical to the estimate of the current (1983) monthly cost. While the monthly cost per \$1,000 benefit for elective participants is expected to increase from current to ultimate levels by 6.8% in the case of the males and 2.0% in the case of females, the impact of this trend is offset by the decrease in the proportion of elective coverage on male lives from its current level of 86% to an ultimate level of 70%.

The ultimate monthly cost for employed and elective participants combined is expected to increase by 32% compared to the estimate of the current (1983) 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 14%;
- (ii) the increase in the proportion of total coverage on elective participants, from 6% in 1983 to 10% ultimately, resulting in an increase of approximately 22%; and
- (iii) the increase in the proportion of total coverage on female lives, from 30% in 1983 to 34% ultimately, resulting in a decrease of approximately 4%.

For purposes of the preceding report, the ultimate monthly cost per \$1000 benefit for employed and elective participants combined was estimated to be \$0.401. A reconciliation of the difference is provided in the following table:

Reconciliation of 1980 and 1983 Report Estimates
of Ultimate Monthly Costs

Estimate of ultimate monthly cost from 1980 report	\$0.401
Effect of:	
a) changes in assumed mortality rates	- \$0.010
b) changes in assumed salary increases and in assumed decrements other than mortality	+ \$0.034
c) changes in assumed new entrants	- \$0.031
d) changes in methodology	<u>- \$0.010</u>
Estimate of ultimate monthly cost in this report	\$0.384

IV. Balance Sheet and Contingency Reserve Projections

The following balance sheet shows the state of the Public Service Death Benefit Account as at December 31, 1983:

<u>Assets</u>	(in thousands)
Balance of Account	\$202,884
Contributions due from Government	<u>3,403</u>
Total assets	\$206,287
<u>Liabilities and Contingency Reserve</u>	
Actuarial liability for \$500 paid-up benefit for participants above age 64 who are employed in the Public Service or entitled to an immediate annuity	\$ 14,706
Actuarial liability for elective participants not entitled to an immediate annuity	300
Reserve for claims incurred but unreported or reported but not paid	<u>6,150</u>
Total liabilities	\$ 21,156
Contingency reserve	<u>185,131</u>
	\$206,287

The contingency reserve of \$185,131,000 shown in the above statement is equal to about 5.4 times the benefits payable from the Account in 1984. For the existing plan, this reserve is expected to grow indefinitely and is more than adequate to offset adverse fluctuations. The following table illustrates the expected contingency reserve based on different contribution rates (any changes are assumed to be effective January 1, 1989).

<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*	16.29	20.70	30.32	37.68
0.24*	12.34	10.27	9.63	7.83
0.32**	13.03	11.75	12.18	11.43
0.28**	12.04	9.14	7.01	3.97

* This rate is assumed to be paid by participants; in addition, government credits to the Account are assumed equal to one-sixth of benefits paid subject to uniform contributions.

** Assumed total contribution from participants and government combined.

V. Actuarial Opinion

In my opinion, for the purposes of this actuarial report:

- (a) the data upon which the calculations have been based are sufficient;
- (b) the assumptions used are reasonable and appropriate;
- (c) the methods employed are consistent with sound actuarial principles.

This report has been prepared and this opinion has been given in accordance with generally-accepted actuarial principles and the recommendations of the Canadian Institute of Actuaries.

Respectfully submitted,



Walter Riese, F.C.I.A.
Chief Actuary

Ottawa, Canada,
June 10, 1988

APPENDIX 1

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 in Appendix 3, 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 of Canada securities similar to those prescribed for purposes of the Canada Pension Plan and they vary from quarter to quarter. For the quarter ending December 31, 1983, the total rate of interest was 2.5633% which is equivalent to 10.65% per annum.

Although actuarial liabilities play a minor role in the operation of this Account, it was considered appropriate to calculate their value by using an assumed rate of 6.0% 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:

1984-1991(%):	9.8,	10.2,	10.1,	10.1,	10.1,	10.0,	9.8,	9.7
1992-1999(%):	9.5,	9.4,	9.3,	9.1,	8.9,	8.7,	8.5,	8.3
2000-2007(%):	8.0,	7.7,	7.2,	6.8,	6.6,	6.2,	6.0,	6.0
2008+ (%):	6.0							

2. Mortality

(a) Employed Participants

We have retained the rates used for purposes of the preceding report. They are equal to 110% of the rates assumed for purposes of the Actuarial Report on the Superannuation Account as at December 31, 1983. The actual deaths during the 1981-83 period were not significantly different from expected on the basis of the assumed rates in the case of males but were about 10% less than expected in the case of females. The rates, which are shown in Appendix 2A, will be reviewed in conjunction with the study of the 1984-86 experience.

(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.

* Actuarial Report on the Superannuation Account as at December 31, 1983, page 22.

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 other reasons.

For elective annuitants entitled to an immediate annuity for reasons other than disability, the 1981-83 experience showed that the mortality rates used for the preceding valuation overstated the experience mortality by about 5%. Since the 1978-1980 experience had indicated that these same rates might be expected to include about a 12% margin, it was decided to retain the rates and re-examine their continued suitability in conjunction with the review of the 1984-86 experience. The rates are equal to those of the Life Tables 1980-82, Canada, published by Statistics Canada; these are shown in Appendix 2B.

For elective participants entitled to an immediate annuity because of disability, the 1981-83 experience indicated that the rates used for the preceding report had overstated actual mortality above age 54, particularly in the case of males. It was therefore decided to adopt rates that more closely reflect current experience. 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 1980-83 experience (excluding the first two years following retirement) of contributors entitled to an immediate annuity due to disability; these rates are shown in Appendix 2C.
- (ii) for participants within the first and second year after date of retirement the rates are 250% and 150%, respectively, of the rates described in (i) above.

(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 liability for the paid-up benefit the mortality rates used are those of the Life Tables 1980-82, Canada, which are shown in Appendix 2B.

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

The mortality rates used to compute the actuarial liability 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 2C.

3. Other Assumptions

For purposes of long-term projections it was assumed that

- (a) the sex, age and salary distribution of persons becoming participants in each future year will be the same as that observed in respect of persons who became contributors to the Superannuation Account during the period from January 1, 1981 to December 31, 1983;
- (b) the number of new entrants during the first three years of the projection period will be the same as those actually observed during that period and thereafter will be such as to result in a constant total employed participant population;
- (c) for participants employed in the Public Service the probabilities of remaining employed and retiring will be the same as the corresponding probabilities assumed for purposes of the examination of the Superannuation Account as at December 31, 1983;
- (d) employed participants will experience mortality in accordance with the bases described in section 2(a) above;
- (e) employed participants who become entitled to an immediate annuity will become elective participants and will experience mortality in accordance with the bases described in section 2(b) above;
- (f) for employed participants the average amounts of benefit coverage will be the same as their coverage as at December 31, 1983, 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, 1983 plus a general (economic) salary increase factor of 5% per year, decreased by 10% for each year of age above 60;
- (g) employed participants 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 (g) above, it seems unlikely that more than a very small proportion of participants who cease to be employed without entitlement to an immediate annuity will become or remain elective participants. This is 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 in the open market, election is not automatic, and contributions are only rarely payable automatically as a deduction from "annuitant" cheques.

APPENDIX 2A

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 2B

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	.0069	.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	.0256	.0126
66	.0279	.0138
67	.0305	.0151
68	.0332	.0166
69	.0360	.0181
70	.0391	.0198
71	.0424	.0218
72	.0462	.0240
73	.0502	.0265
74	.0546	.0291
75	.0593	.0321
76	.0644	.0354
77	.0700	.0394
78	.0761	.0438
79	.0825	.0487
80	.0894	.0540
81	.0968	.0599
82	.1048	.0666
83	.1134	.0738
84	.1224	.0816
85	.1320	.0900
86	.1423	.0991
87	.1532	.1091
88	.1647	.1198
89	.1769	.1313
90	.1897	.1435

APPENDIX 2C

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	.0180	.0164
30	.0193	.0169
35	.0215	.0174
40	.0250	.0179
45	.0291	.0184
50	.0296	.0189
55	.0334	.0194
60	.0413	.0199
65	.0534	.0252
66	.0570	.0269
67	.0611	.0286
68	.0659	.0301
69	.0716	.0315
70	.0783	.0330
71	.0859	.0347
72	.0942	.0369
73	.1031	.0396
74	.1122	.0431
75	.1216	.0473
76	.1315	.0523
77	.1421	.0580
78	.1536	.0645
79	.1663	.0716
80	.1801	.0793
81	.1954	.0874
82	.2122	.0960
83	.2303	.1051
84	.2500	.1146
85	.2710	.1246
86	.2941	.1352
87	.3190	.1470
88	.3462	.1603
89	.3756	.1751
90	.4075	.1917

APPENDIX 3

Summary of the Supplementary Death Benefit Plan

The terms of the plan are set out in Part II of the Public Service Superannuation Act, entitled "Supplementary Death Benefits".

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 employed and elective participants.

(a) Employed Participants

For purposes of this report "employed participants" means all contributors to the Superannuation Account who are employed in the Public Service except (i) employees of Crown corporations who are excluded by regulation from Part II of the Act (6018 persons on Dec 31, 1983) because they have group life insurance plans in operation and (ii) contributors (1210 on Dec 31, 1983) 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 of the Act. 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 employed in 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 elective participants entitled to an immediate annuity on ceasing to be employed in the Public Service as well as for employed participants, 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 (i) by participants who, at the time of death, were employed in the Public Service (other than by Crown corporations and public boards) or (ii) 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 two 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.