GRS Gabriel Roeder Smith & Company
Consultants & Actuaries

MINNESOTA JUDGES RETIREMENT FUND

4-YEAR EXPERIENCE STUDY

JULY 1, 2011 THROUGH JUNE 30, 2015

GRS

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July 26, 2016

Minnesota State Retirement System
Judges Retirement Fund

Dear Board of Directors:

The results of the four-year ***actuarial experience study*** of the Judges Retirement Fund (JRF) are presented in this report. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the Judges Retirement Fund.

The investigation was based upon the statistical data furnished for annual active members and retired life actuarial valuations concerning members who died, withdrew, became disabled or retired during the four-year period of the study by the Minnesota State Retirement System (MSRS). We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by MSRS.

The investigation covered the four-year period from ***July 1, 2011 to June 30, 2015***, and was carried out using generally accepted actuarial principles and techniques.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the Judges Retirement Fund.

This report should not be relied on for any purpose other than that described above. It was prepared at the request of MSRS and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than MSRS only in its entirety and only with the permission of the Board.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report was performed in accordance with Minnesota Statutes Section 356.215 and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement. We certify that, to the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

Brian Murphy and Bonnie Wurst are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,

Bonita J. Wurst

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BJW/BBM:dj

ACTUARIAL EXPERIENCE STUDY
2011 - 2015

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

SUMMARY OF FINDINGS

The four-year period (July 1, 2011 to June 30, 2015) covered by this experience study provided sufficient data to form a basis for recommending changes in some of the assumptions and/or methods used in actuarial valuations of the Judges Retirement Fund (JRF). The recommended changes in actuarial assumptions and methods resulting from this experience study are summarized below:

Recommendations:

- Adjust assumed retirement rates:
  - Increase the assumed unreduced retirements (i.e., Normal Retirement) at ages 66, 67 and 69. Decrease the assumed retirements at ages 65 and 68. The net effect is later retirements.
  - Increase the assumed reduced retirements (i.e., Early Retirement) at age 63 and reduce the assumed retirements at age 64. The net effect is approximately the same number of assumed early retirements.
- Decrease rates of disability for males by setting male rates equal to female rates.
- Change the base mortality table to the RP-2014 mortality table, white collar adjustment, with future improvements projected using scale MP-2015 from a base year of 2006.

The recommendations are summarized on the following pages.

Review of economic assumptions (inflation, payroll growth, investment return) and actuarial methods is outside the scope of this experience study. Please refer to GRS' State Employees Retirement Fund experience study dated June 30, 2015.

INTRODUCTION

Each year as of June 30, the actuarial liabilities of the System are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

- Rates of **withdrawal** of active members (leaving before eligible to retire).
- Rates of **disability** among active members.
- Patterns of **pay increases** to active members.
- Rates of **retirement** among active members.
- Rates of **mortality** among active members, retirees, and beneficiaries.
- Long-term rates of **investment return** to be generated by the assets of the System.

Assumptions should be carefully chosen and continually monitored. An unrealistic set of assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or gradual increases in required contributions as time progresses; and
- Overstated costs resulting in an unnecessarily large burden on the current generation of employers and taxpayers.

All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement or the MSRS Board of Directors.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year to year fluctuations. Actuarial assumptions were last revised for the June 30, 2012 actuarial valuation based on the results of the most recent experience study. Assumptions in effect prior to June 30, 2015 are ignored for purposes of this report.

No single experience period should be given full credibility in the setting of actuarial valuation assumptions. When we see significant differences between what is expected from our assumptions and the actual experience, we generally recommend a change in assumptions that produces results somewhere between the actual and expected experience. In this way, with each experience study the actuarial assumptions become better and better representations of actual experience. Consequently, temporary conditions that might influence a particular experience study period will not unduly influence the choice of long-term assumptions.

We are recommending certain changes in assumptions and methods. The various assumption changes and their impact on the required contribution are described on the following pages.

SUMMARY OF DECREMENT EXPERIENCE
2011 - 2015

Decrement Risk Area	Actual Number	Expected		
		Present Assumptions	Proposed Assumptions	Change
Retirement				
Normal Retirement	48	42.6	46.0	3.4
Early Retirement	14	11.9	11.7	(0.1)
Withdrawal				
Males	3	0.0	0.0	-
Females	2	0.0	0.0	-
Disability				
Males	0	2.1	1.6	(0.5)
Females	0	0.6	0.6	-
Mortality				
Healthy Retired Lives - Male	24	29.2	25.7	(3.5)
- Female	2	2.4	2.5	0.1
Disabled Retired Lives - Male	2	3.2	2.8	(0.4)
- Female	0	0.1	0.1	(0.0)
Active Lives - Male	1	2.9	2.9	0.0
- Female	0	1.2	0.8	(0.4)

SECTION B

PAY INCREASES

PAY INCREASES DUE TO MERIT AND SENIORITY

Pay increases granted to active members typically consist of two pieces:

- An across-the-board, economic type of increase granted to most or all members of the group. This increase is typically tied to inflation or cost of living changes, and

- An increase as a result of merit and seniority. This increase is typically related to the performance of an individual and includes promotions and increased years of experience.

We reviewed total pay increases during the four-year period. For each year, we excluded individual pay increases that were more than 30% and also excluded individual pay increases that were less than 0%. Members with more than 24 years of service and members who are greater than the age of 70 were excluded due to data validity concerns; additionally, we excluded one person with suspicious data. While this was a relatively small number of records, the experience distorted the experience of the overall group.

The current assumption is that salary increases will equal 2.75% each year, consistent with the current inflation assumption.

PAY INCREASES DUE TO MERIT AND SENIORITY

Findings

Gross actual salary increases averaged 2.64% over the four-year period, ranging from 0.80% in 2013 to 4.99% in 2014.

Fiscal Year Ending	Count	Gross	
		Expected	Actual
2012	258	2.75%	0.81%
2013	250	2.75%	0.80%
2014	258	2.75%	4.99%
2015	276	2.75%	3.81%
Total	**1,042**	**2.75%**	**2.64%**

** Net Expected increases are equal to Gross Expected increases minus assumed wage inflation of 2.75%.*

Actual salary increases tend to be consistent for all members each year and not dependent on age or service, which indicates merit and seniority does not influence wages. The Minnesota Legislature sets the compensation for judges. Over the study period, legislated increases were 0% (2012); 0% (2013); 4% (2014); and 3% (2015), for an average increase of 1.73%. Actual increases during this period were slightly greater than the average legislated increase due to changes in assignment and data anomalies.

Recommendation

We recommend no change to the current salary increase assumption of 2.75% per year.

SECTION C

RETIREMENT EXPERIENCE

UNREDUCED (NORMAL) RETIREMENT

Findings

The benefit provisions of the JRF establish the minimum age and service requirements for unreduced or normal retirement. However, the actual cost of retirement is determined by when members actually retire. The assumption about timing of retirements is a major ingredient in cost calculations. Note that higher rates of retirement with full benefits generally results in higher computed contributions, and vice-versa.

The Normal Retirement Benefit is determined as follows:

Tier 1: First appointed as a judge before July 1, 2013:

(a) 2.70% of Average Salary for each year of Allowable Service prior to July 1, 1980; and
(b) 3.20% of Average Salary for each year of Allowable Service after June 30, 1980
(Maximum benefit equal to 76.80% of Average Salary)

Tier 2: First appointed as a judge after June 30, 2013:

(a) 3.20% of Average Salary for each year of Allowable Service prior to January 1, 2014; plus
(b) 2.50% of Average Salary for each year of Allowable Service after December 31, 2013.

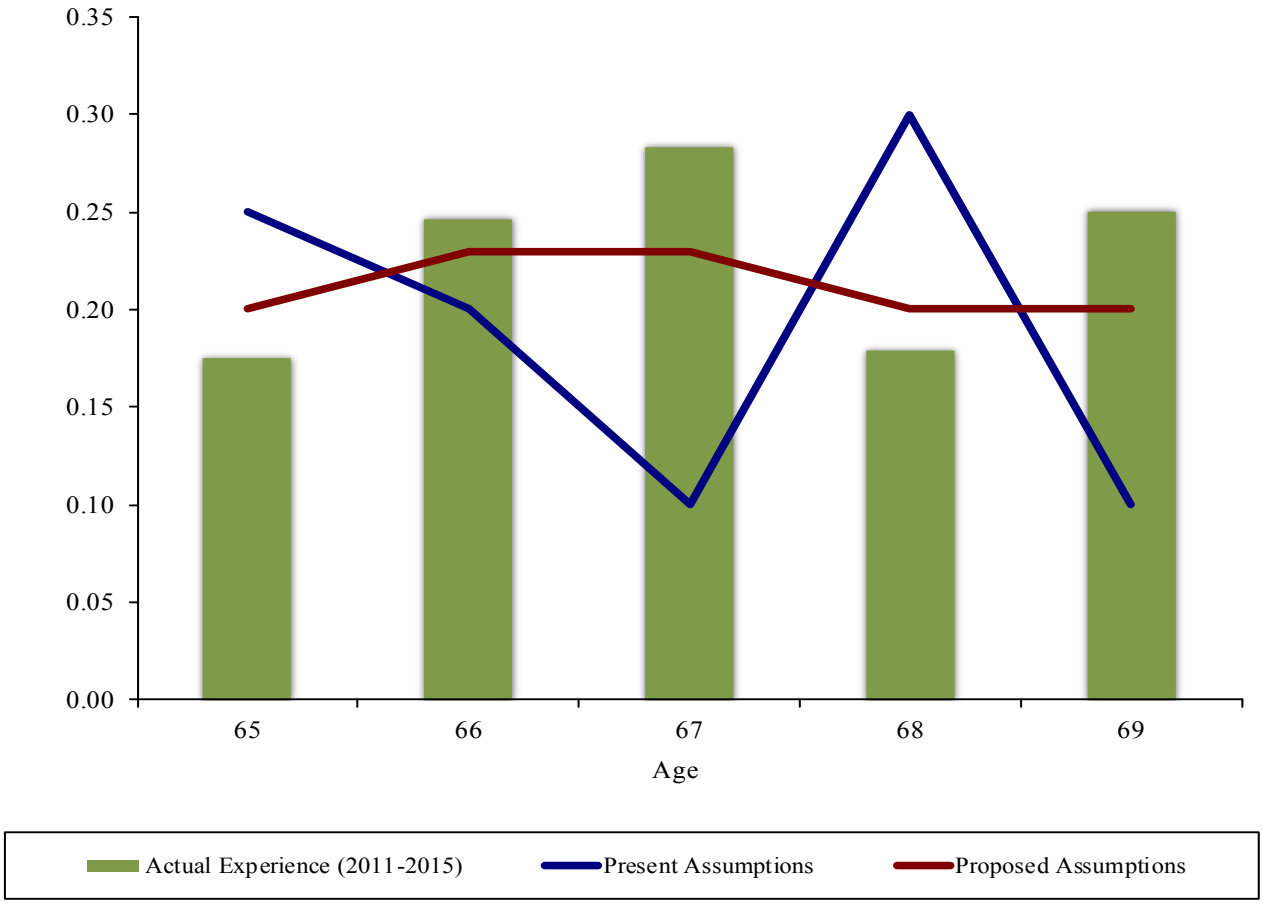
The current assumption ends at age 70; in other words, we assume all members currently under the age of 70 will retire by the age of 70. However, for members currently age 70 or older, we assume retirement one year after the valuation date (effectively 18 months due to mid-year decrementing), as required by the Minnesota Standards for Actuarial Work. As such, there are no exposures for ages over 70 since the valuation assumption is all of these members work until the next valuation date and then retire. During the four-year period, there were nine actual retirements at ages 70 or older, including seven actual retirements at age 70. We believe assuming 100% retirement at age 70 is an appropriate approach.

Recommendations

We recommend minor changes to the retirement rates as indicated below. In addition, we recommend the Minnesota Standards for Actuarial Work be modified to remove the requirement that members currently over age 70 delay retirement one year and instead assume these members retire mid-year, the same as members younger than age 70.

Age	Actual Retirements	Exposure	Crude Rates	Rates		Expected Retirements		Actual / Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
65	11	63	17.5%	25.0%	20.0%	15.75	12.60	69.8%	87.3%
66	15	61	24.6%	20.0%	23.0%	12.20	14.03	123.0%	106.9%
67	13	46	28.3%	10.0%	23.0%	4.60	10.58	282.6%	122.9%
68	5	28	17.9%	30.0%	20.0%	8.40	5.60	59.5%	89.3%
69	4	16	25.0%	10.0%	20.0%	1.60	3.20	250.0%	125.0%
70+	*	*	-	-	-	-	-	N/A	N/A
Totals	**48**	**214**	**22.4%**	**19.9%**	**21.5%**	**42.55**	**46.01**	**112.8%**	**104.3%**

* *The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement one year. Therefore, even though there are members who are over age 70, these members are not included in the Exposures since retirement is assumed to be delayed one year. There were 15 actual retirements at age 70 or later.*



REDUCED (EARLY) RETIREMENT

Findings

JRF members may also retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as early retirements.

The early retirement benefit payable to JRF members is equal to the Normal Retirement Benefit based on allowable service and average salary at retirement date with reduction of 0.50% for each month the member is under Normal Retirement Age at the time of retirement. Normal Retirement Age is 65 for judges hired prior to July 1, 2013 and is 66 for judges hired after June 30, 2013.

Generally, higher rates of early retirement generally result in higher computed contributions due to the enhanced benefit, and vice-versa.

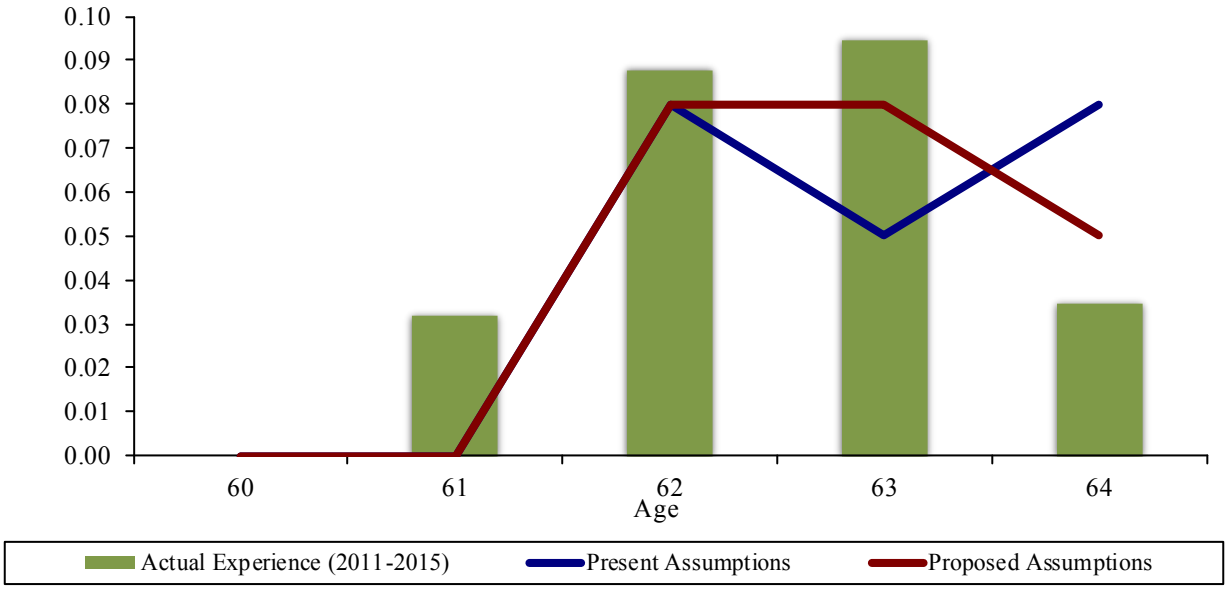
We reviewed the experience during the study period. Overall, the plan experienced more early retirements than projected by the present assumptions (12 expected versus 14 actual – see totals on the following page).

Recommendation

We recommend slight adjustments to the reduced early retirement rates, as indicated on the next page. The proposed rates reflect our expectation that there will be fewer early retirements in the future due to the change in Normal Retirement Age for judges appointed after June 30, 2013.

REDUCED EARLY RETIREMENT

Age	Actual Retirements	Exposure	Crude Rates	Rates		Expected Retirements		Actual / Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
60	-	59	0.0%	0.0%	0.0%	0.00	0.00	N/A	N/A
61	2	63	3.2%	0.0%	0.0%	0.00	0.00	N/A	N/A
62	5	57	8.8%	8.0%	8.0%	4.56	4.56	109.6%	109.6%
63	5	53	9.4%	5.0%	8.0%	2.65	4.24	188.7%	117.9%
64	2	58	3.4%	8.0%	5.0%	4.64	2.90	43.1%	69.0%
Totals	**14**	**290**	**4.8%**	**4.1%**	**4.0%**	**11.85**	**11.70**	**118.1%**	**119.6%**



RETIREMENT FROM DEFERRED STATUS

Members who terminate after completing five years of Allowable Service are vested and entitled to either a refund of employee contributions, with interest, or a deferred retirement benefit.

While some members actually elect a refund even if it is less valuable than the deferred annuity, the current valuation assumption is that members will elect a refund only if it is more valuable than the deferred annuity. When a member elects a refund that is less valuable than his or her deferred annuity (or when a member elects the deferred annuity even if the refund is more valuable), the plan experiences a small liability gain. Since the current valuation assumption results in very small gains to the plan, we recommend no change to this assumption.

For those deferred vested members for whom the deferred benefit is more valuable than a refund, the current valuation assumption is that the member will commence benefits at Normal Retirement Age. We recommend no change to this assumption.

SECTION D

WITHDRAWAL EXPERIENCE

WITHDRAWAL EXPERIENCE

Members who leave active employment, for reasons other than retirement or death, may be eligible for the following payments from the pension trust:

- A refund of employee contributions, or
- A deferred retirement benefit, if they are vested

Deferred retirement benefits are based on the pay and service credit at the time of withdrawal. The benefit is payable at Normal Retirement (or at Early Retirement with a reduction). Consequently, members who withdraw receive much less from the plan than members who stay in employment until retirement. Higher rates of withdrawal result in lower computed contributions, and vice-versa.

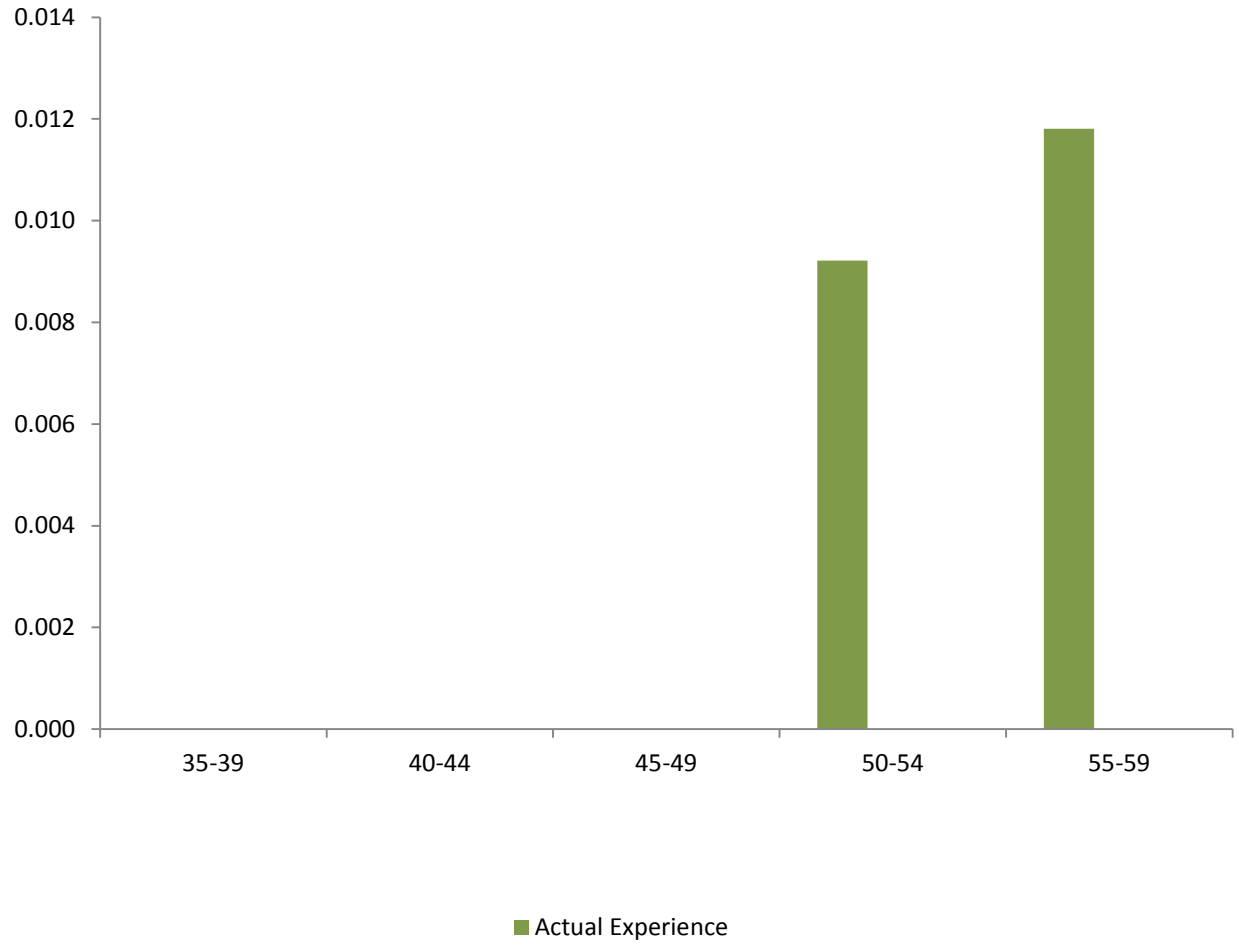
Our current valuation assumptions assume that no members terminate prior to retirement. The actual number of terminations prior to retirement has historically been very low, consistent with the findings in this report. If there are terminations, they will result in small actuarial gains.

Recommendation

We recommend no change to the current assumption that no members terminate prior to retirement eligibility.

WITHDRAWAL EXPERIENCE
MALES & FEMALES

Age Group	Actual Withdrawals	Exposure	Crude Rates	Rates		Expected Withdrawals		Actual / Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
35-39	-	14	0.00%	0.00%	0.00%	-	-	N/A	N/A
40-44	-	49	0.00%	0.00%	0.00%	-	-	N/A	N/A
45-49	-	127	0.00%	0.00%	0.00%	-	-	N/A	N/A
50-54	2	217	0.92%	0.00%	0.00%	-	-	N/A	N/A
55-59	3	254	1.18%	0.00%	0.00%	-	-	N/A	N/A
Totals	**5**	**661**	**0.76%**	**0.00%**	**0.00%**	**-**	**-**	**N/A**	**N/A**



SECTION E

DISABILITY EXPERIENCE

DISABILITY EXPERIENCE

Findings

The assumed rates of disability (leaving active service due to injury or illness while not entitled to age and service retirement benefits) are a minor ingredient in cost calculations, since the incidence of disability is low. Higher rates of disability generally result in somewhat higher computed contributions, and vice-versa.

Disability benefits are not paid by the fund during the first year; instead, salary is continued for one year but not beyond age 70. Employee contributions continue and Allowable Service is earned. If disability continues after the first year (or at age 70, if earlier), the larger of 25.00% of Average Salary or the Normal Retirement benefit (without reduction) is paid.

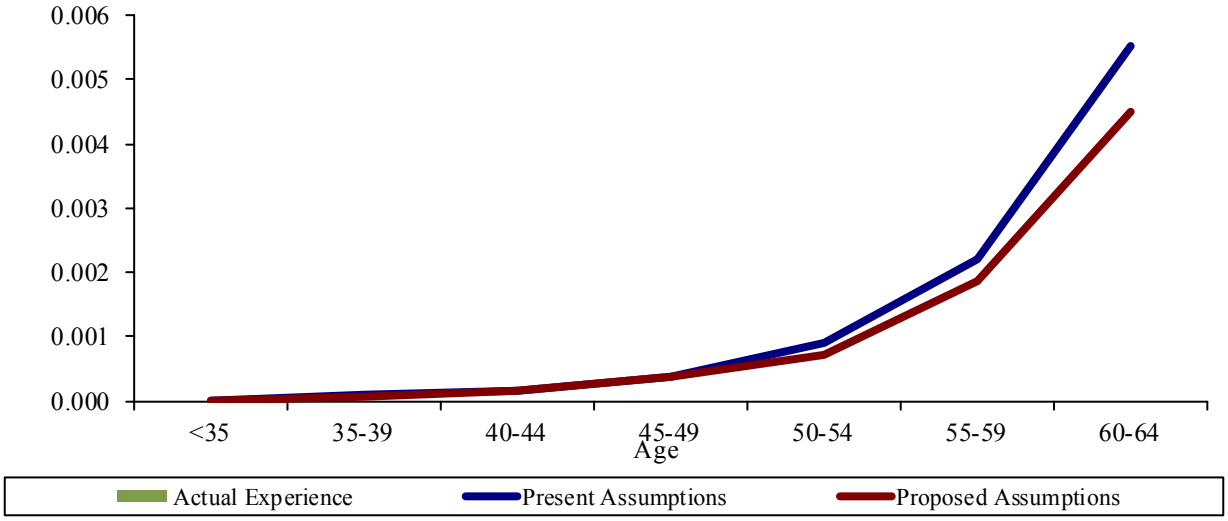
We reviewed the disability experience during the four-year period. The results are shown on the following page. There were no disability retirements, which is less than the expected number of disabilities (3 expected- see chart on next page for details).

Recommendation

We recommend no change to the assumed disability incidence for females and recommend reducing the assumed disability incidence for male rates by using the current female rates for males and females.

DISABILITY EXPERIENCE
MALES & FEMALES

Age	Disabilities	Exposure	Crude Rates	Sample Rates		Expected Disabilities		Ratio of Actuals/Expecteds	
				Old	New	Old	New	Old	New
<35	-	-	N/A	0.0000	0.0000	-	-	N/A	N/A
35-39	-	14	0.0000	0.0001	0.0001	0.00	0.00	0.0%	0.0%
40-44	-	49	0.0000	0.0002	0.0002	0.01	0.01	0.0%	0.0%
45-49	-	127	0.0000	0.0004	0.0004	0.05	0.05	0.0%	0.0%
50-54	-	218	0.0000	0.0009	0.0007	0.20	0.16	0.0%	0.0%
55-59	-	253	0.0000	0.0022	0.0019	0.58	0.48	0.0%	0.0%
60-64	-	339	0.0000	0.0055	0.0045	1.85	1.50	0.0%	0.0%
Totals	**-**	**1,000**	**0.0000**	**0.0034**	**0.0022**	**2.69**	**2.21**	**0.0%**	**0.0%**



SECTION F

MORTALITY EXPERIENCE

MORTALITY EXPERIENCE

Post-retirement mortality is an important component in cost calculations and should be updated from time to time to reflect current and expected future longevity improvements. Pre-retirement mortality is a relatively minor component in cost calculations. The frequency of pre-retirement deaths is so low that mortality assumptions based on actual experience can only be produced for very large retirement systems, if at all.

Actuarial Standards of Practice

Actuarial Standards of Practice (ASOP) No. 35 Disclosure Section 4.1.1 states, "The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement." The current mortality rates used in the valuation include a provision for future mortality improvement.

The New Mortality Tables and Projection Scale

The Society of Actuaries (SOA) released updated mortality tables late in 2014 which reflect the improvement in longevity of the studied group of private pension plan participants, and which also reflects projected future improvements for current and future generations of participants. The new mortality table is called the RP-2014 table. The mortality improvement scale is called the MP-2014 improvement scale. In 2015, the SOA released an updated mortality improvement scale called MP-2015. The mortality improvement scale is applied to the RP-2014 table to show the improvements in mortality that are expected to occur.

The SOA has developed base experience tables and collar-specific experience versions of the RP-2014 tables. The Blue Collar tables have higher mortality rates than the base tables and the White Collar tables have lower mortality than the base tables.

Mortality Improvement Observations at a National Level

The updated mortality and mortality improvement tables show that among males age 65, overall longevity rose 2.0 years, from 84.6 in 2000 to 86.6 in 2014. Saying it another way, men age 65 in the year 2000 were expected to live to be 84.6 years old. Men age 65 in the year 2014 were expected to live to be 86.6 years old. For women age 65, overall longevity rose 2.4 years, from age 86.4 in 2000 to age 88.8 in 2014.

MORTALITY EXPERIENCE

Findings

The RP-2014 mortality rates were developed by the Society of Actuaries using benefit-weighted experience. As such, we show both liability-weighted and population-weighted results in the following exhibits.

Healthy Retirees

We reviewed the mortality experience of healthy retirees during the four-year period. Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study. The results are shown on the following pages.

The plan experienced fewer deaths (26) than projected by the present assumptions (32).

Disabled Retirees

We reviewed the mortality experience of disabled retirees during the four-year period. The results are shown on the following pages.

The plan experienced fewer deaths among disabled retirees (2) than projected by the present assumptions (3).

Active Members

We reviewed the mortality experience among active members during the four-year period. The results are shown on the following pages.

The plan experienced fewer deaths among active members (1) than projected by the present assumptions (4).

Recommendations

Given the small number of plan participants, plan-specific experience should not be relied upon to be credible. We recommend adoption of the following RP-2014 mortality tables:

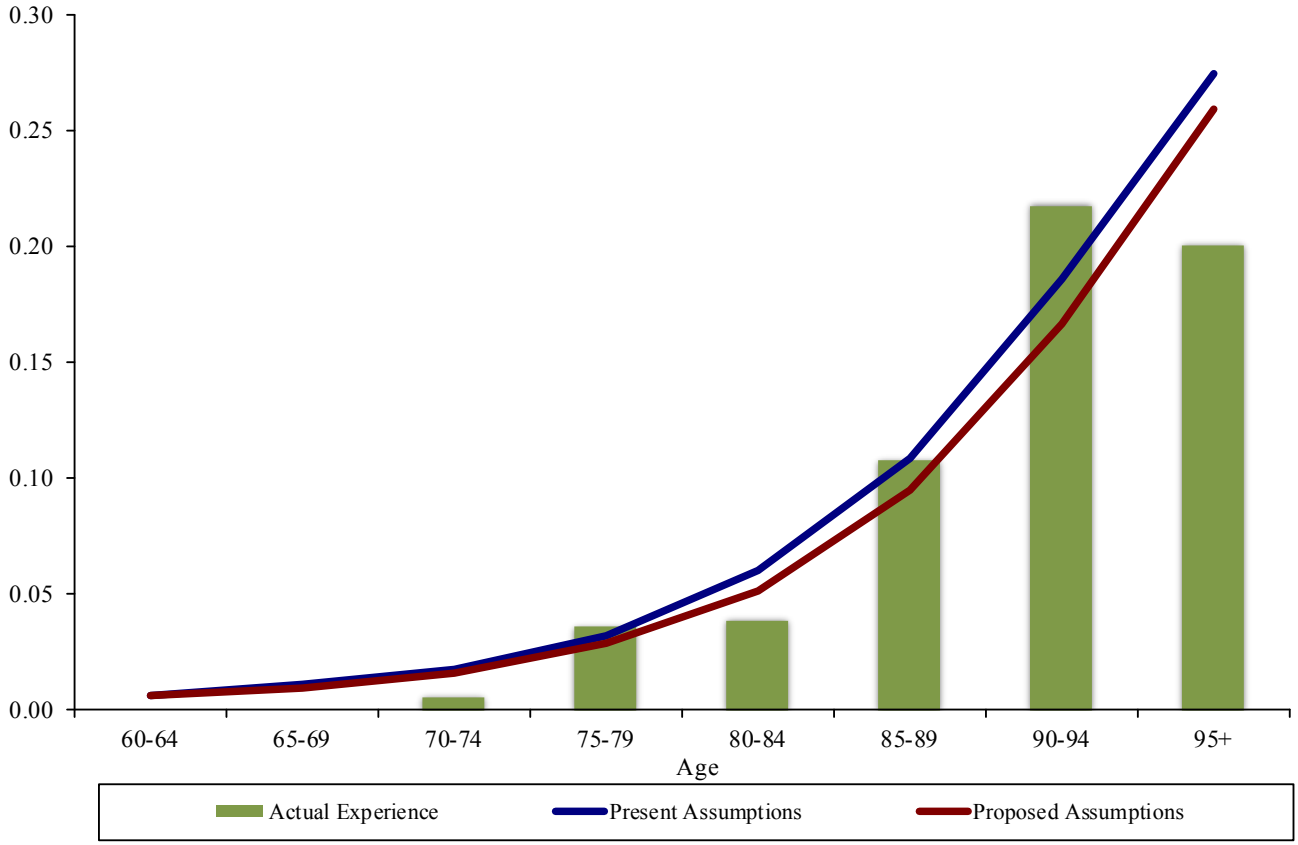
Healthy Male Retirees:	RP-2014 Male Healthy Annuitant Mortality Table, adjusted for white collar and mortality improvements using projection scale MP-2015.
Healthy Female Retirees:	RP-2014 Female Healthy Annuitant Mortality Table, adjusted for white collar and mortality improvements using projection scale MP-2015.
Disabled Male Retirees:	RP-2014 Male Healthy Annuitant Mortality Table, adjusted for white collar and mortality improvements using projection scale MP-2015.
Disabled Female Retirees:	RP-2014 Female Healthy Annuitant Mortality Table, adjusted for white collar and mortality improvements using projection scale MP-2015.
Male Active Members:	RP-2014 Male Employee Mortality Table, adjusted for white collar and mortality improvements using projection scale MP-2015.
Female Active Members:	RP-2014 Female Employee Mortality Table, adjusted for white collar and mortality improvements using projection scale MP-2015.

The RP-2014 tables as published by the Society of Actuaries (SOA) are based on rates for 2006. The SOA applied eight years of projection scale MP-2014 to produce the rates published as the "RP-2014" table, to be used for calendar year 2014. Recently, the SOA published an update to the MP-2014 projection scale, called MP-2015, which generally reflects lower improvements to life expectancy than MP-2014. All the proposed tables referred to in the above exhibit are based on the appropriate RP-2014 table as published by the Society of Actuaries (i.e., healthy retiree, disabled retiree or employee), projected backwards to 2006 using Scale MP-2014 and projected forward from 2006 using Scale MP-2015. Mortality rates at certain ages have been adjusted to prevent decreasing mortality rates.

POST-RETIREMENT MORTALITY EXPERIENCE
HEALTHY MALES

Age	Deaths	Exposure	Crude Rates	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
				Old*	New*	Old*	New*	Old*	New*
60-64	-	23	0.00000	0.00614	0.00607	0.16	0.15	0.0%	0.0%
65-69	-	145	0.00000	0.01091	0.00946	1.62	1.40	0.0%	0.0%
70-74	1	189	0.00529	0.01790	0.01633	3.34	3.06	29.9%	32.7%
75-79	4	113	0.03540	0.03208	0.02863	3.49	3.13	114.6%	127.8%
80-84	4	104	0.03846	0.06014	0.05144	6.35	5.43	63.0%	73.7%
85-89	9	84	0.10714	0.10877	0.09466	8.97	7.79	100.3%	115.5%
90-94	5	23	0.21739	0.18597	0.16678	3.86	3.44	129.5%	145.3%
95+	1	5	0.20000	0.27468	0.25919	1.37	1.30	73.0%	76.9%
Totals	**24**	**686**	**0.03499**	**0.04251**	**0.03746**	**29.16**	**25.70**	**82.3%**	**93.4%**

** In order to show the fit for the four-year period of the study, Sample Rates and Expected Deaths were determined using the current/proposed mortality rates projected forward/backward to the mid-point of the study using proposed projection scale.*

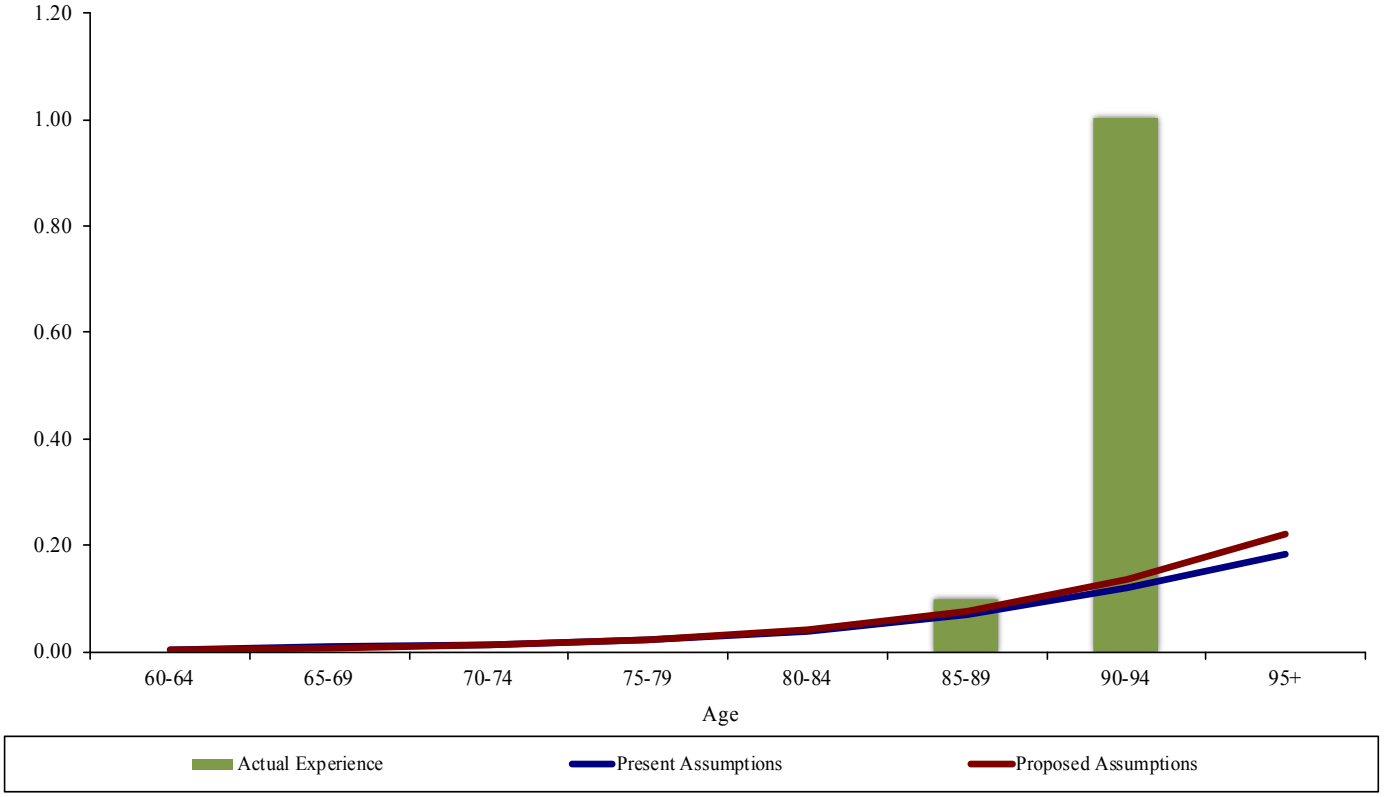


Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.

POST-RETIREMENT MORTALITY EXPERIENCE
HEALTHY FEMALES

Age	Deaths	Exposure	Crude Rates	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
				Old*	New*	Old*	New*	Old*	New*
60-64	-	13	0.00000	0.00531	0.00507	0.08	0.07	0.0%	0.0%
65-69	-	47	0.00000	0.00863	0.00833	0.41	0.39	0.0%	0.0%
70-74	-	20	0.00000	0.01433	0.01372	0.27	0.27	0.0%	0.0%
75-79	-	14	0.00000	0.02358	0.02341	0.32	0.32	0.0%	0.0%
80-84	-	12	0.00000	0.03982	0.04176	0.48	0.51	0.0%	0.0%
85-89	1	10	0.10000	0.06978	0.07660	0.72	0.78	138.9%	128.2%
90-94	1	1	1.00000	0.12149	0.13682	0.10	0.11	1000.0%	909.1%
95+	-	-	N/A	0.18498	0.22203	-	-	N/A	N/A
Totals	**2**	**117**	**0.01709**	**0.02034**	**0.02094**	**2.38**	**2.45**	**84.0%**	**81.6%**

** In order to show the fit for the four-year period of the study, Sample Rates and Expected Deaths were determined using the current/proposed mortality rates projected forward/backward to the mid-point of the study using proposed projection scale.*

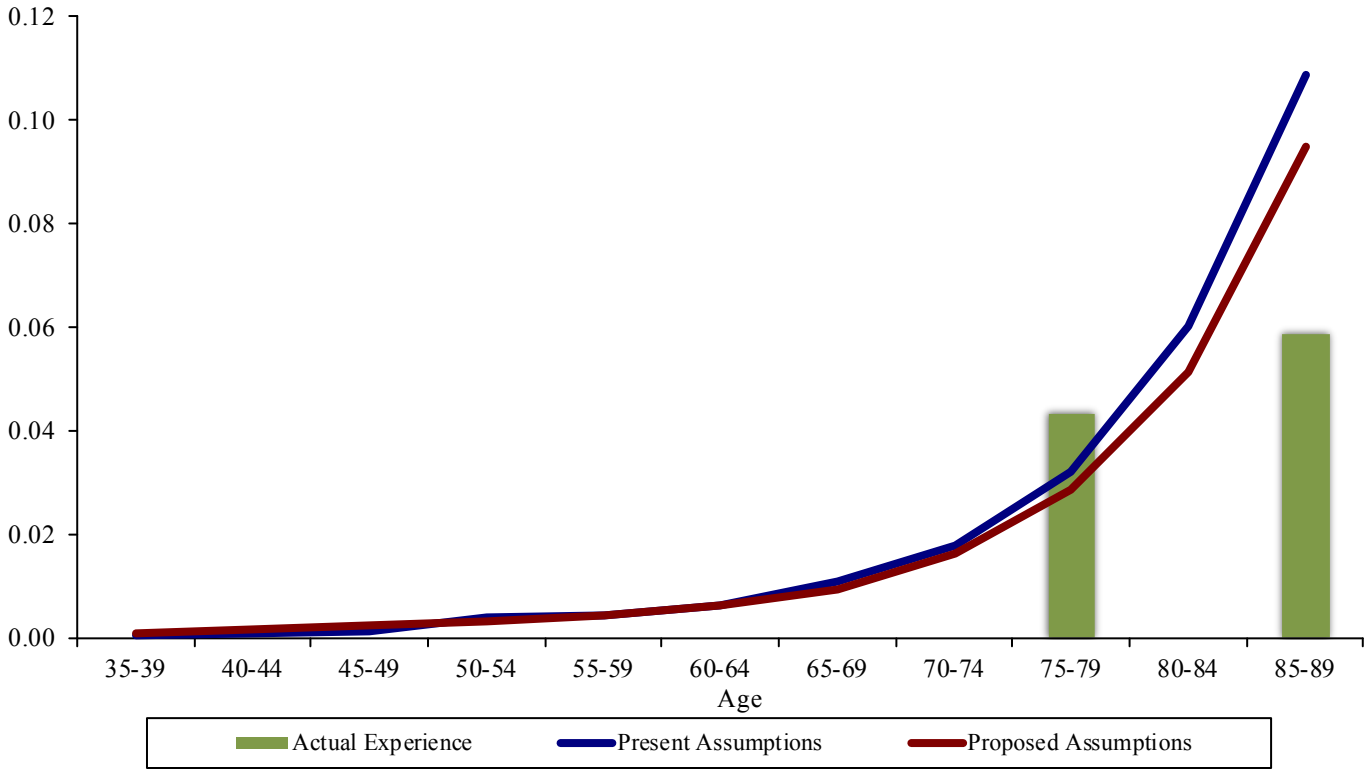


Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.

POST-RETIREMENT MORTALITY EXPERIENCE
DISABLED MALES

Age	Deaths	Exposure	Crude Rates	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
				Old*	New*	Old*	New*	Old*	New*
35-39	-	-	N/A	0.00061	0.00097	-	-	N/A	N/A
40-44	-	-	N/A	0.00086	0.00147	-	-	N/A	N/A
45-49	-	-	N/A	0.00122	0.00224	-	-	N/A	N/A
50-54	-	-	N/A	0.00395	0.00329	-	-	N/A	N/A
55-59	-	2	0.00000	0.00435	0.00442	0.01	0.01	0.0%	0.0%
60-64	-	7	0.00000	0.00614	0.00607	0.05	0.04	0.0%	0.0%
65-69	-	15	0.00000	0.01091	0.00946	0.16	0.14	0.0%	0.0%
70-74	-	21	0.00000	0.01790	0.01633	0.39	0.35	0.0%	0.0%
75-79	1	23	0.04348	0.03208	0.02863	0.71	0.64	140.8%	156.3%
80-84	-	-	N/A	0.06014	0.05144	-	-	N/A	N/A
85-89	1	17	0.05882	0.10877	0.09466	1.89	1.65	52.9%	60.6%
Totals	**2**	**85**	**0.02353**	**0.03776**	**0.03329**	**3.21**	**2.83**	**62.3%**	**70.7%**

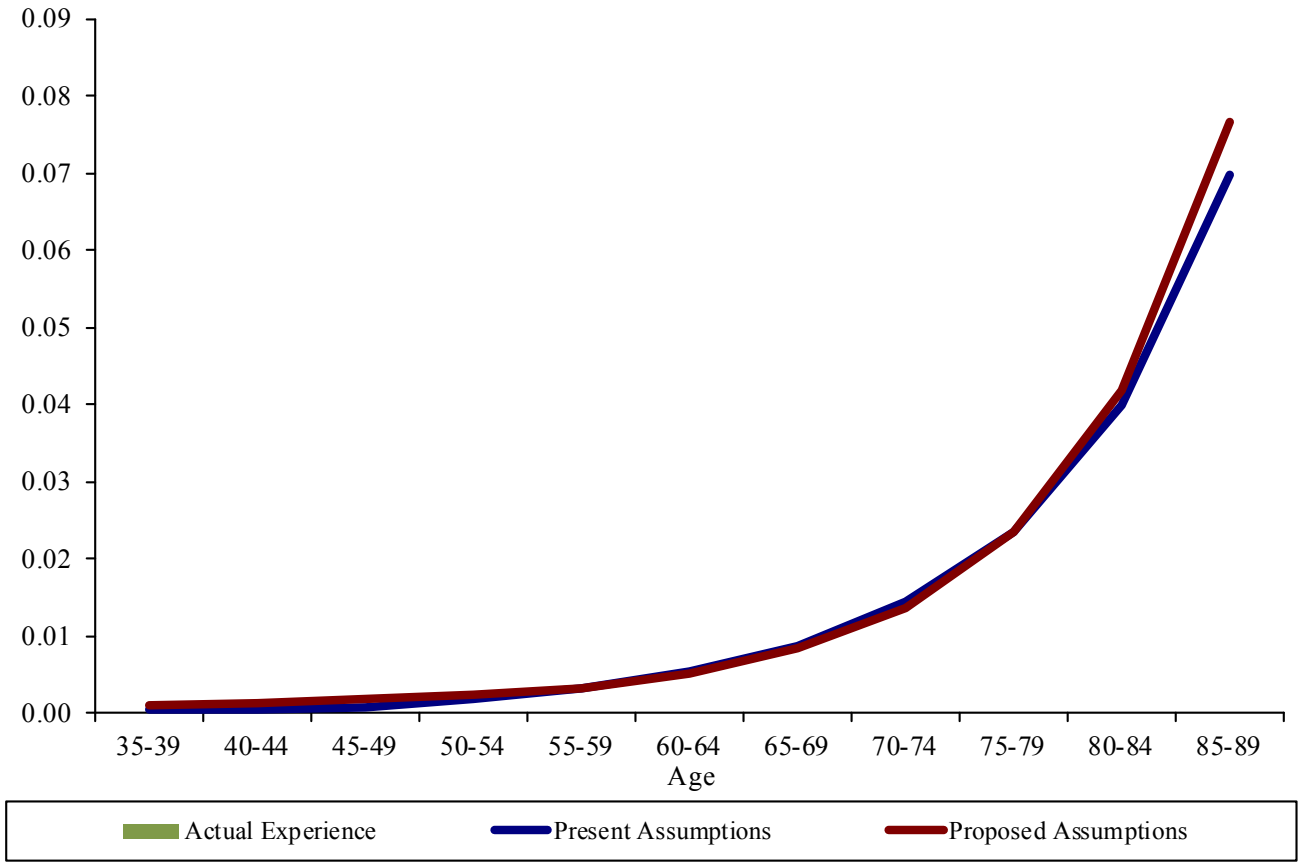
** In order to show the fit for the four-year period of the study, Sample Rates and Expected Deaths were determined using the current/proposed mortality rates projected forward/backward to the mid-point of the study using proposed projection scale.*



POST-RETIREMENT MORTALITY EXPERIENCE
DISABLED FEMALES

Age	Deaths	Exposure	Crude Rates	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
				Old*	New*	Old*	New*	Old*	New*
35-39	-	-	N/A	0.00040	0.00097	-	-	N/A	N/A
40-44	-	-	N/A	0.00054	0.00136	-	-	N/A	N/A
45-49	-	-	N/A	0.00083	0.00179	-	-	N/A	N/A
50-54	-	-	N/A	0.00169	0.00232	-	-	N/A	N/A
55-59	-	-	N/A	0.00319	0.00322	-	-	N/A	N/A
60-64	-	4	0.00000	0.00531	0.00507	0.02	0.02	0.0%	0.0%
65-69	-	8	0.00000	0.00863	0.00833	0.07	0.06	0.0%	0.0%
70-74	-	-	N/A	0.01433	0.01372	-	-	N/A	N/A
75-79	-	-	N/A	0.02358	0.02341	-	-	N/A	N/A
80-84	-	-	N/A	0.03982	0.04176	-	-	N/A	N/A
85-89	-	-	N/A	0.06978	0.07660	-	-	N/A	N/A
Totals	**-**	**12**	**0.00000**	**0.00750**	**0.00667**	**0.09**	**0.08**	**0.0%**	**0.0%**

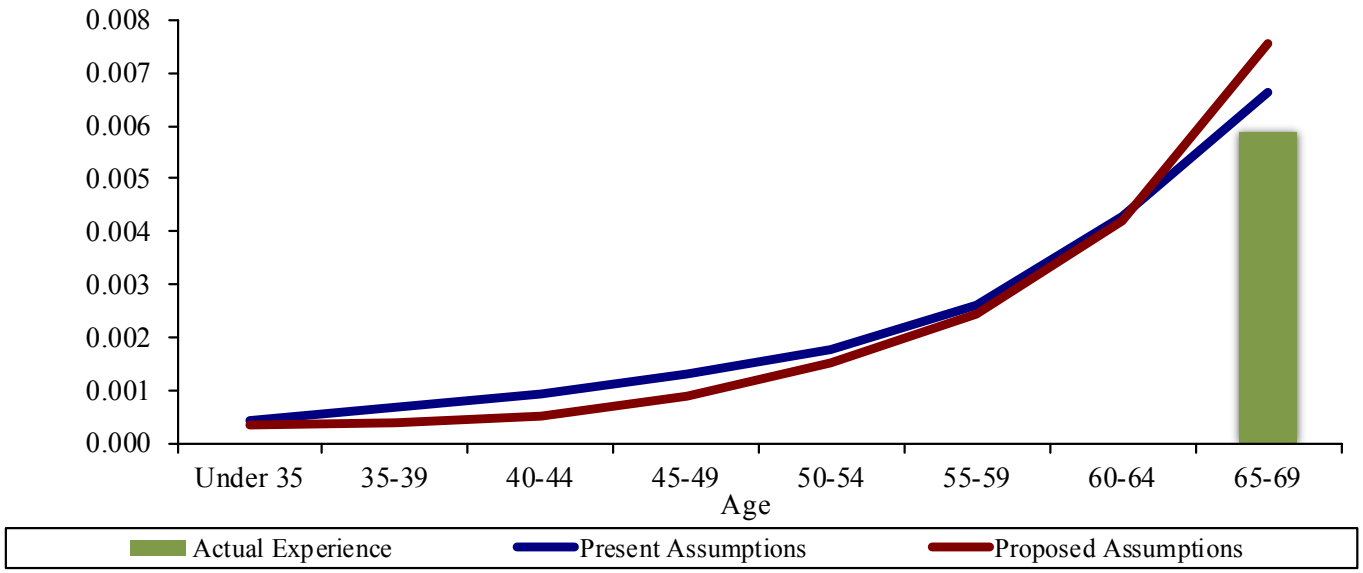
** In order to show the fit for the four-year period of the study, Sample Rates and Expected Deaths were determined using the current/proposed mortality rates projected forward/backward to the mid-point of the study using proposed projection scale.*



PRE-RETIREMENT MORTALITY EXPERIENCE
HEALTHY MALES

Age	Deaths	Exposure	Crude Rates	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
				Old*	New*	Old*	New*	Old*	New*
Under 35	-	-	N/A	0.0004	0.0003	-	-	N/A	N/A
35-39	-	7	0.0000	0.0007	0.0004	0.01	-	0.0%	N/A
40-44	-	20	0.0000	0.0009	0.0005	0.02	0.01	0.0%	0.0%
45-49	-	41	0.0000	0.0013	0.0009	0.05	0.04	0.0%	0.0%
50-54	-	127	0.0000	0.0018	0.0015	0.22	0.19	0.0%	0.0%
55-59	-	158	0.0000	0.0026	0.0024	0.42	0.39	0.0%	0.0%
60-64	-	256	0.0000	0.0043	0.0042	1.09	1.07	0.0%	0.0%
65-69	1	171	0.0058	0.0066	0.0076	1.08	1.19	92.9%	84.0%
Totals	**1**	**780**	**0.0013**	**0.0037**	**0.0037**	**2.90**	**2.90**	**34.5%**	**34.5%**

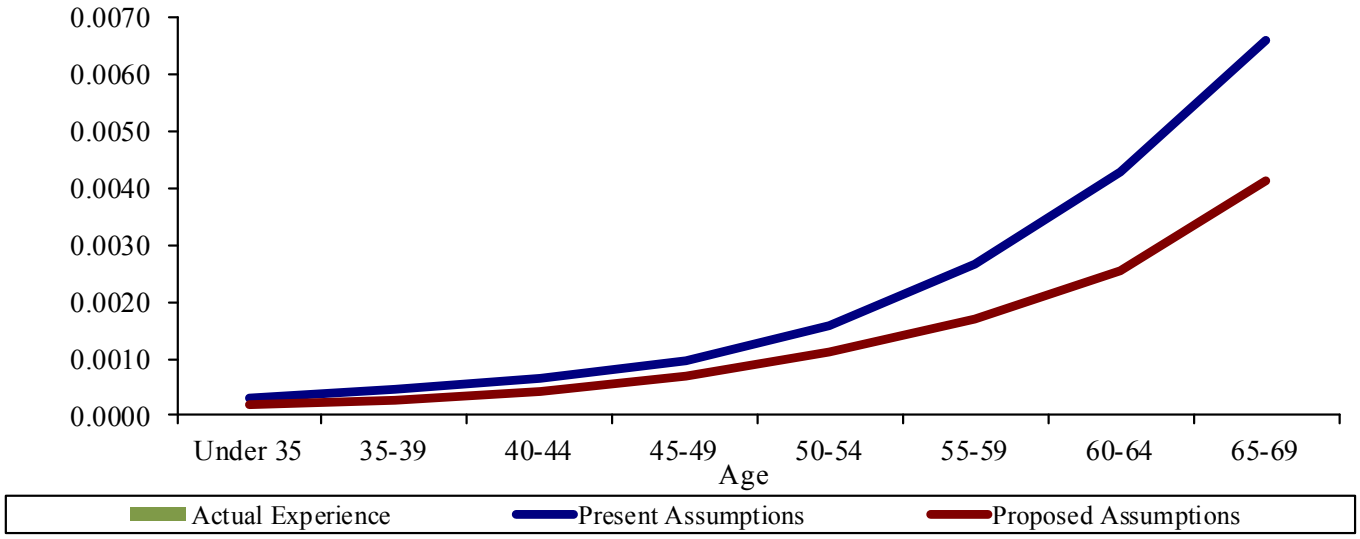
** In order to show the fit for the four-year period of the study, Sample Rates and Expected Deaths were determined using the current/proposed mortality rates projected forward/backward to the mid-point of the study using proposed projection scale.*



PRE-RETIREMENT MORTALITY EXPERIENCE
HEALTHY FEMALES

Age	Deaths	Exposure	Crude Rates	Sample Rates		Expected Deaths		Ratio of Actuals/Expecteds	
				Old*	New*	Old*	New*	Old*	New*
Under 35	-	-	N/A	0.0003	0.0002	-	-	N/A	N/A
35-39	-	7	0.0000	0.0004	0.0003	0.00	0.00	0.0%	0.0%
40-44	-	29	0.0000	0.0006	0.0004	0.02	0.01	0.0%	0.0%
45-49	-	86	0.0000	0.0010	0.0007	0.08	0.06	0.0%	0.0%
50-54	-	91	0.0000	0.0016	0.0011	0.15	0.10	0.0%	0.0%
55-59	-	95	0.0000	0.0027	0.0017	0.25	0.16	0.0%	0.0%
60-64	-	83	0.0000	0.0043	0.0025	0.34	0.20	0.0%	0.0%
65-69	-	52	0.0000	0.0066	0.0041	0.33	0.20	0.0%	0.0%
Totals	**-**	**443**	**0.0000**	**0.0027**	**0.0017**	**1.18**	**0.75**	**0.0%**	**0.0%**

** In order to show the fit for the four-year period of the study, Sample Rates and Expected Deaths were determined using the current/proposed mortality rates projected forward/backward to the mid-point of the study using proposed projection scale.*



SECTION G

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

MARITAL STATUS

Marital Status

We use marital status as provided by MSRS. We propose no change to this practice.

Age of Beneficiary

The current (June 30, 2015) valuation assumption is that females are three years younger than their male spouses. Actual age difference is used for retired members.

Recommendation

We propose no change to these assumptions.

FORM OF PAYMENT

Upon retirement, a member can elect any of the following forms of payment:

- Single life annuity – the benefit is paid for the lifetime of the member. No benefit is payable to a beneficiary upon the member's death.
- 15-Year Certain & Life – a reduced benefit is paid for the lifetime of the member. If the member dies before 180 payments have been made, the benefit continues to be paid to a beneficiary until 180 payments have been made.
- 50% Joint & Survivor* – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 50% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit may revert back to the single life annuity amount.
- 75% Joint & Survivor* – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 75% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit may revert back to the single life annuity amount.
- 100% Joint & Survivor* – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 100% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit may revert back to the single life annuity amount.

* *Joint & Survivor optional forms are available with and without bounceback on an actuarially equivalent basis. If member does not elect the benefit with the bounceback, the benefit is unchanged if the beneficiary predeceases the member.*

We currently assume all members elect a life annuity. Since all optional forms are determined on an actuarially equivalent basis, we are not proposing a change to this assumption.

ACTUARIAL EQUIVALENT OPTIONAL FORM FACTORS

Joint and Survivor benefits are actuarially equivalent to the Single-life annuity. Current actuarial equivalent factors are based on the RP-2000 mortality table for healthy annuitants, white collar adjustment, projected to 2022 using Scale AA, set back one year for males and set back two years for females, blended 80% males and 6.5% interest.

Recommendation

We recommend the actuarial equivalent factors be updated to reflect changes in expected mortality, interest rate, and benefit increase assumption, as applicable.We will work with MSRS staff to develop appropriate factors.

PROPOSED MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Background

A number of miscellaneous and technical assumptions are used in the actuarial valuation. The present assumptions are listed on the following page.

Recommendation

We recommend no changes.

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Benefit Service	Exact fractional service is used to determine the amount of benefit payable.
Decrement Timing	Decrements of all types are assumed to occur mid-year.
Eligibility Testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Forfeitures	For vested separations from service, it is assumed that members separating will withdraw their contributions and forfeit an annuity benefit when the value of member contributions is greater than the value of the annuity benefit.
Incidence of Contributions	Contributions are assumed to be received on a monthly basis, per the Standards of Actuarial Work.
Liability Adjustments	Liabilities for active and deferred members are increased by 0%. We are unable to judge the reasonableness of this assumption without additional data and without performing a substantial amount of additional work beyond the scope of this assignment.
Pay Increase Timing	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Service Credit Accruals	Members were assumed to accrue one year of service credit per year.

SECTION H

PROPOSED ASSUMPTION LISTING

PROPOSED ACTUARIAL ASSUMPTIONS
BASED ON 2011-2015 EXPERIENCE STUDY

MERIT AND SENIORITY PAY INCREASES

We recommend no change to the current salary increase assumption of 2.75% per year. Since the inflation assumption is also 2.75%, the implied merit and seniority increase is 0.00%.

PROPOSED ACTUARIAL ASSUMPTIONS
BASED ON 2011-2015 EXPERIENCE STUDY

AGE & SERVICE RETIREMENT PATTERN
UNREDUCED (NORMAL) RETIREMENT

Age	% Retiring
65	20.0%
66	23.0%
67	23.0%
68	20.0%
69	20.0%
70+	*

** The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement one year.*

AGE & SERVICE RETIREMENT PATTERN
REDUCED (EARLY) RETIREMENT

Age	% Retiring
60	0.0%
61	0.0%
62	8.0%
63	8.0%
64	5.0%

WITHDRAWAL

We recommend no change to the current termination assumption of 0.00%.

DISABILITY RATES

Age	% Becoming Disabled	
	Male	Female
< 30	0.000%	0.000%
31	0.000%	0.000%
32	0.000%	0.000%
33	0.000%	0.000%
34	0.000%	0.000%
35	0.000%	0.000%
36	0.010%	0.010%
37	0.010%	0.010%
38	0.010%	0.010%
39	0.010%	0.010%
40	0.010%	0.010%
41	0.010%	0.010%
42	0.020%	0.020%
43	0.020%	0.020%
44	0.020%	0.020%
45	0.030%	0.030%
46	0.030%	0.030%
47	0.040%	0.040%
48	0.040%	0.040%
49	0.050%	0.050%
50	0.050%	0.050%
51	0.060%	0.060%
52	0.070%	0.070%
53	0.080%	0.080%
54	0.100%	0.100%
55	0.120%	0.120%
56	0.150%	0.150%
57	0.180%	0.180%
58	0.220%	0.220%
59	0.260%	0.260%
60	0.310%	0.310%
61	0.370%	0.370%
62	0.440%	0.440%
63	0.520%	0.520%
64	0.610%	0.610%

HEALTHY POST-RETIREMENT MORTALITY RATES

Age in 2013	% Dying Next Year*	
	Male	Female
50	0.2840%	0.2079%
51	0.3068%	0.2187%
52	0.3302%	0.2307%
53	0.3520%	0.2445%
54	0.3738%	0.2600%
55	0.3970%	0.2774%
56	0.4169%	0.2971%
57	0.4394%	0.3191%
58	0.4646%	0.3439%
59	0.4929%	0.3719%
60	0.5246%	0.4031%
61	0.5603%	0.4525%
62	0.6007%	0.5042%
63	0.6481%	0.5588%
64	0.7031%	0.6171%
65	0.7678%	0.6802%
66	0.8437%	0.7489%
67	0.9321%	0.8250%
68	1.0347%	0.9094%
69	1.1532%	1.0034%
70	1.2882%	1.1082%
71	1.4407%	1.2252%
72	1.6123%	1.3561%
73	1.8040%	1.5028%
74	2.0176%	1.6685%
75	2.2561%	1.8554%
76	2.5233%	2.0669%
77	2.8239%	2.3079%
78	3.1637%	2.5812%
79	3.5490%	2.8926%
80	3.9886%	3.2466%

Age in 2013	% Dying Next Year*	
	Male	Female
81	4.4886%	3.6518%
82	5.0620%	4.1113%
83	5.7170%	4.6365%
84	6.4637%	5.2349%
85	7.3088%	5.9139%
86	8.2636%	6.6847%
87	9.3373%	7.5541%
88	10.5407%	8.5295%
89	11.8811%	9.6174%
90	13.3752%	10.8356%
91	14.9682%	12.1662%
92	16.6306%	13.5952%
93	18.3374%	15.1119%
94	20.0808%	16.7032%
95	21.8547%	18.3774%
96	23.8086%	20.1938%
97	25.8361%	22.1063%
98	27.9519%	24.1175%
99	30.1415%	26.2182%
100	32.1550%	28.2457%
101	34.1861%	30.2637%
102	36.1887%	32.2965%
103	38.1679%	34.3199%
104	40.0940%	36.3151%
105	41.9358%	38.2764%
106	43.7184%	40.1842%
107	45.3890%	42.0039%
108	46.9703%	43.7559%
109	48.4633%	45.4050%
110	49.8308%	46.9470%

* *The rates shown are RP-2014 mortality for healthy annuitants, with adjustments, if applicable (see Section G). Recommended rates include adjustments for white collar and mortality improvements from 2006 to the mid-point of this study (2013) using projection scale MP-2015.*

DISABLED POST-RETIREMENT MORTALITY RATES

Age in 2013	% Dying Next Year*	
	Male	Female
20	0.0273%	0.0145%
21	0.0299%	0.0160%
22	0.0324%	0.0178%
23	0.0348%	0.0203%
24	0.0375%	0.0231%
25	0.0402%	0.0264%
26	0.0430%	0.0296%
27	0.0460%	0.0331%
28	0.0492%	0.0371%
29	0.0528%	0.0416%
30	0.0567%	0.0467%
31	0.0611%	0.0525%
32	0.0659%	0.0587%
33	0.0711%	0.0655%
34	0.0764%	0.0728%
35	0.0824%	0.0805%
36	0.0891%	0.0885%
37	0.0965%	0.0965%
38	0.1047%	0.1046%
39	0.1138%	0.1125%
40	0.1237%	0.1205%
41	0.1342%	0.1278%
42	0.1458%	0.1353%
43	0.1585%	0.1430%
44	0.1726%	0.1511%
45	0.1879%	0.1598%
46	0.2047%	0.1690%
47	0.2228%	0.1786%
48	0.2420%	0.1879%
49	0.2625%	0.1977%
50	0.2840%	0.2079%
51	0.3068%	0.2187%
52	0.3302%	0.2307%
53	0.3520%	0.2445%
54	0.3738%	0.2600%
55	0.3970%	0.2774%

Age in 2013	% Dying Next Year*	
	Male	Female
56	0.4169%	0.2971%
57	0.4394%	0.3191%
58	0.4646%	0.3439%
59	0.4929%	0.3719%
60	0.5246%	0.4031%
61	0.5603%	0.4525%
62	0.6007%	0.5042%
63	0.6481%	0.5588%
64	0.7031%	0.6171%
65	0.7678%	0.6802%
66	0.8437%	0.7489%
67	0.9321%	0.8250%
68	1.0347%	0.9094%
69	1.1532%	1.0034%
70	1.2882%	1.1082%
71	1.4407%	1.2252%
72	1.6123%	1.3561%
73	1.8040%	1.5028%
74	2.0176%	1.6685%
75	2.2561%	1.8554%
76	2.5233%	2.0669%
77	2.8239%	2.3079%
78	3.1637%	2.5812%
79	3.5490%	2.8926%
80	3.9886%	3.2466%
81	4.4886%	3.6518%
82	5.0620%	4.1113%
83	5.7170%	4.6365%
84	6.4637%	5.2349%
85	7.3088%	5.9139%
86	8.2636%	6.6847%
87	9.3373%	7.5541%
88	10.5407%	8.5295%
89	11.8811%	9.6174%
90	13.3752%	10.8356%

** The rates shown are RP-2014 mortality for disabled annuitants, with adjustments, if applicable (see Section G). Recommended rates include mortality improvements from 2006 to the mid-point of this study (2013) using projection scale MP-2015.*

HEALTHY PRE-RETIREMENT MORTALITY RATES

Age in 2013	% Dying Next Year*	
	Male	Female
20	0.0272%	0.0135%
21	0.0301%	0.0135%
22	0.0327%	0.0135%
23	0.0342%	0.0135%
24	0.0342%	0.0135%
25	0.0327%	0.0135%
26	0.0314%	0.0152%
27	0.0305%	0.0157%
28	0.0302%	0.0162%
29	0.0302%	0.0172%
30	0.0310%	0.0182%
31	0.0319%	0.0195%
32	0.0330%	0.0208%
33	0.0341%	0.0223%
34	0.0350%	0.0238%
35	0.0362%	0.0251%
36	0.0371%	0.0266%
37	0.0380%	0.0283%
38	0.0395%	0.0303%
39	0.0413%	0.0325%
40	0.0437%	0.0351%
41	0.0467%	0.0379%
42	0.0505%	0.0413%
43	0.0554%	0.0454%
44	0.0614%	0.0503%
45	0.0685%	0.0559%

Age in 2013	% Dying Next Year*	
	Male	Female
46	0.0771%	0.0622%
47	0.0866%	0.0692%
48	0.0973%	0.0766%
49	0.1089%	0.0845%
50	0.1214%	0.0931%
51	0.1350%	0.1022%
52	0.1499%	0.1117%
53	0.1648%	0.1220%
54	0.1809%	0.1327%
55	0.1986%	0.1442%
56	0.2184%	0.1564%
57	0.2410%	0.1692%
58	0.2668%	0.1829%
59	0.2963%	0.1976%
60	0.3301%	0.2134%
61	0.3688%	0.2309%
62	0.4130%	0.2503%
63	0.4640%	0.2722%
64	0.5219%	0.2964%
65	0.5880%	0.3239%
66	0.6623%	0.3627%
67	0.7461%	0.4062%
68	0.8407%	0.4551%
69	0.9475%	0.5097%
70	1.0677%	0.5705%

** The rates shown are RP-2014 mortality for employees, with adjustments, if applicable (see Section G). Recommended rates include adjustments for white collar and mortality improvements from 2006 to the mid-point of this study (2013) using projection scale MP-2015.*

SECTION I

GLOSSARY

GLOSSARY

The following glossary is intended to provide definitions of a number of terms which are used throughout this report and which are somewhat unique to the discussion of an Experience Study.

Actuarial Decrement. The actual number of decrements which occurred during the study. This number is a straight tabulation of the actual number of occurrences of the particular decrement in question. Normally, the actual number of decrements will be subdivided by age and possibly sex.

Aggregate Assumptions. Assumptions which vary only by sex and/or age. The impact of year of service on the decrement is ignored. All experience is combined by age and/or sex without regard to service. Rates of death and disablement are more appropriate to aggregate measurement in a retirement system.

Crude Rate of Decrement. The rate of decrement determined by dividing the actual number of the respective decrement for that age and sex by the corresponding exposure for that age and sex. The rate is described as a crude rate because no smoothing or elimination of statistical fluctuations has been made. It is indicative of the underlying true rate of the decrement and is the basis used in graduation to obtain the graduated or tabular rate.

Decrements. The decrements are the means by which a member ceases to be a member. For active members, the decrements are death, withdrawal, service retirement, and disability retirement. For retired members, the only decrement is death. The purpose of the Experience Study is to determine the underlying rates of each decrement.

Expected Decrement. This is the number of occurrences of a given decrement expected to occur for a given age and sex based on the number of lives exposed to the risk of the particular decrement and the current assumed rate for that decrement. It may also be referred to as the tabular number of decrements. It is the number of deaths, withdrawals, retirements, or disabilities (whichever is applicable) that would have actually occurred had the actuarial assumptions been exactly realized.

GLOSSARY

Exposure. The number of lives exposed to a given risk of decrement for a particular age and sex. It represents the number of members who could have potentially died, retired, become disabled, or withdrawn at that particular age and for that particular sex. This term will also be described as "the number exposed to a given risk."

Graduated Rates. Graduation is the mathematical process by which a set of crude rates of a particular type is translated into graduated or tabular rates. The graduation process attempts to smooth out statistical fluctuations and to arrive at a set of rates that adequately fit the underlying actual experience of the crude rates that are being graduated. The graduation process involves smoothing the results, but at the same time trying to fit the results to be consistent with the original data. It requires that the actuary exercise his or her judgment in what the underlying shape of the risk curve should look like.

Interpolated Rates. For the active rates of decrement (death, disability, retirement, and withdrawal), the actuary will develop graduated rates based on quinquennial age groupings (see definition). To arrive at the rates of decrement for ages between two quinquennial ages, the graduated quinquennial rates must be interpolated for these intermediate ages. The interpolated results are arrived at by applying a mathematical interpolation formula to the quinquennial graduated rates.

Merit and Seniority Pay Increase Rate. The portion of the total salary scale which varies by service. It reflects the impact of moving up the salary grid in a given year, rather than the increase in the overall grid. It includes the salary increase associated with promotions during the year.

Quinquennial Age Groupings. For the active decrements, it is preferable to group the experience in five-year age groups for graduation and analysis purposes so as to minimize statistical fluctuations resulting from a lack of exposure which may occur for individual ages. Quinquennial age grouping is the five-year age grouping which is used to develop the graduated rates of decrement for active membership. The quinquennial age is the central age of the five-year grouping.

SECTION J

APPENDIX

APPENDIX – DETAILED EXPERIENCE ANALYSIS

In this section, we present the annual experience for each major assumption that was analyzed for the study. Please note that totals may not sum correctly due to rounding of intermediate results.

APPENDIX – DETAILED EXPERIENCE ANALYSIS
SALARY INCREASES

2011-2015 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
35-39	18	7.91%	2.75%
40-44	49	4.81%	2.75%
45-49	125	2.86%	2.75%
50-54	222	2.56%	2.75%
55-59	246	2.31%	2.75%
60-64	277	2.05%	2.75%
65-69	119	1.84%	2.75%
Totals	**1,056**	**2.52%**	**2.75%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
SALARY INCREASES

2011-2012 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
35-39	5	2.75%	2.75%
40-44	12	9.72%	2.75%
45-49	29	0.00%	2.75%
50-54	55	-0.22%	2.75%
55-59	67	0.07%	2.75%
60-64	72	0.00%	2.75%
65-69	25	0.00%	2.75%
Totals	**265**	**0.70%**	**2.75%**

2012-2013 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
35-39	5	26.00%	2.75%
40-44	8	8.11%	2.75%
45-49	30	0.00%	2.75%
50-54	57	0.00%	2.75%
55-59	59	-0.85%	2.75%
60-64	64	0.23%	2.75%
65-69	32	0.00%	2.75%
Totals	**255**	**0.59%**	**2.75%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
SALARY INCREASES

2013-2014 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
35-39	3		
40-44	13	12.12%	2.75%
45-49	30	4.00%	2.75%
50-54	59	4.00%	2.75%
55-59	56	4.00%	2.75%
60-64	67	5.17%	2.75%
65-69	31	3.85%	2.75%
Totals	**259**	**4.94%**	**2.75%**

2014-2015 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
35-39	5	12.76%	2.75%
40-44	16	9.70%	2.75%
45-49	36	3.00%	2.75%
50-54	51	3.00%	2.75%
55-59	64	3.00%	2.75%
60-64	74	3.00%	2.75%
65-69	31	3.00%	2.75%
Totals	**277**	**3.77%**	**2.75%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
RETIREMENT

2011-2015 Experience

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	59	-	N/A
61	2	63	-	N/A
62	5	57	4.56	109.6%
63	5	53	2.65	188.7%
64	2	58	4.64	43.1%
65	11	63	15.75	69.8%
66	15	61	12.20	123.0%
67	13	46	4.60	282.6%
68	5	28	8.40	59.5%
69	4	16	1.60	250.0%
Totals	**62**	**504**	**54.40**	**114.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
RETIREMENT

2011-2012 Experience

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	14	-	N/A
61	1	14	-	N/A
62	-	11	0.88	0.0%
63	3	15	0.75	400.0%
64	1	25	2.00	50.0%
65	1	15	3.75	26.7%
66	3	15	3.00	100.0%
67	2	7	0.70	285.7%
68	2	4	1.20	166.7%
69	1	4	0.40	250.0%
Totals	**14**	**124**	**12.68**	**110.4%**

2012-2013 Experience

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	15	-	N/A
61	-	15	-	N/A
62	4	15	1.20	333.3%
63	2	12	0.60	333.3%
64	-	12	0.96	0.0%
65	7	24	6.00	116.7%
66	2	14	2.80	71.4%
67	3	12	1.20	250.0%
68	-	5	1.50	0.0%
69	-	2	0.20	0.0%
Totals	**18**	**126**	**14.46**	**124.5%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
RETIREMENT

2013-2014 Experience

Age	Actual Retirements	Exposure	Retirements	Expected
60	-	18	-	N/A
61	-	16	-	N/A
62	-	15	1.20	0.0%
63	-	11	0.55	0.0%
64	-	10	0.80	0.0%
65	-	13	3.25	0.0%
66	6	19	3.80	157.9%
67	4	14	1.40	285.7%
68	3	9	2.70	111.1%
69	1	4	0.40	250.0%
Totals	**14**	**129**	**14.10**	**99.3%**

2014-2015 Experience

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
60	-	12	-	N/A
61	1	18	-	N/A
62	1	16	1.28	78.1%
63	-	15	0.75	0.0%
64	1	11	0.88	113.6%
65	3	11	2.75	109.1%
66	4	13	2.60	153.8%
67	4	13	1.30	307.7%
68	-	10	3.00	0.0%
69	2	6	0.60	333.3%
Totals	**16**	**125**	**13.16**	**121.6%**

2011-2015 Experience

	Males & Females			
Age Group	**Actual Withdrawals**	**Exposure**	**Expected Withdrawals**	**Actual/ Expected**
Under 35	-	-	-	N/A
35-39	-	14	-	N/A
40-44	-	49	-	N/A
45-49	-	127	-	N/A
50-54	2	217	-	N/A
55-59	3	254	-	N/A
Totals	**5**	**661**	**-**	**N/A**

2011-2012 Experience

	Males & Females			
Age Group	**Actual Withdrawals**	**Exposure**	**Expected Withdrawals**	**Actual/ Expected**
Under 35	-	-	-	N/A
35-39	-	5	-	N/A
40-44	-	9	-	N/A
45-49	-	29	-	N/A
50-54	1	55	-	N/A
55-59	-	66	-	N/A
Totals	**1**	**164**	**-**	**N/A**

2012-2013 Experience

	Males & Females			
Age Group	**Actual Withdrawals**	**Exposure**	**Expected Withdrawals**	**Actual/ Expected**
Under 35	-	-	-	N/A
35-39	-	3	-	N/A
40-44	-	11	-	N/A
45-49	-	30	-	N/A
50-54	-	56	-	N/A
55-59	2	63	-	N/A
Totals	**2**	**163**	**-**	**N/A**

2013-2014 Experience

	Males & Females			
Age Group	**Actual Withdrawals**	**Exposure**	**Expected Withdrawals**	**Actual/ Expected**
Under 35	-	-	-	N/A
35-39	-	2	-	N/A
40-44	-	13	-	N/A
45-49	-	32	-	N/A
50-54	1	60	-	N/A
55-59	1	56	-	N/A
Totals	**2**	**163**	**-**	**N/A**

2014-2015 Experience

	Males & Females			
Age Group	**Actual Withdrawals**	**Exposure**	**Expected Withdrawals**	**Actual/ Expected**
Under 35	-	-	-	N/A
35-39	-	4	-	N/A
40-44	-	16	-	N/A
45-49	-	36	-	N/A
50-54	-	46	-	N/A
55-59	-	69	-	N/A
Totals	**-**	**171**	**-**	**N/A**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
DISABILITY RETIREMENTS

2011-2015 Experience

	Males				Females			
Age Group	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**
Under 35	-	-	-	N/A	-	-	-	109.9%
35-39	-	7	0.00	0.0%	-	7	0.00	0.0%
40-44	-	20	0.00	0.0%	-	29	0.01	0.0%
45-49	-	41	0.02	0.0%	-	86	0.03	0.0%
50-54	-	127	0.13	0.0%	-	91	0.07	0.0%
55-59	-	158	0.40	0.0%	-	95	0.18	0.0%
60-64	-	256	1.50	0.0%	-	83	0.35	0.0%
Totals	**-**	**609**	**2.05**	**0.0%**	**-**	**391**	**0.64**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
DISABILITY RETIREMENTS

2011-2012 Experience

	Males				Females			
Age Group	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	3	0.00	0.0%	-	2	0.00	0.0%
40-44	-	2	0.00	0.0%	-	7	0.00	0.0%
45-49	-	13	0.01	0.0%	-	16	0.01	0.0%
50-54	-	31	0.03	0.0%	-	24	0.02	0.0%
55-59	-	43	0.11	0.0%	-	23	0.05	0.0%
60-64	-	71	0.43	0.0%	-	19	0.09	0.0%
Totals	**-**	**163**	**0.58**	**0.0%**	**-**	**91**	**0.16**	**0.0%**

2012-2013 Experience

	Males				Females			
Age Group	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	2	0.00	0.0%	-	1	0.00	0.0%
40-44	-	5	0.00	0.0%	-	6	0.00	0.0%
45-49	-	9	0.00	0.0%	-	21	0.01	0.0%
50-54	-	33	0.03	0.0%	-	23	0.02	0.0%
55-59	-	42	0.11	0.0%	-	21	0.04	0.0%
60-64	-	59	0.34	0.0%	-	19	0.08	0.0%
Totals	**-**	**150**	**0.50**	**0.0%**	**-**	**91**	**0.14**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
DISABILITY RETIREMENTS

2013-2014 Experience

	Males				Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	1	0.00	0.0%	-	1	0.00	0.0%
40-44	-	5	0.00	0.0%	-	8	0.00	0.0%
45-49	-	8	0.00	0.0%	-	24	0.01	0.0%
50-54	-	36	0.04	0.0%	-	24	0.02	0.0%
55-59	-	33	0.08	0.0%	-	23	0.04	0.0%
60-64	-	63	0.35	0.0%	-	21	0.08	0.0%
Totals	**-**	**146**	**0.48**	**0.0%**	**-**	**101**	**0.16**	**0.0%**

2014-2015 Experience

	Males				Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	1	0.00	0.0%	-	3	0.00	0.0%
40-44	-	8	0.00	0.0%	-	8	0.00	0.0%
45-49	-	11	0.00	0.0%	-	25	0.01	0.0%
50-54	-	27	0.03	0.0%	-	20	0.02	0.0%
55-59	-	40	0.09	0.0%	-	28	0.05	0.0%
60-64	-	63	0.37	0.0%	-	24	0.10	0.0%
Totals	**-**	**150**	**0.49**	**0.0%**	**-**	**108**	**0.18**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
POST-RETIREMENT MORTALITY

2011-2015 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
60-64	-	23	0.16	0.0%	-	13	0.08	0.0%
65-69	-	145	1.62	0.0%	-	47	0.41	0.0%
70-74	1	189	3.34	29.9%	-	20	0.27	0.0%
75-79	4	113	3.49	114.6%	-	14	0.32	0.0%
80-84	4	104	6.35	63.0%	-	12	0.48	0.0%
85-89	9	84	8.97	100.3%	1	10	0.72	138.9%
90-94	5	23	3.86	129.5%	1	1	0.10	1000.0%
95+	1	5	1.37	73.0%	-	-	-	N/A
Totals	**24**	**686**	**29.16**	**82.3%**	**2**	**117**	**2.38**	**84.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
POST-RETIREMENT MORTALITY

2011-2012 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
60-64	-	5	0.03	0.0%	-	1	0.01	0.0%
65-69	-	28	0.30	0.0%	-	6	0.05	0.0%
70-74	-	43	0.74	0.0%	-	5	0.07	0.0%
75-79	1	28	0.90	111.1%	-	2	0.04	0.0%
80-84	1	27	1.68	59.5%	-	3	0.11	0.0%
85-89	3	19	2.00	150.0%	-	3	0.20	0.0%
90-94	-	4	0.62	0.0%	-	-	-	N/A
95+	1	2	0.49	204.1%	-	-	-	N/A
Totals	**6**	**156**	**6.76**	**88.8%**	**-**	**20**	**0.48**	**0.0%**

2012-2013 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
60-64	-	7	0.05	0.0%	-	2	0.01	0.0%
65-69	-	31	0.34	0.0%	-	8	0.07	0.0%
70-74	-	51	0.91	0.0%	-	4	0.05	0.0%
75-79	2	21	0.65	307.7%	-	4	0.09	0.0%
80-84	-	29	1.72	0.0%	-	3	0.12	0.0%
85-89	1	21	2.25	44.4%	-	3	0.23	0.0%
90-94	2	5	0.84	238.1%	-	-	-	N/A
95+	-	1	0.28	0.0%	-	-	-	N/A
Totals	**5**	**166**	**7.04**	**71.0%**	**-**	**24**	**0.57**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
POST-RETIREMENT MORTALITY

2013-2014 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
60-64	-	7	0.05	0.0%	-	5	0.03	0.0%
65-69	-	41	0.46	0.0%	-	11	0.09	0.0%
70-74	1	47	0.84	119.0%	-	5	0.07	0.0%
75-79	-	29	0.87	0.0%	-	4	0.10	0.0%
80-84	1	24	1.44	69.4%	-	3	0.13	0.0%
85-89	3	25	2.71	110.7%	1	2	0.16	625.0%
90-94	1	5	0.88	113.6%	1	1	0.10	1000.0%
95+	-	1	0.29	0.0%	-	-	-	N/A
Totals	**6**	**179**	**7.54**	**79.6%**	**2**	**31**	**0.68**	**294.1%**

2014-2015 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
60-64	-	4	0.03	0.0%	-	5	0.03	0.0%
65-69	-	45	0.52	0.0%	-	22	0.20	0.0%
70-74	-	48	0.85	0.0%	-	6	0.08	0.0%
75-79	1	35	1.07	93.5%	-	4	0.09	0.0%
80-84	2	24	1.51	132.5%	-	3	0.12	0.0%
85-89	2	19	2.01	99.5%	-	2	0.13	0.0%
90-94	2	9	1.52	131.6%	-	-	-	N/A
95+	-	1	0.31	0.0%	-	-	-	N/A
Totals	**7**	**185**	**7.82**	**89.5%**	**-**	**42**	**0.65**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
DISABLED MORTALITY

2011-2015 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
35-39	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
50-54	-	-	-	N/A	-	-	-	N/A
55-59	-	2	0.01	0.0%	-	-	-	N/A
60-64	-	7	0.05	0.0%	-	4	0.02	0.0%
65-69	-	15	0.16	0.0%	-	8	0.07	0.0%
70-74	-	21	0.39	0.0%	-	-	-	N/A
75-79	1	23	0.71	140.4%	-	-	-	N/A
80-84	-	-	-	N/A	-	-	-	N/A
85-89	1	17	1.89	52.8%	-	-	-	N/A
>= 90	-	-	-	N/A	-	-	-	N/A
Totals	**2**	**85**	**3.21**	**62.3%**	**-**	**12**	**0.09**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
DISABLED MORTALITY

2011-2012 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
35-39	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
50-54	-	-	-	N/A	-	-	-	N/A
55-59	-	1	0.00	0.0%	-	-	-	N/A
60-64	-	3	0.02	0.0%	-	1	0.00	0.0%
65-69	-	3	0.03	0.0%	-	2	0.01	0.0%
70-74	-	7	0.13	0.0%	-	-	-	N/A
75-79	-	3	0.08	0.0%	-	-	-	N/A
80-84	-	-	-	N/A	-	-	-	N/A
85-89	-	5	0.49	0.0%	-	-	-	N/A
>= 90	-	-	-	N/A	-	-	-	N/A
Totals	**-**	**22**	**0.77**	**0.0%**	**-**	**3**	**0.02**	**0.0%**

2012-2013 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
35-39	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
50-54	-	-	-	N/A	-	-	-	N/A
55-59	-	1	0.00	0.0%	-	-	-	N/A
60-64	-	1	0.01	0.0%	-	1	0.00	0.0%
65-69	-	4	0.04	0.0%	-	2	0.02	0.0%
70-74	-	5	0.09	0.0%	-	-	-	N/A
75-79	-	6	0.17	0.0%	-	-	-	N/A
80-84	-	-	-	N/A	-	-	-	N/A
85-89	1	5	0.55	180.6%	-	-	-	N/A
>= 90	-	-	-	N/A	-	-	-	N/A
Totals	**1**	**22**	**0.86**	**116.1%**	**-**	**3**	**0.02**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
DISABLED MORTALITY

2013-2014 Experience

Age Group	Males				Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
35-39	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
50-54	-	-	-	N/A	-	-	-	N/A
55-59	-	-	-	N/A	-	-	-	N/A
60-64	-	2	0.01	0.0%	-	1	0.01	0.0%
65-69	-	4	0.04	0.0%	-	2	0.02	0.0%
70-74	-	4	0.07	0.0%	-	-	-	N/A
75-79	-	7	0.22	0.0%	-	-	-	N/A
80-84	-	-	-	N/A	-	-	-	N/A
85-89	-	4	0.47	0.0%	-	-	-	N/A
>= 90	-	-	-	N/A	-	-	-	N/A
Totals	**-**	**21**	**0.82**	**0.0%**	**-**	**3**	**0.02**	**0.0%**

2014-2015 Experience

Age Group	Males				Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
41-44	-	-	-	N/A	-	-	-	N/A
45-49	-	-	-	N/A	-	-	-	N/A
50-54	-	-	-	N/A	-	-	-	N/A
55-59	-	-	-	N/A	-	-	-	N/A
60-64	-	-	-	N/A	-	-	-	N/A
65-69	-	1	0.01	0.0%	-	1	0.01	0.0%
70-74	-	4	0.04	0.0%	-	2	0.02	0.0%
75-79	-	5	0.10	0.0%	-	-	-	N/A
80-84	1	7	0.24	409.6%	-	-	-	N/A
85-89	-	-	-	N/A	-	-	-	N/A
90-94	-	3	0.38	0.0%	-	-	-	N/A
95+	-	-	-	N/A	-	-	-	N/A
Totals	**1**	**20**	**0.77**	**130.7%**	**-**	**3**	**0.02**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
PRE-RETIREMENT MORTALITY

2011-2015 Experience

	Males				Females			
Age Group	**Actual Deaths**	**Exposure**	**Expected Deaths**	**Actual/ Expected**	**Actual Deaths**	**Exposure**	**Expected Deaths**	**Actual/ Expected**
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	7	0.01	0.0%	-	7	0.00	0.0%
40-44	-	20	0.02	0.0%	-	29	0.02	0.0%
45-49	-	41	0.05	0.0%	-	86	0.08	0.0%
50-54	-	127	0.22	0.0%	-	91	0.15	0.0%
55-59	-	158	0.42	0.0%	-	95	0.25	0.0%
60-64	-	256	1.09	0.0%	-	83	0.34	0.0%
65-69	1	171	1.08	92.9%	-	52	0.33	0.0%
Totals	**1**	**780**	**2.90**	**34.5%**	**-**	**443**	**1.18**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
PRE-RETIREMENT MORTALITY

2011-2012 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	3	0.00	0.0%	-	2	0.00	0.0%
40-44	-	2	0.00	0.0%	-	7	0.00	0.0%
45-49	-	13	0.02	0.0%	-	16	0.01	0.0%
50-54	-	31	0.05	0.0%	-	24	0.04	0.0%
55-59	-	43	0.12	0.0%	-	23	0.06	0.0%
60-64	-	71	0.31	0.0%	-	19	0.08	0.0%
65-69	-	37	0.23	0.0%	-	11	0.07	0.0%
Totals	**-**	**200**	**0.73**	**0.0%**	**-**	**102**	**0.27**	**0.0%**

2012-2013 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	2	0.00	0.0%	-	1	0.00	0.0%
40-44	-	5	0.00	0.0%	-	6	0.00	0.0%
45-49	-	9	0.01	0.0%	-	21	0.02	0.0%
50-54	-	33	0.06	0.0%	-	23	0.04	0.0%
55-59	-	42	0.12	0.0%	-	21	0.06	0.0%
60-64	-	59	0.25	0.0%	-	19	0.08	0.0%
65-69	1	46	0.28	354.6%	-	16	0.10	0.0%
Totals	**1**	**196**	**0.73**	**137.5%**	**-**	**107**	**0.30**	**0.0%**

APPENDIX – DETAILED EXPERIENCE ANALYSIS
PRE-RETIREMENT MORTALITY

2013-2014 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	1	0.00	0.0%	-	1	0.00	0.0%
40-44	-	5	0.00	0.0%	-	8	0.01	0.0%
45-49	-	8	0.01	0.0%	-	24	0.02	0.0%
50-54	-	36	0.06	0.0%	-	24	0.04	0.0%
55-59	-	33	0.09	0.0%	-	23	0.06	0.0%
60-64	-	63	0.26	0.0%	-	21	0.08	0.0%
65-69	-	44	0.28	0.0%	-	15	0.10	0.0%
Totals	**-**	**190**	**0.71**	**0.0%**	**-**	**116**	**0.31**	**0.0%**

2014-2015 Experience

	Males				Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 35	-	-	-	N/A	-	-	-	N/A
35-39	-	1	0.00	0.0%	-	3	0.00	0.0%
40-44	-	8	0.01	0.0%	-	8	0.01	0.0%
45-49	-	11	0.01	0.0%	-	25	0.03	0.0%
50-54	-	27	0.05	0.0%	-	20	0.03	0.0%
55-59	-	40	0.10	0.0%	-	28	0.07	0.0%
60-64	-	63	0.27	0.0%	-	24	0.10	0.0%
65-69	-	44	0.28	0.0%	-	10	0.07	0.0%
Totals	**-**	**194**	**0.73**	**0.0%**	**-**	**118**	**0.30**	**0.0%**