Public Service

Death Benefit Account

Actuarial Report

as at December 31, 1986

Canada

PUBLIC SERVICE DEATH BENEFIT

ACTUARIAL REPORT

AS OF DECEMBER 31, 1986

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<u>PUBLIC SERVICE SUPERANNUATION ACT - PART II</u>

Report on Actuarial Examination of the Public Service Death Benefit Account in the Consolidated Revenue Fund as at December 31, 1986

I. <u>Summary</u>

Pursuant to section 59 of the Public Service Superannuation Act, we have completed an actuarial examination of the Public Service Death Benefit Account as at December 31, 1986. At that date, the total benefit coverage for all participants was approximately $10.36 billion.

The current cost for employed and elective* participants who are entitled to an immediate annuity on ceasing to be employed in the Public Service is estimated to be approximately $0.28 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 $0.35 by 2009 and thereafter to decrease gradually. These changes in estimated costs arise primarily from an increase in the proportion of total coverage attributable to elective participants (which increases costs), an increase in the proportion of female participants (which reduces costs), and also from a reduction in future mortality (which reduces costs).

The contingency reserve in the Public Service Death Benefit Account was $339 million as at December 31, 1986, or about 10.2 times the amount of benefits payable from the Account in 1987, up from $185 million as at December 31, 1983, or about 5.4 times the amount of benefits payable from the Account in 1984, as reported in the previous actuarial examination of this Account. Without any change in the benefit and contribution provisions of the Plan, the contributions and other income, excluding interest credits, are 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.

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* See Appendix 3 for definitions.

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, 1986 as well as some contingency reserve projections. Section V acknowledges the cooperation of the various providers of the data. Section VI 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 Appendices 1 and 2A through 2D and a summary of the plan is provided in Appendix 3.

II. Data

Data for participants employed in the Public Service and for elective participants as at December 31, 1986 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, 1986

Class	Total Number	Total Benefit (in thousands)	Average Benefit
Employed Participants			
Males	183,247	$6,403,814	$34,946
Females	115,247	3,176,269	27,561
Elective Participants			
a) entitled to an immediate annuity* under the Act			
Males	66,765	654,092	9,797
Females	19,462	119,209	6,125
b) not entitled to an immediate annuity under the Act			
Males	102	1,678	16,454
Females	21	275	13,111
Total	384,844	$10,355,337	$26,908

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* Throughout the report, the expression "entitled to an immediate annuity" includes entitlement to an immediate reduced allowance, but does not include entitlement to a deferred annuity.

III. Cost of Benefits 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 $0.40 per $1,000 of benefit, regardless of age (except for the $0.20 reduction after age 65 in respect of the $500 of benefit paid-up by the employer).

For these participants, the benefit cost expected to be experienced in 1987 was estimated by applying the mortality rates described in Appendix 1, and displayed in Appendices 2A, 2B and 2C, to the benefit coverage of participants of the plan as at December 31, 1986. The results are shown in the following table:

Current Cost per $1,000 Benefit

Class	Monthly Cost
Employed participants	$0.188
Elective participants entitled to an immediate annuity	$1.399
Employed and elective participants combined	$0.276

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 $0.28 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, 1988. These indicate recent average monthly claim payments per $1,000 benefit coverage of between $0.250 and $0.294.

Since monthly contributions from participants together with government credits currently are about $0.45 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 $1,000 Benefit

Class	1987	1995	2010	2025	2050
Employed participants	$0.188	$0.210	$0.256	$0.226	$0.232
Elective participants entitled to an immediate annuity	$1.399	$1.276	$0.918	$0.828	$0.599
Employed and elective participants combined	$0.276	$0.292	$0.354	$0.293	$0.275

The estimates for employed participants are based on the assumption that their age-specific mortality rates will not decrease with the passage of time, i.e., that the mortality rates in Appendix 2A will remain valid indefinitely. The distribution of employed participants in the year 2050 is weighted more heavily at the older ages than the current population, and the monthly cost per $1,000 benefit is expected to increase approximately 21 per cent for males and 48 per cent for females. At the same time, however, there is a reduction in the proportion of employed participants' coverage attributable to males, from 67 per cent in 1987 to a level of 65 per cent in 2050. These two factors combined result in an increase of only 23 per cent in the combined monthly cost for employed participants from the current (1987) level to the ultimate (2050) level. This can be explained by the fact that the average female cost remains substantially lower than the average male cost, and, therefore, the change in female cost has much less weight than the change in male cost in determining the combined cost change.

The estimated monthly cost for elective participants entitled to an immediate annuity in the year 2050 is expected to decrease by approximately 57 per cent from the current (1987) monthly cost. This reduction is almost entirely due to the very low mortality anticipated in the year 2050 in accordance with the projection factors of Appendix 2D being applied to the current mortality rates shown in Appendices 2B and 2C.

Although the ultimate (2050) costs for employed and elective participants are, respectively, 23 per cent greater and 57 per cent less than current (1987) costs, the monthly cost in the year 2050 for both groups combined is expected to be virtually the same as the current (1987) monthly cost because the proportion of elective participants (which carry a much higher cost) will almost double from 7 per cent to 12 per cent.

For purposes of the preceding report, the ultimate monthly cost per $1,000 benefit for employed and elective participants combined was estimated to be $0.384. A reconciliation of the difference with the $0.275 cost shown in this report is provided in the following table:

Reconciliation of 1983 and 1986 Report Estimates
of Ultimate (2050) Monthly Costs

Estimate of ultimate monthly cost from 1983 report $0.384

Effect of:

a) changes in assumed mortality rates   - $0.114

b) changes in assumed salary increases and
   in assumed decrements other than mortality   + $0.004

c) changes in assumed new entrants   + $0.007

d) changes in methodology   - $0.002

e) changes in population composition   - $0.004

Estimate of ultimate monthly cost in this report $0.275

The decrease of $0.114 due to changes in assumed mortality rates is primarily attributable to the fact that in this report mortality of elective participants was assumed to decrease with the passage of time in accordance with the projection factors of Appendix 2D, while in the 1983 report the mortality of elective participants was not assumed to so decrease.

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, 1986:

Assets	(in thousands)
Balance of Account	$361,445
Contributions due from Government	579
Total assets	$362,024

Liabilities and Contingency Reserve	
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	$ 17,806
Actuarial liability for elective participants not entitled to an immediate annuity	87
Reserve for claims incurred but unreported or reported but not paid	5,483
Total liabilities	$ 23,376
Contingency reserve	338,648
	$362,024

The contingency reserve of $338,648,000 shown in the above statement is equal to about 10.2 times the benefits payable from the Account in 1987. 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, 1991).

Assumed monthly contribution per $1,000 benefit	Projected ratio of contingency reserve to annual benefit payments in following year			
	1995	2010	2025	2050
$0.40*	21.6	32.2	57.6	94.7
0.16*	17.0	15.1	17.2	15.5
0.20**	16.9	14.3	15.1	11.8

The above table suggests that the monthly contribution rate could be reduced to $0.16 by participants per $1,000 benefits with the government paying one-sixth of benefits, or to a combined government-participant contribution rate of $0.20, effective January 1, 1991, with reasonable expectation that a substantial contingency reserve will be maintained at least until the year 2050.

The above forecasts are based on the assumption that there will be substantial reductions in elective participant mortality in the future, reductions that appear to be reasonable but are not certain of being fully realized. On the other hand, they do not assume any reduction in employed participant mortality, and there almost certainly will be significant reductions in these mortality rates as well. Consequently, it is likely that future contribution rates required will be somewhat lower than those estimated in this report.

As indicated above, the continuation of the current contributions and coverage will result in the contingency reserve increasing indefinitely to exorbitant levels. Consequently, consideration should be given to reviewing the contribution rates and/or amounts of coverage.

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* 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. <u>Acknowledgments</u>

We wish to acknowledge the co-operation and able assistance of the Pension and Insurance Products Group, the Superannuation Branch and the Information Systems Directorate of Supply and Services Canada for providing the data used.
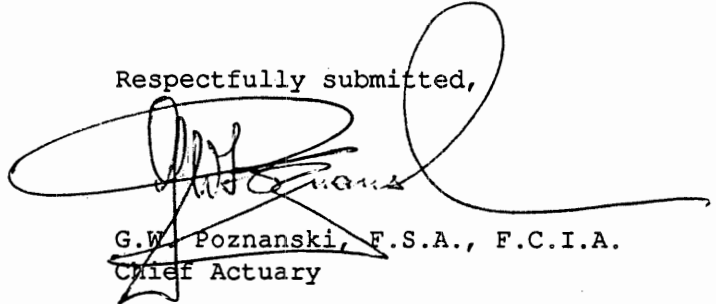
VI. <u>Actuarial Opinion</u>

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

(a) the data upon which the calculations have been based
     are sufficient and reliable for the purpose of the
     calculations;

(b) the assumptions used are reasonable and appropriate for
     purposes of the actuarial calculations; emerging experience
     may vary from the assumptions and produce experience gains
     or losses; and

(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,

G.W. Poznanski, F.S.A., F.C.I.A.
Chief Actuary

Ottawa, Canada
February 12, 1990

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 30 of the Supplementary Death Benefits
Regulations. 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, 1986, the total rate of interest was 2.6825 per cent
which is equivalent to 11.17 per cent 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 cent 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:

Assumed Fund Yields

1987	10.1%	1995	9.5%	2003	7.3%
1988	10.1	1996	9.3	2004	7.1
1989	10.1	1997	9.1	2005	6.8
1990	10.0	1998	8.9	2006	6.6
1991	10.0	1999	8.6	2007	6.4
1992	9.9	2000	8.3	2008	6.2
1993	9.7	2001	8.0	2009	6.0
1994	9.6	2002	7.6	2010+	6.0

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* Actuarial Report on the Superannuation Account as at December 31, 1986,
  page 4.

2. Mortality

(a) Employed Participants

The mortality rates adopted for the purpose of this report (see Appendix 2A) were those used in the Actuarial Report on the Superannuation Account as at December 31, 1986. The mortality rates closely reflected the 1981-86 experience of the Superannuation Account for contributors employed in the Public Service with five or more years of pensionable service. The mortality rates in this report are generally comparable to those used in the previous report except for significant increases at ages 55 and higher.

(b) Elective participants entitled to an immediate annuity

While these are referred to as elective participants, since July 14, 1960 the only action such participants may 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 both types of annuitants, it was decided to use the bases in the Actuarial Report on the Superannuation Account as at December 31, 1986. The mortality rates for 1987 are shown in Appendix 2B for elective participants entitled to an immediate annuity for reasons other than disability and in Appendix 2C for elective participants entitled to an immediate annuity because of disability. They are generally slightly lower than those experienced during the 1984-86 period, and are significantly lower than the static mortality assumed in the previous report. Mortality rates for later years were obtained by means of projection factors which are shown in Appendix 2D.

(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 shown in Appendix 2B projected according to the factors in Appendix 2D.

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

The mortality rates used to compute the actuarial liability are
the same as those described above for elective participants
entitled to an immediate annuity because of disability. The
rates for 1987 are shown in Appendix 2C and the projection
factors in Appendix 2D.

3. <u>Other Assumptions</u>

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, 1984 to
    December 31, 1986;

(b) the number of new entrants 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,
    1986;

(d) for employed participants the average amounts of benefit coverage
    will be the same as their coverage as at December 31, 1986, 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, 1986 plus a general
    (economic) salary increase factor varying by calendar year, and
    coverage after age 60 will be decreased by 10 per cent annually;

(e) 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;

(f) no elective participants entitled to an immediate annuity will
    elect to reduce their coverage to $500 (in practice approximately
    2 per cent so elect).

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

APPENDIX 2A

Rates of Mortality for Employed Participants

Age	Males	Females
20	.001167	.000223
25	.000934	.000298
30	.000732	.000404
35	.000805	.000558
40	.001337	.000796
41	.001505	.000861
42	.001678	.000935
43	.001855	.001021
44	.002038	.001122
45	.002239	.001241
46	.002462	.001374
47	.002717	.001518
48	.003011	.001672
49	.003353	.001830
50	.003743	.001992
51	.004185	.002165
52	.004683	.002355
53	.005225	.002572
54	.005821	.002823
55	.006467	.003114
56	.007161	.003448
57	.007905	.003825
58	.008690	.004246
59	.009503	.004712
60	.010341	.005225
61	.011205	.005789
62	.012091	.006410
63	.012990	.007095
64	.013899	.007849
65	.014815	.008686
66	.015739	.009646
67	.016665	.010780
68	.017592	.012135
69	.018518	.013761
70	.019445	.015708

APPENDIX 2B

Rates of Mortality in 1987 for Elective Participants
Entitled to an Immediate Annuity for Reasons other than Disability

Age	Males	Females
50	.004804	.001992
51	.005283	.002165
52	.005778	.002355
53	.006289	.002572
54	.006812	.002823
55	.007353	.003114
56	.007932	.003448
57	.008577	.003825
58	.009315	.004246
59	.010175	.004712
60	.011182	.005225
61	.012370	.005789
62	.013768	.006410
63	.015409	.007095
64	.017324	.007849
65	.019532	.008686
66	.022004	.009646
67	.024699	.010780
68	.027574	.012135
69	.030589	.013761
70	.033727	.015698
71	.037078	.017955
72	.040756	.020534
73	.044876	.023435
74	.049552	.026658
75	.054876	.030205
76	.059649	.033305
77	.064789	.036605
78	.070285	.040106
79	.076126	.043809
80	.082300	.047717
81	.090538	.052950
82	.099244	.058546
83	.108361	.064523
84	.117830	.070897
85	.127595	.077687
86	.137967	.085078
87	.148744	.093843
88	.160081	.102150
89	.172066	.112616
90	.184785	.124167

APPENDIX 2C

Rates of Mortality in 1987 for Elective Participants who are in Receipt of an Immediate Annuity Because of Disability, or Not Entitled to an Immediate Annuity

Age	Males	Females
25	.0071	.0069
30	.0108	.0074
35	.0145	.0079
40	.0179	.0086
45	.0214	.0096
50	.0248	.0109
55	.0279	.0128
60	.0333	.0157
65	.0447	.0203
66	.0481	.0215
67	.0520	.0228
68	.0561	.0243
69	.0604	.0259
70	.0648	.0277
71	.0692	.0296
72	.0736	.0318
73	.0779	.0343
74	.0822	.0370
75	.0866	.0401
76	.0913	.0435
77	.0964	.0473
78	.1020	.0516
79	.1081	.0564
80	.1149	.0620
81	.1225	.0685
82	.1308	.0761
83	.1401	.0847
84	.1501	.0942
85	.1607	.1048
86	.1718	.1164
87	.1834	.1293
88	.1952	.1434
89	.2073	.1590
90	.2197	.1762

APPENDIX 2D

Projection Factors Assumed Applicable in 1988 and Later Years
 for Elective Participants Entitled to an Immediate Annuity

Annual Reduction from Mortality Assumed to Exist in 1987
(as a Percentage)

Age	Males	Females	Age	Males	Females
25	0.10	0.50	70	1.00	1.25
30	0.50	0.75	71	1.00	1.20
35	0.75	1.25	72	1.00	1.15
40	1.00	1.75	73	1.00	1.10
45	1.50	1.75	74	1.00	1.05
50	1.50	1.50	75	1.00	1.00
51	1.45	1.50	76	0.95	1.00
52	1.40	1.50	77	0.90	1.00
53	1.35	1.50	78	0.85	1.00
54	1.30	1.50	79	0.80	1.00
55	1.25	1.50	80	0.75	1.00
56	1.25	1.45	81	0.75	1.00
57	1.25	1.40	82	0.75	1.00
58	1.25	1.35	83	0.75	1.00
59	1.25	1.30	84	0.75	1.00
60	1.25	1.25	85	0.75	1.00
61	1.25	1.25	86	0.70	0.95
62	1.25	1.25	87	0.65	0.90
63	1.25	1.25	88	0.60	0.85
64	1.25	1.25	89	0.55	0.80
65	1.25	1.25	90	0.50	0.75
66	1.20	1.25			
67	1.15	1.25			
68	1.10	1.25			
69	1.05	1.25			

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 (7,365 persons
on December 31, 1986) because they have group life insurance
plans in operation and (ii) contributors who had elected not to
come under the provisions of Part II of the Act at its inception
in 1955 (890 on December 31, 1986).

(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
30 days thereafter. In the case of a participant not entitled to
an immediate annuity on cessation of employment, the death
benefit coverage is extended for 30 days after the date of
cessation whether or not the participant exercises the 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 per cent 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 the annual rate of pay at the time of cessation of
employment in the Public Service. The benefit payable on account of
an employed 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 employed 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 $0.10 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
$0.20 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:

Age Last Birthday	Annual Contribution per $1,000 Benefit	Monthly Contribution per $1,000 Benefit
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) and (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 4 per cent per annum.

Crown corporations and public boards whose employees are participants contribute at the rate of $0.02 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.