CalPERS Experience Study and Review of Actuarial Assumptions November 2017

CalPERS

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Executive Summary

The purpose of this experience study is to review actual experience of the system in relation to the current actuarial assumptions, and to recommend changes in actuarial assumptions for the rates of decrement, salary increase rates and economic assumptions, as may be indicated by the review.

The report presents the results of the experience study of the California Public Employees' Retirement System. The report is derived from data collected during fiscal years 1997 to 2015. The last study was completed in January 2014 and reflected the experience between 1997 and 2011. This study reviewed retirement rates (service, industrial related disability and non-industrial related disability retirement), termination rates* (vested terminations and refunds), mortality rates (pre- and post-retirement) and rates of salary increase (increases of salary in excess of inflation) and recommends new assumptions for use in actuarial valuations of plans that participate in the California Public Employees' Retirement Fund (State, Schools and Public Agencies).

The recommended assumptions include:

- The life expectancy at age 55 of males is decreasing by about 0.1 years while it is remaining unchanged for females.
- Earlier retirement ages for the State CHP, and POFF, later retirement ages for State Miscellaneous, Industrial, Safety, and the Schools Pool, no changes for Public Agency Fire and mixed results for Pubic Agency Miscellaneous members and Public Agency Police and CPO members.
- Lower rates of Termination with Vested Benefits.
- Mixed results for other assumptions (these are described in detail in this report).

* In this report "termination rates" mean a cessation of participation in the system

Introduction

Introduction

The purpose of this experience study was to review the actual experience of the system in relation to the current actuarial assumptions, and to recommend changes to the actuarial assumptions for rates of decrement, salary increase and economic factors as may be indicated by such a review. The report has been prepared in accordance with current board policy which requires that an actuarial experience study be performed every four years. The report presents findings of demographic assumptions of the plans that participate in the California Public Employees' Retirement Fund (State, Schools and Public Agencies) for the 18 year period from 1997 to 2015. The results have been reviewed by CalPERS Actuarial Offie, and are presented in this report.

BACKGROUND

An experience study is a summarization of actual experience over a defined period of time. A study can be on past economic experience (such as past inflation, real rates of return on various asset classes, real salary growth relative to inflation, and payroll growth of the active population) and/or on past demographic experience (with an analysis of recent patterns of termination, death, disability, and retirement).

This study includes all the experience of the system for both demographic and economic experience. We consider the advancement of salaries due to seniority, merit, and promotion, independent of inflation as demographic experience for the purposes of this study.

Actuaries use the term decrement to describe the circumstances under which individuals leave a population under study. For example, an individual may decrement from the group of active members of the plan due to termination (vested or non-vested), death (industrial related or not), disability (industrial related or not), or service retirement. Exposure is the term used by actuaries to represent the length of time that an individual was exposed to the possibility of leaving the population due to the decrement being studied.

We first compute the raw rates of decrement and salary increases. The raw rate of decrement (for a given decrement and studied population) is defined as the total number of individuals that left the population due to that decrement divided by the total exposure to that decrement for the group. The raw rate of salary increase for a given group is the observed percentage change in salaries for the group from one year to the next. The rates are functions calculated by a series of factors such as age and/or length of service. They do not necessarily become new actuarial assumptions about patterns of behavior for the future for two major reasons. First, the raw rates may represent only a sample of what might be a smooth underlying formula that actually predicts behavior; an actuary frequently will smooth or graduate the raw rates to approximate the smoother underlying formula. Second, and more importantly, the future does not necessarily repeat the past; the actuary must use professional judgment to estimate possible future outcomes based on past experience as well as future expectations and select assumptions based upon application of that professional judgment.

PURPOSE OF REPORT

The purpose of this experience study is to review the actual experience of the system against the current assumptions and to recommend new actuarial rates of decrement, salary increase (in excess of inflation) and economic assumptions based on that experience.

SCOPE OF THE STUDY

This study focused on demographic experience and economic assumptions. The study reviewed retirement rates (service, industrial related disability and non-industrial related disability retirement), termination rates (vested terminations and refunds), mortality rates (pre- and post- retirement), rates of salary increase (increases of salary in excess of inflation), the proportion of members who are married, and the age difference between a member and his/her spouse. The study did not investigate other demographic assumptions such as the amount of unused sick leave or the load to account for the use of best factors.

Demographic Experience Methodology

Demographic Experience Methodology

A general discussion of the methodology used follows. Additional details about the methods used are included in the description of the findings for each decrement.

DATA SOURCE

The source of the data used in this study was the data stored in the actuarial valuation system. This data consists of a series of snapshots of the member data taken as of the end of each fiscal year.

The data for the experience study was extracted from the actuarial database in the form of 18 annual snapshots as of June 30th of the years 1997 to 2015. The data represents the participants in all the retirement plans included in the California Public Employees' Retirement System.

These consecutive snapshots were used to generate four main files, one for active members, one for retired members, one for beneficiaries and one for the inactive members. Each individual member is tracked from the time he or she enters the study. Those who exit are assigned an exit reason.

CALCULATION OF EXPOSURES AND ASSIGNMENT OF DECREMENTS

In general, an individual's exposure to a particular decrement begins only after that individual is eligible to receive benefits should that decrement occur. To reflect this, the exposure of each individual in the study commenced at either the study start date or the eligibility date, whichever was later. Similarly, exposure ended at the study end date or the date at which the eligibility ceased, whichever was earlier. We excluded individuals who decremented before the study start date or were not eligible to receive a benefit by the study end date. The Balducci hypothesis was applied, so if the decrement under study occurred during the observation period, exposure continued to the end of the age and/or service interval in which the decrement occurred.

The calculation of exposures, decrements and rates was applied consistently for all assumptions and was consistent with the method used by the actuarial valuation software. The decrement timing used for age was age nearest birthday on decrement date and the decrement timing used for service was service nearest whole year on decrement date, again consistent with the method used by the actuarial valuation software.

RATES STUDIED

As was specified in the methodology report, the following demographic assumptions were studied.

Retirement Rates

- Service Retirement
- Industrial Disability Retirement
- Non-Industrial Disability Retirement

Mortality Rates

- Pre-retirement Mortality - Ordinary
- Pre-retirement Mortality - Industrial
- Post-retirement Mortality - Service Retiree
- Post-retirement Mortality - Non-Industrial Disability Retiree
- Post-retirement Mortality - Industrial Disability Retiree

Termination Rates

- Termination (with and without refund)

Non-Decrement Rates

- Salary Increases (due to factors other than wage inflation)

GROUPING FACTORS

Actuarial assumptions are based on several factors, including, but not limited to age, gender, and service. For each decrement, different factors were examined for possible use in setting actuarial assumptions. The decision as to which factor to use was based on CalPERS actuaries' professional judgment.

The factors that were examined are documented in the methodology report. Possible factors included:

- Age nearest birthday on decrement date. Service nearest whole year on decrement date.
- Entry Age (Computed as Attained Age - Service)
- Age at Retirement
- Gender
- Retirement Formula
- Organization Category (State, Schools, or Public Agency)
- Membership Category (e.g., Miscellaneous, Industrial, Fire, Police)
- Employer Type (City, County, or Other)

Note that with the passage of Senate Bill 400 in 1999, State Miscellaneous and State Industrial Tier 2 members were given the right to convert their service to Tier 1 any time prior to retirement. Thus, the number of members being covered under these two plans continues to decrease year after year. Therefore, only Tier 1 assumptions were derived as part of this experience study and Tier 2 assumptions will remain unchanged.

GRADUATION

Various methodologies were used to graduate the results depending on the decrement and the amount of data available ranging from a modified Whittaker-Henderson graduation formula to a simple linear fit to manual adjustment. Details are discussed in the sections dealing with the individual decrements and in the section dealing with the salary scale.

MARGINS

A margin is the difference between the assumption used for a calculation and the corresponding best estimate assumption. The actuarial assumptions recommended in this report represent our best estimate of future experience with no margins for adverse deviation except for pre- and post-retirement mortality. For these decrements, a margin, based on the projection table MP2016 published by the Society of Actuaries, has been subtracted from the mortality rates for service retirees and beneficiaries to account for on-going improvements in mortality. More details can be found under the findings for the pre- and post-retirement mortality.

ANALYSIS

The analysis of the demographic experience for this study involved the following steps:

1. First, the number of decrements and exposures for the decrement under study were calculated and tabulated.
2. Next, the number of members expected to decrement was calculated by multiplying the exposures by the expected rates of decrement (current assumptions).
3. Finally, the number of actual decrements was compared with the number of expected decrements over a given period. The comparison which was expressed as a percentage is called the actual to expected ratio (A/E Ratio).

If the actual experience, based on the A/E ratios differed significantly from the overall expected results, whether by the pattern based on graphs, or whether the crude probability rates versus current assumptions differed significantly, then new assumptions were considered, otherwise, no changes to current rates were recommended.

The findings for each decrement are presented in the tables in the following sections.

Findings

Findings

SERVICE RETIREMENT FOR ACTIVE MEMBERS

Summary

The experience over the study period shows that, in general, there were fewer retirements than expected based on the current retirement assumptions for most of the State, Schools Pool and Public Agency Miscellaneous plans.

For most plans, the recommendation is to revise the age and service based retirement assumptions which closely align with the actual retirement experience observed during the experience study period for each benefit formula. In other cases, most notably the Schools Pool, the recommended retirement rates are based on a blending of actual experience and the current assumptions due to the greater than expected differences between actual and assumed experience or cases with limited experience. In these cases, the actual plan experience cannot be considered fully credible. In addition to considering the observed experience, the actuary is required to use professional judgment and reflect the actuary's best estimate of future experience.

No changes in assumptions are being proposed for Public Agency Fire members.

For the following benefit formulas and/or member classifications the proposed assumptions predict lower numbers of expected retirements as compared with the current assumptions:

- Public Agency Miscellaneous members under the 2% at age 55, 2.5% at age 55, 2.7% at age 55 and 3% at age 60 formulas,
- Public Agency Police members under the 2% at age 55 and 3% at age 50 formulas,
- State plans, Industrial, Safety and Miscellaneous.

For the following benefit formulas and/or member classifications the proposed assumptions predict higher number of expected retirements as compared with the current assumptions:

- Public Agency Miscellaneous members under the 2% at age 60 formula,
- Public Agency Police members under the 2% at age 50 and 3% at age 55 formulas,
- State plans CHP and POFF.

All current and proposed assumptions are based on age and service except for the Public Agency Police and Fire 2% at age 55 plans which is simply age based. The age and service based retirement assumptions result in more accurate modeling of future retirements and associated liabilities. However, due to the size of the covered population, there is too little experience to develop credible age and service based assumptions for the Public Agency Safety 2% at age 55 plans.

Although there was not enough retirement data to directly study PEPRA members, new retirement rates were developed for most PEPRA formulas by adjusting the corresponding proposed classic member retirement assumptions by a factor based on each formula's benefit multipliers. This is the same methodology that was used to create the current retirement assumptions for PEPRA members. No change in the service retirement assumption is being proposed for Public Agency Fire PEPRA members, since no change is being proposed for Classic members.

Method

The retirement rates were based on data collected between June 30, 2003 to June 30, 2015. Other periods within the date range were also studied to identify the effects of certain events on retirement rates.

The data was first grouped by membership category and benefit formula. To assess whether the current assumptions continue to be appropriate we compared the actual number of retirements to the expected number of retirements anticipated by our current assumptions. The expected number of retirements was compared to the actual number of retirements (A/E ratio) for all ages and for all services. Based on this comparison, changes to the current assumptions were made where appropriate using adjustments to current retirement probabilities to achieve overall and age specific (i.e. each and every age) actual to expected retirement ratios as close as possible to 100 percent.

Findings (continued)

SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

Active and terminated members' retirement experience was studied separately. Transferred members records were excluded to prevent potential double counting of exposures and decrements. The proportion of transferred members who do not have an active record elsewhere in the system is so small that excluding such members will not compromise the results of the study. Since most transferred members are also active members with another CalPERS employer, the active retirement rates will be applied to the transferred members.

We also attempted to exclude any experience in the periods before and after an agency experienced an increase in their retirement formula. Experience has shown that members delay retirement from the year before the change in the retirement formula to the year after the improvement. Therefore, any data from these two years was excluded from the study.

Factors used for grouping data:

- Age: The retirement rates display a strong pattern by age, due to influences such as the variance in benefit by age, traditional retirement ages, and eligibility for Social Security.
- Service: Retirement rates generally increase with service.
- Retirement Formula:
- Organization Category: State and Schools Pool were studied separately.
- Membership Category: Separate retirement rates were developed for Miscellaneous, Police and Fire members.
- Employment Status: active and terminated were studied separately.

Factors studied but not used for grouping data:

Gender: The data indicated there has been somewhat different retirement experience between males and females over the experience study period. We have chosen not to develop separate retirement rates for males and females, this decision will be reevaluated in the next experience study.

County Peace Officers were studied separately from Public Agency Police, as in the previous study, and the results indicated that it is still appropriate to use the same assumptions for both groups.

Some public agencies may have mandatory retirement policies at certain ages for safety members. No data was available about these policies and it was not possible to identify or exclude the impact of these policies in this study. However, such policies would have affected the results.

Results

The service retirement rates display a strong and consistent pattern by age. This can be attributed to a combination of the psychology of the membership and the structure of the benefits. It has long been observed that members tend to display a preference for retiring at ages divisible by 5, thus, retirement rates tend to be higher at ages 50, 55, and 60 or at the age when the benefit factors no longer increase. After age 55 the 2.5% at age 55 and 2.7% at age 55 benefit factors no longer increase. After age 60 the 3% at age 60 benefit factor no longer increases. In addition, retirement rates are also higher at age 62, when Social Security becomes available, age 65, when Medicare becomes available, and age 66, the current Social Security full retirement age.

Findings (continued)

SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

State and Schools Pool

For the current experience study, data from 2003-2015 was studied. The retirement rates were also studied by four year periods within the study window to try to isolate the impact certain events might have had on the retirement behavior.

For the Schools Pool, the actual number of retirements were lower than expected during the study period for ages 50 to 65 and higher for ages 66 and above. Upon further analysis, we found that the actual experience for the first four years of the study period matched the current assumptions. However, the experience for the most recent eight-year period was very different with actual retirement rates being lower than assumed. After careful deliberations, the actuarial office decided that given the long stability period of the lower than expected results, that there were temporary conditions influencing the experience. It is possible that the reduction in retirement rates was a result of the economic climate during that eight-year period which could have influenced members to work longer. The recommendation is to lower the retirement rates for the Schools Pool, but not to fully reflect the experience of the last eight years since it is unclear whether the reduction in retirement rates is a temporary or permanent change in behavior. Therefore, the recommended assumption result in a ratio of actual to expected retirements is 93 percent. The retirement behavior of school members will be monitored and reviewed once again as part of the next experience study and if the recent experience continues to occur, further reduction in retirement rates may be needed in the future.

For State Miscellaneous, State Industrial and State Safety, the actual numbers of service retirements were lower than assumed during the study period. In general, the proposed retirement rates are lower than the current rates to reflect this experience. However, as for the Schools Pool, the proposed rates are a blend of the current rates and the actual experience, with more weight placed on actual experience.

For State CHP and POFF, the actual numbers of service retirements were generally greater than assumed during the study period. In general the proposed retirement rates are greater than the current rates to reflect this experience. The proposed assumptions were calculated as a blend of the current rates and actual experience.

Public Agency Miscellaneous

For members subject to the Public Agency Miscellaneous 2% at age 60 formula, more retirements than expected were observed for ages 60 and below and above age 66, while they were lower for ages 61 to 65. The assumptions have been adjusted to more closely match both overall expected retirements and number of retirements by age.

All other Public Agency Miscellaneous plans saw fewer retirements than expected, the proposed assumptions have been adjusted to predict around 3 to 10 percent less retirements than expected from the current assumptions over the study period.

Public Agency Safety Fire

No changes are being proposed to Public Safety Fire service retirement assumptions. For 3% at age 50 members the actual number of retirements was very close to the expected number from the current assumptions. The other formulas were also generally close to expected over the study period.

Public Agency Safety Police

For the Public Agency Safety police 2% at age 50 and 3% at age 55 formulas, the proposed assumptions have been adjusted to reflect that there were fewer retirements than expected under the current assumptions while the 3% at age 50 formula was adjusted to reflect slightly more retirements. For 2% at age 55 the service retirement assumption for ages 60 to 64 was changed from 100 percent to 30 percent to reflect data showing members working past age 60, consistent with the assumptions and experience for the other formulas. The rates for the other ages were not changed.

Findings (continued)

SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

The table below compares the actual number of retirements due to service retirement with the expected number of such retirements under both the current and proposed assumptions for active members by plan for the State plans and by benefit formula for Public Agencies.

Service Retirement Rates for Active Members

	Actual[1]	Expected (Current)	A/E Ratio	Expected (Proposed)	A/E Ratio
State and Schools					
State Miscellaneous	64,654	74,057	87.3%	67,639	95.6%
State Industrial	3,472	3,559	97.6%	3,485	99.6%
State Safety	8,837	9,302	95.0%	9,006	98.1%
POFF	16,081	14,617	110.0%	15,743	102.1%
CHP	2,236	2,115	105.7%	2,220	100.7%
Schools	88,049	104,064	84.6%	94,339	93.3%
Public Agency					
2% at age 55 Miscellaneous	30,426	31,969	95.2%	31,086	97.9%
2% at age 60 Miscellaneous	3,734	3,227	115.7%	3,645	102.4%
2.5% at age 55 Miscellaneous	13,043	14,936	87.3%	13,454	96.9%
2.7% at age 55 Miscellaneous	16,181	18,432	87.8%	16,975	95.3%
3.0% at age 60 Miscellaneous	7,528	8,187	92.0%	7,773	96.8%
2% at age 50 Fire	159	141	112.8%	No Changes	
2% at age 55 Fire	10	10	100.0%	No Changes	
3% at age 50 Fire	3,525	3,539	99.6%	No Changes	
3% at age 55 Fire	927	968	95.8%	No Changes	
2% at age 50 Police/CPO	630	579	108.8%	603	104.5%
2% at age 55 Police/CPO	54	108	50.0%	51	105.9%
3% at age 50 Police/CPO	7,981	8,100	98.5%	7,961	100.3%
3% at age 55 Police/CPO	807	681	118.5%	799	101.0%

(1) The number of actual and expected retirements has been adjusted to exclude all retirements on and above the age at which 100% of members are assumed to retire.

SERVICE RETIREMENT FOR TERMINATED MEMBERS

Summary

Currently, it is assumed that vested, terminated members (those in terminated status on the valuation date) are assumed to follow the same service retirement pattern as active members, but with a load factor to reflect the expected higher rates of retirement. For future terminated members (those in active status on the valuation date), a simplified version of the assumption is used. When an active member is projected to terminate, it is assumed that the benefit will commence at a single age (59 for Miscellaneous and 54 for Safety). Staff recommends using the simplified assumption (single age) for all terminated members. The proposed methodology is common practice for public retirement systems due, in part, to the relatively small liability associated with this decrement.

Method

The development of the terminated member single average retirement age for Miscellaneous and Safety members was based on the actual number of service retirements by age and a weighted average of each plan's exposure. Data from the plans listed below were used for this analysis. For Public Agency plans, the analysis was limited to the Miscellaneous 2% at age 55 plans and the Safety 3% at age 50 plans.

The following table summarizes the results:

Separate Member Average Retirement Age

	Total Exposure (Male and Female)	Actual Service Retirement	Average Retirement Age
Miscellaneous			
State Miscellaneous Tier 1	128,510	10,758	59.32
State Industrial Tier 1	71,183	5,138	58.53
Schools	4,796	371	56.46
Public Agency Miscellaneous	107,068	10,280	57.69
Average Retirement Age			**59**
Safety			
State Safety	5,488	582	56.67
State POFF	2,942	628	52.68
Public Agency Fire	1,183	250	52.67
Public Agency Police	3,774	986	52.12
Average Retirement Age			**54**

Results

The average retirement ages for terminated members are 59 and 54 for Miscellaneous and Safety members, respectively. Staff recommends no change to the retirement assumption for active members who terminate in the future with vested benefits, and staff recommends that the retirement assumption for members in terminated status on the valuation date be changed to age 59 for Miscellaneous members and age 54 for Safety members.

NON-INDUSTRIAL DISABILITY RETIREMENT

Summary

In most cases, the proposed rates produce lower numbers of disability. No changes in assumptions are being proposed for State Miscellaneous Tier 1 males or for Public Agency Police or CPO. Slightly higher rates are being proposed for POFF at younger ages. Lower overall rates are being proposed for Schools, State Miscellaneous Tier 1 females and Tier 2, State Industrial, State Safety, CHP, Public Agency Miscellaneous and Public Agency Fire members.

Method

The decrement study reviewed the non-industrial disability retirement (NIDR) experience over the 15 year period 2000 to 2015. The last decrement study was performed four years ago using experience from 2001 to 2011. During the period following the last decrement study, 2011 to 2015, the change in the incidence of NIDR was variable, depending on the group. This 4 year period was deemed too short to be fully reflected in the proposed rates. Where changes have been recommended, the proposed rates were derived using the results of 10 years of experience from 2005 to 2015.

Transferred members were excluded from the study of this decrement.

Factors used for grouping data:

- Age: Rates displayed a strong and fairly consistent pattern by age.
- Gender: For some groups, male and female disability rates differed significantly and separate tables were produced. For other groups, the male and female rates did not differ materially, or there was insufficient data to determine if rates were materially different, and the results were combined.
- Membership Category: There are substantial differences in the disability rates by membership category.

Results

No changes in assumptions are being proposed for State Miscellaneous Tier 1 males or for Public Agency Police or CPO members. New rates are being proposed for all other members. The overall rates are lower for groups with new rates except for State POFF, where they are slightly higher. In the recent past, State Miscellaneous Tier 2 had not been studied, but rates had been set higher than Tier 1 for ages over 30. We are recommending that Tier 2 be set to the same rates as Tier 1. Tier 2 is only about 5 percent of the State Miscellaneous population and will shrink in the future until it disappears. PEPRA members are not differentiated in any group.

In Schools, males had higher disability rates; in State Miscellaneous, females had higher disability rates; in Public Agency Miscellaneous, disability rates were slightly higher for males. These results are consistent with the results from the previous experience study.

For Miscellaneous groups, disability rates at high ages (60 and above) are lower than the rates at initial retirement ages (50 to 55). This pattern was observed in multiple groups where substantial portions of the active population work beyond age 60 (e.g. State Miscellaneous, Public Agency Miscellaneous, and Schools Pool). We believe that an explanation for this effect could be that, beyond age 55, the service retirement benefit is greater than the disability benefit, which encourages people to choose service retirement.

Findings (continued)

NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

The table below compares actual number of NIDR with expected number of such retirements under both the current and proposed assumptions. The counts are for 2005-2015.

Non-Industrial Disability Retirements

	Actual	Expected (Current)	A/E Ratio	Expected (Proposed)	A/E Ratio
State					
Miscellaneous Tier 1 Male	902	995	91%	No Changes	
Miscellaneous Tier 1 Female	1,625	1,875	87%	1,808	90%
Miscellaneous Tier 2 Male	70	164	43%	60	117%
Miscellaneous Tier 2 Female	153	335	46%	112	137%
Industrial	322	430	75%	395	82%
Safety	280	362	77%	321	87%
POFF	244	235	104%	243	100%
CHP	5	13	38%	9	56%
Schools					
Schools Male	1,087	1,471	74%	1,034	105%
Schools Female	1,770	2,014	88%	1,742	102%
Public Agency					
Miscellaneous Male	847	1,240	68%	912	93%
Miscellaneous Female	927	1,197	77%	1,012	92%
Fire	28	42	67%	36	78%
Police	71	104	68%	No Changes	
CPO	71	67	106%	No Changes	

INDUSTRIAL DISABILITY RETIREMENT

Summary

The proposed Industrial Disability Retirement (IDR) rates are not being adjusted except for CHP and Public Agency Fire where the proposed rates are lower than the previous rates.

Method

The decrement study reviewed the IDR experience over (a) the 5 year period 2010 to 2015, and (b) the 10 year period 2005 to 2015. The last decrement study was performed about four years ago covering experience from 1997 to 2011. The 5 year period and 10 year period results were consistent with each other.

Transferred and terminated members were excluded from the study for the same reasons listed in the study of the service retirement decrement.

Factors used for grouping data:

- Age: Rates increase with age. There were very few decrements below age 30 while some groups had very high IDR rates close to or at service retirement eligibility ages.
- Employee Category: The IDR rates differed by employee category. Therefore, separate rates are used for State Industrial, State Safety, State POFF, State CHP, Public Agency Fire, Public Agency Police and Public Agency CPO members.

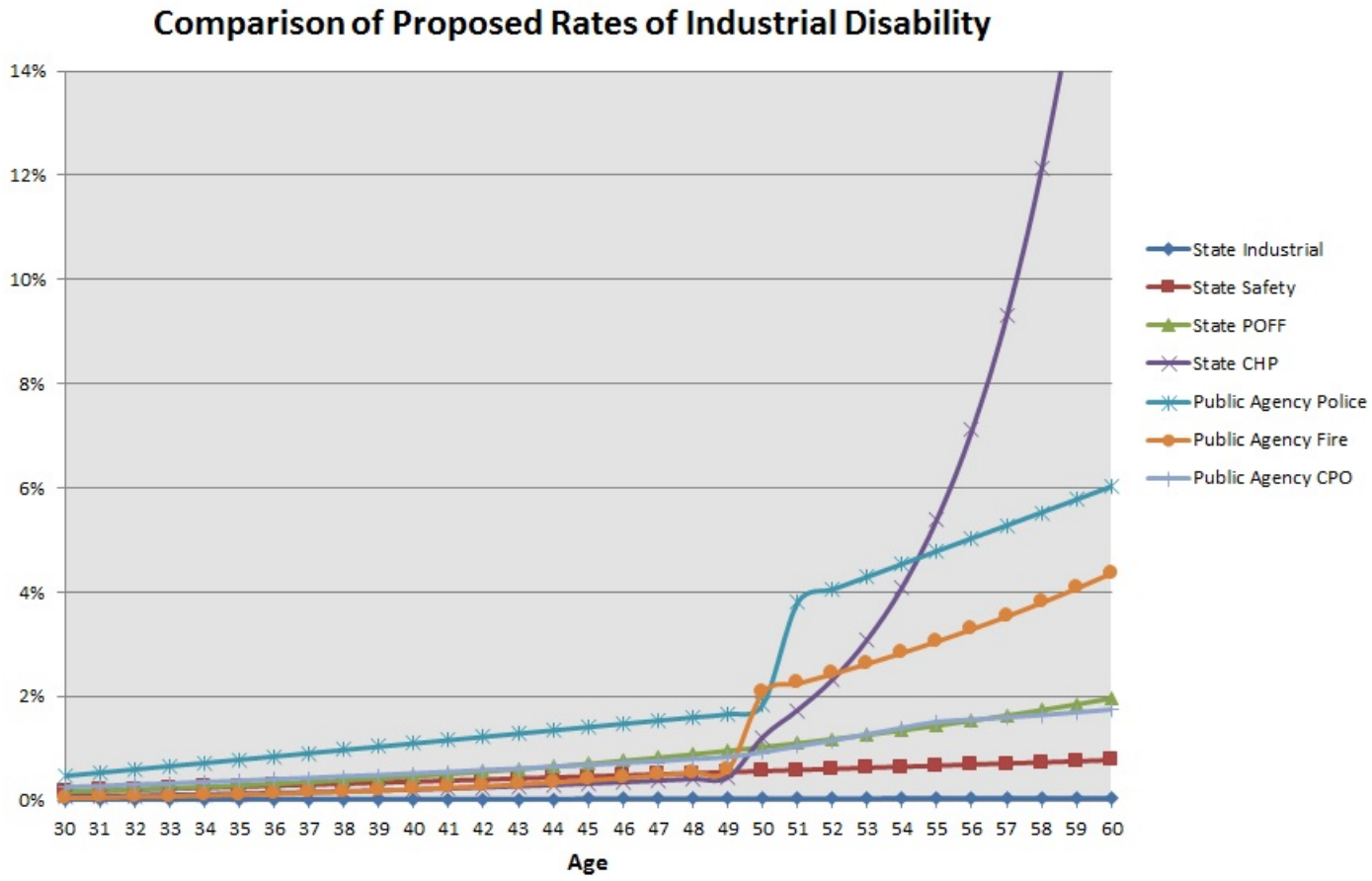
The data indicated there is difference in IDR rates for male and female members. There was also indications that rates varied by length of service. However, there is not sufficient credible experience to produce male/female specific IDR rates on age and service.

Discussion

There are significant variations in the patterns of industrial related disability between the various membership categories. It is believed that these differences represent real underlying differences in the behavior of members. For example, three of the groups (Public Agency Police, Public Agency Fire and California Highway Patrol) show a very substantial increase in the rates of industrial disability at or shortly after age 50. Three other groups (State Safety, State POFF and Public Agency CPO's) do not display this effect. This difference is believed to be due to how strictly the disability criteria are enforced for the different groups.

Findings (continued)

INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)



One group (State Industrial) has much lower IDR rates at all ages than the other groups. This is believed to reflect a difference in the nature of the work performed by this group as compared to the nature of the work performed by the other groups.

Results

The IDR rates remain unchanged for all employee categories except for CHP and Public Agency Fire. The proposed CHP rates are 40 percent lower than the current rates. The proposed Public Agency Fire rates are 25 percent lower than the current rates.

The basic IDR benefit is 50 percent of final compensation plus an annuity purchased pursuant to statute. If the employee is eligible for service retirement, the service retirement benefit is payable, if greater. The rates of IDR are highest over age 50. As many members are eligible for service retirement at this age, they receive the larger service retirement pension in the event of IDR. IDR's at these higher ages has minimal impact on pension costs. However, the preferable tax treatment of IDR benefits does result in additional costs to taxpayers.

Pension Reform legislation (PEPRA), effective January 1, 2013, added a provision for safety members who qualify for IDR under age 50. In some circumstances, an IDR pension larger than 50 percent of final compensation may be payable at ages less than 50. IDR experience will be monitored to see if the change in legislation has any impact on reporting of IDR events. The data available for this experience study did not contain enough credible data to examine the impact of the PEPRA legislation.

Findings (continued)

INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

The table below compares the actual number of IDR decrements with the expected number of such decrements under both the current and proposed assumptions.

Industrial Related Disability Retirements

	2005 - 2015 Period			2010 - 2015 Period				
	Actual	Expected (Current)	A/E Ratio	Actual	Expected (Current)	A/E Ratio	Expected (Proposed)	A/E Ratio
State and Schools								
Industrial	27	38	70.0%	13	21	63.0%	No Changes	
Safety	1,058	1,186	89.0%	684	615	111.0 %	No Changes	
POFF	2,596	2,851	91.0%	1,571	1,412	111.0 %	No Changes	
CHP	438	716	61.0%	195	349	56.0%	210	93.0%
Schools	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Public Agency								
Fire	1,158	1,574	74.0%	608	783	78.0%	587	104.0%
Police	2,975	3,393	88.0%	1,683	1,693	99.0%	No Changes	
CPO	553	639	87.0%	300	324	93.0%	No Changes	

TERMINATIONS WITH VESTED BENEFITS AND TERMINATIONS WITH REFUND

Summary

A new set of assumptions for terminations with vested benefits is being proposed for eight out of eleven groups. The actual versus expected ratios for the period of 2000 through 2015 ranged from 79 percent to 103 percent. After graduating the new assumptions, the actual versus expected ratios for the period of 2000 through 2015 ranged from 94 percent to 107 percent.

A new set of assumptions for terminations with refunds is being proposed for seven out of eleven groups. The actual versus expected ratios ranged from 75 percent to 128 percent. After graduating the new assumptions, the actual versus expected ratios for the period of 2000 through 2015 ranged from 93 percent to 109 percent.

Method

Terminations with vested benefits and terminations with refunds were looked at separately. All terminated members having less than 5 years of service were considered refunds.

The termination data from June 30, 1997 to 1999 was found to be inconsistent with the other years of data and was not included in the study. For simplicity and to avoid double counting, only data from active members was included in the study.

Factors used for grouping data:

- Age: Termination rates declined as age increased. Age was used as a grouping factor for State Miscellaneous, Schools, Public Agency Miscellaneous and State Industrial categories. However, Safety groups generally have less variance in the age at date of hire than do Miscellaneous groups. This results in a higher correlation with service and makes this factor less useful in predicting terminations. Given this effect and the lesser amount of data available for safety groups, age was not used as a grouping factor for safety categories.
- Service: Termination rates declined as service increased. Service is used as a grouping factor in the current rates for all employee categories.
- Employee Category: Significant differences were observed in the termination rates applicable to different employee categories. Separate tables of termination rates were used for Miscellaneous, Police, Fire and CPO members.

Factors studied but not used for grouping data:

- Gender: While females generally terminated at slightly higher rates than males, the difference was insignificant compared to the effects of other factors.

The raw rates were smoothed using the following methods or a combination of the methods: Whittaker-Henderson, log-normal, and manual adjustment. In the prior study, the raw rates were fitted by fitting three line segments through the data. This methodology did not seem to match the pattern of raw rates in the data and thus was not deemed to still be appropriate.

Results

Overall, termination rates with vested benefits and refunds decrease as age and service increase. The proposed assumptions predict lower rates of termination.

Findings (continued)

TERMINATIONS WITH VESTED BENEFITS AND TERMINATIONS WITH REFUND (CONTINUED)

The table below compares the actual versus expected number of terminations with vested benefits.

Termination with Vested Benefits

	Actual	Expected (Current)	A/E Ratio	Expected (Proposed)	A/E Ratio
State					
Miscellaneous Tier 1	21,841	21,812	100%	20,822	105%
Miscellaneous Tier 2	2,378	2,536	94%	No Changes	
Industrial	1,626	1,601	102%	No Changes	
Safety	2,700	2,921	92%	2,694	100%
POFF	3,686	4,644	79%	3,676	100%
CHP	438	520	84%	438	100%
Schools	45,801	48,483	94%	42,646	107%
Public Agency					
Miscellaneous	39,365	40,859	96%	37,465	105%
Fire	880	1,034	85%	880	100%
Police	2,670	2,581	103%	No Changes	
CPO	1,238	1,488	83%	1,237	100%

The table below compares the actual versus expected number of terminations with refunds.

Termination with Refunds

	Actual	Expected (Current)	A/E Ratio	Expected (Proposed)	A/E Ratio
State					
Miscellaneous Tier 1	49,954	60,556	82%	49,238	101%
Miscellaneous Tier 2	13,998	15,103	93%	No Changes	
Industrial	2,428	1,892	128%	2,402	101%
Safety	8,738	7,423	118%	8,634	101%
POFF	9,559	8,742	109%	No Changes	
CHP	294	390	75%	285	103%
Schools	191,184	161,642	118%	189,505	101%
Public Agency					
Miscellaneous	111,798	112,158	100%	No Changes	
Fire	1,900	1,709	111%	1,835	104%
Police	4,408	4,077	108%	No Changes	
CPO	2,976	3,158	94%	3,037	98%

PRE-RETIREMENT MORTALITY - NON-INDUSTRIAL RELATED

Summary

A new set of pre-retirement mortality rates is being proposed for both male and female plan participants. Over all time periods reviewed there has been a modest improvement in pre-retirement mortality for male and female members. The new graduated rates for non-industrial related pre-retirement mortality during the period 2005 through 2015 are lower than the current rates and vary by age and gender only. In the prior experience study for the period 1997 through 2011 the study showed lower than expected rates of mortality and a further improvement in mortality is seen over the duration of this study.

The proposed new rates reflect the adoption of a new mortality projection table, MP 2016, from the Society of Actuaries. This new projection table replaces projection Scale BB that was used in the previous experience study. 15 years of mortality projection using 90 percent of Scale MP 2016 was built into the recommended rates to be consistent with findings from analysis of post retirement mortality that demonstrated 15 years of mortality projection produced equivalent retirement liabilities to a fully generational mortality table (further discussion can be found in the post-retirement section of this report).

Previous studies have determined that there are no material differences in the pre-retirement mortality rates between plan participants from safety groups as compared to plan participants from Miscellaneous groups. The current study confirmed that there continues to be no significant differences in rates between the two groups.

Method

Data for active members from June 30, 1997 through June 30, 2015 was available for use in this study. Mortality improvement was seen over various time periods examined with greater improvement in the most recent years. Rates were developed using the most recent ten-year data period.

Factors used for grouping data:

- Age: Rates increase with age.
- Gender: Male mortality rates are roughly 1.9 times the female rates.

Factors studied but not used for grouping data:

- Membership Category: Rates for Miscellaneous members are similar to those for Safety members.

Raw rates were developed using the Whitaker-Henderson method. For both the male and female rates at lower ages the raw rates are zero or volatile due to low exposure at early ages and the data is less credible. At these lower ages rates were fitted using a finite difference methodology.

Discussion

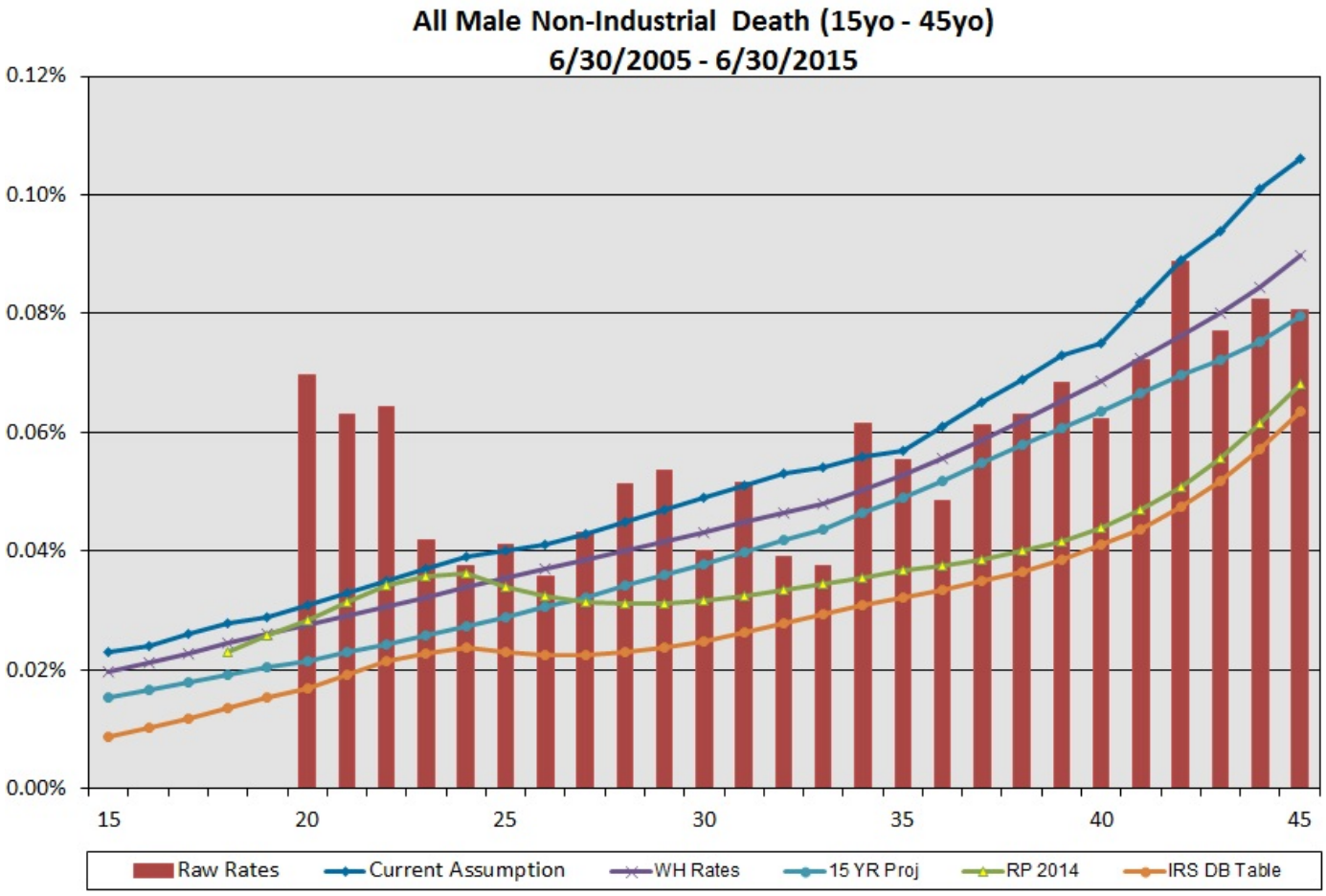
In the prior study, the period from 1997 through 2011 showed that the rates of pre-retirement non-industrial related mortality were lower than assumed and the rates were decreased for both male and female. The current study shows a continued improvement in mortality during the last four years as well as over the entire ten years of experience. Actuarial Standards of Practice number 35 requires an explicit assumption for future mortality improvements. In October 2016, the Society of Actuaries published its Mortality Improvement Scale MP-2016. CalPERS has implemented a 15-year static mortality improvement on the smoothed curve using 90 percent of MP-2016.

Findings (continued)

PRE-RETIREMENT MORTALITY - NON-INDUSTRIAL RELATED (CONTINUED)

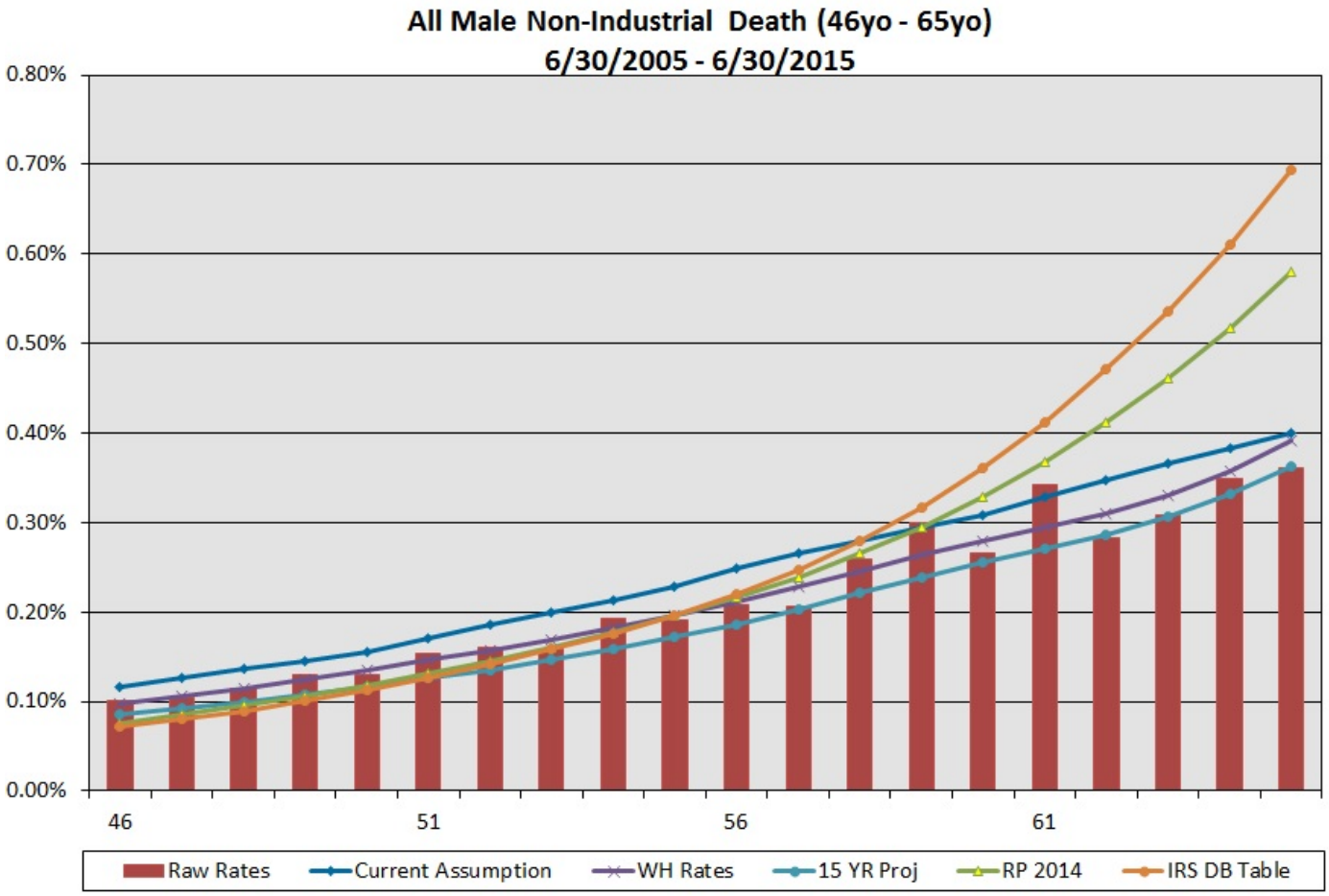
Results

Mortality rates increase with age with male mortality rates higher than female mortality rates. The graphs below show the experience study results for the male and female populations. The graphs compare the raw rates, current rates, smoothed rates and proposed rates with mortality improvement. Also shown are some commonly used mortality tables for comparison purposes. The new mortality rates are lower at all ages for both males and females.



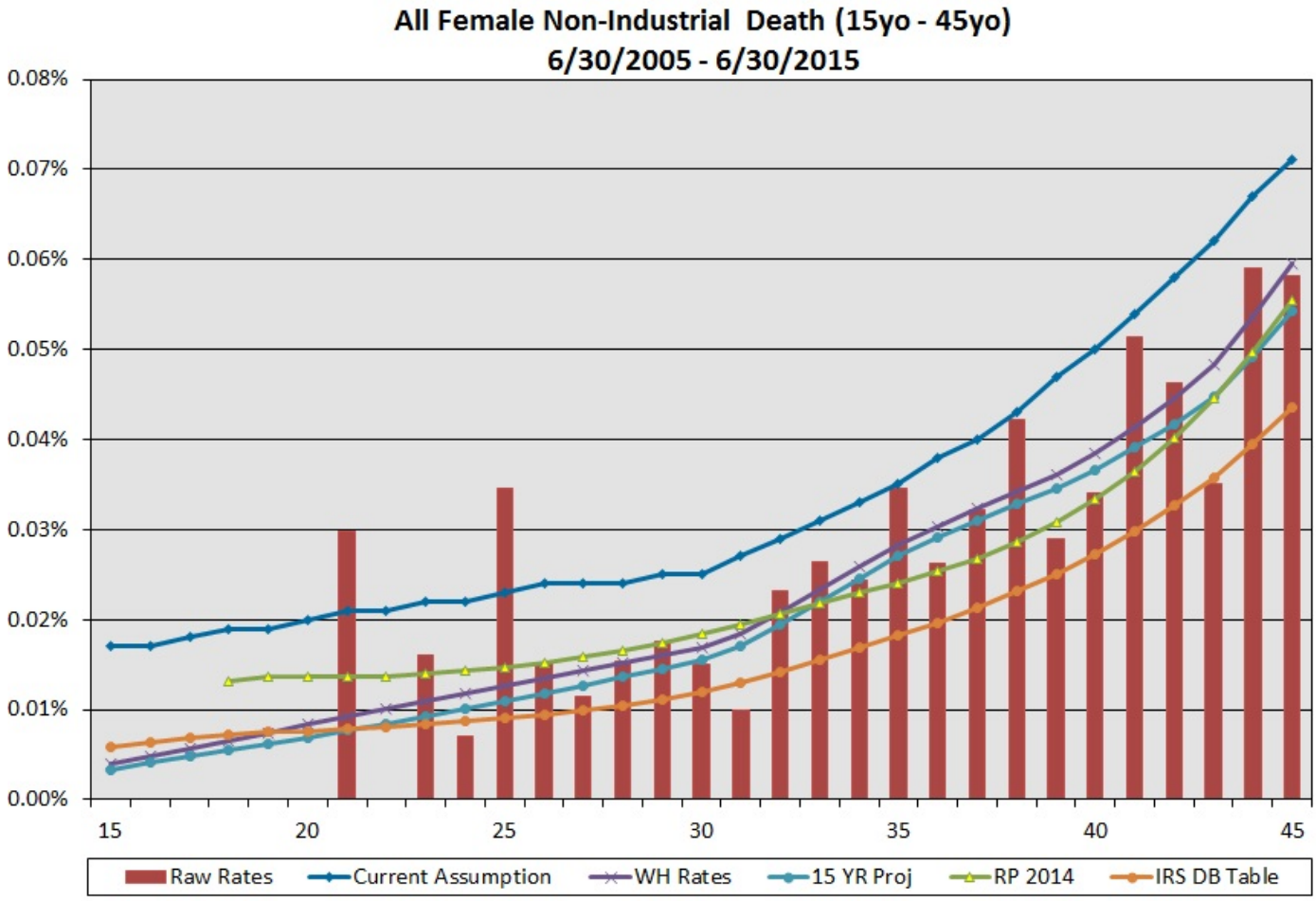
Findings (continued)

PRE-RETIREMENT MORTALITY - NON-INDUSTRIAL RELATED (CONTINUED)



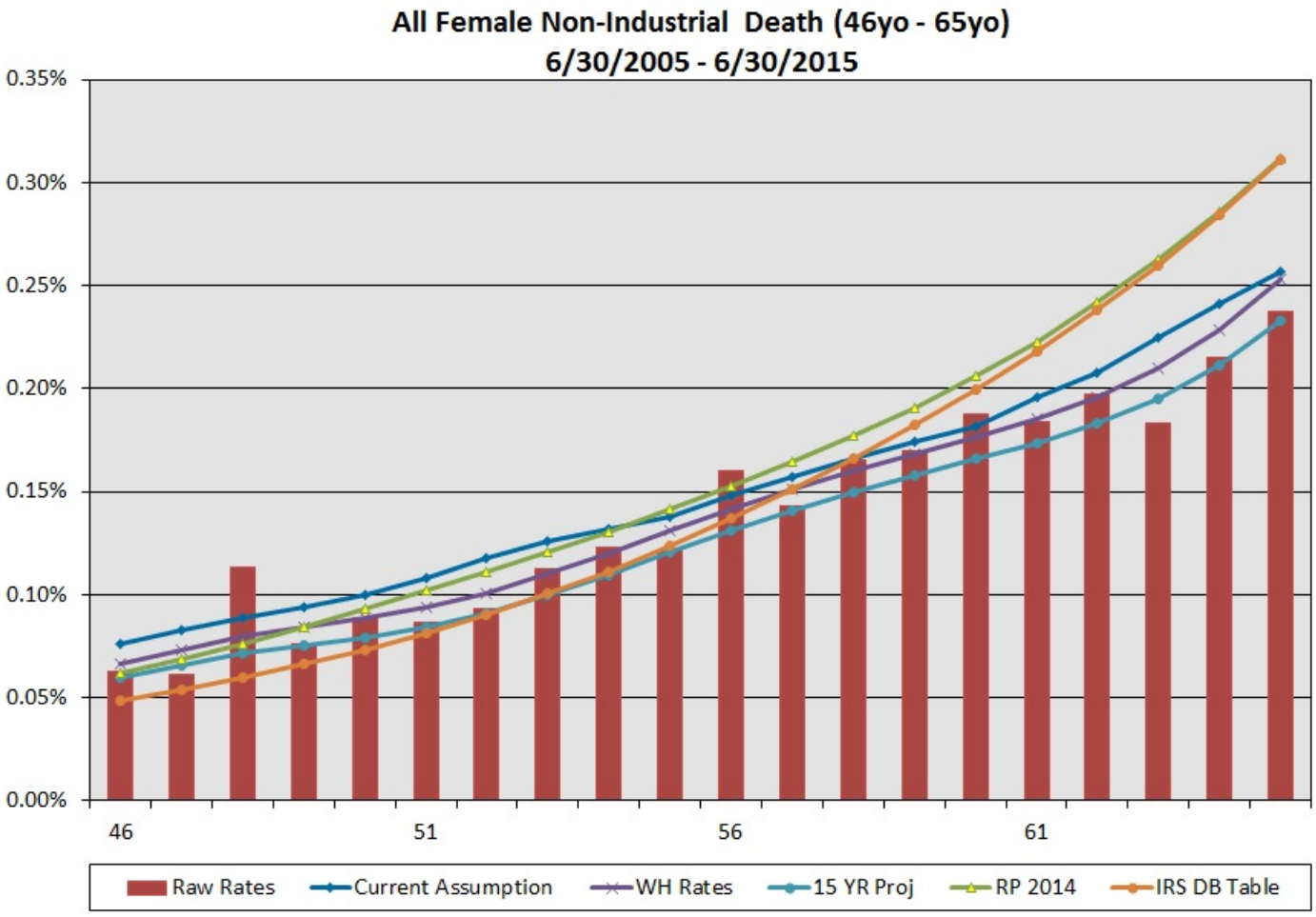
Findings (continued)

PRE-RETIREMENT MORTALITY - NON-INDUSTRIAL RELATED (CONTINUED)



Findings (continued)

PRE-RETIREMENT MORTALITY - NON-INDUSTRIAL RELATED (CONTINUED)



The table below compares the actual number of non-industrial related deaths with the expected number of such deaths under both the proposed and proposed with 15-year mortality improvement assumptions.

Non-Industrial Related Deaths

	Actual	Expected (Current)	A/E Ratio	Expected (with MP-2016 Scale)	A/E Ratio
Male	4,729	5,187	91.0%	4,211	112.0%
Female	3,921	4,277	92.0%	3,599	109.0%

PRE-RETIREMENT MORTALITY - INDUSTRIAL RELATED

Summary

Observed rates of industrial related mortality during the eighteen year study period were lower than the current rates in the aggregate. The number of decrements is very low and this severely limited the amount of data grouping that was possible.

Method

Only active members are eligible for this benefit, so we studied only active member data. The number of decrements is very low and this severely limited the amount of data grouping that was possible.

The only factor used for grouping data was age:

- Age: Rates increase with age.

Factors studied but not used for grouping data:

- Gender: There were insufficient female decrements to group by gender.
- Employee Category: There were insufficient decrements.
- Employer Type: There were insufficient decrements.

Male data from Industrial, Safety, POFF, CHP, and Public Agency Safety plans was combined and grouped into 10-year bands by age. As there was insufficient data to justify a more exact treatment, a straight line was fitted to the raw data. There were only seven female decrements so male and female data was combined.

Results

The observed rates of industrial related mortality during the eighteen year study period were lower than the current rates. The table below compares the actual number of industrial related deaths with the expected number of such deaths under both the current and proposed assumptions.

Industrial Related Deaths

	Actual	Expected (Current)	A/E Ratio	Expected (Proposed)	A/E Ratio
All Groups (Non-Miscellaneous)	246	291	85.0%	237	104.0%

POST-RETIREMENT MORTALITY FOR HEALTHY RECIPIENTS

Summary

A new set of post-retirement mortality rates is being proposed for both male and female healthy recipients. We have seen modest improvements in post-retirement mortality rates for healthy male and female recipients. The new mortality rates are lower from ages 50 through 60 and slightly higher from ages 60 through 110 for both genders. This is primarily due to the adoption of a new mortality projection table from the Society of Actuaries. The new projection table MP2016 has replaced projection Scale BB that was used in the previous experience study. Further analysis was done to demonstrate that 15 years of mortality projection was required to produce equivalent liabilities to a fully generational mortality table.

Improved mortality leads to an increase in life expectancy. Assuming 15 years of projected mortality improvement, life expectancy at age 55 is expected to increase from the current base rates by 1.1 years for males and by 1.1 years for females by the year 2030 for healthy recipients.

Previous studies have determined that there are no material differences in the post-retirement mortality rates between retirees from safety groups as compared to retirees from miscellaneous groups. The current study confirmed that there continues to be no significant differences in rates between the two groups.

Method

Factors used for grouping data:

- Age
- Gender

Raw rates were developed by age and gender and then graduated (by age) using the Whittaker-Henderson method.

Mortality rates were studied by analyzing the annual exposures and decrements over the period from June 30, 1997 through June 30, 2015. In doing so, it became clear that mortality improvements had occurred over the whole period. In the last study, 20 years of projected on-going mortality improvement using Scale BB published by the Society of Actuaries was applied to the mortality rates to bring the then graduated rates from the midpoint of the last study to 2028. This scale consists of an expected annual improvement in mortality that varies by age and also differs for males and females. The expected improvement is greater for males than females.

Since the last study, updated mortality projection Scales MP 2014, MP 2015 and MP 2016 have been published by the Society of Actuaries as a tool for actuaries to project mortality improvement. These scales consist of an expected annual improvement in mortality that varies by age and also differs for males and females. Scale MP 2014 projected fairly significant improvement in mortality rates over the previous Scale BB. However, this has been tempered by recent relatively flat mortality improvement experience, reflecting lower levels of improvement in the MP 2015 scale and even lower levels of improvement with the MP2016 scale.

A very useful tool to analyze the trends in mortality is to calculate a Standardized Mortality Ratio (SMR). The SMR compares the actual deaths over a period of years using the same exposures for each year applied to the actual mortality rates by age for each year. This gives us a much better picture of the underlying mortality improvement trends over a longer period of time.

In this study, we propose including 15 years of projected on-going mortality improvement using 90 percent of Scale MP 2016 published by the Society of Actuaries. The 15 years was determined to be the years of projection needed to approximate the liabilities determined for the system if we were to adopt a fully generational mortality assumption. The male and female service retiree raw rates between ages 50 and 99 were graduated using the Whittaker-Henderson method. Then, exponential interpolation was used to derive mortality estimates for ages below age 50. Those rates were then projected to reflect 15 years of mortality improvement using 90 percent of Scale MP 2016. Finally, due to insufficient exposures to calculate any meaningful raw rates at ages 100 through 110, the current rates for current healthy recipients were used for those ages and were also projected forward to reflect 15 years of mortality improvement.

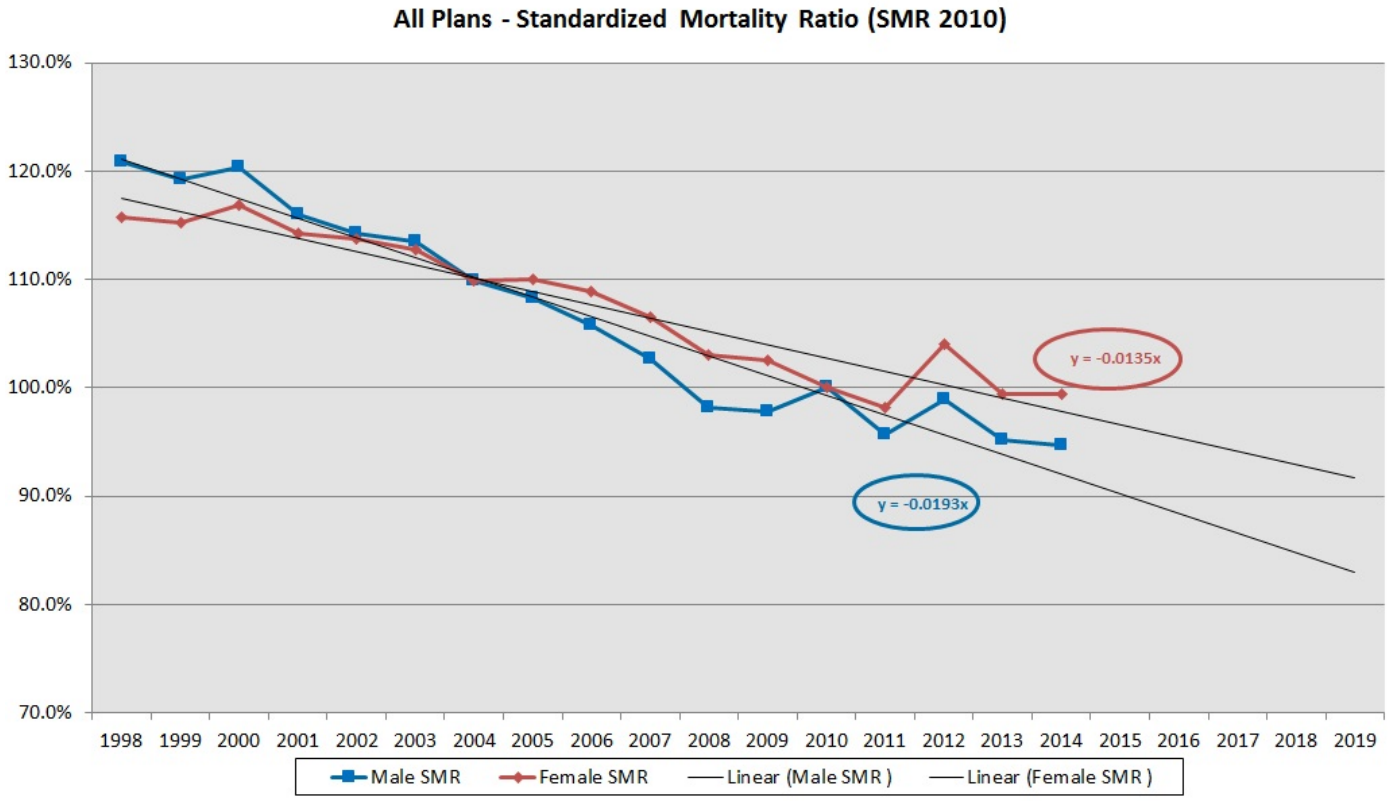
POST-RETIREMENT MORTALITY FOR HEALTHY RECIPIENTS (CONTINUED)

Results

Mortality rates increase with age. Male mortality rates are higher than female mortality rates. The new mortality rates are moderately lower at ages 50 through 62 and over age 91 for males and lower at ages 50 through 55, 68 through 77 and over age 92 for females, while moderately higher at the other ages.

Standardized Mortality Ratio (SMR)

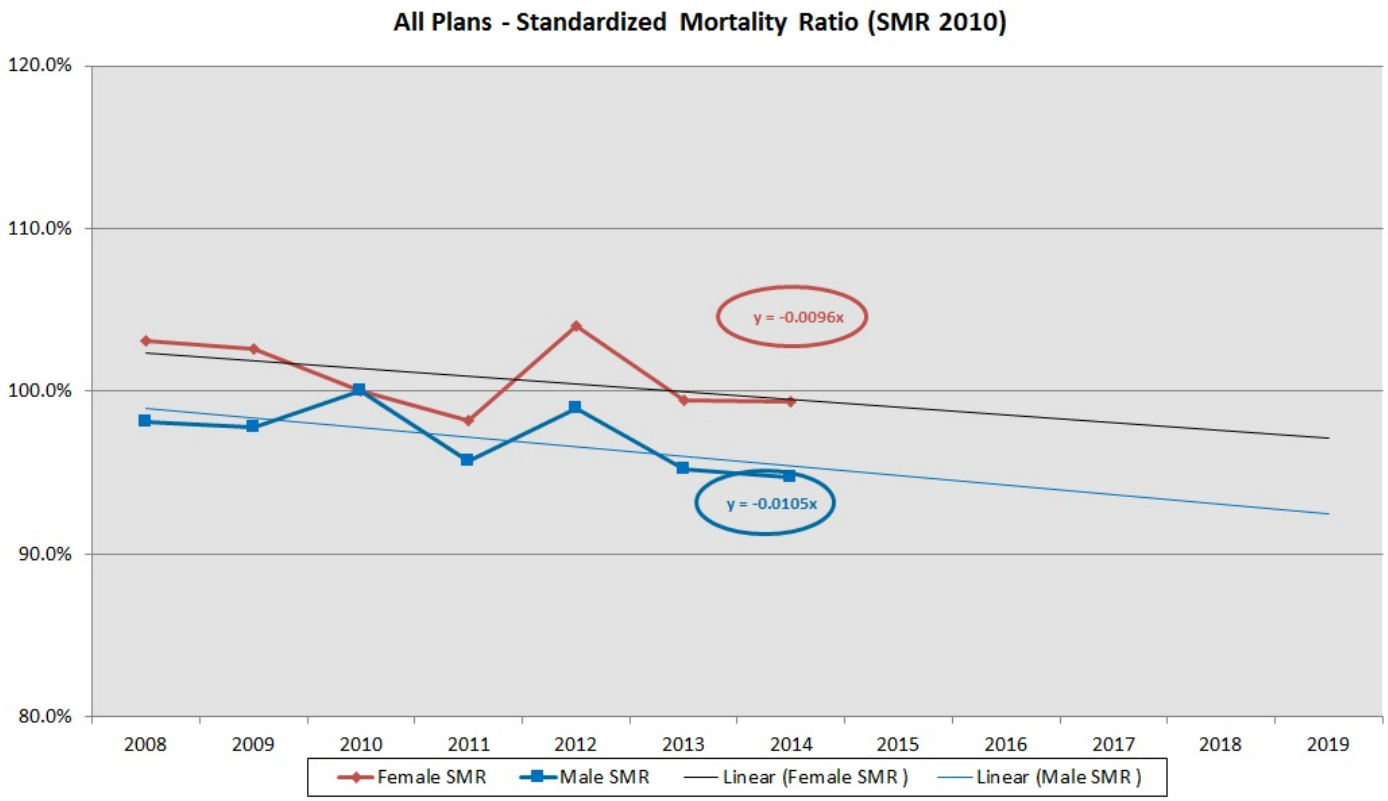
The Standardized Mortality Ratio for each gender was developed using the exposures for the Fiscal Year ending 2010 as the base year. Using the 2010 exposures and the actual mortality rates for each year from 1998 through 2015, the following graph provides a comparison of the calculated deaths by year divided by the actual deaths in 2010 to illustrate the improvement in mortality from 1998 to 2015. For example, the data indicates that 20 percent more males died in 1998 as compared to 2010 with the same assumed exposures. The linear trend lines of best fit show the expected improvement into the future, with annualized improvements of 1.93 percent for males and 1.35 percent for females. This is consistent with the national experience that male mortality rates have been decreasing a little more than the female mortality rates.



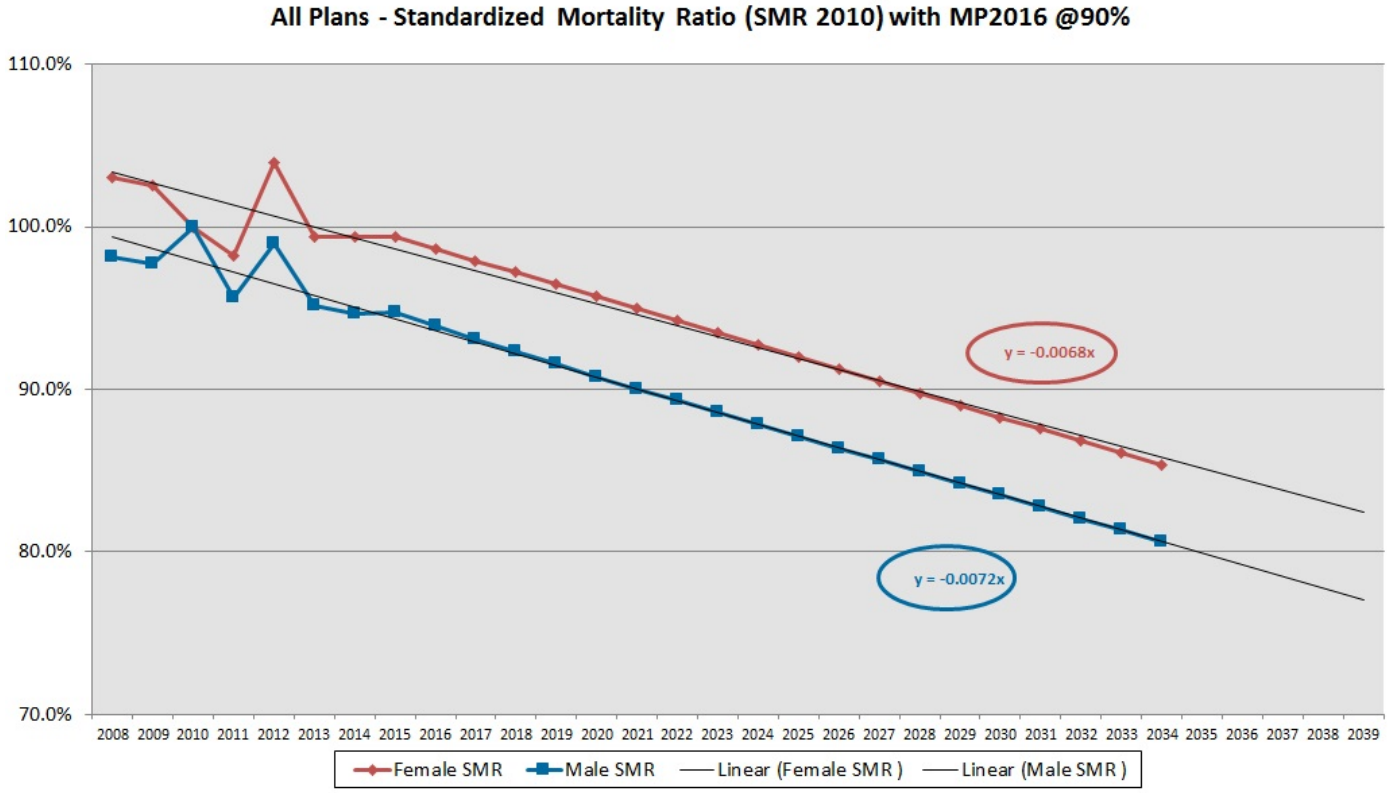
Over the period from 1998 through 2008 the data shows significant mortality improvement. However, it is also evident from this graph that the pace of mortality improvement has slowed considerably since 2008. A graph of the SMR (see below) for the more recent period from 2008 to 2015 shows a definite slowing of the pace of mortality improvement. For females, the annual improvement over the period 2008 to 2015 is slightly less than 1 percent per year while the mortality improvement is just slightly more than 1 percent a year for males

Findings (continued)

POST-RETIREMENT MORTALITY FOR HEALTHY RECIPIENTS (CONTINUED)



Finally, projecting into the future it is evident from the following graph that the projected SMR's using 90 percent of Scale MP 2016 line up very well with the plan experience over the past 8 years and this projection table provides the best estimate for future mortality improvement.

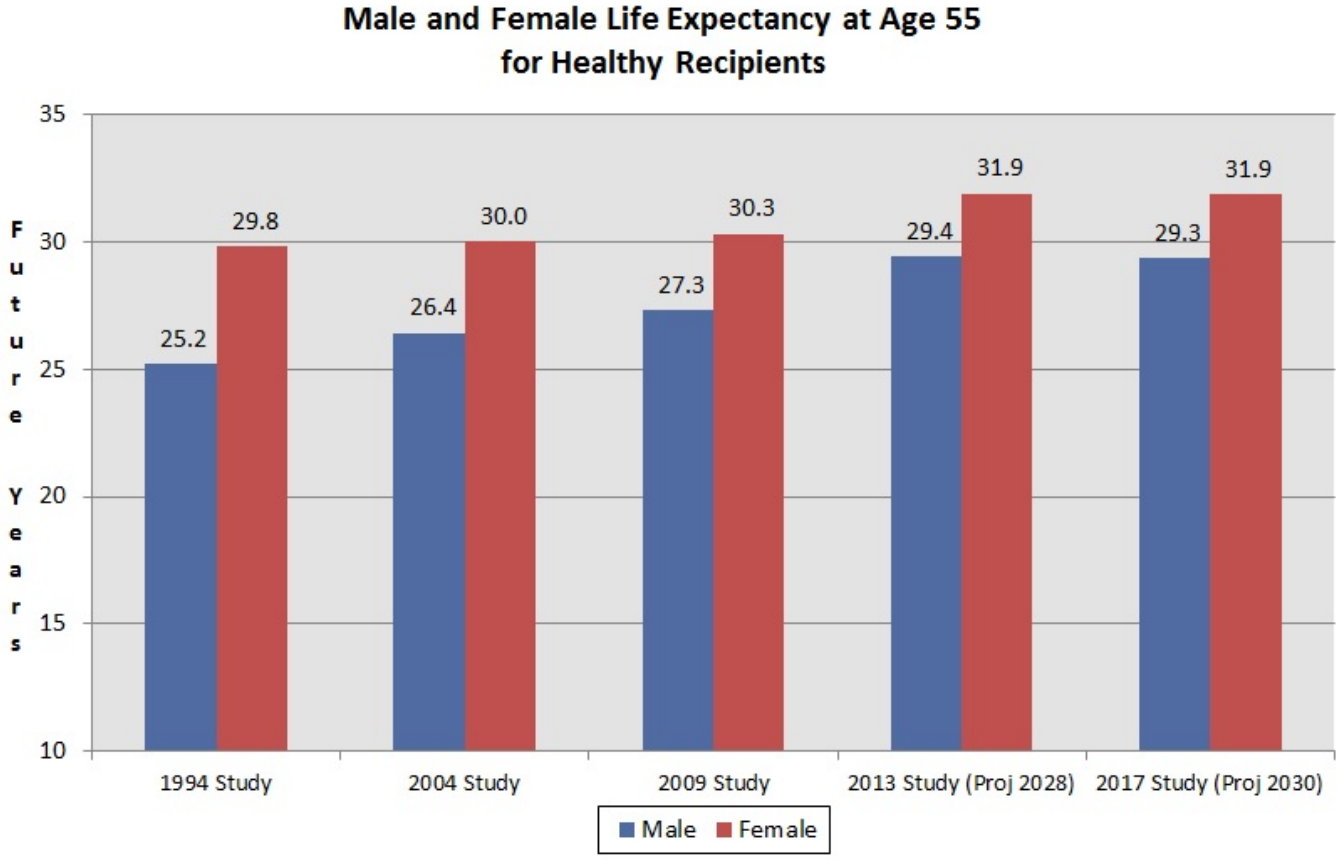


POST-RETIREMENT MORTALITY FOR HEALTHY RECIPIENTS (CONTINUED)

Life Expectancy

Life expectancy is the average remaining number of years a member is expected to live if subjected the rest of their life to the current mortality assumptions. The chart below provides a comparison of life expectancy at age 55 for both male and female healthy recipients, based on prior CalPERS mortality experience. Life expectancy at age 55 remains at basically the same levels as the previous study for healthy recipients.

The table below provides a comparison of the life expectancy for males and females under the current assumptions and the proposed assumptions which include 20 years of mortality improvement. For example, based on the current assumptions, you would expect a male age 50 to live 31.8 more years and a female the same age to live 35.0 more years.



The table below provides a comparison of the life expectancy for males and females under the current assumptions and the proposed assumptions which include 15 years of mortality improvement. For example, based on the current assumptions, you would expect a male age 50 to live 33.5 more years and a female the same age to live 36.1 more years, under the proposed assumptions a male age 50 is now expected to live 33.7 years, while a female age 50 is expected to live 36.2 years.

Life Expectancy (In Years) Healthy Recipients

	Current Assumptions with 20 Years of Mortality Improvement		Base Rates with No Improvement		Assumptions With 15 Years of Mortality Improvement	
Attained Age	Male	Female	Male	Female	Male	Female
50	33.5	36.1	32.5	35.1	33.7	36.2
55	29.4	31.9	28.2	30.8	29.3	31.9
60	25.2	27.5	23.9	26.5	25.0	27.5
65	21.1	23.1	19.9	22.2	20.9	23.2
70	17.0	18.9	15.9	18.0	16.9	18.9

POST-RETIREMENT MORTALITY FOR NON-INDUSTRIAL RELATED DISABLED RETIREES

Summary

A new set of post-retirement mortality rates is being proposed for both male and female non-industrial (non-work) related disabled recipients. The new mortality rate assumptions for non-industrial related disability male retirees are lower at ages under 61 and over age 92 and modestly higher between ages 63 and 80. For the females, the new mortality assumptions produce slightly higher mortality rates between ages 55 and 68 and similar rates to the previous study at all other ages.

Method

Factors used for grouping data:

- Age
- Gender

Raw rates were developed by age and gender and then graduated (by age) using the Whittaker-Henderson method.

Mortality rates for non-industrial disabled retirees were studied by analyzing the annual exposures and decrements over the period from June 30, 1997 through June 30, 2015. In doing so, it became clear that mortality improvements had occurred over the length of the period.

For the non-industrial related disabled retirees, the male and female raw rates between ages 50 and 95 were graduated using the Whittaker-Henderson method. Exponential interpolation was then used to derive mortality estimates for ages below age 50. Consistent with the healthy recipients, these rates were also then projected to reflect 15 years of mortality improvement using 90 percent of Scale MP 2016. Finally, due to insufficient exposures to calculate any meaningful raw rates above age 95, the proposed rates for non-industrial related disabled retirees at those ages are the mortality rates proposed for the healthy recipients.

Results

Mortality rates increase with age. Male mortality rates are higher than female mortality rates. The new mortality rates for non- industrial related males are lower at ages under 61 and over age 92, while modestly higher between ages 63 and 80. The new female mortality rates for non-industrial disabled retirees are slightly higher at ages between 55 and 68 and not significantly different than the previous rates at all other ages.

POST-RETIREMENT MORTALITY FOR INDUSTRIAL RELATED DISABLED RETIREES

Summary

A new set of post-retirement mortality rates is being proposed for both male and female industrial related disabled recipients. Compared to the previous rates, the new mortality rates for industrial related disability male retirees are lower at ages under 60 and higher at ages 82 through 92. For the females, the new mortality assumptions produce lower mortality rates at ages under 56, 64 through 83, and over age 93.

Method

Factors used for grouping data:

- Age
- Gender

Raw rates were developed by age and gender and then graduated (by age) using the Whittaker-Henderson method.

Just as with mortality rates for healthy and non-industrial related recipients, mortality rates for industrial disabled retirees were studied by analyzing the annual exposures and decrements over the period from June 30, 1997 through June 30, 2015. In doing so, it became clear that mortality improvements had occurred over the length of the period.

For the industrial related disabled retirees, the male and female raw rates between ages 50 and 95 were graduated using the Whittaker-Henderson method. Exponential interpolation was then used to derive mortality estimates for ages below age 50. Consistent with the healthy recipients, these rates were also then projected to reflect 15 years of mortality improvement using 90 percent of Scale MP 2016. Finally, due to insufficient exposures to calculate any credible raw rates above age 95, the proposed rates for industrial related disabled retirees at those ages are the mortality rates proposed for the healthy recipients.

Results

Mortality rates increase with age. Male mortality rates are higher than female mortality rates. The new mortality rates for industrial related disabled male recipients are lower at ages under 60 and higher at ages 82 through 92, with no significant changes to the previous rates at all other ages. The new mortality rates for industrial related disabled female recipients are lower at ages under 56, at ages 64 through 83 and over age 93.

MORTALITY CONTINGENCY LOAD FOR TERMINATING PLANS

Summary

When a contract with a public agency is terminated, Government Code Section 20576 authorizes the Board to include contingencies for mortality fluctuations when determining the obligations of the System after the effective date of plan termination. The Actuarial Office has been using a 7 percent load for mortality fluctuations since 1985, which means the actuarial liability for terminating plans is first calculated using the mortality assumptions for ongoing plans, then the resulting liability is increased by 7 percent. At the time the 7 percent load was established, the mortality assumptions for ongoing plans did not provide for any future mortality improvement. If mortality were to improve more than expected, the mortality assumptions would be modified through future experience studies, and contribution rates for ongoing plans would be adjusted. For terminating plans, however, there is no future contribution rate adjustment possible, which is why a contingency load is authorized by statute and recommended by the Actuarial Office.

Method

This Experience Study proposes a post-retirement mortality assumption for healthy recipients using 90 percent of Scale MP 2016 with projected mortality improvements through to 2029. To determine an appropriate mortality adjustment for plans moving to the Terminated Pool, the actuarial office recommends measuring the sensitivity of a more conservative mortality improvement assumption. The methodology to determine how sensitive mortality projection is, the Actuarial Staff has recommended that percentages greater than or relative to 100 percent of Scale MP 2016 be used with generational mortality improvement using a base year of 2020. The year 2020 is used as the base year, since the next experience study is in 4 years (2021), and generational mortality improvement is used to allow for improvement through the entire lifetime of an individual.

Results

Using 110 percent of Scale MP 2016 to calculate alternate annuity factors and weighting these factors by the ages of the retiree population leads to a hypothetical liability that is 2.6 percent higher than it is under the proposed mortality assumption. Using 130 percent of Scale MP 2016 would lead to a liability that is 4.0 percent higher than the proposed mortality assumption. Based on this analysis, the Actuarial Office recommends the Board reduce the contingency load for mortality fluctuations for terminating plans from 7 percent to 5 percent of which includes a small margin.

SALARY INCREASE

Summary

The new proposed salary assumptions are changing for all membership and organizational categories. There are 10 different salary increase assumption groups, 4 Miscellaneous groups (State Miscellaneous and Industrial, Schools, and Public Agencies) and 6 Safety groups (State Safety, POFF, CHP and Public Agency Police, Fire and CPO). The study has shown that:

- Salary increases are slightly lower than expected by the current assumptions for the CHP, POFF, and State Industrial, at least at the higher service levels.
- The Schools Pool, State Safety and State Miscellaneous groups experienced slightly higher salary increases at most age and service levels than what was expected from the current assumptions.
- Public Agency Safety and Miscellaneous groups experienced lower than expected pay increases at higher service levels than what the current assumptions had predicted.

Method

The study included data from active members only. Factors used for grouping data:

- Entry Age: Employees with lower entry ages tend to get larger pay increases at the same amount of service.
- Service: Salary increases are generally higher for low-service individuals.
- Membership Category:
- Organization Category:
- Periods Studied: Last 5 years, last 10 years and last 15 years.

Factors not used for grouping data:
Gender: Prior studies have indicated that salary increases for CalPERS members do not depend on gender.

Sources of Salary Increases: Seniority, Merit, and Promotion (SMP) and Inflation

Salary increases can be thought of as the product of two distinct components: increases due to wage inflation and increases due to seniority, merit and promotion. Salary increases due to wage inflation tend to be driven by global or national trends although they can also be driven by industry specific trends as well. As such, these increases are best treated as an economic assumption and should be considered in conjunction with other economic assumptions such as price inflation and productivity increases. The pattern of increases due to seniority, merit and promotion tend to differ due to member specific or employer specific factors and are best treated as a demographic assumption. In this study, only the seniority, merit and promotion component of salary increases were studied. The salary increase assumptions recommended in this study should be combined with a wage inflation assumption to get total expected salary increases.

As part of this study, the data for developing a new set of salary increase assumptions was studied using a closed group method. The closed group study method is described by McGill et al. (2005) in *Fundamentals of Private Pensions (8th ed., p. 610)*. This method is the same as was used in the previous study.

Using this method, the way to construct a merit salary scale is to examine the historical relationship between the average compensation of employees at various ages to the average compensation of the entire population. For example, if in year 1 the average salary of members age 30 with 5 years of service is 50 percent of the average salary of the total population and that in year 2 the average salary of those same members still working and now age 31 with 6 years of service is 52 percent of the average salary of the total population then the merit salary increase between year 1 and year 2 for that age and service group was 4 percent (52 divided by 50). We used this method and calculated a merit salary increase for each age and service cell for each of the plan years between June 30, 2000 and June 30, 2015. Finally, the merit salary increase for each age and service cell for the 15 year period were averaged over the years based on the number of people present in each cell in each of those years. These average increases were then graphed and fitted using a log function splined at years 8, 9 or 10 depending on the observed curve that resulted. Other curves were fitted using manual smoothing due to known or visual discontinuities such contractual longevity increases in years further out in the service period.

Findings (continued)

SALARY INCREASE (CONTINUED)

Results

The current assumptions vary by service and entry age for all assumption groups except CHP. The current assumption for CHP only depends on service. The data continues to show that salary increases for CHP depend far more on service than entry age. In fact, this is true for all safety groups. Combining all entry ages for each safety assumption group allows for greater credibility in the proposed assumptions. The proposed assumptions depend only on service for all safety groups.

As in the previous study, the data continues to the show that members with high service continue to receive salary increases more than the increase in average salary, particularly for safety groups. The data is consistent from year to year and indicates that a significant number of members continue to receive promotions after many years of service.

The last 15, 10 and 5 year periods were examined and found very little variability. We are recommending small changes in the pattern of salary increases, and continue to refine the assumption for known or observed seniority pay increases.

Below are tables showing the current and proposed ultimate merit salary increase for each of the groups. Note that the assumed wage inflation of 2.75 percent (3 percent for CHP) is added to these merit increases to obtain the overall assumed salary increase used in the actuarial valuations. For example, if the ultimate rate in the table below is 0.5 percent, the assumed ultimate salary increase rate used in the actuarial valuations is 3.25 percent. Also, the current assumptions vary based on entry age and service for all but CHP; the proposed assumptions vary based on entry age and service for miscellaneous groups but service only for safety groups.

Current Assumptions (Ultimate Only)

	Members with Entry Age 25	Members with Entry Age 35	Members with Entry Age 45
State and Schools			
State Miscellaneous	0.5%	0.5%	0.3%
State Industrial	0.6%	0.6%	0.6%
State Safety	0.6%	0.3%	0.1%
State POFF	1.2%	0.9%	0.6%
State CHP	0.8%	0.8%	0.8%
Schools	0.5%	0.2%	0.0%
Public Agency			
Miscellaneous	0.5%	0.3%	0.0%
Fire	0.8%	0.4%	0.3%
Police	1.5%	1.1%	0.3%
CPO	1.6%	1.3%	0.3%

Proposed Assumptions (Ultimate Only)

	Members with Entry Age 25	Members with Entry Age 35	Members with Entry Age 45
State and Schools			
State Miscellaneous	0.5%	0.4%	0.3%
State Industrial	0.5%	0.5%	0.4%
State Safety	0.5%	0.5%	0.5%
State POFF	1.0%	1.0%	1.0%
State CHP	0.7%	0.7%	0.7%
Schools	0.9%	0.7%	0.5%
Public Agency			
Miscellaneous	0.8%	0.7%	0.4%
Fire	1.0%	1.0%	1.0%
Police	1.7%	1.7%	1.7%
CPO	2.0%	2.0%	2.0%

GENDER BLENDING FOR OPTIONAL FORMS OF BENEFITS

Summary

The purpose of this assumption is to determine the male/female mortality rate blending ratios used for developing unisex mortality tables for optional forms of benefits. Three categories of mortality are applicable in this analysis, Service Retirement (SR), Non-Industrial Disability (NIDR) and Industrial Disability (IDR) and two optional forms Single Life (SL) and Joint and Survivor (J&S) In determining an appropriate blending method two methods of blending were studied, one by number of retirees for a given optional form and one by volumes of benefits being paid to retirees categorized by sex.

Method

By observing the significant difference in results between by count and by benefit volume for each of the categories studied the decision made was to use the benefit weighting method as it more accurately applies the corresponding benefit to the applicable mortality rate.

Results

Under the three categories of mortality studied and two categories of optional forms, 3 changes are recommended.

1. Reduce the male weighting portion under the SL /NIDR and the SL/IDR combinations by 5 percent.
2. Reduce the male weighting portion under the J&S/SR combination by 5 percent.

Data on retirees (retired after 1997) receiving benefits as of June 30, 2003 through June 30, 2015 were tabulated. We counted the number by type of retirement, sex and option elected. The table below shows the tabulation over the last ten years.

Single Life Forms (SL)

Number of Retirees as of Valuation Date	Service Retirement (SR)		Non-Industrial Disability (NIDR)		Industrial Disability (IDR)	
	Tabulation	% Male	Tabulation	% Male	Tabulation	% Male
6/30/2006	80,624	27.9%	9,083	31.8%	4,911	65.5%
6/30/2007	90,301	28.0%	9,531	31.6%	5,299	65.0%
6/30/2008	99,803	28.0%	9,883	31.4%	5,615	64.6%
6/30/2009	110,045	28.2%	10,365	31.1%	5,955	64.4%
6/30/2010	122,968	28.3%	10,824	30.7%	6,182	64.7%
6/30/2011	136,732	28.5%	11,414	30.4%	6,717	64.2%
6/30/2012	149,685	28.6%	11,663	30.2%	7,145	63.4%
6/30/2013	162,167	28.7%	12,027	30.0%	7,688	63.4%
6/30/2014	172,672	28.7%	12,922	29.8%	8,528	63.5%
6/30/2015	184,283	28.7%	13,434	29.6%	9,114	63.4%

Joint and Survivor Forms (J&S)

Number of Retirees as of Valuation Date	Service Retirement (SR)		Non-Industrial Disability (NIDR)		Industrial Disability (IDR)	
	Tabulation	% Male	Tabulation	% Male	Tabulation	% Male
6/30/2006	81,133	62.0%	4,217	54.5%	6,540	88.6%
6/30/2007	91,513	61.6%	4,555	54.2%	7,158	88.6%
6/30/2008	101,817	61.5%	4,796	53.7%	7,708	88.3%
6/30/2009	113,000	61.2%	5,080	53.7%	8,227	88.2%
6/30/2010	127,182	61.0%	5,375	53.1%	8,667	88.1%
6/30/2011	141,370	60.8%	5,725	52.7%	9,324	87.8%
6/30/2012	154,630	60.4%	5,822	52.4%	9,725	87.6%
6/30/2013	167,350	60.0%	6,080	52.1%	10,331	87.5%
6/30/2014	177,187	59.7%	6,648	51.8%	11,389	87.2%
6/30/2015	189,108	59.3%	6,998	51.2%	12,161	86.9%

Findings (continued)

GENDER BLENDING FOR OPTIONAL FORMS OF BENEFITS (CONTINUED)

A mortality blend by a strict count of retirees will not necessarily produce a cost neutral set of option factors. In order to better reflect the value of the benefits being paid, we also looked at the total monthly benefit payable to tabulate the ratio of male and female retirees. The table below shows the tabulation over the last ten years.

Benefit Payments - Single Life Forms (SL)

Benefits in $1,000 as of Valuation Date	Service Retirement (SR)		Non-Industrial Disability (NIDR)		Industrial Disability (IDR)	
	Tabulation	% Male	Tabulation	% Male	Tabulation	% Male
6/30/2006	143,598	38.3%	10,064	36.1%	15,048	70.6%
6/30/2007	165,827	38.3%	10,840	35.9%	16,840	70.1%
6/30/2008	191,034	38.3%	11,450	35.5%	18,460	69.7%
6/30/2009	220,257	38.3%	12,230	35.3%	20,268	69.6%
6/30/2010	254,938	38.2%	12,928	34.8%	20,894	71.0%
6/30/2011	297,642	38.4%	14,053	34.6%	24,411	69.2%
6/30/2012	336,542	38.5%	14,706	34.3%	26,544	69.5%
6/30/2013	375,246	38.4%	15,503	34.1%	29,445	69.3%
6/30/2014	408,166	38.3%	16,922	33.7%	33,892	68.8%
6/30/2015	445,637	38.2%	17,926	33.5%	37,211	68.6%

Benefit Payments - Joint and Survivor Forms (J&S)

Benefits in $1,000 as of Valuation Date	Service Retirement (SR)		Non-Industrial Disability (NIDR)		Industrial Disability (IDR)	
	Tabulation	% Male	Tabulation	% Male	Tabulation	% Male
6/30/2006	226,716	75.9%	5,087	61.2%	26,517	93.1%
6/30/2007	264,067	75.5%	5,623	60.9%	29,990	93.0%
6/30/2008	305,913	75.1%	6,028	60.1%	33,469	92.7%
6/30/2009	305,913	75.1%	6,580	60.1%	37,124	92.6%
6/30/2010	410,261	74.0%	6,987	59.2%	39,621	93.0%
6/30/2011	474,341	73.7%	7,680	59.0%	44,848	92.2%
6/30/2012	531,194	73.1%	7,975	58.5%	47,874	92.0%
6/30/2013	587,091	72.7%	8,496	58.3%	52,238	91.9%
6/30/2014	632,628	72.3%	9,462	58.1%	58,691	91.5%
6/30/2015	687,035	71.8%	10,142	57.4%	63,925	91.2%

Findings (continued)

GENDER BLENDING FOR OPTIONAL FORMS OF BENEFITS (CONTINUED)

Proposed Percentages

Based on the tabulations above, the following table summarizes the proposed male/female percentages. The proposed percentages give more weight to the total monthly benefits payable than the actual counts.

All Single Life Forms

	Weighting of Male Retirees		Weighting of Male Beneficiaries	
	Current	Proposed	Current	Proposed
Service Retirement	35%	No Change	n/a	n/a
Non-Industrial Disability	35%	30%	n/a	n/a
Industrial Disability	75%	70%	n/a	n/a

Joint and Survivor Forms

	Weighting of Male Retirees		Weighting of Male Beneficiaries	
	Current	Proposed	Current	Proposed
Service Retirement	75%	70%	25%	30%
Non-Industrial Disability	60%	No Change	40%	No Change
Industrial Disability	90%	No Change	10%	No Change

PERCENTAGE MARRIED AND AGE DIFFERENCE

Summary

The purpose of this assumption is to determine the percentage married and age difference between male and female spouses for purposes of valuing the likelihood of a member having a statutory spouse at retirement. Many plans at CalPERS have either 25 percent or 50 percent post retirement survivor allowance benefit in their contract and this assumption serves to estimate the additional payment steam after the death of the member. The results show that the percentage married ranged from 70 percent to 90 percent depending on the member category. Generally 70 percent of miscellaneous members are married while 85 to 90 percent of safety members are married. Males on average are three years older than their female spouses. Same gender marriages were not studied due to limited data.

Method

Data on retirees retired after 1997 receiving benefits were tabulated. For the percentage married assumption, married members were tabulated by member category with detail given below. The average age difference between male and female spouses was calculated for each member category.

Results

The table below shows the current and proposed assumptions for the percentage married along with the average percentage of accumulated members married in 2013 and in 2017.

Summary Percent Married

Employer and Member Category	Current	Proposed	Raw Data	
			2013	2017
State				
Miscellaneous	85%	70%	69.5%	69.6%
State Industrial	85%	70%	66.5%	67.2%
State Safety	90%	70%	69.7%	69.7%
POFF	90%	80%	78.5%	79.4%
CHP	90%	90%	86.7%	88.4%
Schools				
Miscellaneous	85%	70%	67.7%	67.5%
Public Agency				
Miscellaneous	85%	70%	68.3%	66.8%
Police	90%	85%	82.4%	82.8%
Fire	90%	90%	85.0%	85.9%
Other Safety	90%	70%	67.9%	67.2%
School Police	90%	85%	74.1%	73.5%
CPO	90%	75%	75.3%	75.2%

Generally, the Miscellaneous assumption was reduced from 85 percent to 70 percent and Safety categories were reduced from 90 percent to a range of 75 percent to 80 percent. For the purposes of this assumption, State Industrial, State Safety and Other Public Agency Safety (i.e. Lifeguards) were considered to behave more like Miscellaneous than Safety. School Police were considered to be more like Police than the raw data indicated.

Findings (continued)

PERCENTAGE MARRIED AND AGE DIFFERENCE (CONTINUED)

For the age difference, count tabulations were done by member category, member gender, and spouse gender. The table below shows the tabulation over the last ten years. The weighted average was determined for each category.

Employer and Member Category	Member Gender[1]	Count	Spouse Gender[1]	Average Difference	Weighted Average
State					
Miscellaneous	Female	38,299	Male	(2.22)	
Miscellaneous	Male	41,126	Female	3.69	2.98
Industrial	Female	3,037	Male	(2.14)	
Industrial	Male	993	Female	3.98	2.59
Safety	Female	3,631	Male	(2.03)	
Safety	Male	7,242	Female	3.65	3.11
POFF	Female	3,513	Male	(2.12)	
POFF	Male	18,914	Female	2.91	2.78
CHP	Female	212	Male	(3.09)	
CHP	Male	3,637	Female	3.08	3.08
Schools					
Miscellaneous	Female	74,645	Male	(2.25)	
Miscellaneous	Male	30,746	Female	3.29	2.55
Police	Female	15	Male	(6.22)	
Police	Male	257	Female	3.92	4.04
Public Agency					
Miscellaneous	Female	34,802	Male	(2.23)	
Miscellaneous	Male	48,409	Female	3.14	2.76
Other Safety	Female	1	Male	0.59	
Other Safety	Male	44	Female	3.97	3.86
Police	Female	787	Male	(2.37)	
Police	Male	12,936	Female	3.08	3.04
Fire	Female	165	Male	(1.98)	
Fire	Male	8,987	Female	2.78	2.77
CPO	Female	791	Male	(2.11)	
CPO	Male	3,947	Female	3.09	2.92
Sheriff	Female	58	Male	(0.72)	
Sheriff	Male	419	Female	3.28	2.97
Prosecutor	Male	1	Female	4.94	N/A

(1) Same gender marriages were not studied due to limited data.

Rounding the weighted average to the nearest whole year for each category resulted in a value of three years with the exception of Public Agency Other Safety and Prosecutor. The data was less creditable in these two categories due to the lack of data. Since there were no categories with significant differences, the proposed age difference was unchanged at three years.

Economic Study

Economic Study

To perform actuarial valuations, and in addition to demographic assumptions, actuaries use certain economic assumptions to set a contribution schedule of employee and employer contributions designed to accumulate with interest to an amount sufficient to provide for all benefits expected to be paid to members and their beneficiaries. The economic assumptions used by the Actuarial Office to determine liabilities and set contribution rates are price inflation, wage inflation, payroll growth and the discount rate assumption.

PRICE INFLATION

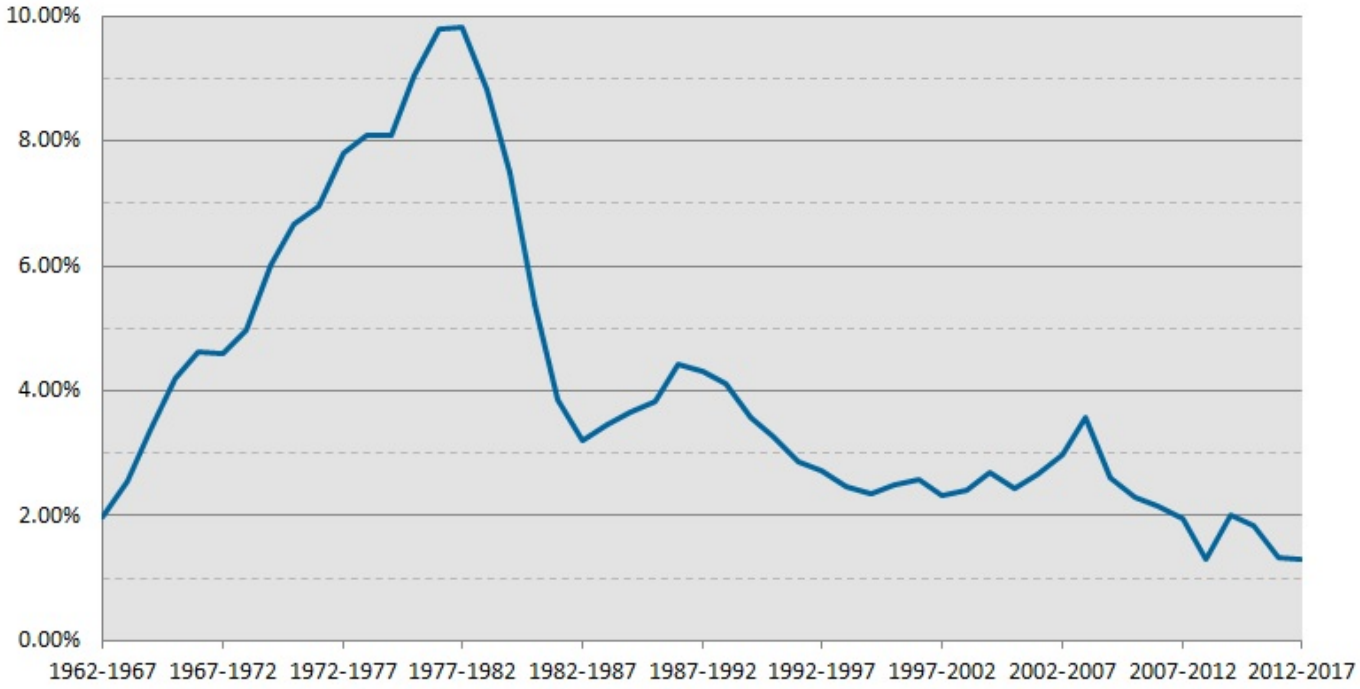
Price inflation is the increase in price over time of some standardized basket of goods and services. The annual increases in the Consumer Price Index (CPI-U) as measured by the Bureau of Labor Statistics is the inflation measure referenced in the State Government Code for determining the annual cost-of-living adjustment (COLA) for CalPERS retirees. The inflation assumption also underlies most of the other economic assumptions used in an actuarial valuation, including the investment return, individual salary increases, and payroll growth. Changing the price inflation assumption would have an impact on employer contribution rates, service credit purchases, Optional Settlements at retirement and possibly employee contribution rates for PEPRA members.

CalPERS currently assumes a 2.75 percent annual price inflation. The last time the inflation assumption was changed was in 2011 when the assumption was decreased from 3.00 percent to 2.75 percent. The following analysis considers historical price inflation, market expectations, forecasts of other economists, and a number of other factors.

Historical Changes in the Consumer Price Index

The chart below shows the five-year moving average annual inflation (July through June) over the last fifty years:

Average Annual Inflation
CPI-U, Five-Year Moving Average



Source: Bureau of Labor Statistics, CPI-U, all items (series ID: CUUR0000SA0)

PRICE INFLATION (CONTINUED)

The table below shows the average inflation over various periods, ending June 30, 2016:

Periods Ending June 2017	U.S City Average Annual Increase in CPI-U
Last five (5) years	1.31%
Last ten (10) years	1.63%
Last fifteen (15) years	2.08%
Last twenty (20) years	2.14%
Last twenty-five (25) years	2.26%
Last thirty (30) years	2.60%
Last one hundred (100) years	2.98%

Source: Bureau of Labor Statistics, CPI-U, all items (series ID: CUUR0000SA0)

Not only has inflation remained relatively low over the last twenty five years, the most recent five year period has produces the lowest five-year moving average in the last 50 years. The average annual inflation over the last 5, 10, 15, 20, 25 and 30 years have all been lower than CalPERS current inflation assumption of 2.75 percent. It is worth noting that in the six years since CalPERS lowered the inflation assumption to 2.75 percent the average annual inflation has been 1.37 percent. However, historical inflation is only one consideration in developing an assumption for future inflation.

Investment Consulting Firms

Most investment consulting firms develop an underlying inflation assumption for their forecasting and derivation of forward-looking capital market assumptions. Two such assumptions were presented to the Board in December 2016. The Board's pension consultant, Wilshire Associates, used a capital market inflation assumption of 1.60 percent per year, while Pension Consulting Alliance's inflation assumption was 2.25 percent per year. Note that both of these represented the expected annual inflation over the next 10 years. The actuarial assumptions for funding purposes use a longer time horizon, typically 20 to 30 years, consistent with the Board's funding policy.

Bond Market

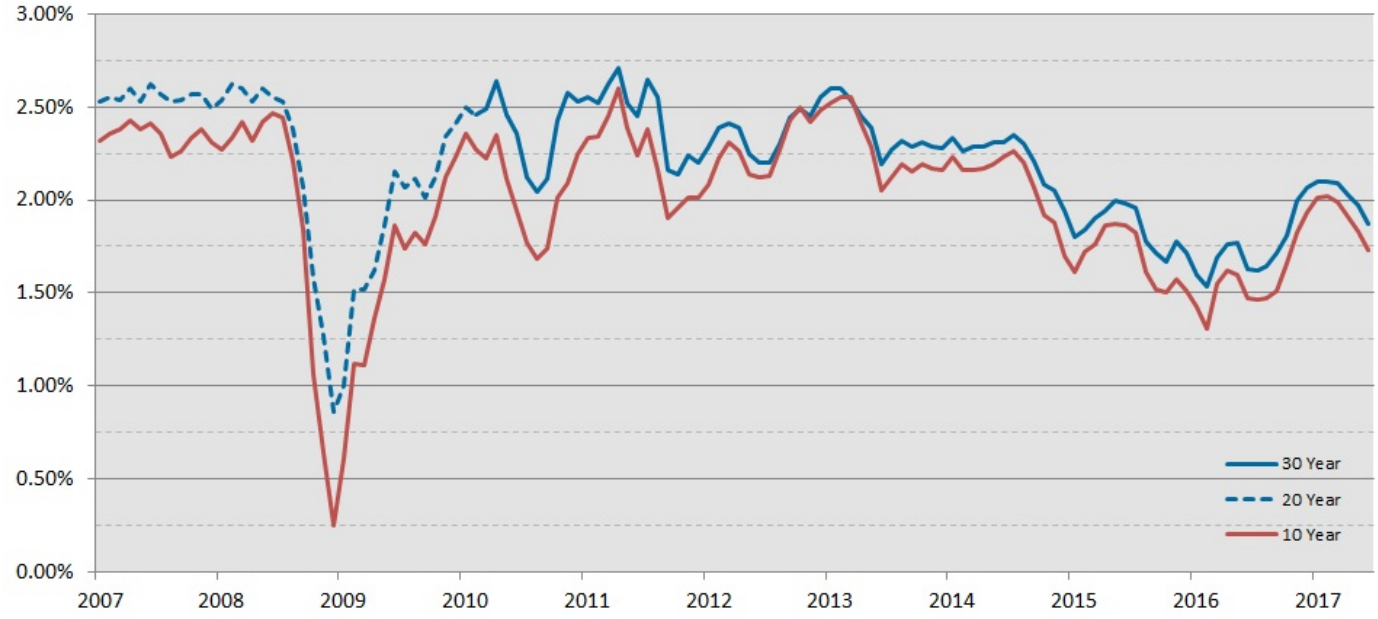
Another source of information about future inflation is the market for US Treasury bonds. Comparing the yields for conventional Treasury securities and Treasury Inflation-Protected Securities (TIPS) can be used to measure the market's expectation of future inflation. Both conventional Treasury securities and TIPS provide investors with a fixed rate yield, but with TIPS the principal is adjusted to reflect the actual change in CPI, and the interest payment is calculated using the adjusted principal value of the bond. Since holders of TIPS will receive the yield and an increase in the principal, the yield on TIPS is lower than the yield on conventional securities. Assuming an efficient market, the difference in the yield is the market's inflation expectation, referred to as the "breakeven" inflation rate.

For example, if the 20-year Treasury has a yield of 3 percent and the 20-year TIPS has a yield of 1 percent, the 20-year breakeven inflation rate is 2 percent per year. An investor who takes a long position in one type and a short position in the other will break even if the inflation rate turns out to be 2 percent per year. The yields themselves are determined by how much investors are willing to pay to take long positions and asking to receive to take short positions, so the breakeven inflation rate is the average expected inflation rate of every market participant.

PRICE INFLATION (CONTINUED)

Below is a chart with the historical spread between 10 and 30-year conventional and 10 and 30-year inflation-protected Treasury bonds. The 20-year spread is shown as a proxy for the 30-year spread prior to February 2010 when no 30-year TIPS were being issued.

Interest Rate Spread
Conventional Treasuries versus TIPS



Source: Board of Governors of the Federal Reserve System (US)

Prior to the 2008-09 financial crisis, the spread between the long-term conventional and inflation-protected securities was relatively constant and slightly above 2.50 percent. The resulting collapse of the US investment markets caused a decrease in the spread as well as an increase in the volatility of the spread, making long-term assumption setting difficult. For the last two years the spread, although volatile, has held below 2.25 percent. Note that Wilshire's expectation of 1.60 percent for the next 10 years was a reasonable assumption in 2016 based on this analysis.

Note that the market spread between conventional and inflation-protected Treasuries includes other market factors aside from pure inflation expectations. The market also reflects inflation and liquidity premiums. More complex models have been developed to adjust for these other factors.

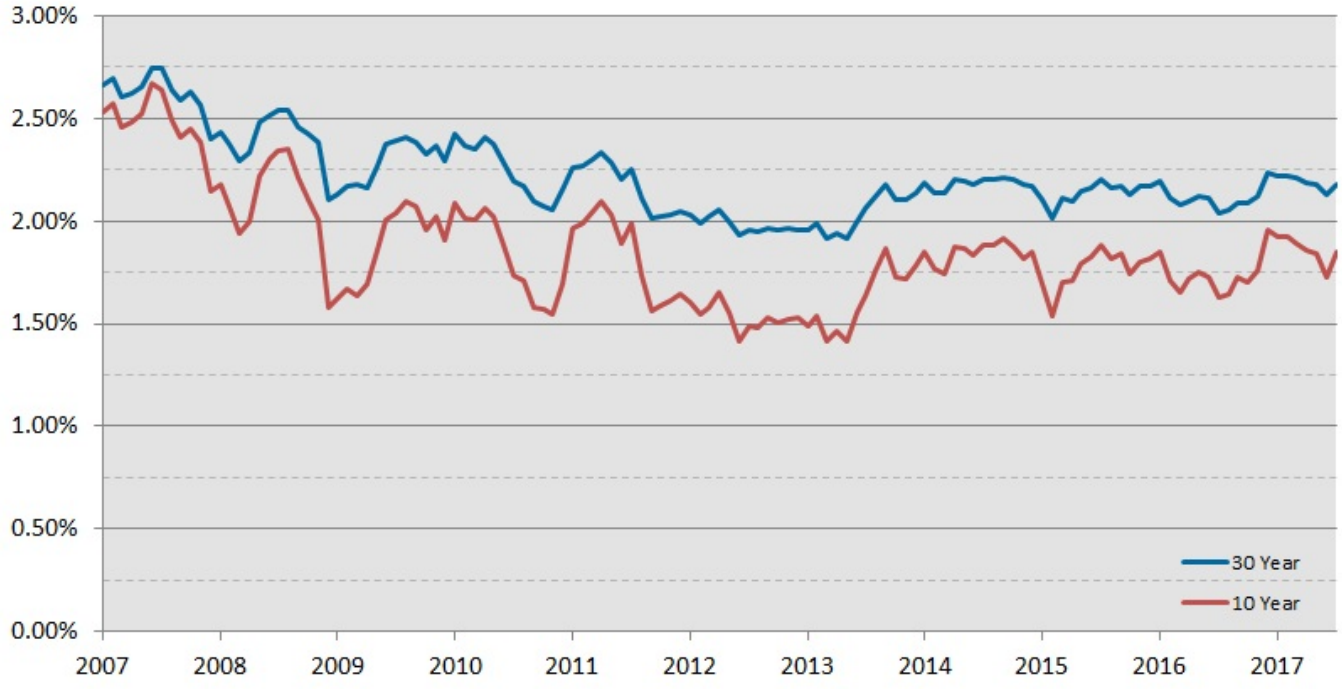
The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. The most recent survey (fourth quarter of 2016) was for inflation over the next ten years to average 2.22 percent.

The Federal Reserve Bank of Cleveland has developed a model that combines information from Treasury yields, inflation data, inflation swaps, and survey-based measures of inflation expectations to calculate the expected inflation rate. In its July 14, 2017 release, the Federal Reserve Bank of Cleveland reported 10 and 30-year inflation expectations of 1.85 percent and 2.18 percent respectively.

PRICE INFLATION (CONTINUED)

Below is a chart with Federal Reserve Bank of Cleveland's expected inflation values from January 2007 through July 2017 for 10 and 30 years.

Expected Annual Inflation
10 and 30 Year Time Horizons



Source: Federal Reserve Bank of Cleveland

While the Federal Reserve Bank of Cleveland's model removes some of the more extreme volatility implied by the market spreads, the long-term expectations are clearly lower than CalPERS current assumption. The long-term inflation expectations have been below 2.25 percent since 2011 and below 2.50 percent since before the 2008-09 financial crisis.

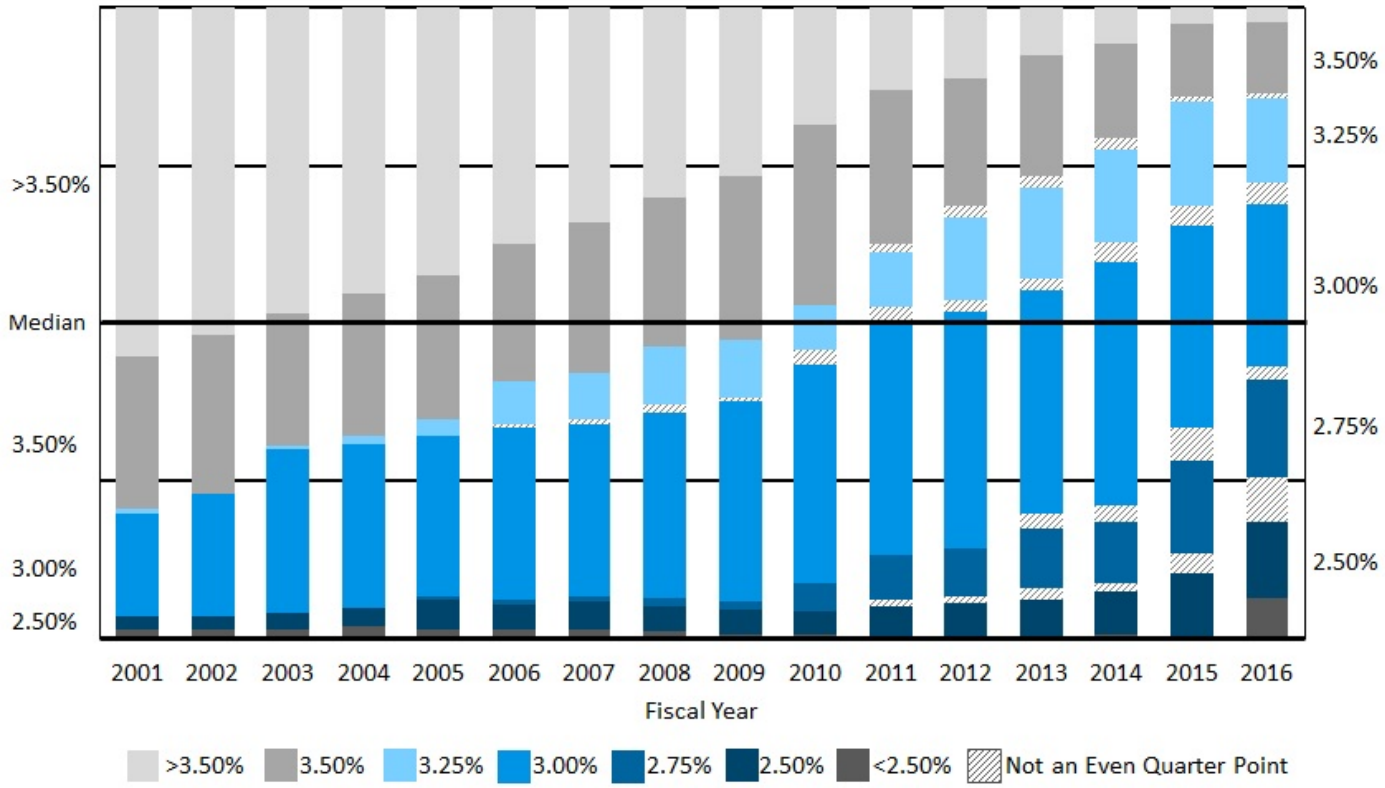
Other Sources of Inflation Forecasts

In the Social Security Administration's 2016 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.6 percent under the intermediate cost assumption, down from 2.7 percent the prior year. (The inflation assumptions are 3.2 percent and 2.0 percent respectively in the low cost and high cost projection scenarios.)

Another source of information about this assumption is the Public Plans Data that is compiled and maintained through a collaboration of the Center for State and Local Government Excellence (SLGE), the National Association of State Retirement Administrators (NASRA), and the Center for Retirement Research at Boston College. This data set includes the inflation assumption for fiscal years 2001 through 2016 for 169 public pension funds, including all of the largest public funds covering state employees or teachers.

PRICE INFLATION (CONTINUED)

Change in the Distribution of Price Inflation Assumptions
Public Plans Data



Source: Public Plans Data, December 2016

As of the 2016 Fiscal Year, the mean inflation rate assumed for large public retirement systems in the U.S. was 2.95 percent, and the median was 3.00 percent. Approximately 43 percent of the surveyed systems used an assumption of less than 3.00 percent. Note that some actuaries imply inflation to mean price inflation while others use their inflation assumption as wage inflation, so the data may not correspond precisely to the price inflation assumption being studied. The CalPERS inflation assumptions are currently 2.75 percent for price inflation and 3.00 percent for wage inflation. Nevertheless, the survey does show a clear trend towards lower inflation assumptions.

Another reason why inflation assumptions for retirement systems remain higher than the current economic environment would suggest is due to the belief than inflation will, at some point, revert to historical norms. Many systems treat the market analysis as a predictor of short and mid-term inflation while assuming that extremely long-term inflation will be above 3 percent per year, consistent with the average increase in actual CPI since the statistic was first tabulated over 100 years ago. This methodology is falling out of favor as further analysis continues to indicate that historical averages including data from the distant past cannot be relied on as a predictor of future inflation.

Also, the information in the Public Plans Data is more than a year old. The trend towards lower inflation assumptions does not appear to be slowing, and economic analysis does not suggest it should be. Already in 2017 CalSTRS and Ohio STRS reduced their annual inflation assumptions by 0.25 percent down to 2.75 percent and 2.50 percent respectively. Any change in the CalPERS inflation assumption would be for the 2017 or 2018 actuarial valuation when we can expect the public plans survey to show even lower inflation assumptions than it did in 2016.

PRICE INFLATION (CONTINUED)

Additional Considerations

The Federal Open Market Committee (FOMC) continues to employ a monetary policy strategy that targets an annual inflation rate of 2 percent (as measured by the annual change in the price index for personal consumption expenditures, or PCE, which is typically lower than the change in CPI). The FOMC has repeatedly stated that the 2 percent target is most consistent with the Federal Reserve's statutory objective for monetary policy of -- maximum employment, stable prices, and moderate long-term interest rates. However, monetary policy alone does not determine inflation, as evidenced by the fact that the inflation rate is not a constant 2 percent per year. There are other economic forces related to the return demanded on capital and money that are at work.

As noted in the previous section, average annual inflation of 2.60 percent over the previous 30 years is not expected to be repeated over the next 30 years, and one explanation for this is demographics. There is growing evidence to suggest that demographic factors play a predictable role in rates of inflation. Younger cohorts rely on wages as the main source of income, and they prefer relatively low real interest rates and high rates of inflation. Older cohorts, on the other hand, rely more on real rates of return from their savings, less on wages, and therefore prefer relatively low inflation. These preferences can result in price distortions that redistribute wealth from one generation to the other without the need for intervention from fiscal or monetary policy.

Economists have studied this effect and found support for the notion that Japan’s rapidly aging population is the force behind the country’s persistently low inflation, and if fact, deflation. The US population, although not as old as Japan’s, is also aging. As the baby boomers begin retiring in large numbers it perhaps should not have surprised anyone that inflation, which seemed low five years ago, has actually decreased.

Aside from affecting inflation directly, an aging population also causes real interest rates to remain low. The short-term interest rate consistent with price stability and healthy economic growth (the equilibrium real interest rate) has been near (or even below) zero several times since the 2008 financial crisis. Note that the FOMC keeps inflation from going too high by raising short-term interest rates and keeps inflation from going too low by lowering them. Even though interest rates can be negative, there is a limit to how low they can go. If the FOMC succeeds in preventing PCE inflation for going above 2 percent but is unable to prevent it from going below 2 percent for some periods, then the average PCE inflation over the long term will be less than 2 percent per year.

Recommendation

In February of 2014 the Actuarial Office presented an analysis of the inflation assumption to the Board and acknowledged that market indicators pointed to an expectation that future price inflation may be less than the assumption of 2.75 percent per year. However, the assumption was still reasonable, and the Actuarial Office did not recommend changing it at that time.

Based on all of the most current information, the Actuarial Office believes a reasonable long-term inflation assumption is between 2.00 percent and 2.50 percent per year. The Actuarial Office recommends the inflation assumption be decreased from 2.75 percent to 2.50 percent per year, placing it closer to the levels expected in the financial markets and predicted by economic models.

WAGE INFLATION

Wage inflation impacts plan costs in two ways. First, wage inflation is a component of individual salary increases. A higher salary scale assumption means a higher projected retirement benefit for every active member and a higher normal cost rate for the plan as a percent of current salary. Second, wage inflation is used to determine the payroll growth assumption, which is used in amortizing the Unfunded Accrued Liability as a level percent of future payroll. A higher payroll growth assumption means a lower amortization payment today but a faster increase in amortization payments and ultimately a higher amortization payment in the future.

The individual salary increase assumption is made up of three components.

1) Price inflation - If salary increases are not as least as much as price inflation, employees will experience a decrease in income in terms of "real" dollars, and a decrease in the standard of living they can afford. Although salaries may not keep pace with inflation over a short period of time, if an employer is to retain employees over the long-term it must allow its employees to at least maintain their standard of living.

Price inflation was discussed in the previous section and the recommendation is for CalPERS to decrease its annual price inflation assumption from 2.75 percent to 2.50 percent.

2) Productivity increases - This component is so named, because it represents labor's share of the organization's productivity gains. The bulk of this increase is the result of economies of scales, which is why this component is typically higher with employers or industries that are new and experiencing high growth.

The current CalPERS productivity increase assumption is 0.25 percent per year, and will be analyzed in this section.

3) Seniority, merit and promotion (SMP) increases - These increases result from step increases and other service related increases as well as occasional promotions that individual members experience throughout their careers. These increases vary by employment category as well as age and service.

This component is a demographic assumption and is analyzed in the Findings Section of this report under the Salary Increase subsection.

Productivity increases

In the Social Security Administration's 2016 Trustees Report, the Office of the Chief Actuary is projecting a long-term "real-wage differential" (average salary increase above inflation) of 1.2 percent per year under the intermediate cost assumption. (The real-wage differential is 1.82 percent and 0.58 percent respectively in the low cost and high cost projection scenarios.) This projection takes into account productivity forecasts for the total U.S. economy, and adjusts for the fact that salary is expected to continue to decline as a percentage of total compensation. Both effects are different for State and Public Agency government employers than for the U.S. economy as a whole.

The Bureau of Labor Statistics publishes an employment cost index, which analyzes total compensation separately from salary, and specifically for State and local government workers. Shown below are the 5, 10 and 15 year average annual increases in salary, in constant dollars (net of inflation), published January 2017.

State and Local Government Workers Average Annual Compensation Increases (All Workers)

Periods Ending June 2016	Total Compensation	Wages and Salaries
Last five (5) years	0.64%	0.08%
Last ten (10) years	0.71%	0.21%
Last fifteen (15) years	0.83%	0.18%

Economic Study (continued)

WAGE INFLATION (CONTINUED)

What this table shows is that productivity gains are, in fact, being passed through to state and Public Agency government workers in the form of compensation (albeit at a decreasing rate), however, those gains are being consumed by forms of compensation other than salary. This is mainly due to increases in benefit costs, most notably health care costs and pension contributions. For CalPERS employers in particular, it is expected that increases in pension contributions alone over the next seven years will far exceed any productivity gains that those employers might reasonably be expected to enjoy.

It could be some time before significant productivity gains are passed through to CalPERS members in the form of salary. To illustrate this, assume an employer experiences a five percent annual increase (above inflation) in pension contributions over the next seven years, and that pension contributions level off after that point. Assume further that health care costs only increase with general price inflation, and that the employer can afford to pass through productivity gains at a rate of 1.2 percent per year. Under these assumptions it would take 29 years until employers could afford the salary levels that they are currently paying, even if no salary increases above inflation are granted.

We also analyzed CalPERS experience for the 5, 10 and 15 year periods ending June 30, 2016. Below is a table with average salary increases, net of price inflation, by group for all active members.

CalPERS Members Average Annual Compensation Increases

Periods Ending June 2015	Safety						
	State			Public Agencies			
	CHP	POFF	Safety	Fire	Police	CPO	Safety Total
5 years	1.084%	(0.324)%	(1.404)%	(1.591)%	(0.959)%	(0.325)%	(0.749)%
10 years	2.150%	(0.170)%	1.449 %	0.235 %	0.581 %	0.864 %	0.440 %
15 years	1.849%	0.400 %	0.674 %	1.004 %	0.958 %	1.222 %	0.751 %

Periods Ending June 2015	Miscellaneous					
	State Tier 1 & Tier 2	State Industrial	Schools	Public Agencies	Miscellaneous Total	Grand Total
5 years	(0.969)%	(0.121)%	(0.768)%	(0.890)%	(0.909)%	**(0.961)%**
10 years	0.117 %	0.491 %	(0.116)%	0.260 %	0.017 %	**0.113 %**
15 years	0.087 %	0.183 %	0.478 %	0.886 %	0.419 %	**0.511 %**

This analysis shows that the only employee group that has consistently received salary increases above inflation is the CHP. For the plan as a whole the productivity increases in salaries have been negative for the last 5 years, and close to zero over the last ten years. This supports the idea that productivity increases in compensation, which have averaged 0.640 percent per year for the last five years nationally, are being more than consumed by forms of compensation other than salary for CalPERS employers. Note that the exception to this, the CHP, receives salary increases based on a total compensation survey that does not consider employer contributions towards retirement, so future increases in CalPERS retirement contributions will not have the same effect on increases in CHP salaries as they will with the other groups.

The productivity increase is an economic assumption and should be consistent for all membership groups. Average salary increases beyond inflation and productivity for individual groups can be accounted for by making an across-the-board increase to the seniority, merit and promotion assumption.

Recommendation

Based on this analysis and keeping in mind that state and Public Agency governments are expected to remain under financial stress for some time to come; the Actuarial Office recommends that the productivity component of the annual wage inflation assumption remain at 0.25 percent. In addition, for the CHP, the Actuarial Office recommends an across-the-board increase to the seniority, merit and promotion assumption of 0.25 percent.

PAYROLL GROWTH

The payroll growth assumption is used to calculate the amortization payments for the Unfunded Accrued Liability, since it is CalPERS practice to fund the plan as a level percent of payroll. Often times the payroll growth assumption is set equal to the wage inflation assumption, which is the annual price inflation assumption (recommended 2.50 percent) plus the annual productivity assumption (approximately 0.25 percent), but this is not always the case.

One difference between the wage inflation assumption and the payroll growth assumption is that the latter could include a component for population growth. A growing (or shrinking) active membership base will cause payroll to grow faster (or slower) than the average salary. The current assumption is that there will be no population growth (or decline), and the Actuarial Office believes this assumption is reasonable.

Also note that for anyone subject to the PEPRA pensionable compensation limit, their pensionable compensation can increase by no more than price inflation, since the PEPRA pensionable compensation limits increase only with price inflation. As PEPRA members become a higher percentage of active members, and as those members attain more service, are appointed to higher positions, and become subject to the compensation limit in greater numbers this will further constrain payroll growth to no more than price inflation. At this time, however, the PEPRA pensionable compensation limit does not have a material impact on overall payroll growth.

Finally, note that since wage inflation is used to project benefit payments and value the liability, we must guard against setting the wage inflation assumption too low, which would lead to increasing costs as time goes on. For the payroll growth assumption, on the other hand, the opposite is true. Setting the assumption too high will lead to increasing costs, as a percent of payroll, as time goes on. Setting the payroll growth assumption lower than the wage inflation assumption adds a measure of conservatism and decreases the probability that contribution rates will increase in the future. This can be accomplished by making an adjustment to the payroll growth assumption known as a “margin for adverse deviation.” The Actuarial Office does not recommend introducing a margin for adverse deviation at this time.

Recommendation

The Actuarial Office recommends a payroll growth assumption of 2.75 percent per year, which is equal to the wage inflation assumption. The assumption is comprised of a price inflation assumption of 2.50 percent per year and a productivity increase assumption of 0.25 percent per year.

DISCOUNT RATE

The discount rate is set equal to the long-term expected geometric return on assets, net of both investment and administrative expenses. This assumption is reviewed as part of the Asset Liability Management (ALM) process.

Recommendation

We recommend adopting the actuarial assumptions as discussed above and as summarized in Appendix A.

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Appendix A
Summary of Proposed Rates

For the spreadsheet of actual summary rates, please refer to the following link:
<TBD>

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES

State Miscellaneous Tier 1 - 2% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.007	0.010	0.014	0.019	0.019	0.022	0.029
51	0.009	0.009	0.013	0.016	0.018	0.020	0.024
52	0.013	0.012	0.013	0.018	0.020	0.023	0.031
53	0.012	0.013	0.015	0.022	0.024	0.029	0.032
54	0.011	0.017	0.020	0.030	0.035	0.039	0.049
55	0.020	0.037	0.048	0.071	0.094	0.123	0.216
56	0.023	0.035	0.043	0.062	0.083	0.106	0.165
57	0.022	0.036	0.042	0.067	0.084	0.113	0.164
58	0.027	0.043	0.047	0.074	0.089	0.121	0.170
59	0.033	0.048	0.060	0.084	0.107	0.143	0.183
60	0.037	0.062	0.075	0.119	0.141	0.175	0.246
61	0.050	0.068	0.079	0.119	0.142	0.179	0.250
62	0.087	0.127	0.152	0.221	0.263	0.310	0.356
63	0.082	0.125	0.168	0.248	0.263	0.337	0.381
64	0.078	0.119	0.140	0.226	0.235	0.283	0.324
65	0.090	0.158	0.175	0.245	0.249	0.301	0.344
66	0.112	0.184	0.210	0.268	0.285	0.347	0.355
67	0.101	0.152	0.170	0.233	0.233	0.274	0.274
68	0.125	0.140	0.155	0.211	0.216	0.237	0.237
69	0.122	0.131	0.158	0.217	0.265	0.291	0.291
70	0.140	0.176	0.184	0.223	0.276	0.299	0.299
71	0.138	0.140	0.155	0.188	0.218	0.264	0.264
72	0.131	0.136	0.136	0.187	0.249	0.265	0.265
73	0.109	0.113	0.137	0.157	0.233	0.256	0.256
74	0.091	0.120	0.164	0.175	0.241	0.243	0.243
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

State Industrial Tier 1 - 2% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.006	0.008	0.013	0.019	0.026	0.029	0.036
51	0.006	0.009	0.014	0.020	0.027	0.030	0.038
52	0.007	0.009	0.015	0.023	0.031	0.034	0.043
53	0.010	0.015	0.023	0.034	0.045	0.050	0.063
54	0.014	0.020	0.030	0.046	0.062	0.069	0.086
55	0.032	0.047	0.073	0.110	0.148	0.165	0.205
56	0.028	0.040	0.062	0.094	0.126	0.140	0.174
57	0.025	0.036	0.056	0.085	0.114	0.127	0.157
58	0.029	0.041	0.064	0.098	0.131	0.145	0.181
59	0.033	0.048	0.075	0.113	0.153	0.171	0.210
60	0.042	0.060	0.093	0.142	0.191	0.211	0.262
61	0.045	0.064	0.101	0.152	0.205	0.228	0.282
62	0.079	0.113	0.176	0.266	0.357	0.398	0.493
63	0.071	0.103	0.160	0.243	0.328	0.364	0.451
64	0.062	0.090	0.140	0.212	0.286	0.318	0.394
65	0.081	0.117	0.182	0.276	0.371	0.413	0.511
66	0.100	0.143	0.223	0.337	0.455	0.506	0.626
67	0.089	0.126	0.198	0.298	0.402	0.448	0.554
68	0.071	0.101	0.157	0.238	0.321	0.357	0.441
69	0.074	0.106	0.165	0.249	0.336	0.373	0.462
70	0.097	0.139	0.217	0.329	0.443	0.493	0.611
71	0.087	0.125	0.194	0.294	0.396	0.441	0.546
72	0.087	0.125	0.194	0.294	0.396	0.441	0.546
73	0.087	0.125	0.194	0.294	0.396	0.441	0.546
74	0.113	0.161	0.251	0.381	0.513	0.571	0.707
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

State Safety - 2.5% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.008	0.013	0.020	0.030	0.032	0.039	0.045
51	0.003	0.010	0.015	0.020	0.026	0.031	0.033
52	0.008	0.017	0.017	0.030	0.030	0.035	0.044
53	0.011	0.015	0.022	0.033	0.037	0.044	0.044
54	0.016	0.023	0.023	0.034	0.041	0.054	0.099
55	0.039	0.043	0.072	0.127	0.188	0.282	0.332
56	0.032	0.039	0.058	0.109	0.138	0.171	0.231
57	0.030	0.041	0.061	0.104	0.151	0.198	0.221
58	0.035	0.047	0.069	0.109	0.132	0.179	0.256
59	0.040	0.049	0.069	0.122	0.146	0.169	0.243
60	0.048	0.056	0.090	0.154	0.158	0.201	0.257
61	0.060	0.080	0.091	0.136	0.165	0.220	0.273
62	0.084	0.095	0.140	0.239	0.253	0.308	0.356
63	0.080	0.105	0.137	0.233	0.255	0.324	0.375
64	0.089	0.102	0.133	0.227	0.255	0.280	0.403
65	0.111	0.138	0.172	0.249	0.257	0.311	0.359
66	0.129	0.141	0.197	0.285	0.313	0.371	0.418
67	0.107	0.164	0.191	0.258	0.312	0.377	0.381
68	0.115	0.164	0.164	0.273	0.300	0.363	0.419
69	0.105	0.163	0.225	0.295	0.325	0.357	0.468
70	0.137	0.167	0.214	0.281	0.309	0.373	0.401
71	0.101	0.169	0.221	0.288	0.370	0.444	0.533
72	0.105	0.156	0.192	0.286	0.315	0.400	0.463
73	0.134	0.168	0.196	0.224	0.323	0.464	0.566
74	0.153	0.136	0.177	0.302	0.435	0.522	0.732
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

POFF - 3% at 50

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.012	0.030	0.044	0.109	0.224	0.449	0.467
51	0.011	0.026	0.033	0.078	0.154	0.301	0.331
52	0.012	0.026	0.041	0.096	0.145	0.255	0.257
53	0.014	0.029	0.042	0.107	0.162	0.279	0.283
54	0.021	0.042	0.053	0.118	0.162	0.292	0.306
55	0.032	0.054	0.081	0.138	0.209	0.367	0.372
56	0.031	0.044	0.057	0.135	0.213	0.335	0.345
57	0.033	0.047	0.064	0.146	0.215	0.358	0.358
58	0.020	0.065	0.070	0.158	0.224	0.354	0.354
59	0.033	0.057	0.090	0.178	0.276	0.337	0.351
60	0.035	0.066	0.094	0.179	0.276	0.360	0.367
61	0.062	0.064	0.093	0.184	0.251	0.404	0.404
62	0.067	0.104	0.130	0.221	0.324	0.415	0.440
63	0.060	0.093	0.147	0.205	0.268	0.404	0.412
64	0.052	0.081	0.155	0.239	0.306	0.382	0.394
65	0.065	0.081	0.127	0.231	0.342	0.427	0.453
66	0.110	0.137	0.172	0.215	0.285	0.427	0.431
67	0.073	0.114	0.143	0.261	0.471	0.490	0.505
68	0.037	0.112	0.140	0.216	0.311	0.466	0.466
69	0.066	0.162	0.162	0.300	0.360	0.531	0.547
70 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

CHP - 3% at 50

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.038	0.038	0.038	0.049	0.107	0.418	0.453
51	0.031	0.031	0.031	0.031	0.102	0.332	0.332
52	0.027	0.027	0.027	0.027	0.093	0.315	0.383
53	0.028	0.028	0.028	0.028	0.085	0.299	0.336
54	0.038	0.038	0.038	0.038	0.124	0.309	0.404
55	0.050	0.050	0.050	0.050	0.117	0.353	0.459
56	0.051	0.051	0.051	0.084	0.139	0.350	0.380
57	0.051	0.051	0.051	0.051	0.156	0.342	0.342
58	0.049	0.049	0.049	0.049	0.171	0.338	0.350
59	0.088	0.088	0.088	0.088	0.274	0.460	0.532
60 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Schools - 2% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.004	0.007	0.011	0.012	0.013	0.015	0.018
51	0.004	0.008	0.011	0.014	0.016	0.017	0.021
52	0.005	0.010	0.014	0.016	0.018	0.021	0.024
53	0.006	0.012	0.016	0.020	0.022	0.025	0.028
54	0.008	0.017	0.023	0.027	0.031	0.034	0.040
55	0.021	0.042	0.058	0.069	0.077	0.086	0.101
56	0.019	0.037	0.053	0.062	0.069	0.078	0.091
57	0.019	0.038	0.054	0.064	0.071	0.079	0.093
58	0.022	0.045	0.062	0.074	0.082	0.092	0.108
59	0.025	0.049	0.069	0.082	0.090	0.101	0.119
60	0.033	0.066	0.092	0.109	0.121	0.135	0.158
61	0.037	0.072	0.101	0.119	0.133	0.149	0.174
62	0.066	0.131	0.184	0.218	0.242	0.271	0.318
63	0.064	0.126	0.178	0.209	0.233	0.261	0.307
64	0.059	0.117	0.163	0.193	0.215	0.240	0.282
65	0.080	0.158	0.221	0.261	0.291	0.326	0.383
66	0.081	0.160	0.224	0.265	0.296	0.330	0.389
67	0.070	0.139	0.194	0.229	0.255	0.286	0.335
68	0.063	0.124	0.173	0.205	0.228	0.255	0.300
69	0.066	0.130	0.183	0.216	0.241	0.270	0.317
70	0.071	0.140	0.196	0.231	0.258	0.289	0.338
71	0.061	0.121	0.170	0.200	0.224	0.250	0.293
72	0.056	0.112	0.156	0.185	0.206	0.229	0.270
73	0.056	0.113	0.156	0.186	0.206	0.230	0.271
74	0.061	0.120	0.168	0.198	0.221	0.248	0.290
75	0.067	0.132	0.184	0.218	0.243	0.272	0.320
76	0.057	0.111	0.156	0.184	0.205	0.230	0.270
77	0.063	0.123	0.173	0.204	0.228	0.255	0.300
78	0.064	0.128	0.179	0.211	0.236	0.264	0.310
79	0.082	0.163	0.227	0.268	0.299	0.334	0.393

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Miscellaneous - 2% at 60

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.020	0.020	0.020	0.020	0.020	0.150	0.150
51	0.006	0.019	0.027	0.031	0.035	0.038	0.040
52	0.011	0.024	0.031	0.034	0.037	0.040	0.041
53	0.010	0.015	0.021	0.027	0.033	0.040	0.042
54	0.025	0.025	0.029	0.035	0.041	0.048	0.050
55	0.019	0.026	0.033	0.092	0.136	0.146	0.150
56	0.030	0.034	0.038	0.060	0.093	0.127	0.140
57	0.030	0.046	0.061	0.076	0.090	0.104	0.110
58	0.040	0.044	0.059	0.080	0.101	0.122	0.130
59	0.024	0.044	0.063	0.083	0.103	0.122	0.130
60	0.070	0.074	0.089	0.113	0.137	0.161	0.246
61	0.080	0.086	0.093	0.118	0.156	0.195	0.255
62	0.100	0.117	0.133	0.190	0.273	0.357	0.396
63	0.140	0.157	0.173	0.208	0.255	0.301	0.388
64	0.140	0.153	0.165	0.196	0.239	0.283	0.330
65	0.140	0.178	0.215	0.264	0.321	0.377	0.412
66	0.140	0.178	0.215	0.264	0.321	0.377	0.412
67	0.140	0.178	0.215	0.264	0.321	0.377	0.412
68	0.112	0.142	0.172	0.211	0.257	0.302	0.330
69	0.112	0.142	0.172	0.211	0.257	0.302	0.330
70	0.140	0.178	0.215	0.264	0.321	0.377	0.412
71	0.140	0.178	0.215	0.264	0.321	0.377	0.412
72	0.140	0.178	0.215	0.264	0.321	0.377	0.412
73	0.140	0.178	0.215	0.264	0.321	0.377	0.412
74	0.140	0.178	0.215	0.264	0.321	0.377	0.412
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Miscellaneous - 2% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.008	0.013	0.018	0.021	0.022	0.033	0.050
51	0.009	0.016	0.020	0.023	0.026	0.036	0.050
52	0.015	0.018	0.020	0.021	0.025	0.030	0.050
53	0.016	0.020	0.024	0.028	0.031	0.035	0.050
54	0.018	0.022	0.026	0.030	0.034	0.038	0.050
55	0.040	0.040	0.056	0.093	0.109	0.154	0.210
56	0.034	0.050	0.066	0.092	0.107	0.138	0.200
57	0.042	0.048	0.058	0.082	0.096	0.127	0.168
58	0.046	0.054	0.062	0.090	0.106	0.131	0.171
59	0.045	0.055	0.066	0.097	0.115	0.144	0.178
60	0.058	0.075	0.093	0.126	0.143	0.169	0.207
61	0.065	0.088	0.111	0.146	0.163	0.189	0.231
62	0.136	0.118	0.148	0.190	0.213	0.247	0.258
63	0.130	0.133	0.174	0.212	0.249	0.285	0.313
64	0.113	0.129	0.165	0.196	0.223	0.249	0.275
65	0.145	0.173	0.201	0.233	0.266	0.289	0.316
66	0.170	0.199	0.229	0.258	0.284	0.306	0.324
67	0.250	0.204	0.233	0.250	0.257	0.287	0.317
68	0.227	0.175	0.193	0.215	0.240	0.262	0.270
69	0.200	0.180	0.180	0.198	0.228	0.246	0.250
70	0.150	0.171	0.192	0.239	0.304	0.330	0.330
71	0.150	0.171	0.192	0.239	0.304	0.330	0.330
72	0.150	0.171	0.192	0.239	0.304	0.330	0.330
73	0.150	0.171	0.192	0.239	0.304	0.330	0.330
74	0.150	0.171	0.192	0.239	0.304	0.330	0.330
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Miscellaneous - 2.5% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.008	0.014	0.020	0.026	0.033	0.050	0.060
51	0.008	0.015	0.023	0.030	0.037	0.059	0.072
52	0.009	0.016	0.023	0.030	0.037	0.061	0.075
53	0.014	0.021	0.028	0.035	0.042	0.063	0.096
54	0.014	0.022	0.030	0.039	0.047	0.068	0.107
55	0.020	0.038	0.055	0.073	0.122	0.192	0.304
56	0.025	0.047	0.069	0.091	0.136	0.196	0.304
57	0.030	0.048	0.065	0.083	0.123	0.178	0.238
58	0.035	0.054	0.073	0.093	0.112	0.153	0.208
59	0.035	0.054	0.073	0.092	0.131	0.183	0.250
60	0.044	0.072	0.101	0.130	0.158	0.197	0.261
61	0.050	0.078	0.105	0.133	0.161	0.223	0.309
62	0.055	0.093	0.130	0.168	0.205	0.268	0.339
63	0.090	0.124	0.158	0.192	0.226	0.279	0.312
64	0.080	0.112	0.144	0.175	0.207	0.268	0.306
65	0.120	0.156	0.193	0.229	0.265	0.333	0.387
66	0.132	0.172	0.212	0.252	0.292	0.366	0.426
67	0.132	0.172	0.212	0.252	0.292	0.366	0.405
68	0.120	0.156	0.193	0.229	0.265	0.333	0.387
69	0.120	0.156	0.193	0.229	0.265	0.333	0.368
70	0.120	0.156	0.193	0.229	0.265	0.333	0.387
71	0.120	0.156	0.193	0.229	0.265	0.333	0.387
72	0.120	0.156	0.193	0.229	0.265	0.333	0.387
73	0.120	0.156	0.193	0.229	0.265	0.333	0.387
74	0.120	0.156	0.193	0.229	0.265	0.333	0.387
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Miscellaneous - 2.7% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.003	0.010	0.016	0.034	0.033	0.045	0.120
51	0.009	0.016	0.023	0.042	0.038	0.047	0.103
52	0.015	0.019	0.024	0.040	0.036	0.046	0.088
53	0.012	0.020	0.028	0.047	0.046	0.060	0.106
54	0.020	0.027	0.035	0.054	0.056	0.073	0.113
55	0.033	0.055	0.078	0.113	0.156	0.234	0.361
56	0.039	0.067	0.095	0.135	0.169	0.227	0.340
57	0.050	0.067	0.084	0.113	0.142	0.198	0.268
58	0.043	0.066	0.089	0.124	0.151	0.201	0.268
59	0.050	0.070	0.090	0.122	0.158	0.224	0.280
60	0.060	0.086	0.112	0.150	0.182	0.238	0.302
61	0.071	0.094	0.117	0.153	0.184	0.241	0.280
62	0.091	0.122	0.152	0.194	0.226	0.279	0.334
63	0.143	0.161	0.179	0.209	0.222	0.250	0.309
64	0.116	0.147	0.178	0.221	0.254	0.308	0.342
65	0.140	0.174	0.208	0.254	0.306	0.389	0.422
66	0.170	0.209	0.247	0.298	0.310	0.324	0.341
67	0.170	0.199	0.228	0.269	0.296	0.342	0.411
68	0.150	0.181	0.212	0.255	0.287	0.339	0.360
69	0.150	0.181	0.212	0.255	0.287	0.339	0.360
70	0.150	0.181	0.212	0.243	0.291	0.350	0.390
71	0.150	0.181	0.212	0.243	0.291	0.350	0.390
72	0.150	0.181	0.212	0.243	0.291	0.350	0.390
73	0.150	0.181	0.212	0.243	0.291	0.350	0.390
74	0.150	0.181	0.212	0.243	0.291	0.350	0.390
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Miscellaneous - 3% at 60

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.013	0.019	0.026	0.042	0.038	0.064	0.100
51	0.035	0.037	0.039	0.052	0.047	0.062	0.070
52	0.023	0.030	0.038	0.055	0.051	0.056	0.059
53	0.025	0.032	0.040	0.057	0.056	0.066	0.100
54	0.035	0.042	0.050	0.067	0.066	0.076	0.104
55	0.040	0.052	0.064	0.085	0.095	0.120	0.172
56	0.043	0.056	0.070	0.094	0.102	0.150	0.203
57	0.045	0.060	0.074	0.099	0.109	0.131	0.208
58	0.053	0.056	0.059	0.099	0.126	0.185	0.266
59	0.050	0.068	0.085	0.113	0.144	0.202	0.270
60	0.089	0.106	0.123	0.180	0.226	0.316	0.387
61	0.100	0.117	0.133	0.212	0.230	0.298	0.407
62	0.130	0.155	0.180	0.248	0.282	0.335	0.394
63	0.120	0.163	0.206	0.270	0.268	0.352	0.400
64	0.150	0.150	0.150	0.215	0.277	0.300	0.300
65	0.200	0.242	0.283	0.330	0.300	0.342	0.370
66	0.220	0.264	0.308	0.352	0.379	0.394	0.400
67	0.250	0.279	0.309	0.338	0.371	0.406	0.420
68	0.170	0.196	0.223	0.249	0.290	0.340	0.384
69	0.220	0.261	0.302	0.344	0.378	0.408	0.420
70	0.220	0.255	0.291	0.326	0.358	0.388	0.400
71	0.220	0.255	0.291	0.326	0.358	0.388	0.400
72	0.220	0.255	0.291	0.326	0.358	0.388	0.400
73	0.220	0.255	0.291	0.326	0.358	0.388	0.400
74	0.220	0.255	0.291	0.326	0.358	0.388	0.400
75 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Public Agency Fire - 0.5% at 55[1]

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.015880	0.015880	0.015880	0.015880	0.015880	0.015880	0.015880
51	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
52	0.034420	0.034420	0.034420	0.034420	0.034420	0.034420	0.034420
53	0.019900	0.019900	0.019900	0.019900	0.019900	0.019900	0.019900
54	0.041320	0.041320	0.041320	0.041320	0.041320	0.041320	0.041320
55	0.075130	0.075130	0.075130	0.075130	0.075130	0.075130	0.075130
56	0.110790	0.110790	0.110790	0.110790	0.110790	0.110790	0.110790
57	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
58	0.094990	0.094990	0.094990	0.094990	0.094990	0.094990	0.094990
59	0.044090	0.044090	0.044090	0.044090	0.044090	0.044090	0.044090
60 - 79	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Police - 0.5% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.025520	0.025520	0.025520	0.025520	0.025520	0.025520	0.025520
51	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
52	0.016370	0.016370	0.016370	0.016370	0.016370	0.016370	0.016370
53	0.027170	0.027170	0.027170	0.027170	0.027170	0.027170	0.027170
54	0.009490	0.009490	0.009490	0.009490	0.009490	0.009490	0.009490
55	0.166740	0.166740	0.166740	0.166740	0.166740	0.166740	0.166740
56	0.069210	0.069210	0.069210	0.069210	0.069210	0.069210	0.069210
57	0.051130	0.051130	0.051130	0.051130	0.051130	0.051130	0.051130
58	0.072410	0.072410	0.072410	0.072410	0.072410	0.072410	0.072410
59	0.070430	0.070430	0.070430	0.070430	0.070430	0.070430	0.070430
60	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
61	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
62	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
63	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
64	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
65 - 79	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Public Agency Fire - 2% at 55[1]

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.015880	0.015880	0.015880	0.015880	0.015880	0.015880	0.015880
51	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
52	0.034420	0.034420	0.034420	0.034420	0.034420	0.034420	0.034420
53	0.019900	0.019900	0.019900	0.019900	0.019900	0.019900	0.019900
54	0.041320	0.041320	0.041320	0.041320	0.041320	0.041320	0.041320
55	0.075130	0.075130	0.075130	0.075130	0.075130	0.075130	0.075130
56	0.110790	0.110790	0.110790	0.110790	0.110790	0.110790	0.110790
57	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
58	0.094990	0.094990	0.094990	0.094990	0.094990	0.094990	0.094990
59	0.044090	0.044090	0.044090	0.044090	0.044090	0.044090	0.044090
60 - 79	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Police - 2% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.025520	0.025520	0.025520	0.025520	0.025520	0.025520	0.025520
51	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
52	0.016370	0.016370	0.016370	0.016370	0.016370	0.016370	0.016370
53	0.027170	0.027170	0.027170	0.027170	0.027170	0.027170	0.027170
54	0.009490	0.009490	0.009490	0.009490	0.009490	0.009490	0.009490
55	0.166740	0.166740	0.166740	0.166740	0.166740	0.166740	0.166740
56	0.069210	0.069210	0.069210	0.069210	0.069210	0.069210	0.069210
57	0.051130	0.051130	0.051130	0.051130	0.051130	0.051130	0.051130
58	0.072410	0.072410	0.072410	0.072410	0.072410	0.072410	0.072410
59	0.070430	0.070430	0.070430	0.070430	0.070430	0.070430	0.070430
60	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
61	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
62	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
63	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
64	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000	0.300000
65 - 79	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Public Agency Fire - 2% at 50[1]

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.009	0.009	0.009	0.009	0.013	0.020	0.022
51	0.013	0.013	0.013	0.013	0.020	0.029	0.033
52	0.018	0.018	0.018	0.018	0.028	0.042	0.048
53	0.052	0.052	0.052	0.052	0.079	0.119	0.134
54	0.067	0.067	0.067	0.067	0.103	0.154	0.174
55	0.089	0.089	0.089	0.089	0.136	0.204	0.230
56	0.083	0.083	0.083	0.083	0.127	0.190	0.215
57	0.082	0.082	0.082	0.082	0.126	0.189	0.213
58	0.088	0.088	0.088	0.088	0.136	0.204	0.230
59	0.074	0.074	0.074	0.074	0.113	0.170	0.192
60	0.100	0.100	0.100	0.100	0.154	0.230	0.260
61	0.072	0.072	0.072	0.072	0.110	0.165	0.186
62	0.099	0.099	0.099	0.099	0.152	0.228	0.257
63	0.114	0.114	0.114	0.114	0.175	0.262	0.295
64	0.114	0.114	0.114	0.114	0.175	0.262	0.295
65 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Police - 2% at 50

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.050	0.050	0.050	0.050	0.050	0.100	0.110
51	0.040	0.040	0.040	0.040	0.058	0.094	0.139
52	0.040	0.040	0.040	0.040	0.061	0.087	0.139
53	0.040	0.040	0.040	0.040	0.082	0.123	0.305
54	0.040	0.040	0.040	0.046	0.098	0.158	0.350
55	0.072	0.072	0.072	0.096	0.141	0.255	0.408
56	0.066	0.066	0.066	0.088	0.129	0.228	0.363
57	0.060	0.060	0.060	0.080	0.118	0.213	0.320
58	0.080	0.080	0.080	0.088	0.138	0.228	0.350
59	0.080	0.080	0.080	0.092	0.140	0.228	0.400
60	0.150	0.150	0.150	0.150	0.150	0.228	0.350
61	0.144	0.144	0.144	0.144	0.144	0.170	0.264
62	0.150	0.150	0.150	0.150	0.150	0.213	0.330
63	0.150	0.150	0.150	0.150	0.150	0.213	0.400
64	0.150	0.150	0.150	0.150	0.150	0.319	0.525
65 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Public Agency Fire - 3% at 55[1]

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.001	0.001	0.001	0.006	0.016	0.069	0.069
51	0.002	0.002	0.002	0.006	0.018	0.071	0.071
52	0.012	0.012	0.012	0.021	0.040	0.098	0.098
53	0.032	0.032	0.032	0.049	0.085	0.149	0.149
54	0.057	0.057	0.057	0.087	0.144	0.217	0.217
55	0.073	0.073	0.073	0.109	0.179	0.259	0.259
56	0.064	0.064	0.064	0.097	0.161	0.238	0.238
57	0.063	0.063	0.063	0.095	0.157	0.233	0.233
58	0.065	0.065	0.065	0.099	0.163	0.241	0.241
59	0.088	0.088	0.088	0.131	0.213	0.299	0.299
60	0.105	0.105	0.105	0.155	0.251	0.344	0.344
61	0.118	0.118	0.118	0.175	0.282	0.380	0.380
62	0.087	0.087	0.087	0.128	0.210	0.295	0.295
63	0.067	0.067	0.067	0.100	0.165	0.243	0.243
64	0.067	0.067	0.067	0.100	0.165	0.243	0.243
65 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Police - 3% at 55

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.035	0.035	0.035	0.035	0.070	0.090	0.154
51	0.028	0.028	0.028	0.029	0.065	0.101	0.266
52	0.032	0.032	0.032	0.039	0.066	0.109	0.280
53	0.028	0.028	0.028	0.043	0.075	0.132	0.245
54	0.038	0.038	0.038	0.074	0.118	0.333	0.333
55	0.070	0.070	0.070	0.120	0.175	0.340	0.340
56	0.060	0.060	0.060	0.110	0.165	0.330	0.330
57	0.060	0.060	0.060	0.110	0.165	0.320	0.320
58	0.080	0.080	0.080	0.100	0.185	0.350	0.350
59	0.090	0.090	0.095	0.130	0.185	0.350	0.350
60	0.150	0.150	0.150	0.150	0.185	0.350	0.350
61	0.120	0.120	0.120	0.120	0.160	0.350	0.350
62	0.150	0.150	0.150	0.150	0.200	0.350	0.350
63	0.150	0.150	0.150	0.150	0.200	0.400	0.400
64	0.150	0.150	0.150	0.150	0.175	0.350	0.350
65 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Public Agency Fire - 3% at 50[1]

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.020	0.020	0.020	0.040	0.130	0.192	0.202
51	0.008	0.008	0.008	0.023	0.107	0.164	0.173
52	0.023	0.023	0.023	0.043	0.136	0.198	0.209
53	0.023	0.023	0.023	0.043	0.135	0.198	0.208
54	0.027	0.027	0.027	0.048	0.143	0.207	0.218
55	0.043	0.043	0.043	0.070	0.174	0.244	0.257
56	0.053	0.053	0.053	0.085	0.196	0.269	0.285
57	0.054	0.054	0.054	0.086	0.197	0.271	0.287
58	0.052	0.052	0.052	0.084	0.193	0.268	0.283
59	0.075	0.075	0.075	0.116	0.239	0.321	0.341
60	0.065	0.065	0.065	0.102	0.219	0.298	0.316
61	0.076	0.076	0.076	0.117	0.241	0.324	0.343
62	0.068	0.068	0.068	0.106	0.224	0.304	0.322
63	0.027	0.027	0.027	0.049	0.143	0.208	0.220
64	0.094	0.094	0.094	0.143	0.277	0.366	0.389
65 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

SERVICE RETIREMENT RATES (CONTINUED)

Public Agency Police - 3% at 50

	Years of Service						
Attained Age	5	10	15	20	25	30	35
50	0.050	0.050	0.050	0.100	0.155	0.400	0.400
51	0.040	0.040	0.040	0.090	0.140	0.380	0.380
52	0.040	0.040	0.040	0.070	0.115	0.350	0.350
53	0.040	0.040	0.040	0.080	0.135	0.350	0.350
54	0.040	0.040	0.040	0.090	0.145	0.350	0.350
55	0.070	0.070	0.070	0.120	0.175	0.340	0.340
56	0.060	0.060	0.060	0.110	0.165	0.330	0.330
57	0.060	0.060	0.060	0.110	0.165	0.320	0.320
58	0.080	0.080	0.080	0.100	0.185	0.350	0.350
59	0.090	0.090	0.095	0.130	0.185	0.350	0.350
60	0.150	0.150	0.150	0.150	0.185	0.350	0.350
61	0.120	0.120	0.120	0.120	0.160	0.350	0.350
62	0.150	0.150	0.150	0.150	0.200	0.350	0.350
63	0.150	0.150	0.150	0.150	0.200	0.400	0.400
64	0.150	0.150	0.150	0.150	0.175	0.350	0.350
65 - 79	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix A - Summary of Proposed Rates (continued)

NON-INDUSTRIAL DISABILITY RETIREMENT RATES

	Age						
	20	30	40	50	60	70	80
State							
Miscellaneous Tier 1 Female	0.00039	0.00046	0.00186	0.00405	0.00256	0.00256	0.00256
Miscellaneous Tier 1 Male[1]	0.00019	0.00019	0.00103	0.00274	0.00200	0.00200	0.00200
Miscellaneous Tier 2 Female	0.00039	0.00046	0.00186	0.00405	0.00256	0.00256	0.00256
Miscellaneous Tier 2 Male	0.00019	0.00019	0.00103	0.00274	0.00200	0.00200	0.00200
Industrial	0.00043	0.00106	0.00295	0.00601	0.00771	0.00771	0.00771
Safety	0.00036	0.00063	0.00072	0.00201	0.00320	0.00459	0.00459
POFF	0.00030	0.00030	0.00040	0.00098	0.00188	0.00233	0.00233
CHP	0.00010	0.00010	0.00010	0.00020	0.00020	0.00020	0.00020
Schools							
Female	0.00011	0.00016	0.00081	0.00224	0.00109	0.00065	0.00065
Male	0.00010	0.00011	0.00119	0.00261	0.00221	0.00206	0.00206
Public Agency							
Miscellaneous Female	0.00010	0.00024	0.00135	0.00199	0.00105	0.00084	0.00088
Miscellaneous Male	0.00017	0.00019	0.00102	0.00158	0.00153	0.00102	0.00102
Fire	0.00010	0.00010	0.00010	0.00050	0.00070	0.00070	0.00070
Police[1]	0.00010	0.00020	0.00040	0.00080	0.00200	0.00200	0.00200
CPO[1]	0.00010	0.00012	0.00066	0.00180	0.00057	0.00057	0.00057

(1) No Changes Being Proposed.

INDUSTRIAL DISABILITY RETIREMENT RATES

	Age						
	20	30	40	50	60	70	80
State							
Industrial[1]	0.00015	0.00015	0.00029	0.00044	0.00058	0.00058	0.00058
Safety[1]	0.00002	0.00170	0.00360	0.00557	0.00762	0.00978	0.01205
POFF[1]	0.00039	0.00167	0.00464	0.01027	0.01966	0.03403	0.05474
CHP	0.00016	0.00068	0.00202	0.01214	0.20431	0.27551	0.27773
Public Agency							
Fire	0.00005	0.00056	0.00225	0.02079	0.04375	0.08221	0.14219
Police[1]	—	0.00476	0.01100	0.01846	0.06024	0.08549	0.11161
CPO[1]	0.00042	0.00249	0.00513	0.00919	0.01740	0.02624	0.07621

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

TERMINATION WITH REFUND

State Miscellaneous Tier 1

	Entry Age		
Service	20	30	40
0	0.1657	0.1512	0.1292
5	0.0272	0.0223	0.0160
10	0.0048	0.0043	0.0027
15	0.0016	0.0012	0.0007
20	0.0011	0.0008	0.0005
25	0.0008	0.0006	0.0003
30	0.0006	0.0004	0.0002
35	0.0004	0.0003	0.0002
40	0.0003	0.0002	0.0001
45	0.0002	0.0001	0.0001
50	0.0001	0.0001	0.0001

State Miscellaneous Tier 2[1]

	Entry Age		
Service	20	30	40
0	0.1496	0.1370	0.1244
5	0.1365	0.1239	0.1113
10	0.1234	0.1109	0.0983
15	0.1104	0.0978	0.0852
20	0.0973	0.0848	0.0722
25	0.0843	0.0717	0.0591
30	0.0792	0.0666	0.0540
35	0.0741	0.0615	0.0490
40	0.0691	0.0565	0.0439
45	0.0640	0.0514	0.0388
50	0.1496	0.1370	0.1244

(1) No Changes Being Proposed.

State

Service	Industrial	Safety	POFF[1]	CHP
0	0.0912	0.1408	0.1217	0.1050
5	0.0190	0.0155	0.0056	0.0029
10	0.0029	0.0033	0.0039	0.0005
15	0.0016	0.0019	0.0025	0.0003
20	0.0010	0.0011	0.0015	0.0002
25	0.0006	0.0006	0.0006	0.0002
30	0.0004	0.0004	0.0003	0.0002
35	0.0002	0.0002	0.0003	0.0001
40	0.0001	0.0001	0.0003	0.0001
45	0.0001	0.0001	0.0003	0.0001
50	0.0001	—	—	0.0001

(1) No Changes Being Proposed.

Schools

	Entry Age		
Service	20	30	40
0	0.2107	0.1827	0.1375
5	0.0808	0.0634	0.0409
10	0.0202	0.0157	0.0087
15	0.0107	0.0077	0.0034
20	0.0056	0.0037	0.0016
25	0.0026	0.0018	0.0012
30	0.0013	0.0011	0.0012
35	0.0008	0.0009	0.0012
40	0.0008	0.0009	0.0012
45	0.0008	0.0009	0.0012
50	0.0008	0.0009	0.0012

Appendix A - Summary of Proposed Rates (continued)

TERMINATION WITH REFUND (CONTINUED)

Public Agency Miscellaneous[1]

	Entry Age		
Service	20	30	40
0	0.1742	0.1606	0.1468
5	0.0212	0.0174	0.0136
10	0.0138	0.0104	0.0071
15	0.0060	0.0042	0.0023
20	0.0037	0.0021	0.0005
25	0.0017	0.0005	0.0001
30	0.0005	0.0001	0.0001
35	0.0001	0.0001	0.0001
40	0.0001	0.0001	0.0001
45	0.0001	0.0001	—
50	0.0001	0.0001	—

(1) No Changes Being Proposed.

Public Agency

Service	Fire	Police[1]	CPO
0	0.1298	0.1013	0.1188
5	0.0052	0.0086	0.0121
10	0.0005	0.0053	0.0053
15	0.0004	0.0027	0.0025
20	0.0003	0.0017	0.0012
25	0.0002	0.0012	0.0005
30	0.0002	0.0009	0.0003
35	0.0001	0.0009	0.0002
40	0.0001	0.0009	0.0001
45	0.0001	0.0009	0.0001
50	0.0001	—	—

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

TERMINATION WITH VESTED BENEFITS

State Miscellaneous Tier 1

	Entry Age		
Service	20	30	40
0	—	—	—
5	0.0441	0.0394	0.0289
10	0.0251	0.0227	0.0156
15	0.0146	0.0122	0.0074
20	0.0095	0.0071	0.0038
25	0.0050	0.0029	0.0007
30	0.0026	0.0013	—
35	0.0012	0.0006	—
40	—	—	—
45	—	—	—
50	—	—	—

State Miscellaneous Tier 2[1]

	Entry Age		
Service	20	30	40
0	—	—	—
5	—	—	—
10	0.0589	0.0463	—
15	0.0453	0.0327	—
20	0.0317	—	—
25	0.0180	—	—
30	—	—	—
35	—	—	—
40	—	—	—
45	—	—	—
50	—	—	—

(1) No Changes Being Proposed.

State Industrial[1]

	Entry Age		
Service	20	30	40
0	—	—	—
5	0.0496	0.0405	0.0311
10	0.0353	0.0253	—
15	0.0302	0.0194	—
20	0.0232	—	—
25	0.0159	—	—
30	—	—	—
35	—	—	—
40	—	—	—
45	—	—	—
50	—	—	—

(1) No Changes Being Proposed.

State

Service	Safety	POFF	CHP
0	—	—	—
5	0.0246	0.0117	0.0090
10	0.0141	0.0098	0.0067
15	0.0097	0.0069	0.0049
20	0.0073	0.0049	0.0034
25	0.0050	0.0031	0.0023
30	0.0034	0.0020	0.0010
35	—	—	—
40	—	—	—
45	—	—	—
50	—	—	—

Appendix A - Summary of Proposed Rates (continued)

TERMINATION WITH VESTED BENEFITS (CONTINUED)

Schools

	Entry Age		
Service	20	30	40
0	—	—	—
5	0.0405	0.0346	0.0264
10	0.0324	0.0280	0.0211
15	0.0202	0.0179	0.0126
20	0.0144	0.0114	0.0042
25	0.0091	0.0046	—
30	0.0015	0.0007	—
35	—	—	—
40	—	—	—
45	—	—	—
50	—	—	—

Public Agency Miscellaneous

	Entry Age		
Service	20	30	40
0	—	—	—
5	0.0422	0.0393	0.0344
10	0.0278	0.0271	0.0215
15	0.0192	0.0174	0.0120
20	0.0139	0.0109	0.0047
25	0.0083	0.0048	0.0007
30	0.0015	0.0007	—
35	—	—	—
40	—	—	—
45	—	—	—
50	—	—	—

Public Agency

Service	Fire	Police[1]	CPO
0	—	—	—
5	0.0094	0.0163	0.0187
10	0.0064	0.0126	0.0134
15	0.0048	0.0082	0.0092
20	0.0038	0.0065	0.0064
25	0.0026	0.0058	0.0042
30	0.0014	0.0056	0.0022
35	—	—	—
40	—	—	—
45	—	—	—
50	—	—	—

(1) No Changes Being Proposed.

Appendix A - Summary of Proposed Rates (continued)

NON-INDUSTRIAL RELATED MORTALITY

Age	Female	Male
20	0.00007	0.00022
25	0.00011	0.00029
30	0.00015	0.00038
35	0.00027	0.00049
40	0.00037	0.00064
45	0.00054	0.00080
50	0.00079	0.00116
55	0.00120	0.00172
60	0.00166	0.00255
65	0.00233	0.00363
70	0.00388	0.00623
75	0.00623	0.01057
80	0.00939	0.01659

INDUSTRIAL RELATED MORTALITY

Female	Male
0.00004	0.00004
0.00006	0.00006
0.00007	0.00007
0.00009	0.00009
0.00010	0.00010
0.00012	0.00012
0.00013	0.00013
0.00015	0.00015
0.00016	0.00016
0.00018	0.00018
0.00019	0.00019
0.00021	0.00021
0.00022	0.00022

Appendix A - Summary of Proposed Rates (continued)

POST MORTALITY RATES WITH 15-YEAR MORTALITY IMPROVEMENT

SERVICE RETIREE AND BENEFICIARY MORTALITY

Age	Female	Male
20	0.00007	0.00022
25	0.00011	0.00029
30	0.00015	0.00038
35	0.00027	0.00049
40	0.00037	0.00064
45	0.00054	0.00080
50	0.00346	0.00372
55	0.00410	0.00437
60	0.00476	0.00671
65	0.00637	0.00928
70	0.00926	0.01339
75	0.01635	0.02316
80	0.03007	0.03977
85	0.05418	0.07122
90	0.10089	0.13044
95	0.17698	0.21658
100	0.28151	0.32222
105	0.43491	0.46691
110	1.00000	1.00000

NON-INDUSTRIAL RELATED DISABILITY RETIREE MORTALITY

Female	Male
0.00007	0.00022
0.00011	0.00029
0.00015	0.00038
0.00027	0.00049
0.00037	0.00064
0.00054	0.00080
0.01083	0.01183
0.01178	0.01613
0.01404	0.02166
0.01757	0.02733
0.02183	0.03358
0.02969	0.04277
0.04641	0.06272
0.07847	0.09793
0.13220	0.14616
0.21015	0.21658
0.32226	0.32222
0.43491	0.46691
1.00000	1.00000

INDUSTRIAL RELATED DISABILITY RETIREE MORTALITY

Female	Male
0.00004	0.00004
0.00006	0.00006
0.00007	0.00007
0.00009	0.00009
0.00010	0.00010
0.00012	0.00012
0.00346	0.00372
0.00410	0.00437
0.00476	0.00671
0.00765	0.01113
0.01111	0.01607
0.01962	0.02779
0.03609	0.04773
0.06501	0.08547
0.11098	0.14348
0.17698	0.21658
0.28151	0.32222
0.43491	0.46691
1.00000	1.00000

POST MORTALITY RATES WITH BASE RATE (no projection)

SERVICE RETIREE AND BENEFICIARY MORTALITY

Age	Female	Male
20	0.00008	0.00028
25	0.00013	0.00035
30	0.00017	0.00043
35	0.00028	0.00053
40	0.00038	0.00069
45	0.00059	0.00090
50	0.00393	0.00440
55	0.00453	0.00508
60	0.00517	0.00749
65	0.00706	0.01020
70	0.01060	0.01503
75	0.01904	0.02669
80	0.03486	0.04639
85	0.06196	0.08276
90	0.11382	0.14938
95	0.19798	0.24534
100	0.30618	0.35368
105	0.46000	0.49680
110	1.00000	1.00000

NON-INDUSTRIAL RELATED DISABILITY RETIREE MORTALITY

Female	Male
0.00008	0.00028
0.00013	0.00035
0.00017	0.00043
0.00028	0.00053
0.00038	0.00069
0.00059	0.00090
0.01229	0.01400
0.01303	0.01874
0.01524	0.02415
0.01946	0.03006
0.02500	0.03769
0.03458	0.04929
0.05379	0.07316
0.08973	0.11379
0.14915	0.16738
0.23509	0.24534
0.35051	0.35368
0.46000	0.49680
1.00000	1.00000

INDUSTRIAL RELATED DISABILITY RETIREE MORTALITY

Female	Male
0.00004	0.00004
0.00006	0.00006
0.00007	0.00007
0.00009	0.00009
0.00010	0.00010
0.00012	0.00012
0.00393	0.00440
0.00453	0.00508
0.00517	0.00749
0.00847	0.01224
0.01272	0.01803
0.02285	0.03203
0.04183	0.05567
0.07435	0.09931
0.12521	0.16431
0.19798	0.24534
0.30618	0.35368
0.46000	0.49680
1.00000	1.00000

Appendix A - Summary of Proposed Rates (continued)

SALARY INCREASE

The following tables list the proposed Seniority, Merit, and Promotion salary increases added to the 2.75 percent (3 percent for CHP) wage inflation assumptions.

Miscellaneous

State Miscellaneous

	Entry Age		
Service	20	30	40
0	6.4%	5.6%	4.4%
3	5.3%	4.4%	3.1%
5	4.3%	3.6%	2.4%
10	2.3%	1.8%	1.2%
15	1.5%	1.2%	0.8%
20	1.0%	0.9%	0.6%
25	0.7%	0.6%	0.4%
30	0.5%	0.4%	0.3%

State Industrial

	Entry Age		
Service	20	30	40
0	7.3%	7.0%	6.4%
3	5.1%	4.7%	3.9%
5	4.0%	3.6%	2.8%
10	2.7%	2.2%	1.4%
15	1.8%	1.5%	1.1%
20	1.2%	1.0%	0.8%
25	0.8%	0.7%	0.6%
30	0.5%	0.5%	0.4%

Public Agency Miscellaneous

	Entry Age		
Service	20	30	40
0	8.5%	7.8%	6.5%
3	4.7%	4.3%	3.4%
5	3.4%	3.0%	2.2%
10	1.6%	1.4%	0.9%
15	1.2%	1.0%	0.6%
20	0.9%	0.8%	0.5%
25	0.8%	0.7%	0.4%
30	0.8%	0.7%	0.4%

Schools

	Entry Age		
Service	20	30	40
0	4.3%	4.2%	3.8%
3	3.5%	3.3%	2.8%
5	2.6%	2.3%	1.8%
10	1.7%	1.5%	1.1%
15	1.5%	1.3%	1.0%
20	1.3%	1.2%	0.9%
25	1.2%	1.0%	0.8%
30	0.9%	0.7%	0.5%

Safety

State

Service	State Safety	POFF	CHP
0	5.0%	14.7%	6.8%
3	3.1%	6.7%	4.0%
5	2.1%	4.0%	2.4%
10	0.8%	1.2%	1.0%
15	0.7%	0.5%	1.0%
20	0.6%	1.4%	1.8%
25	0.5%	1.5%	2.0%
30	0.5%	1.0%	1.0%

Public Agency

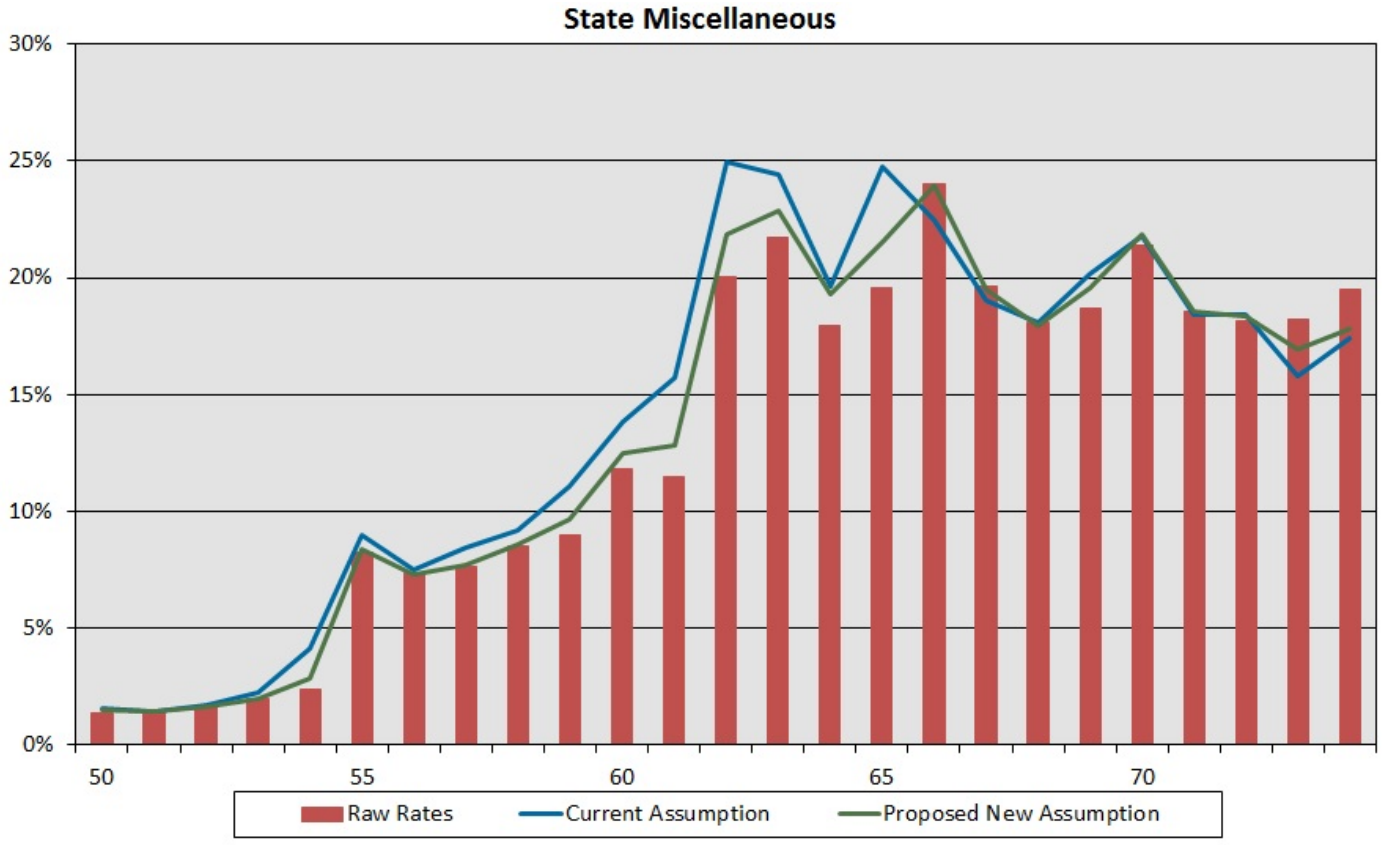
Service	Fire	Police	CPO
0	17.0%	10.3%	13.2%
3	5.8%	4.9%	5.3%
5	3.7%	3.0%	3.3%
10	1.6%	1.5%	1.7%
15	1.4%	1.5%	1.5%
20	1.3%	1.5%	1.5%
25	1.1%	1.6%	1.8%
30	1.0%	1.7%	2.0%

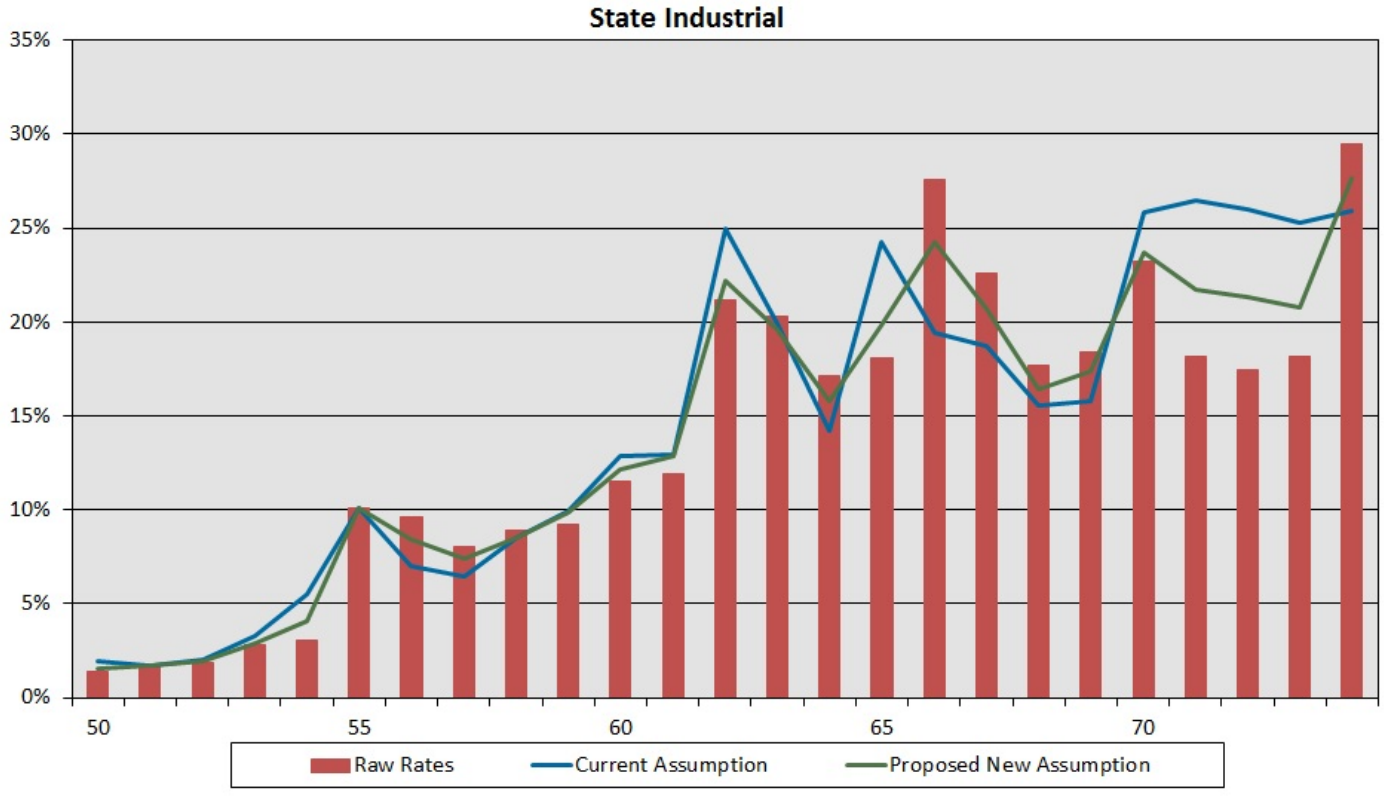
Appendix B
Summary Comparison of Assumptions

Appendix B - Summary Comparison of Assumptions (continued)

SERVICE RETIREMENT FOR ACTIVE MEMBERS

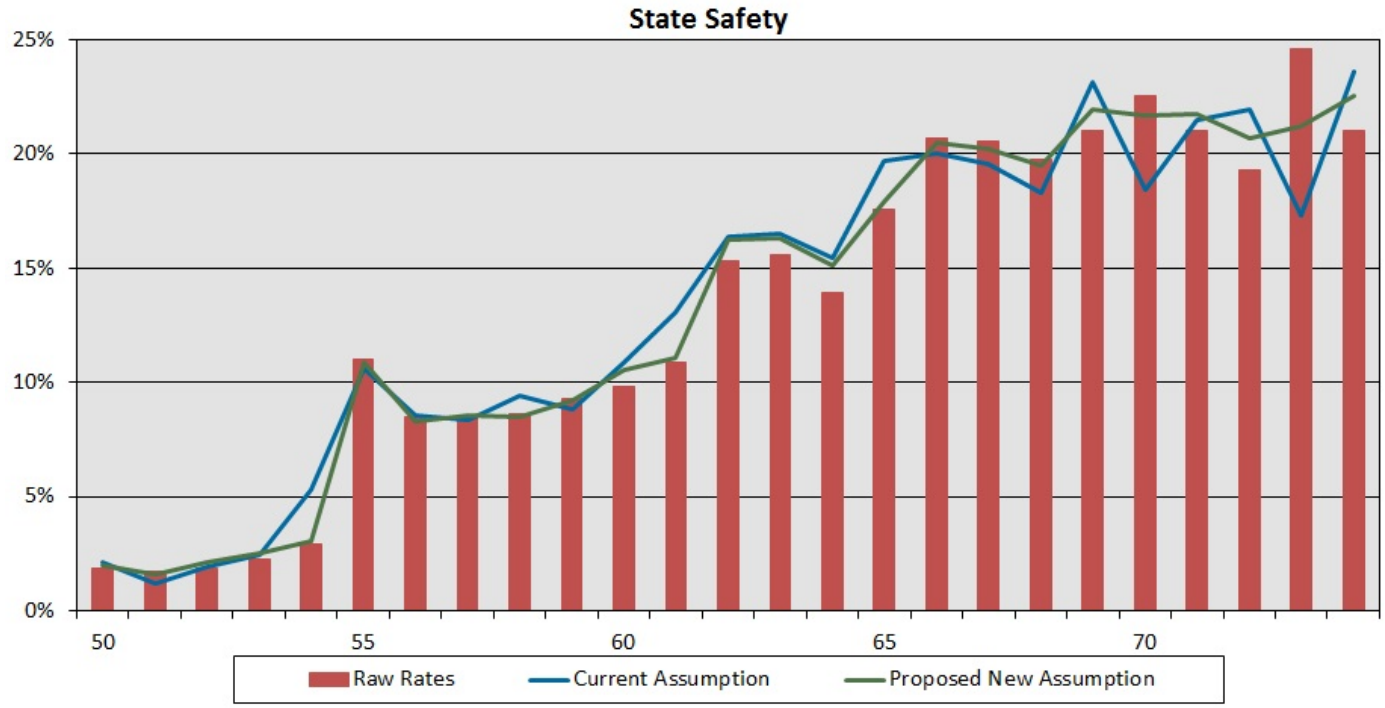
The following charts illustrate the current assumptions compared to the proposed assumptions for Service Retirement.

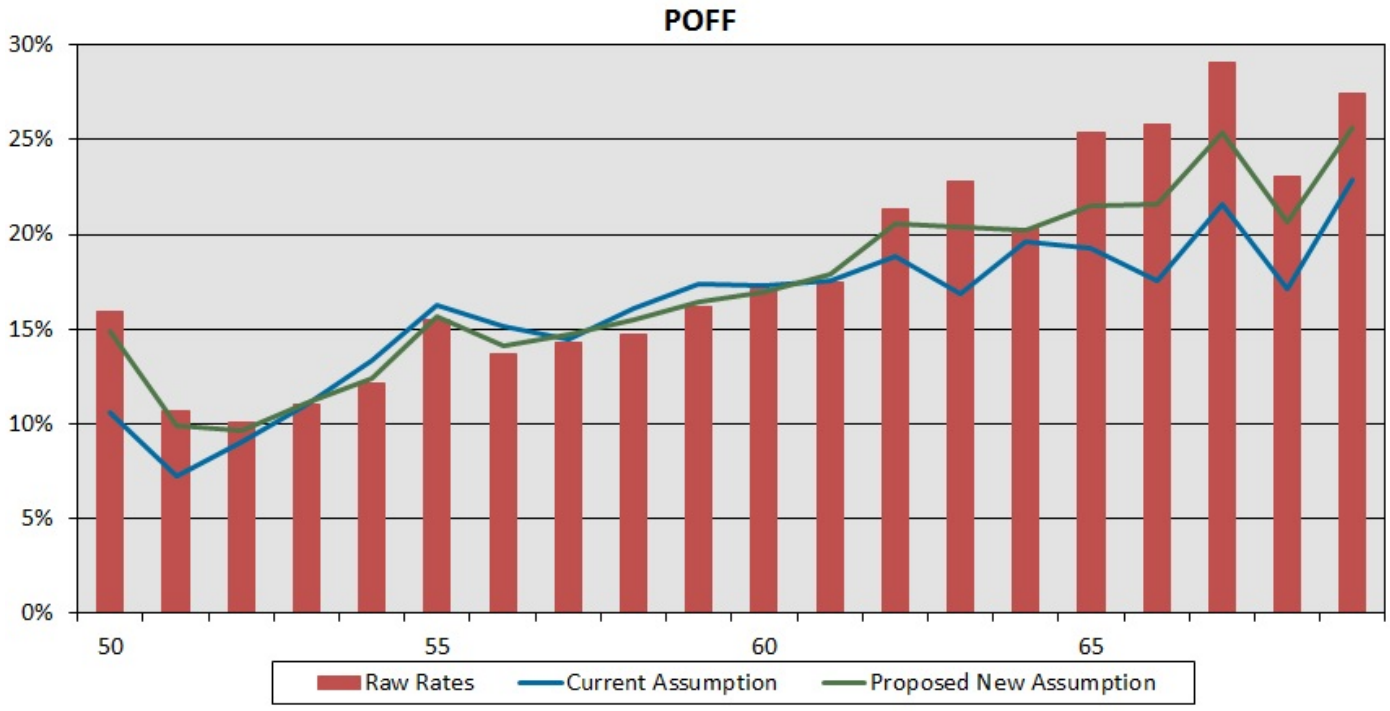




Appendix B - Summary Comparison of Assumptions (continued)

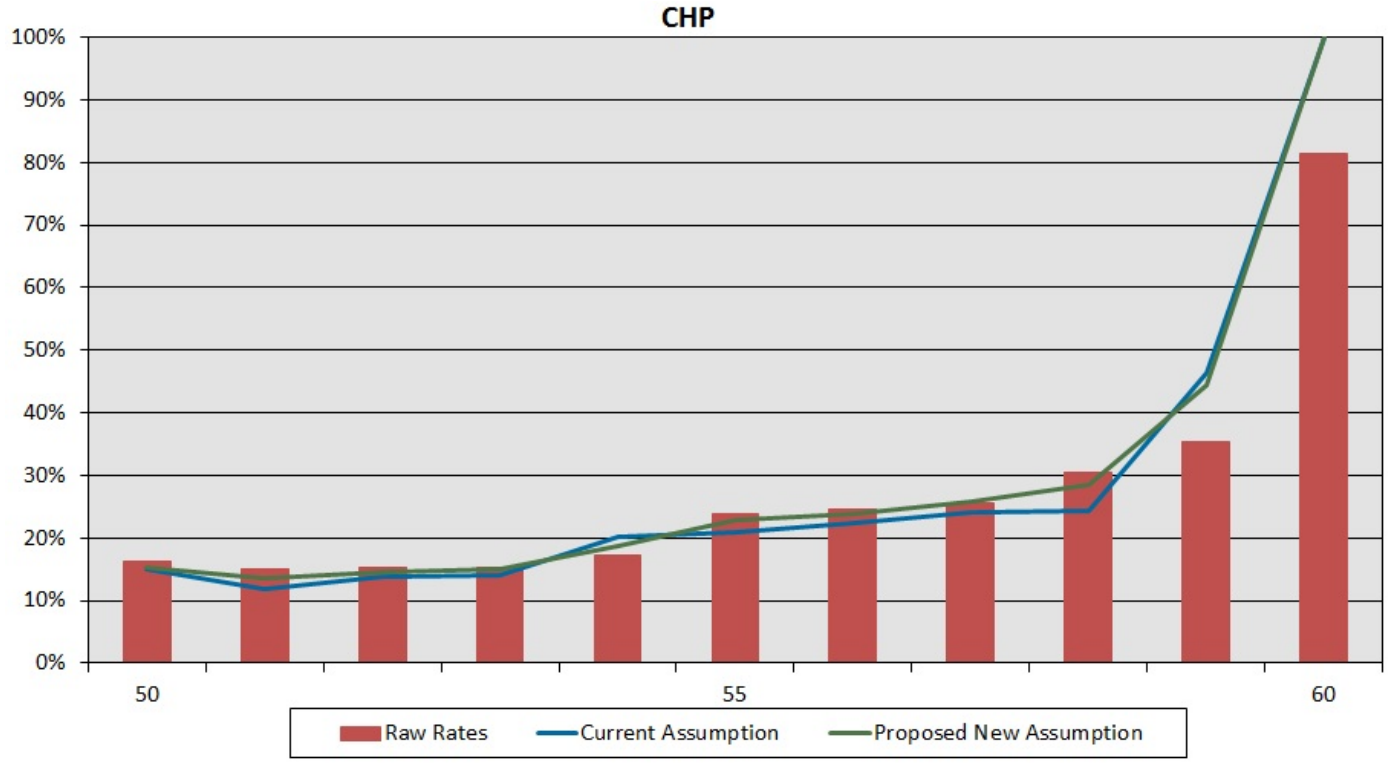
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

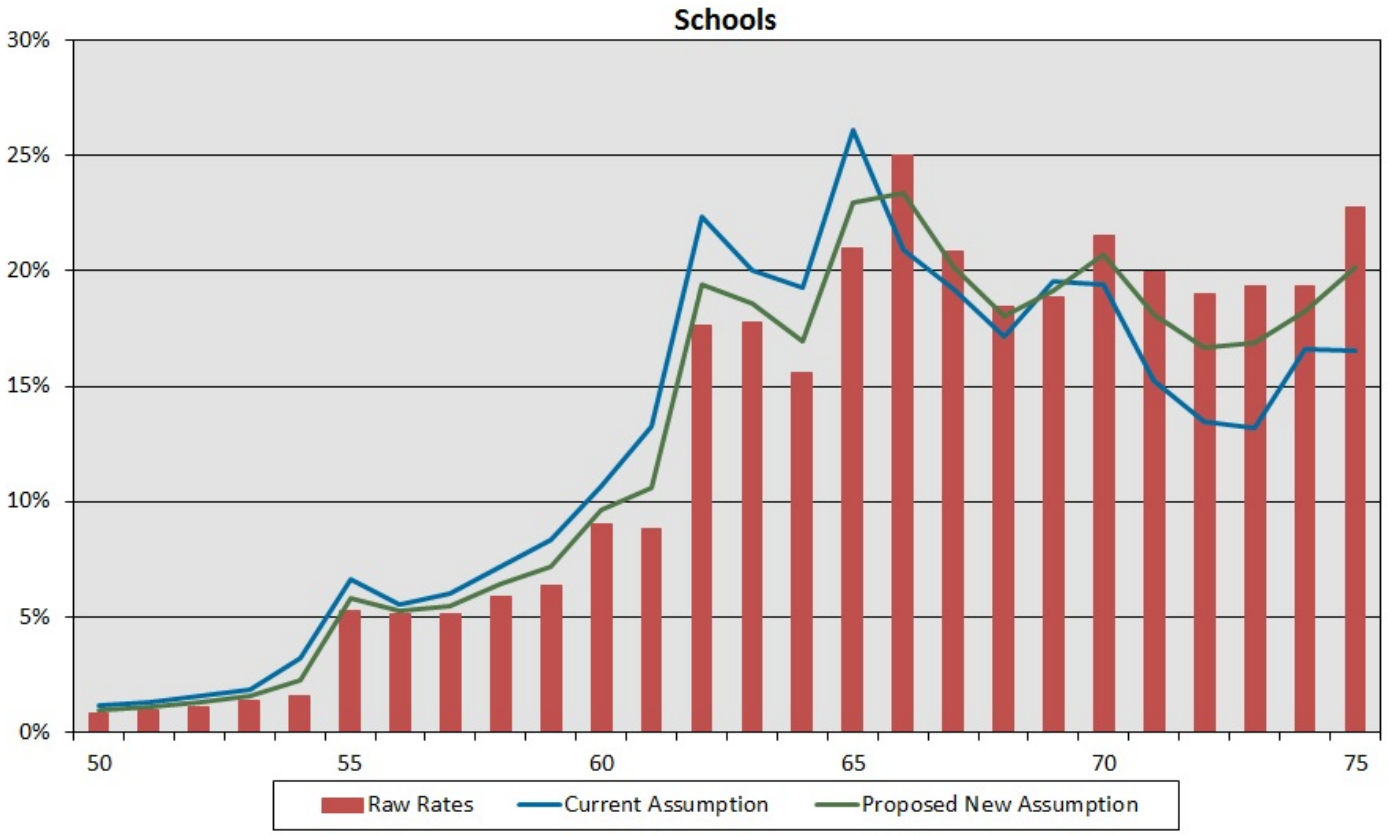




Appendix B - Summary Comparison of Assumptions (continued)

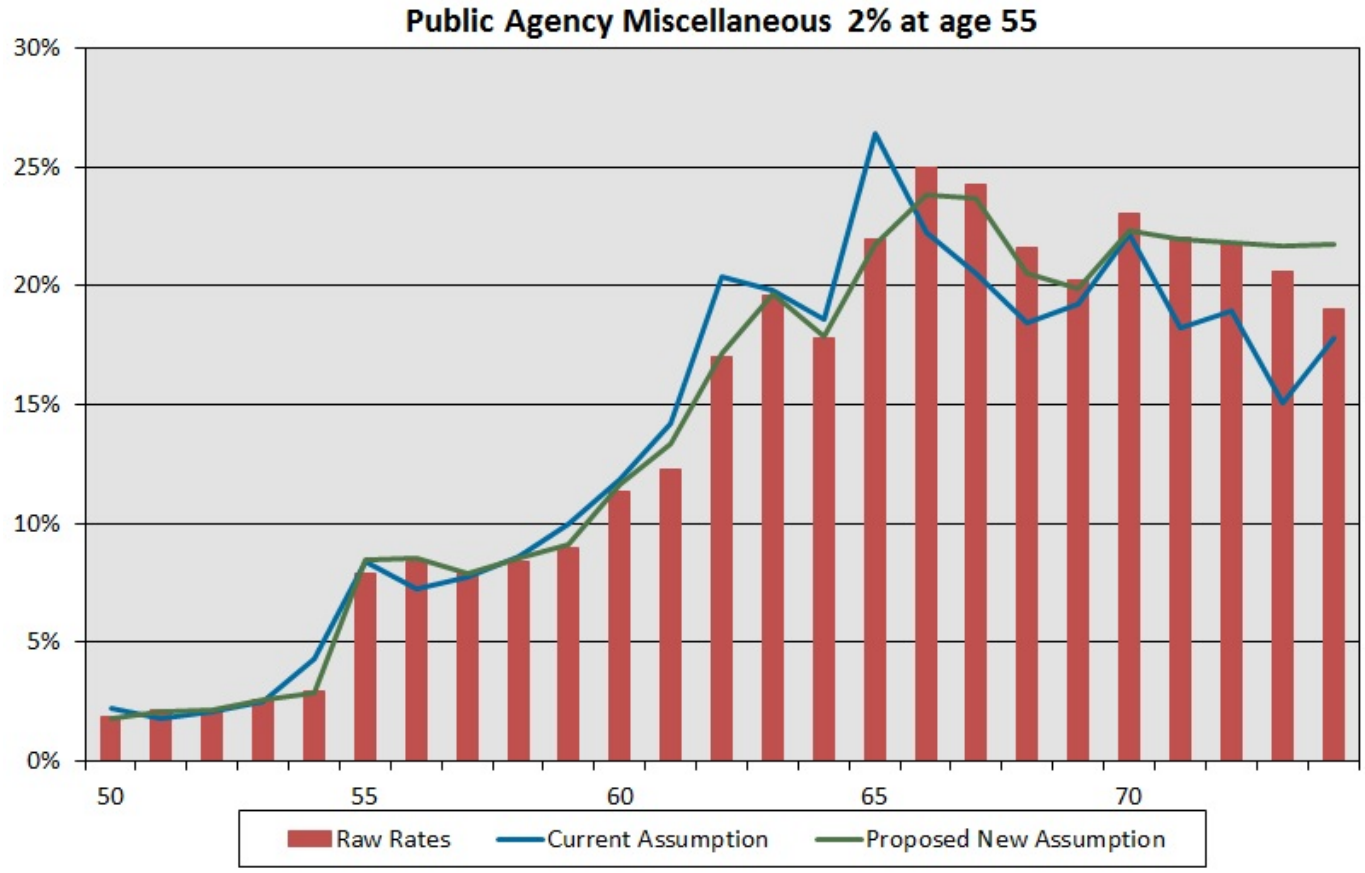
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

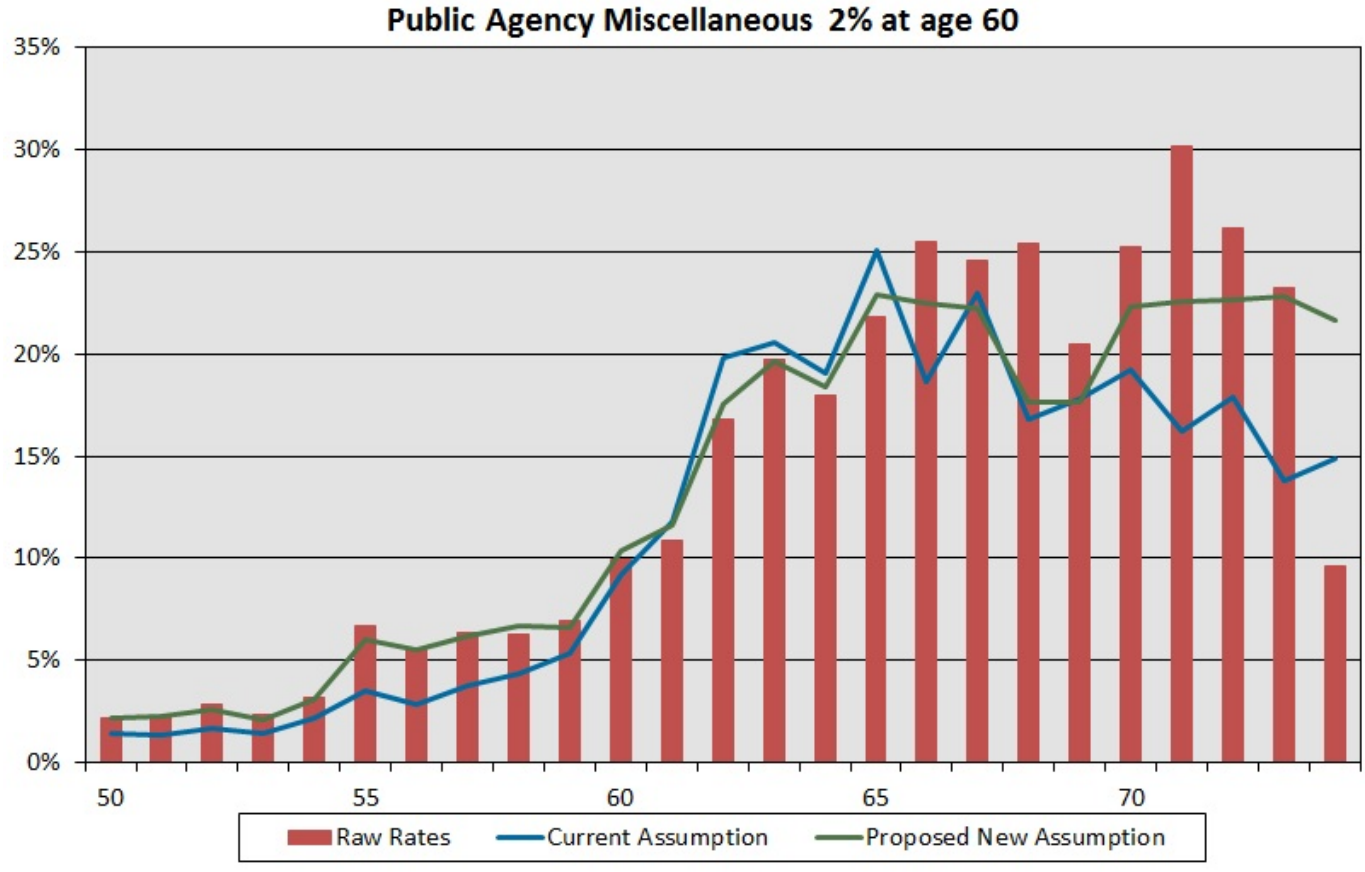




Appendix B - Summary Comparison of Assumptions (continued)

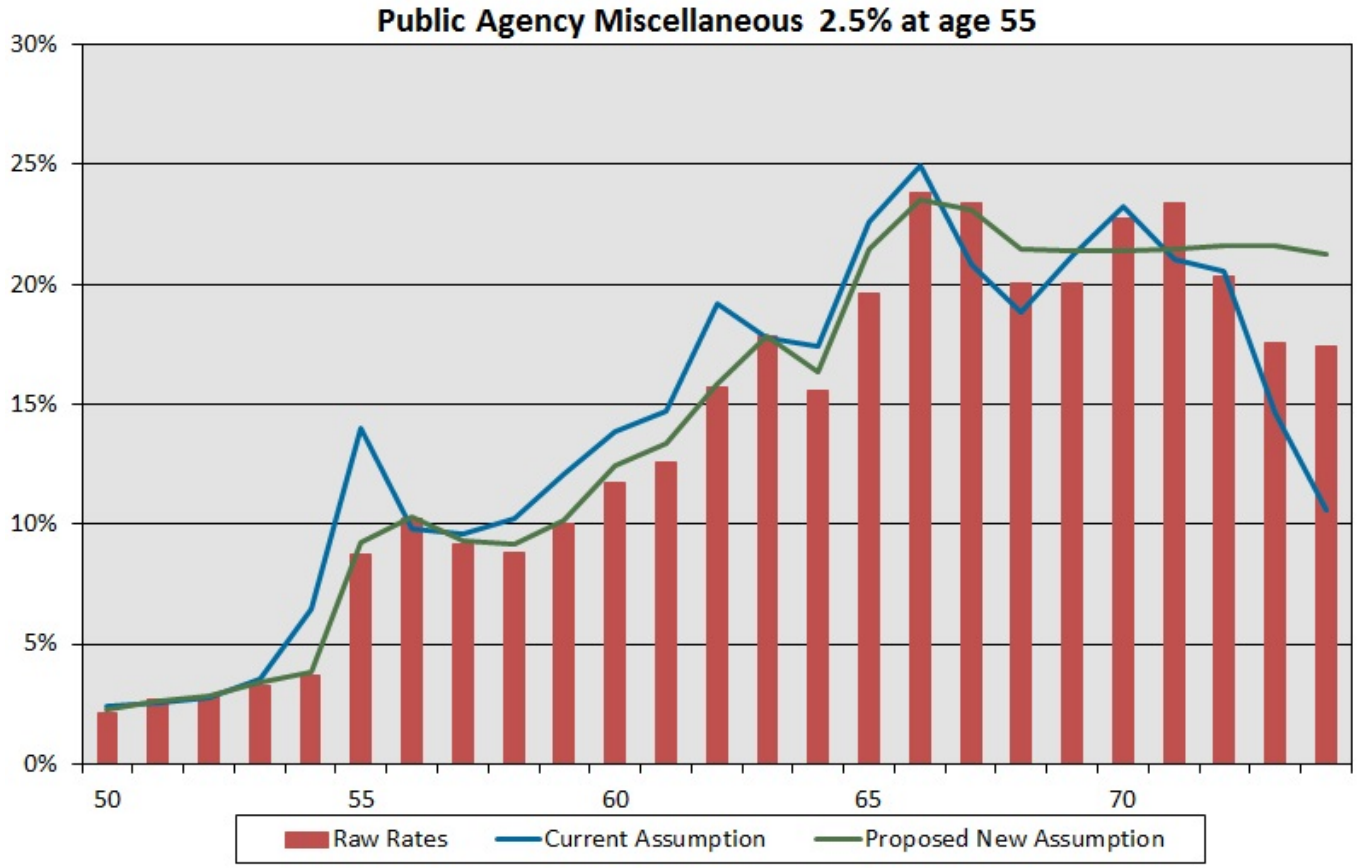
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

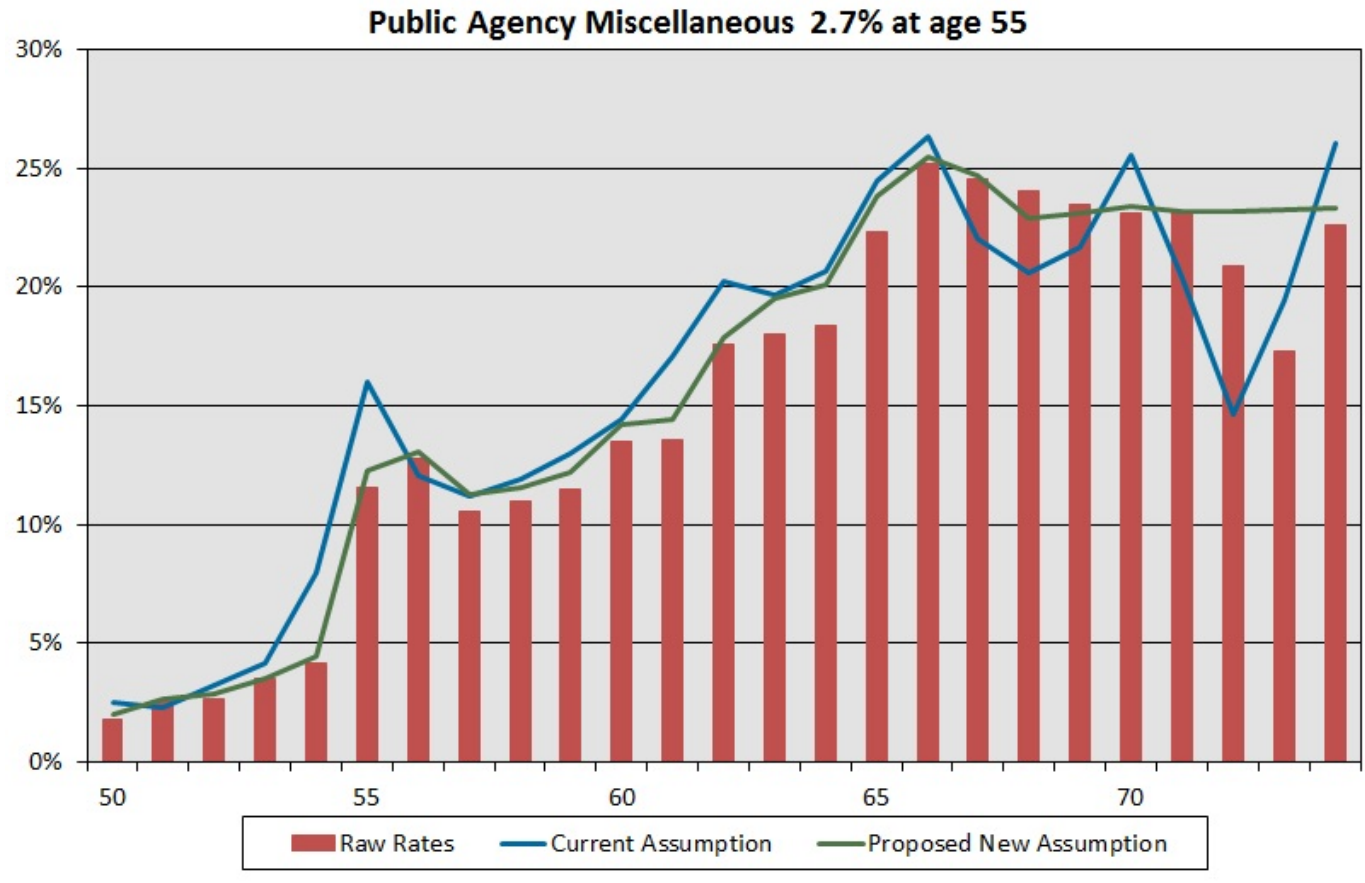




Appendix B - Summary Comparison of Assumptions (continued)

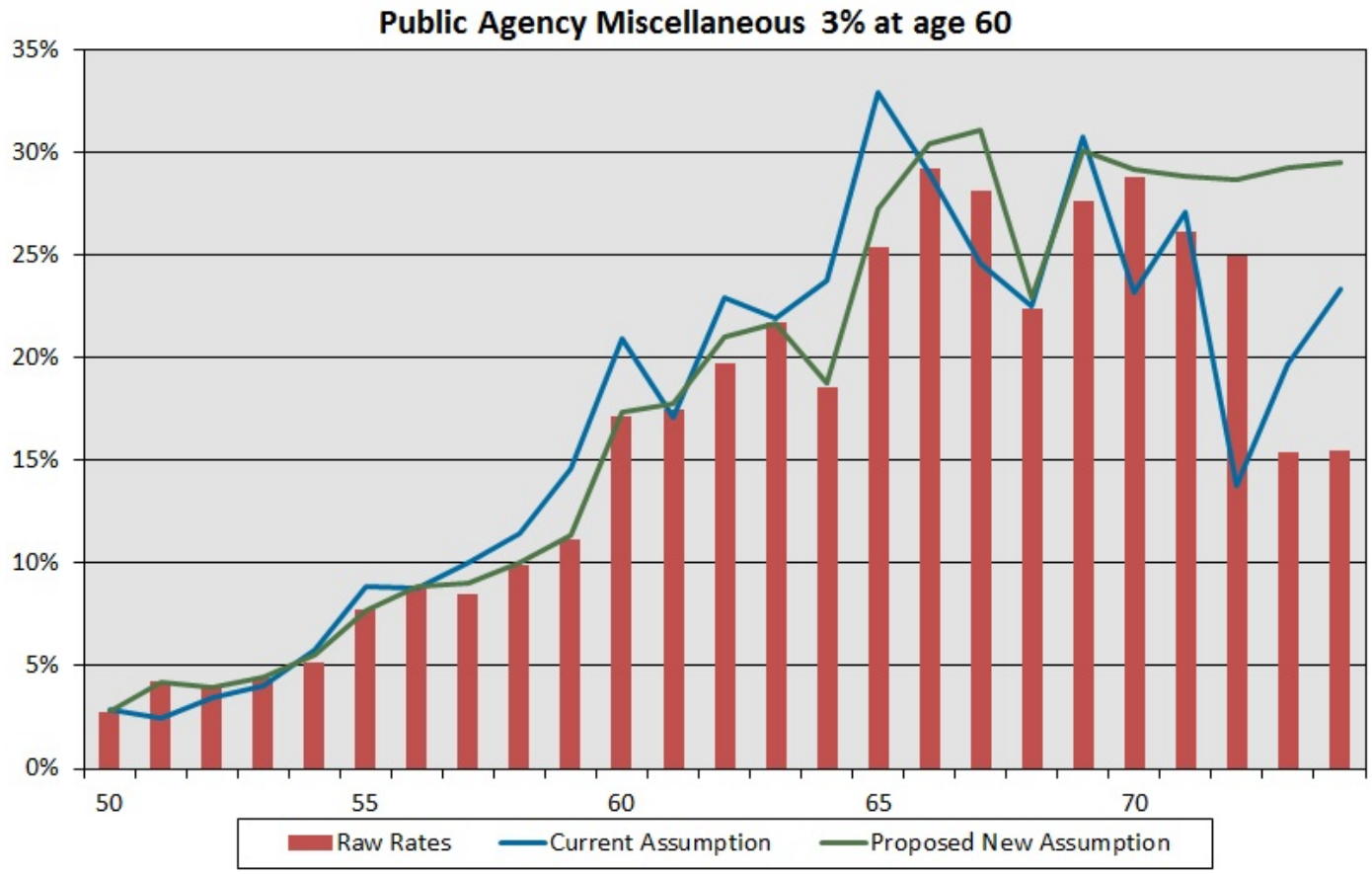
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

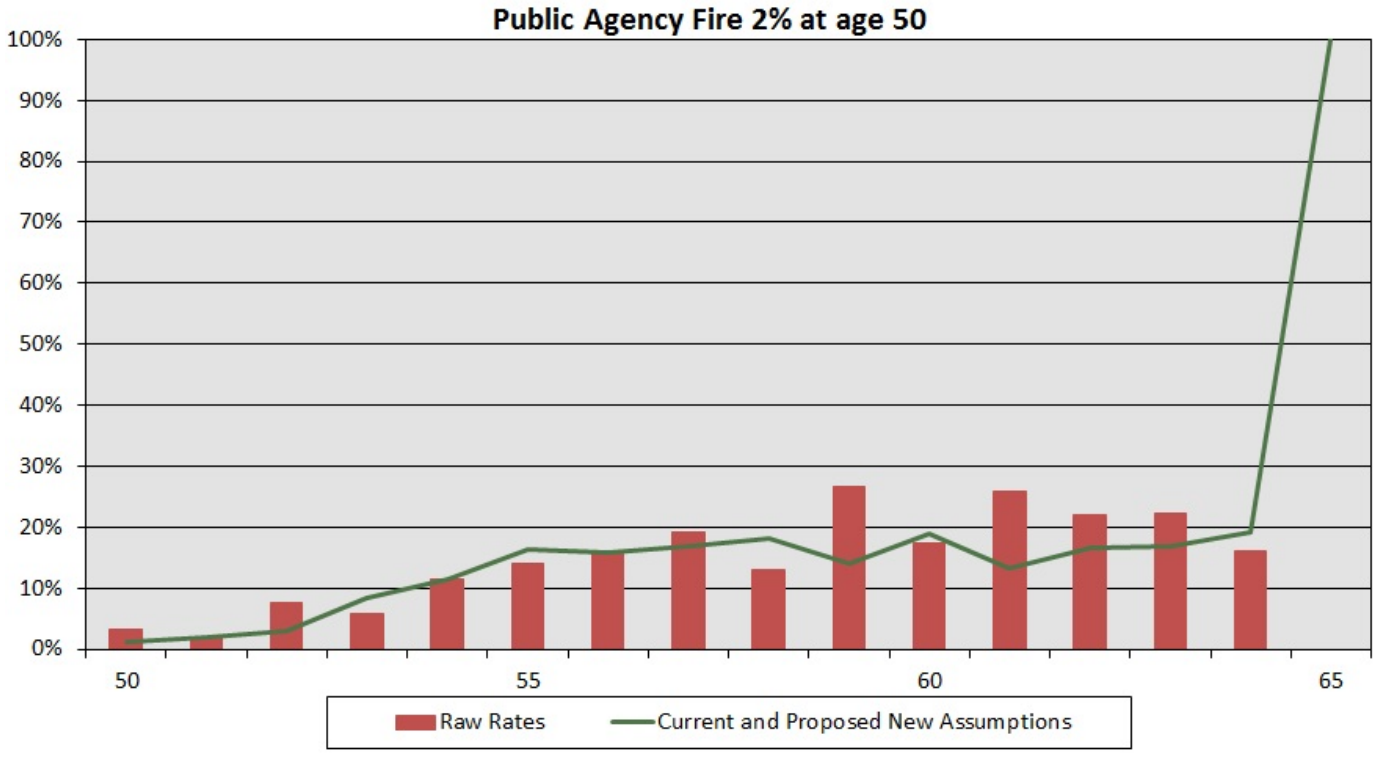




Appendix B - Summary Comparison of Assumptions (continued)

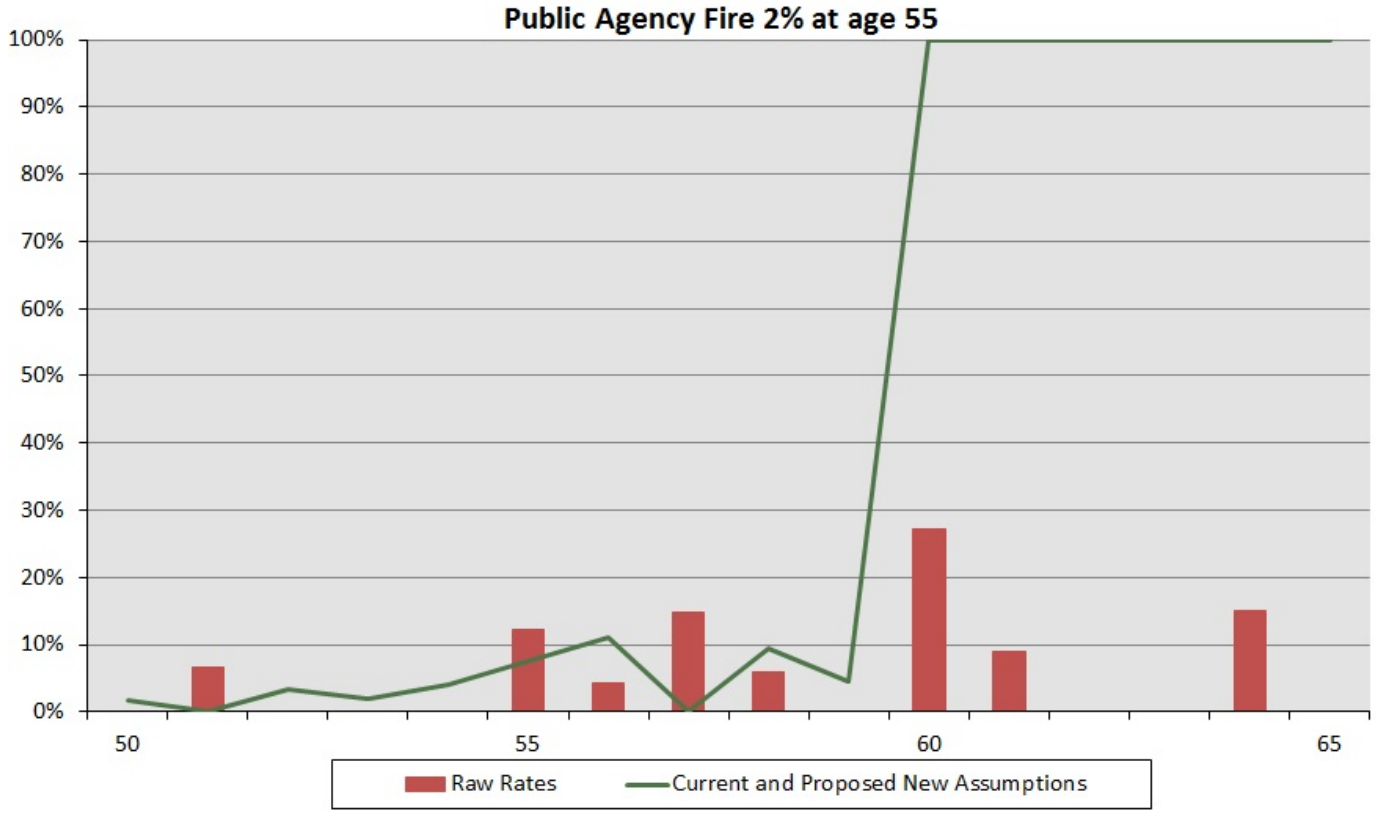
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

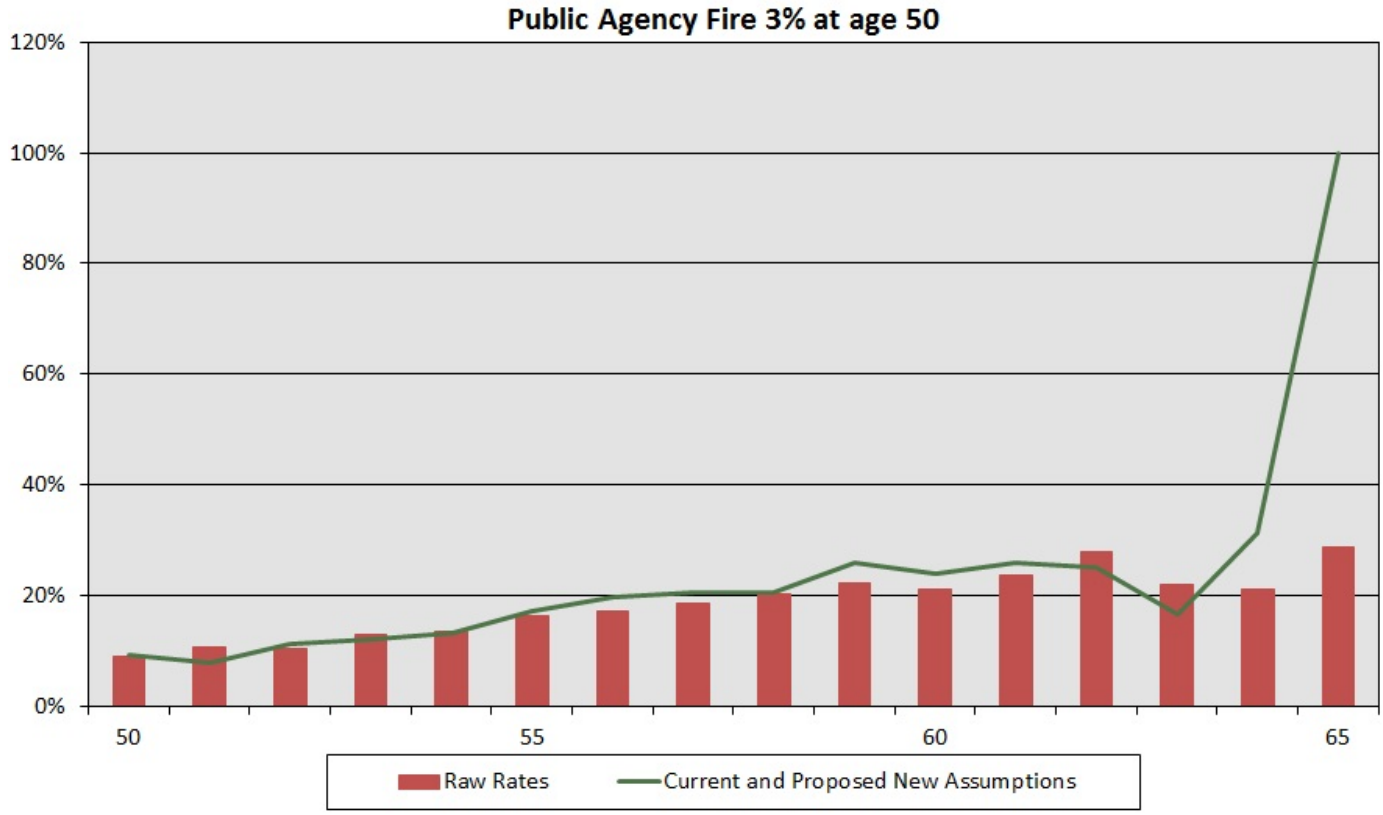




Appendix B - Summary Comparison of Assumptions (continued)

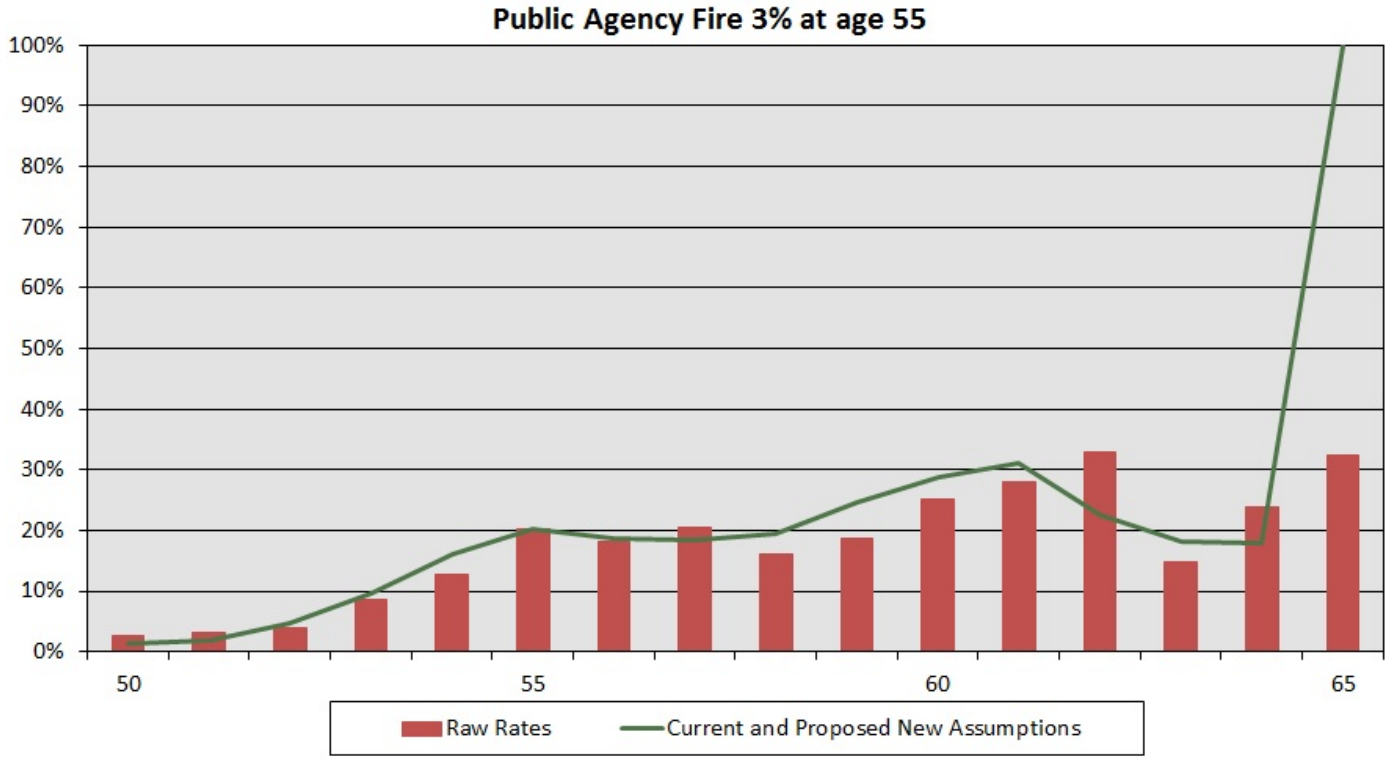
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

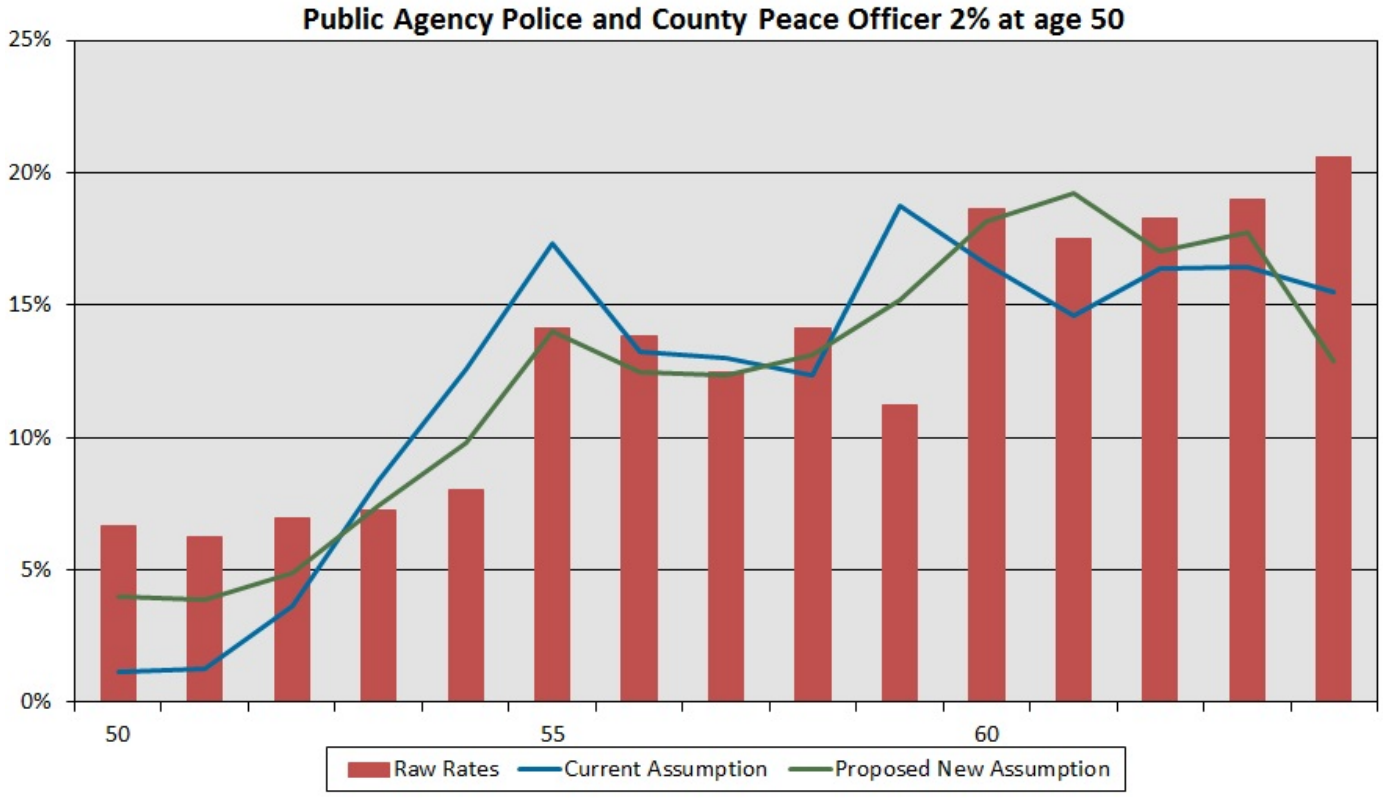




Appendix B - Summary Comparison of Assumptions (continued)

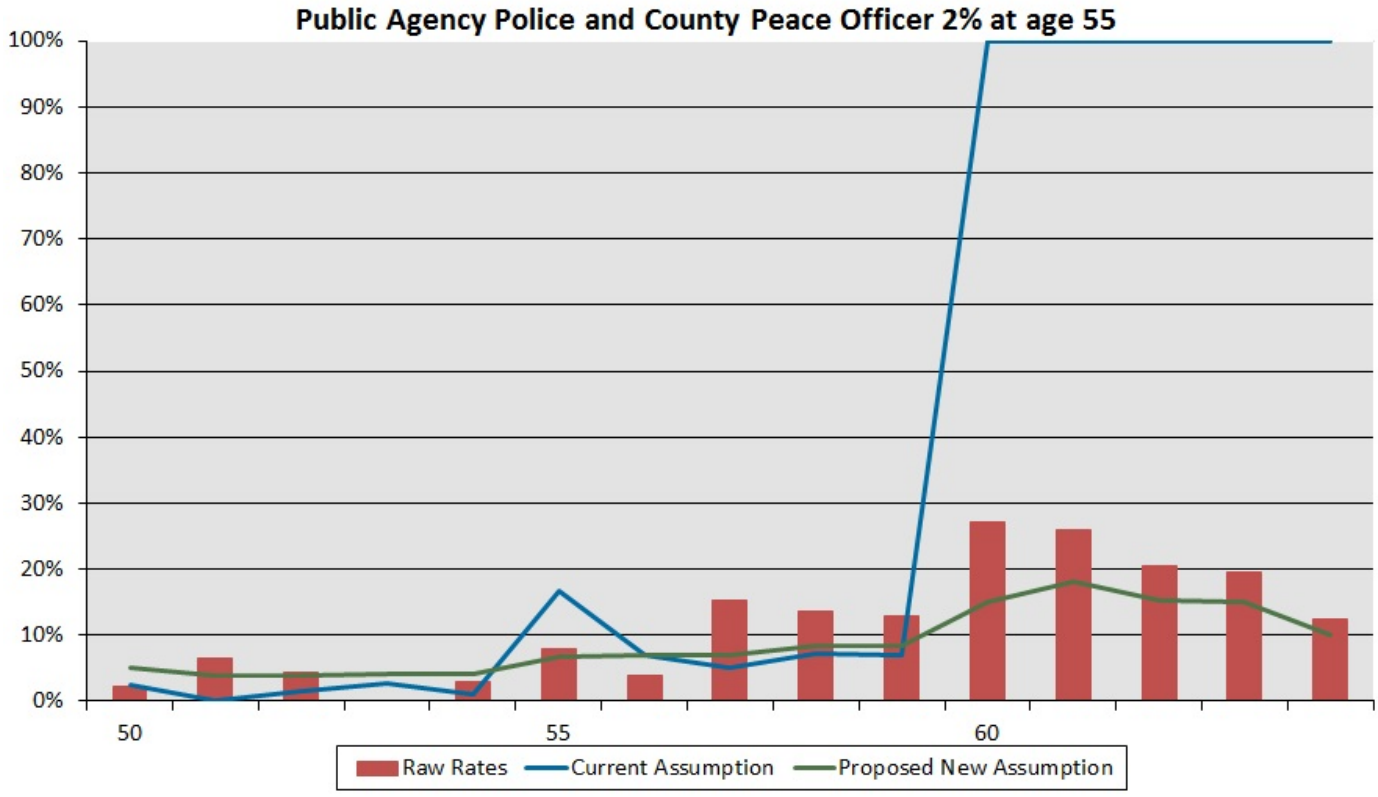
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

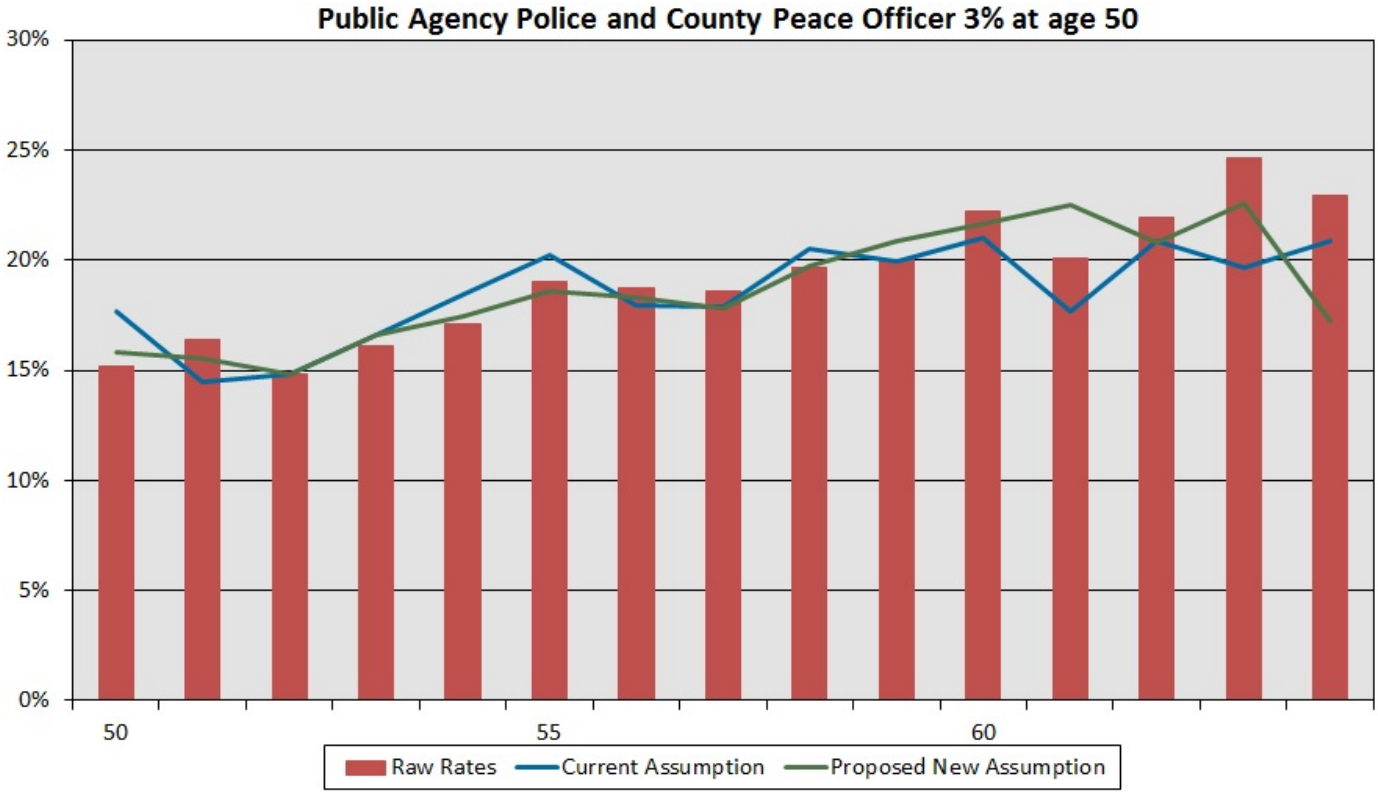




Appendix B - Summary Comparison of Assumptions (continued)

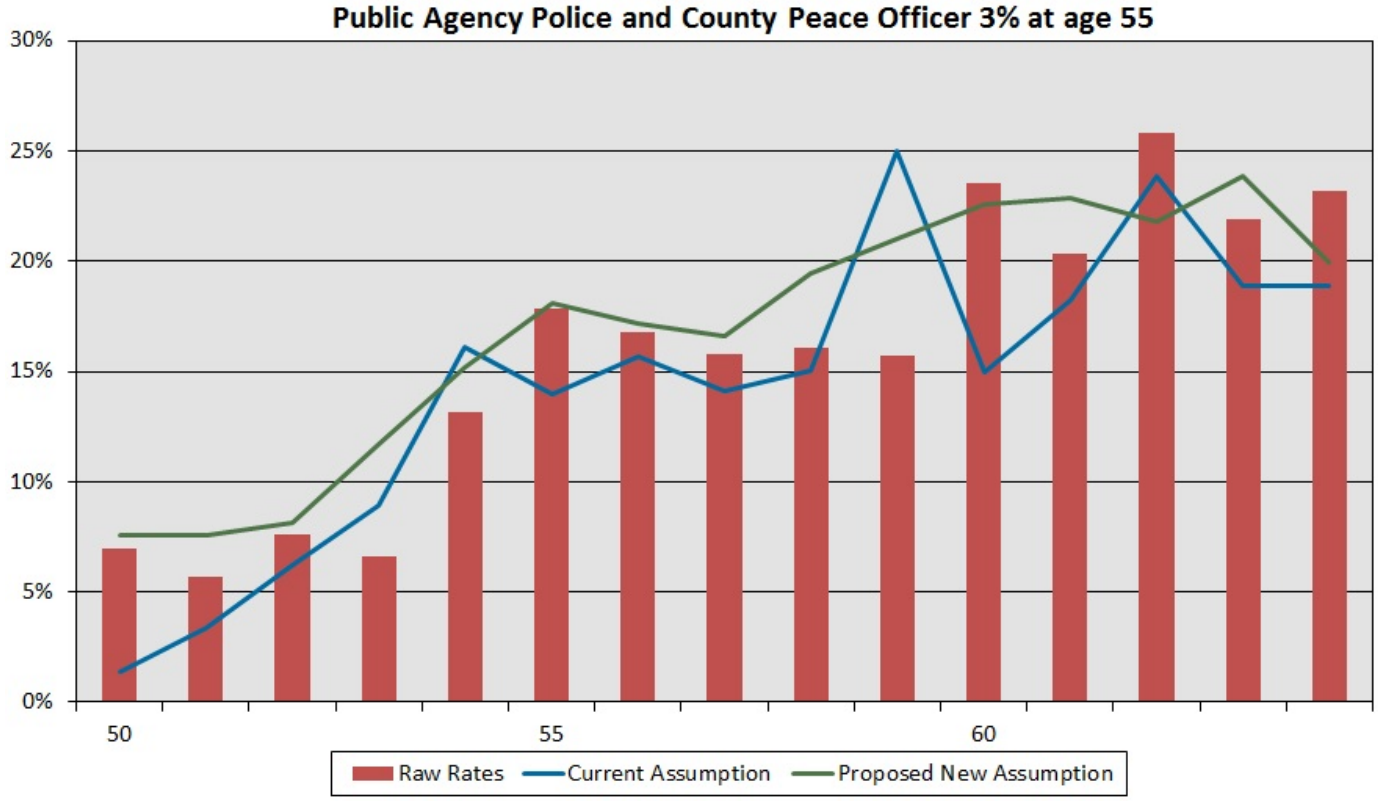
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)





Appendix B - Summary Comparison of Assumptions (continued)

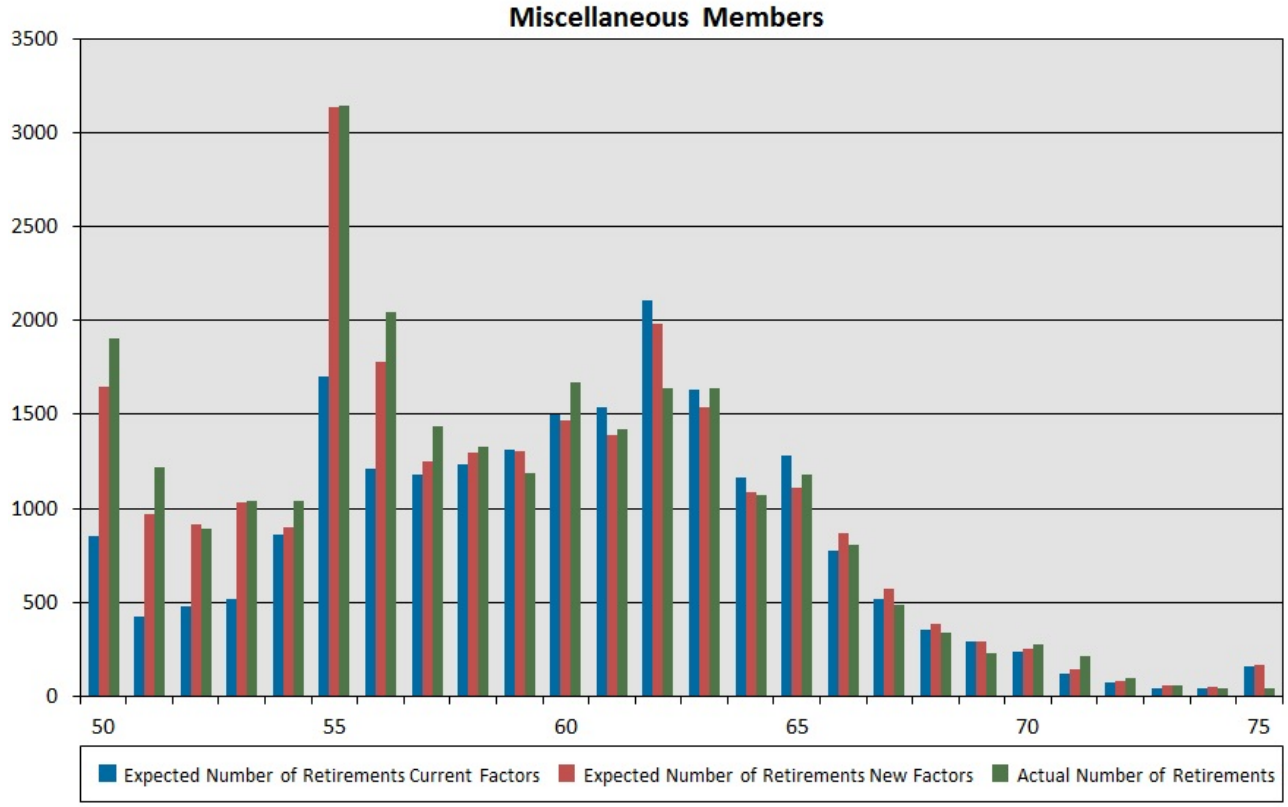
SERVICE RETIREMENT FOR ACTIVE MEMBERS (CONTINUED)

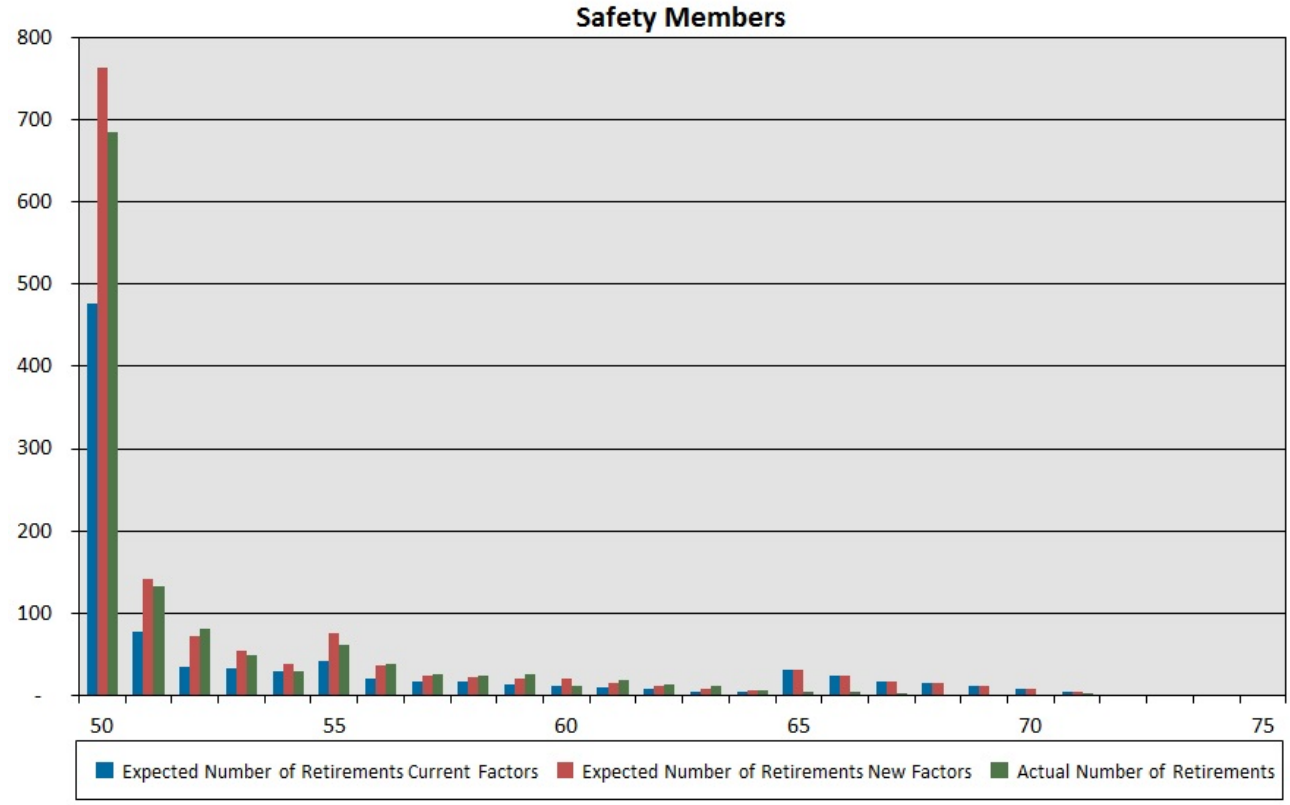


Appendix B - Summary Comparison of Assumptions (continued)

SERVICE RETIREMENT FOR TERMINATED MEMBERS

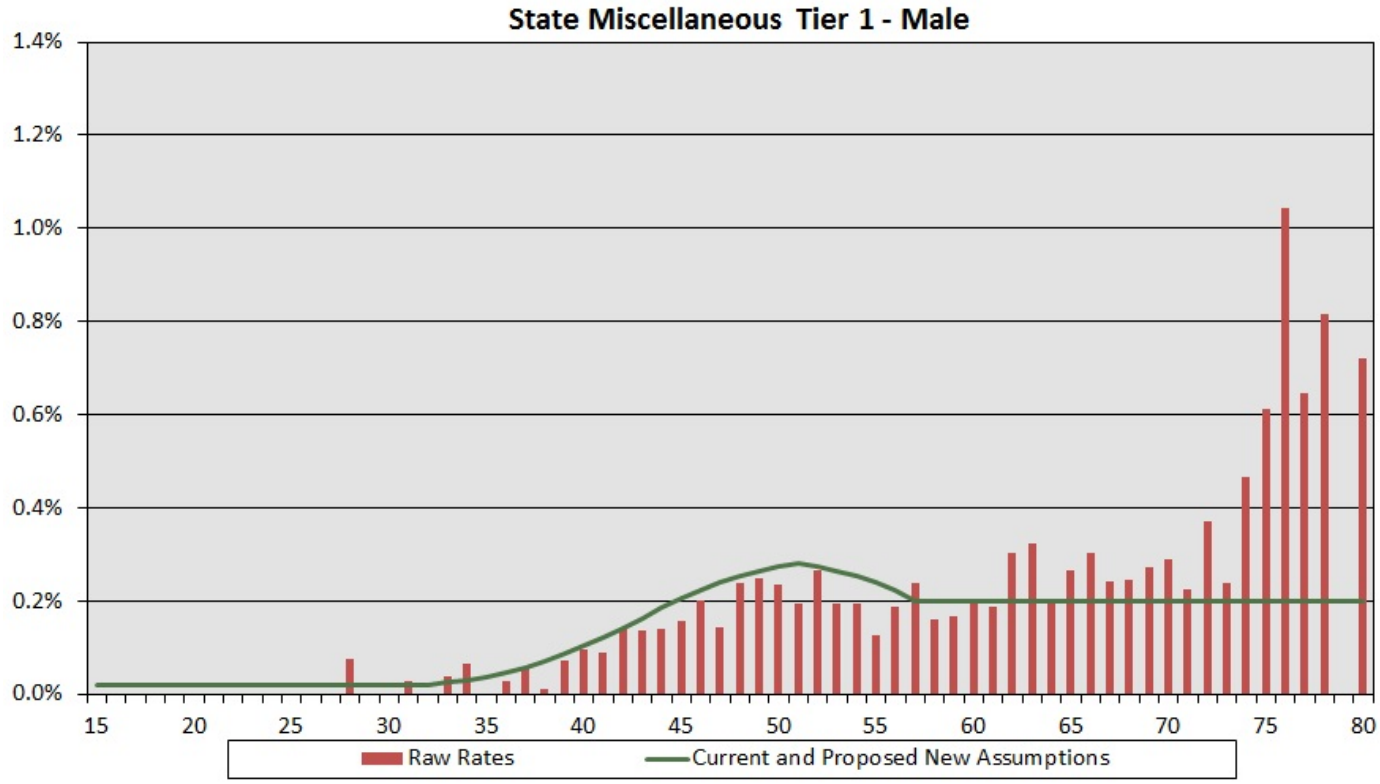
Below are two charts comparing the expected number of retirements using the current assumptions and the proposed assumptions for Separated Service Retirement Miscellaneous and Safety.

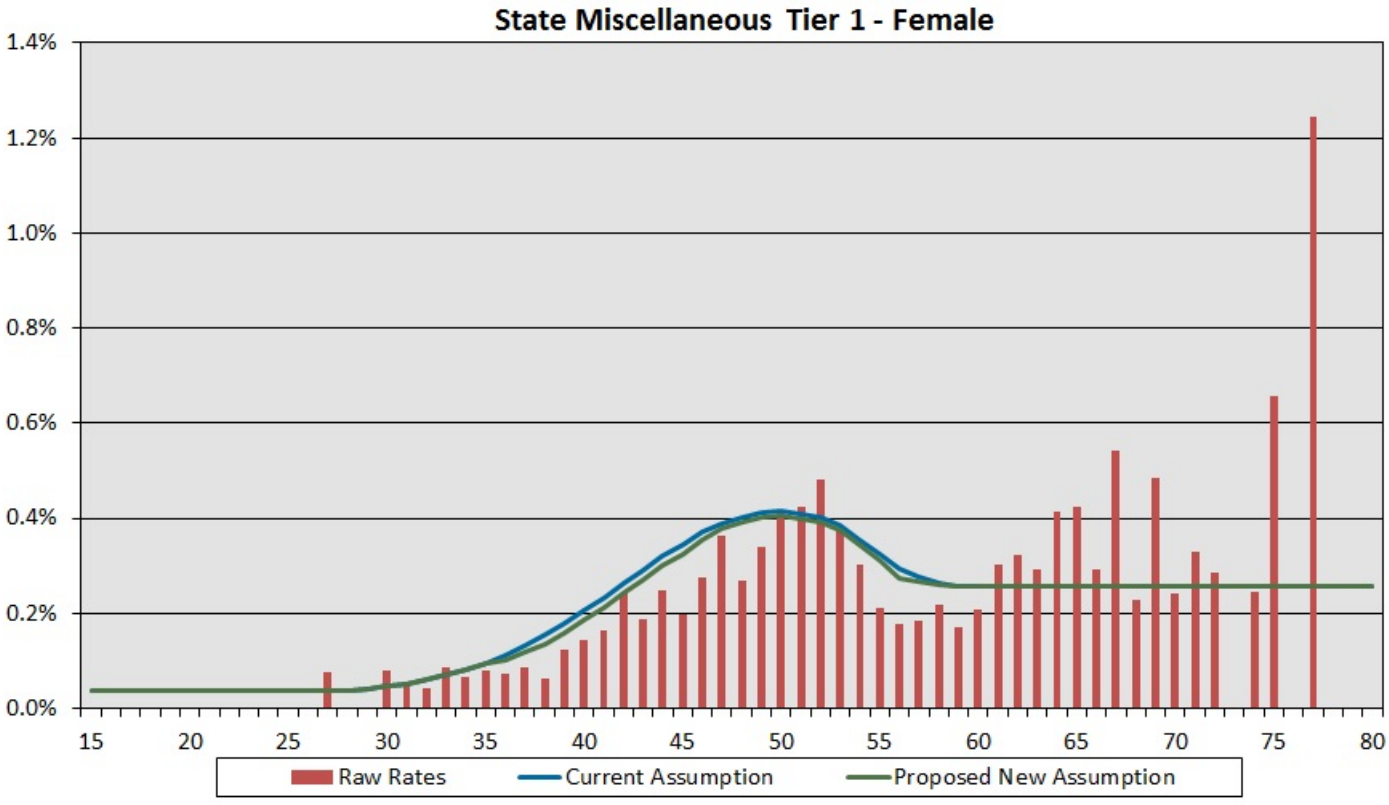




NON-INDUSTRIAL DISABILITY RETIREMENT

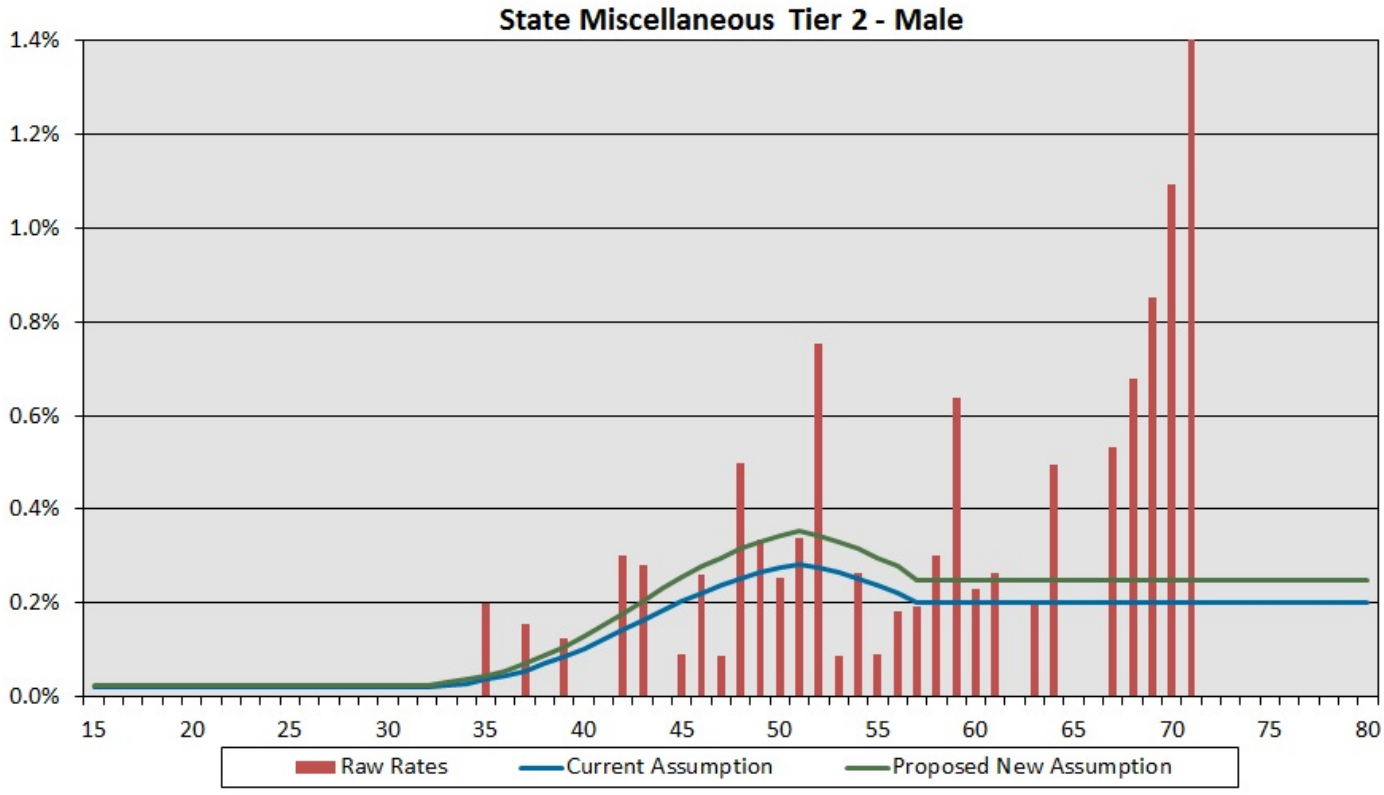
The following charts illustrate the current assumptions compared to the proposed assumptions for Non-Industrial Disability.

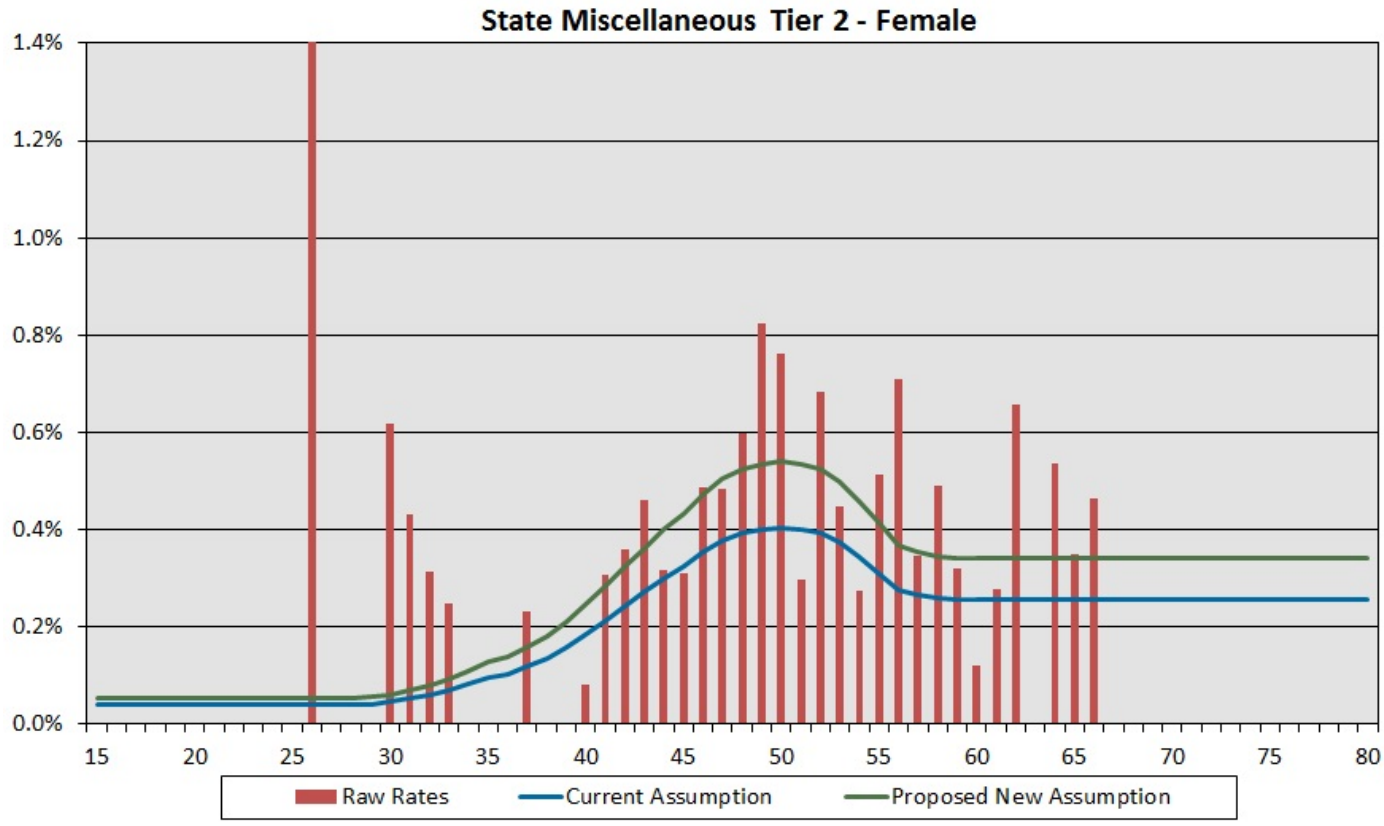




Appendix B - Summary Comparison of Assumptions (continued)

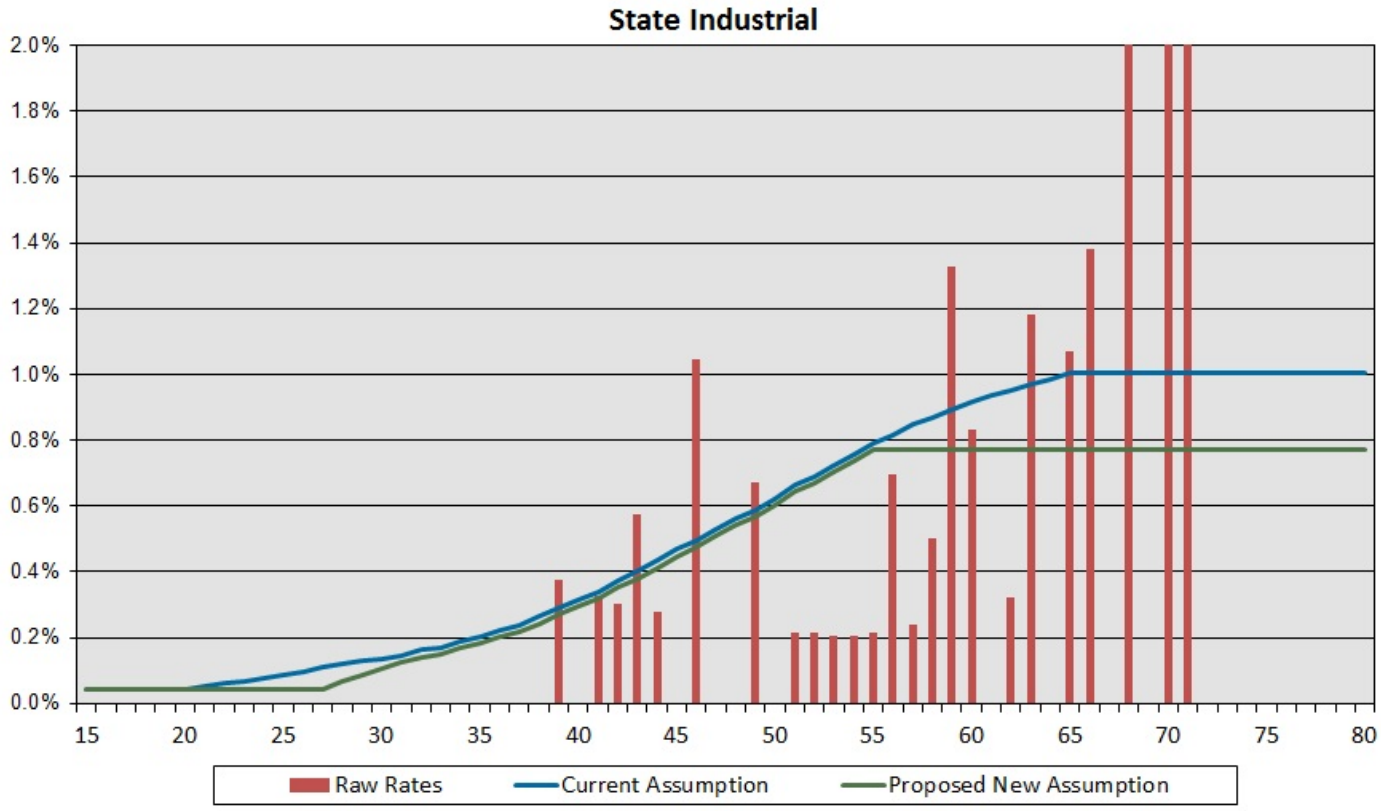
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

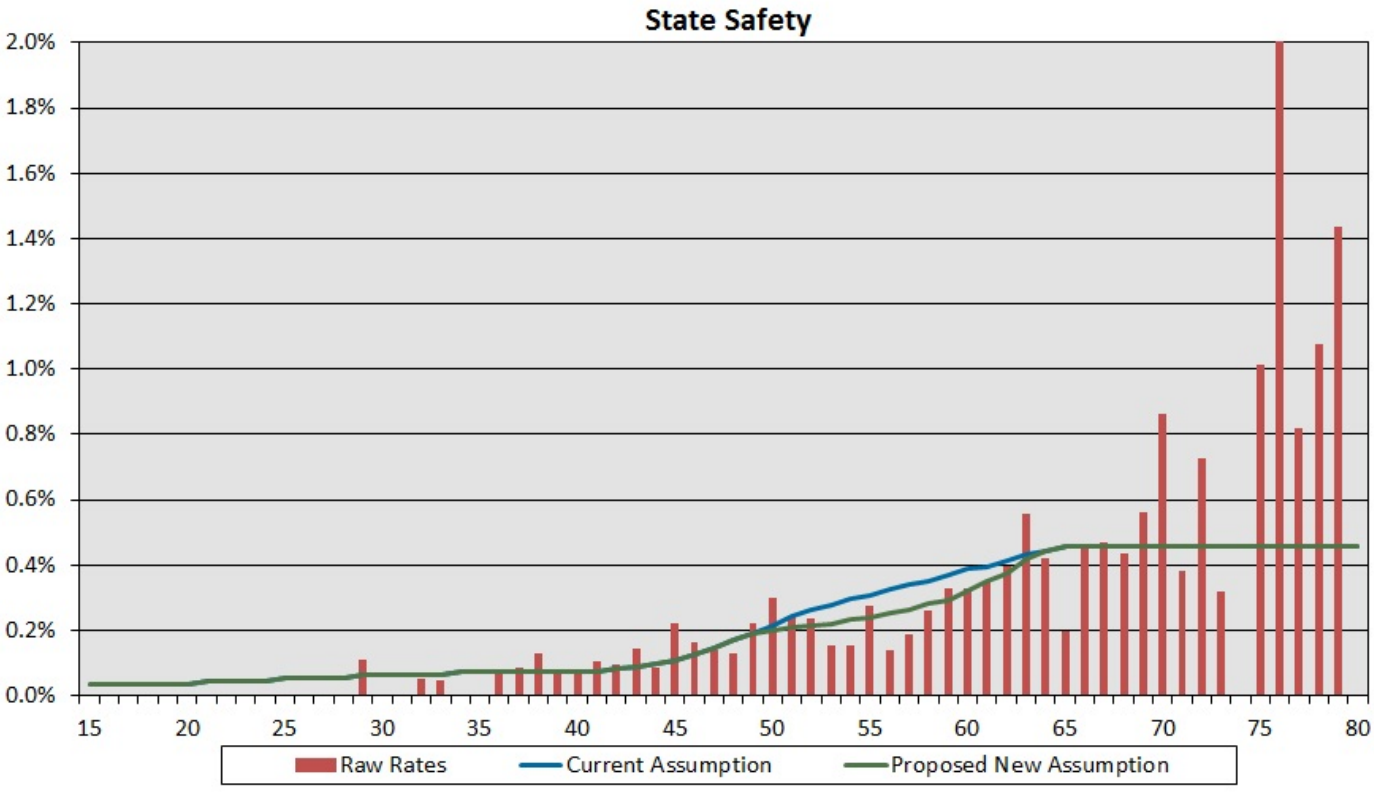




Appendix B - Summary Comparison of Assumptions (continued)

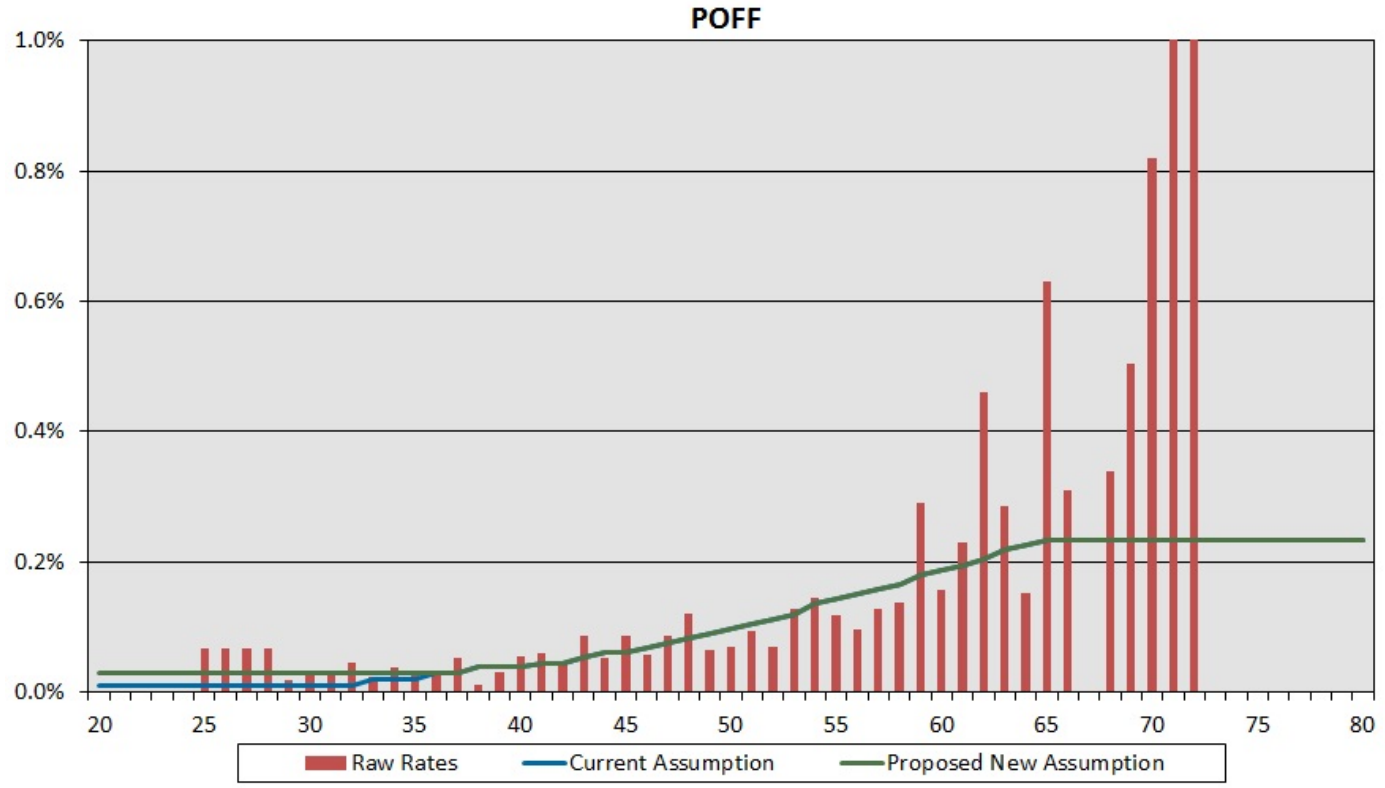
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

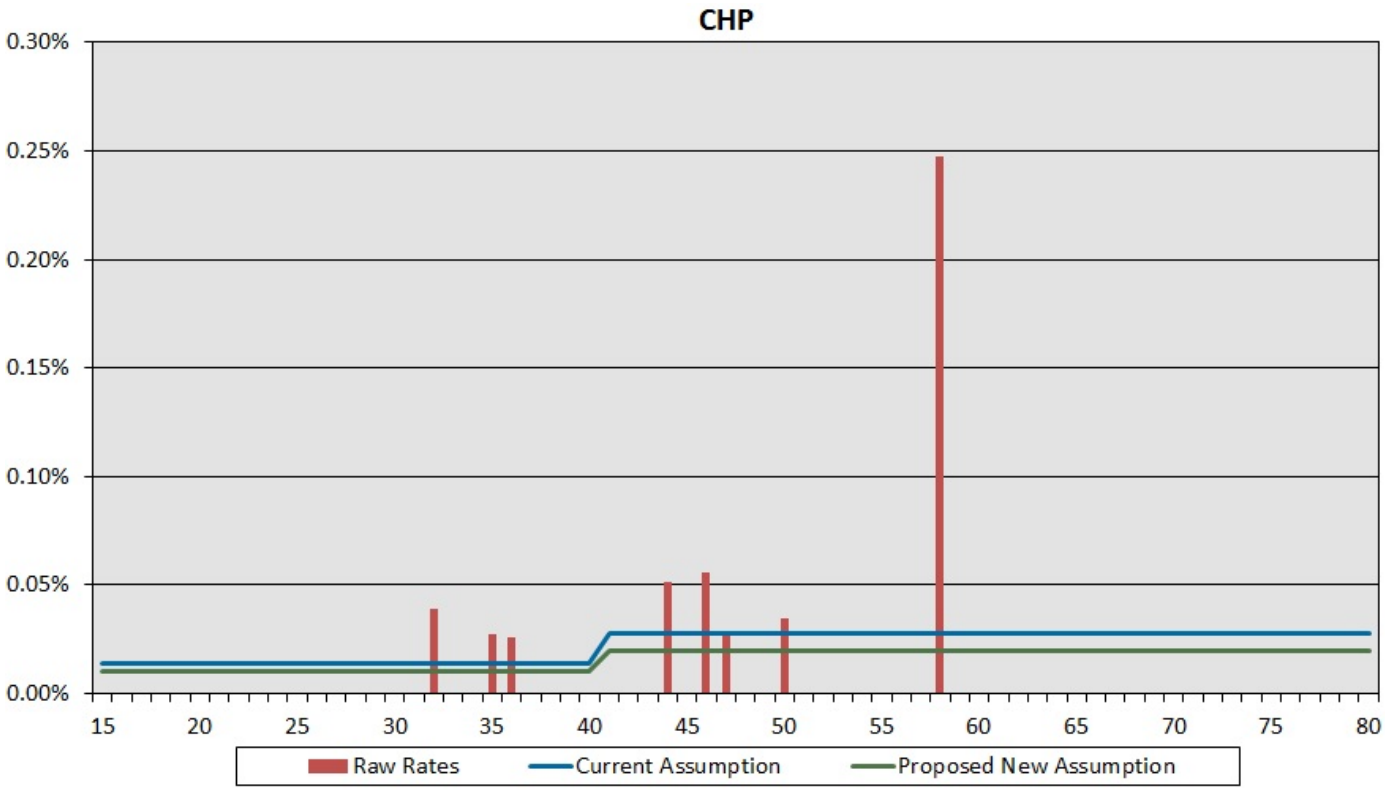




Appendix B - Summary Comparison of Assumptions (continued)

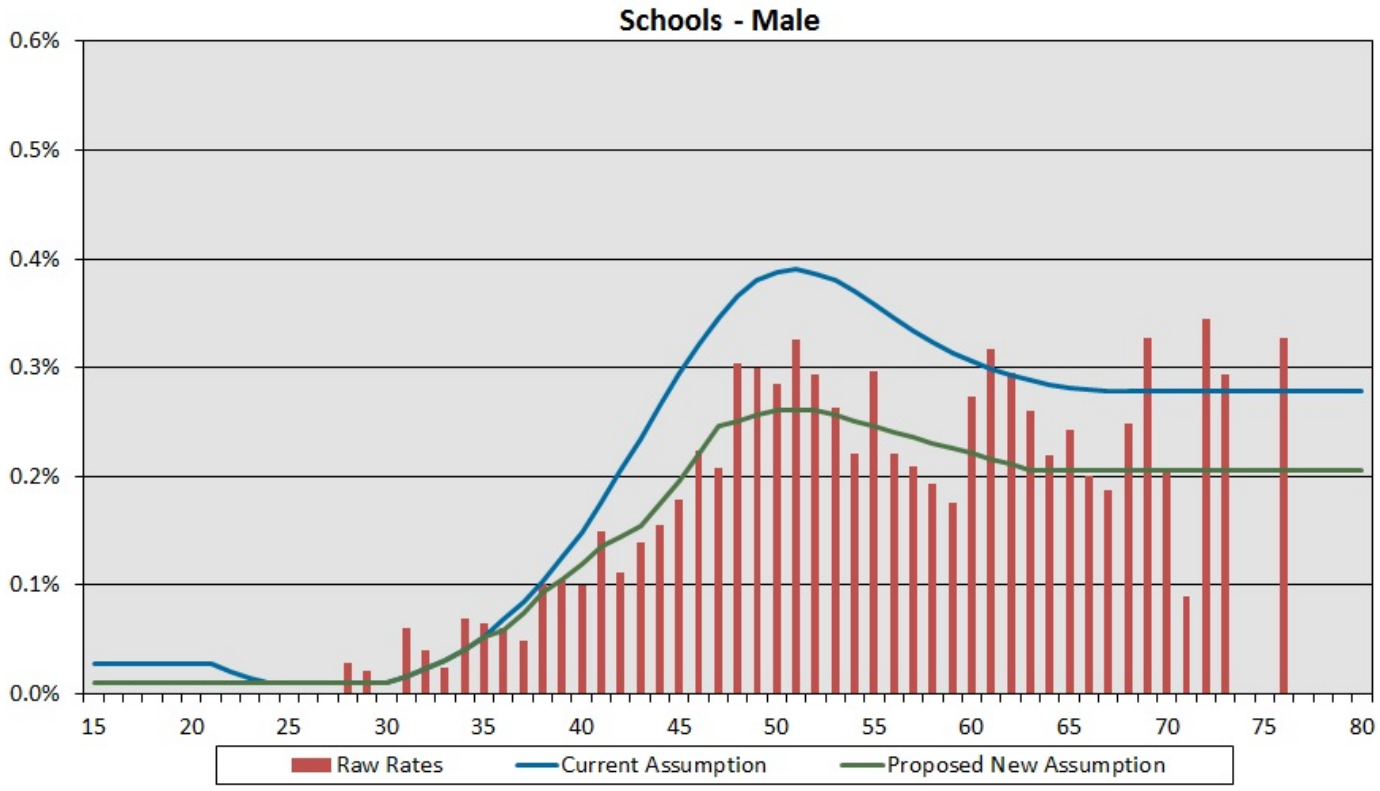
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

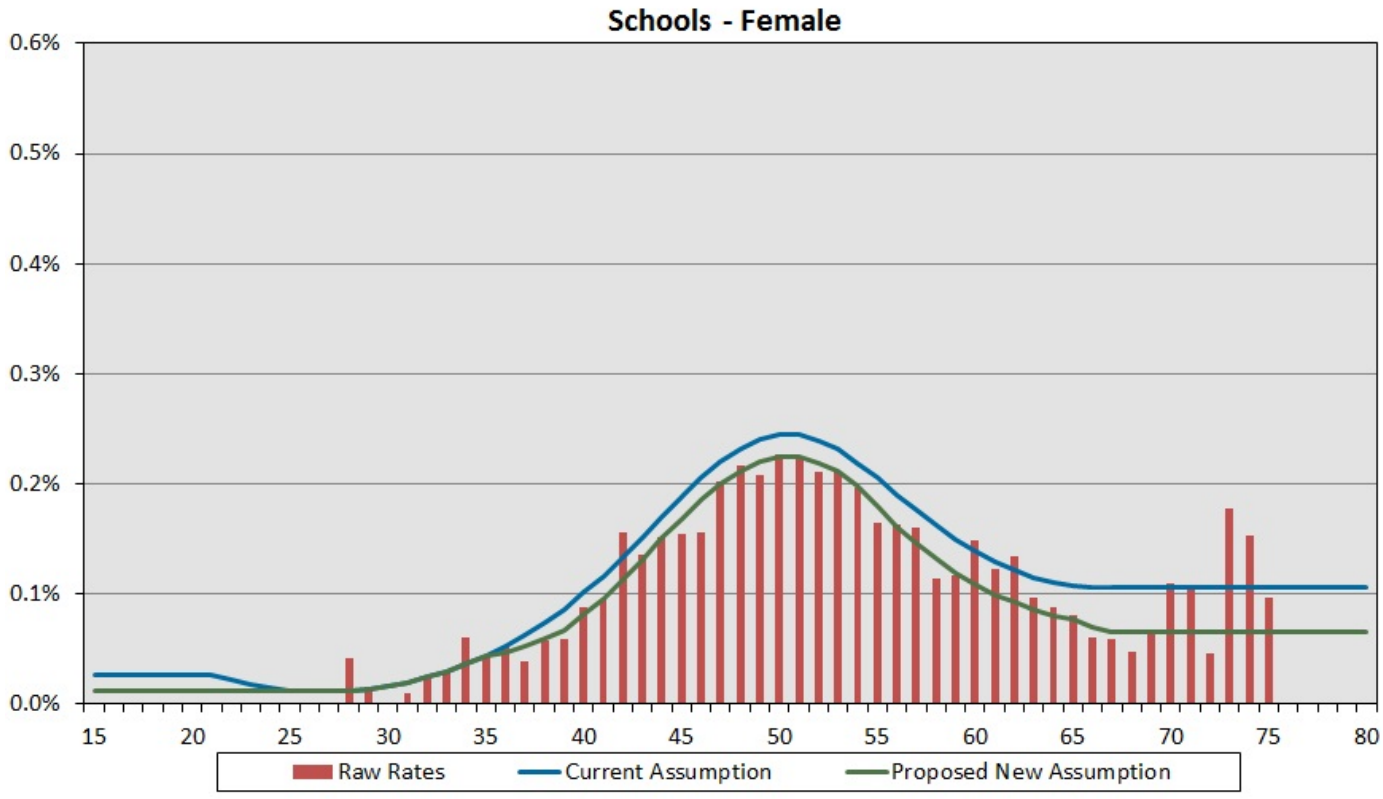




Appendix B - Summary Comparison of Assumptions (continued)

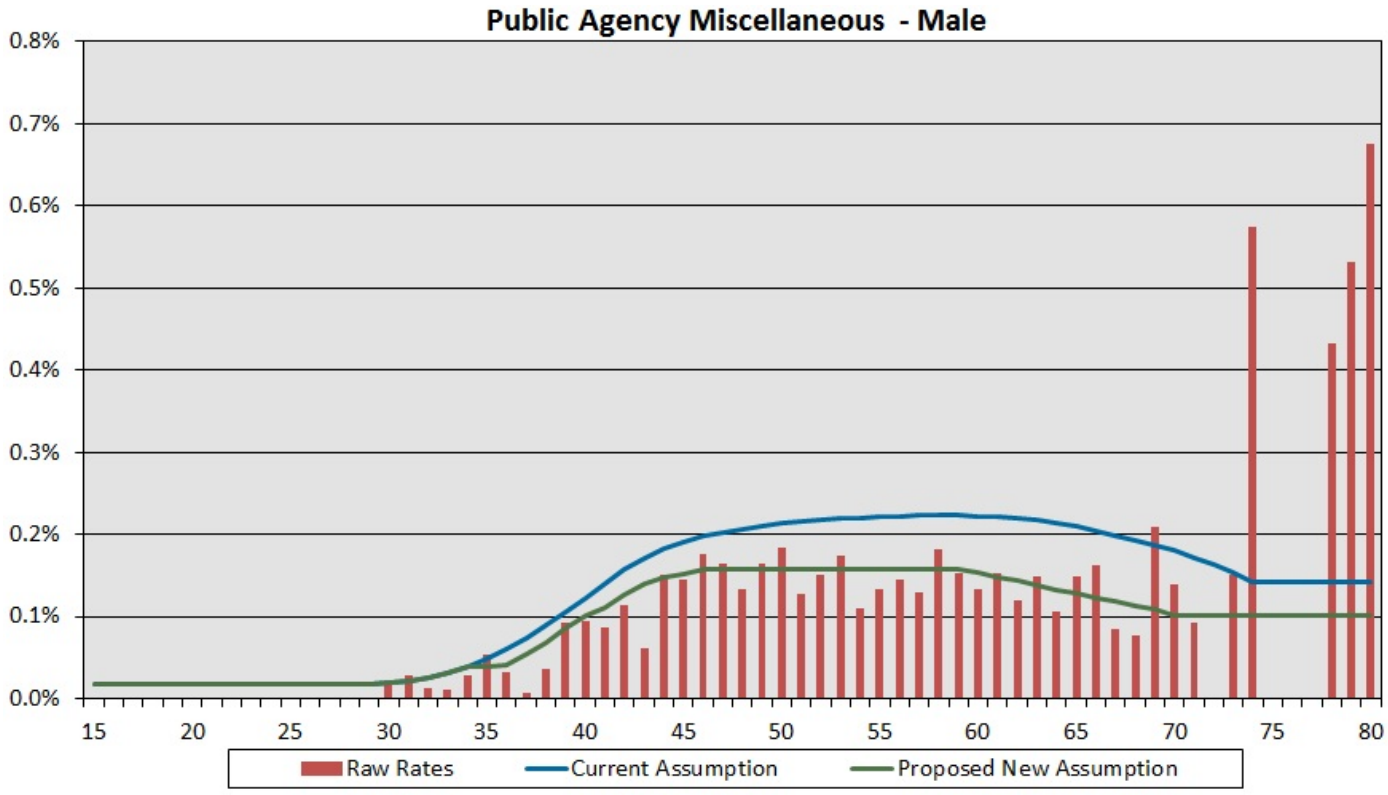
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

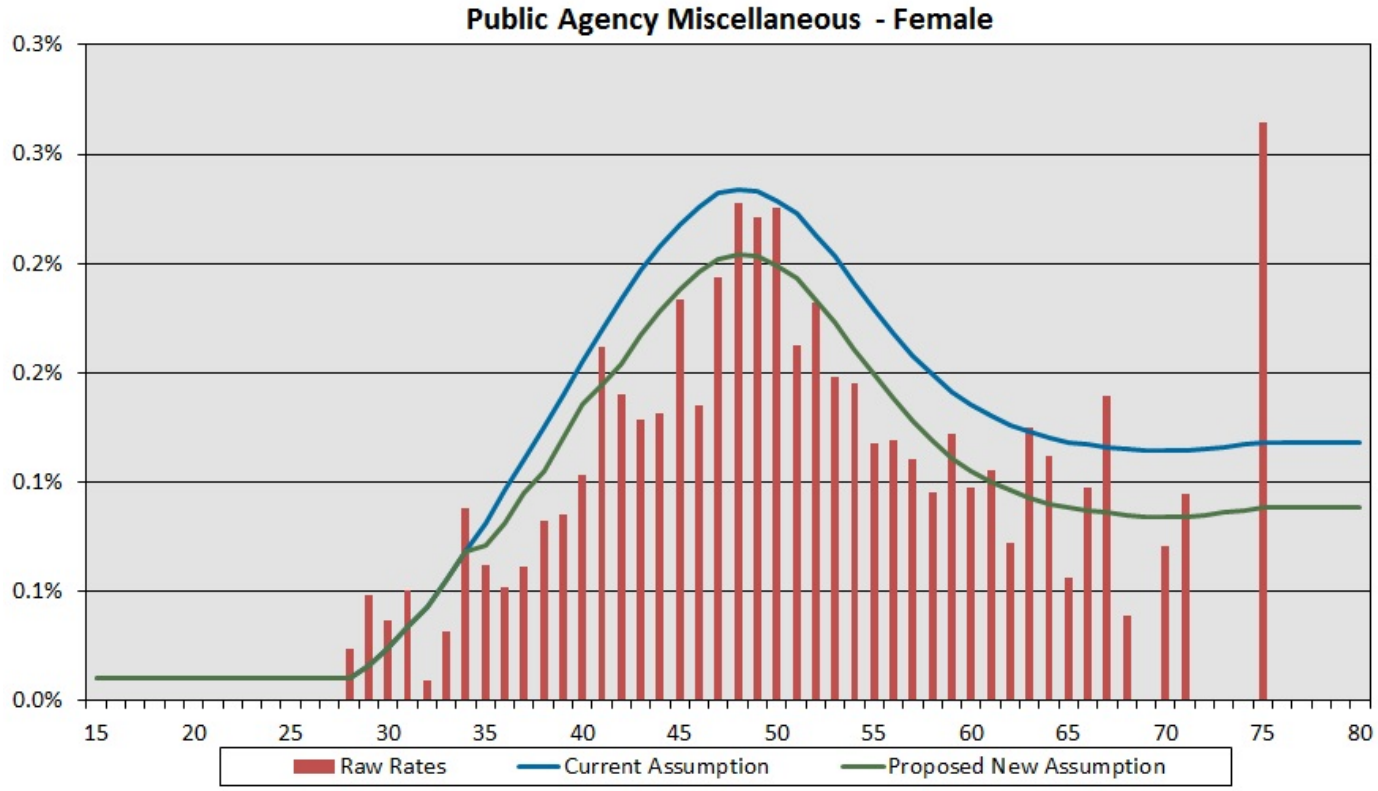




Appendix B - Summary Comparison of Assumptions (continued)

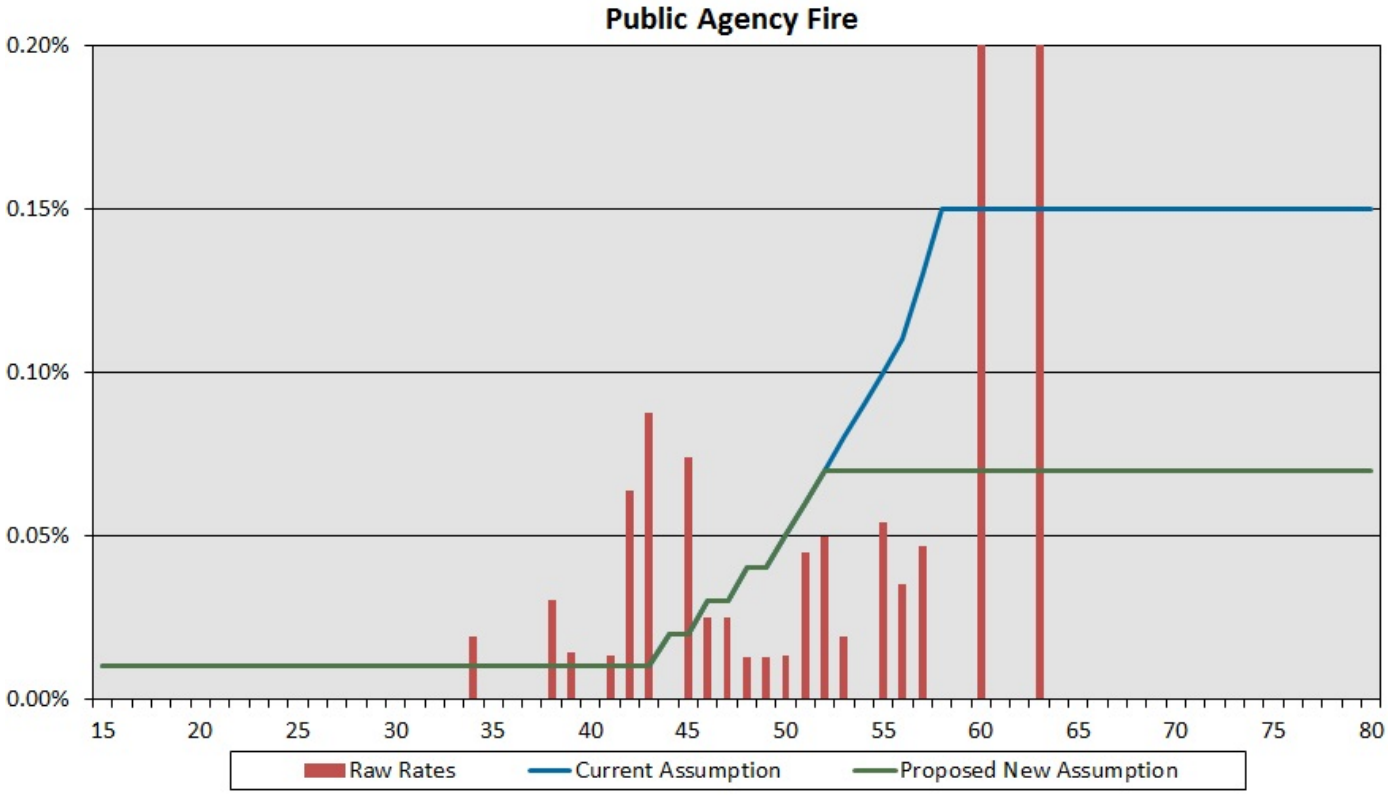
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

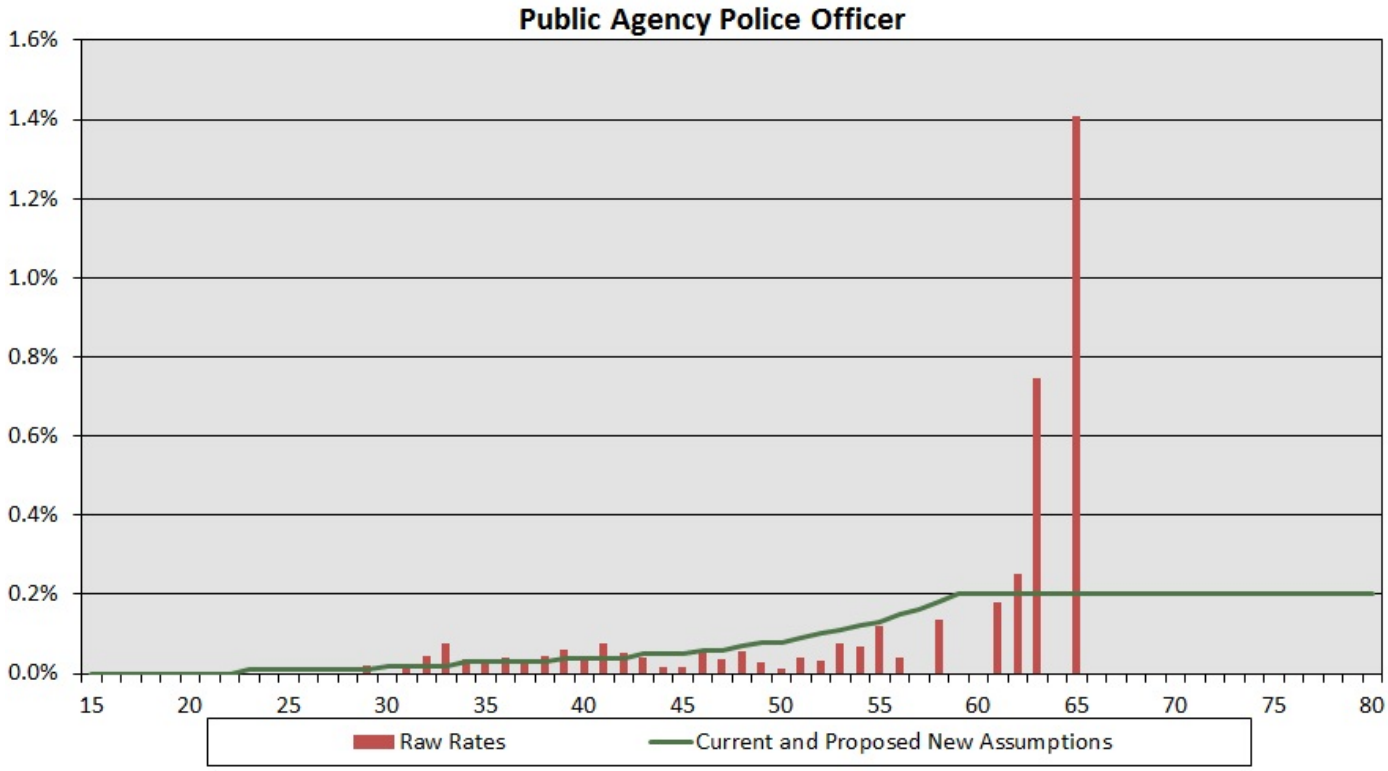




Appendix B - Summary Comparison of Assumptions (continued)

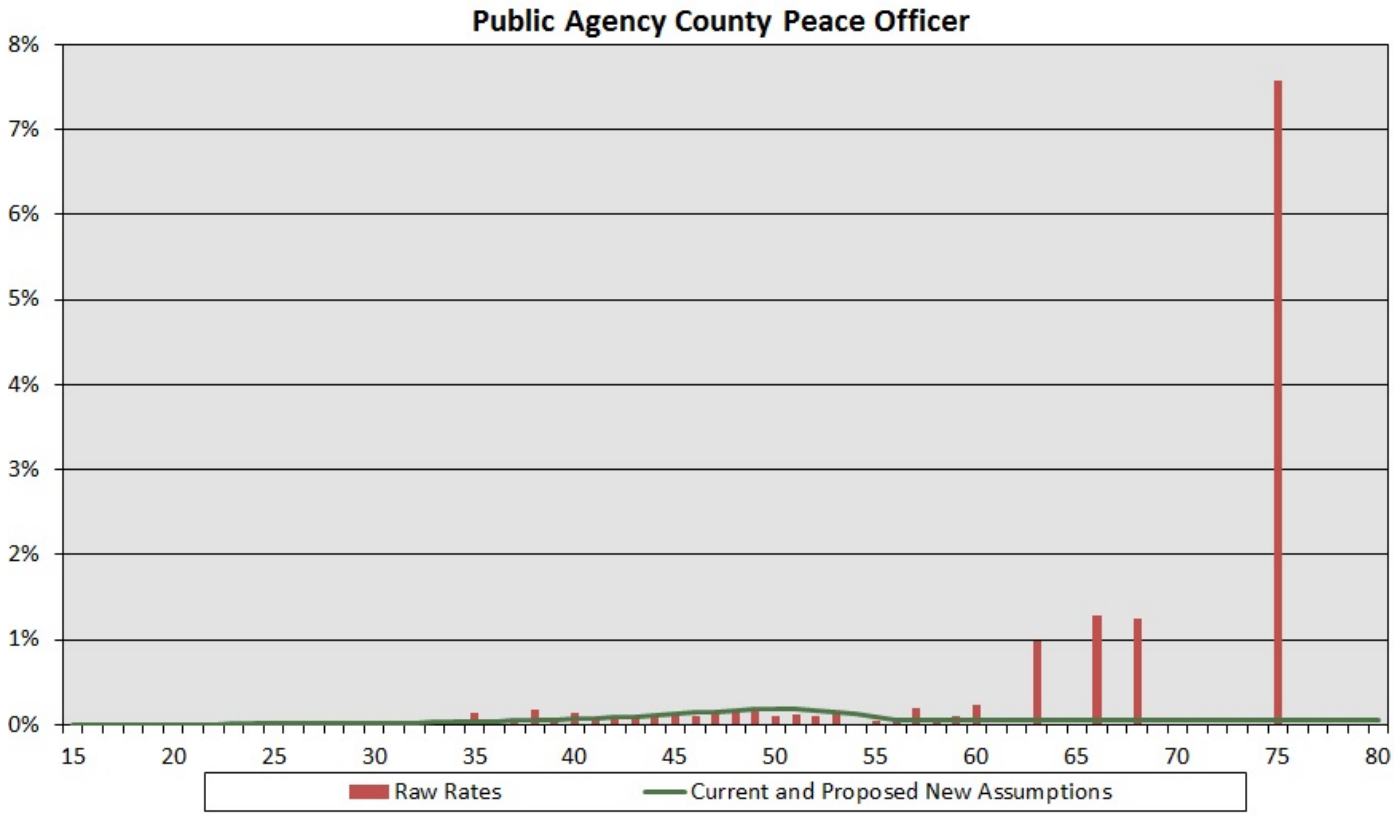
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)





Appendix B - Summary Comparison of Assumptions (continued)

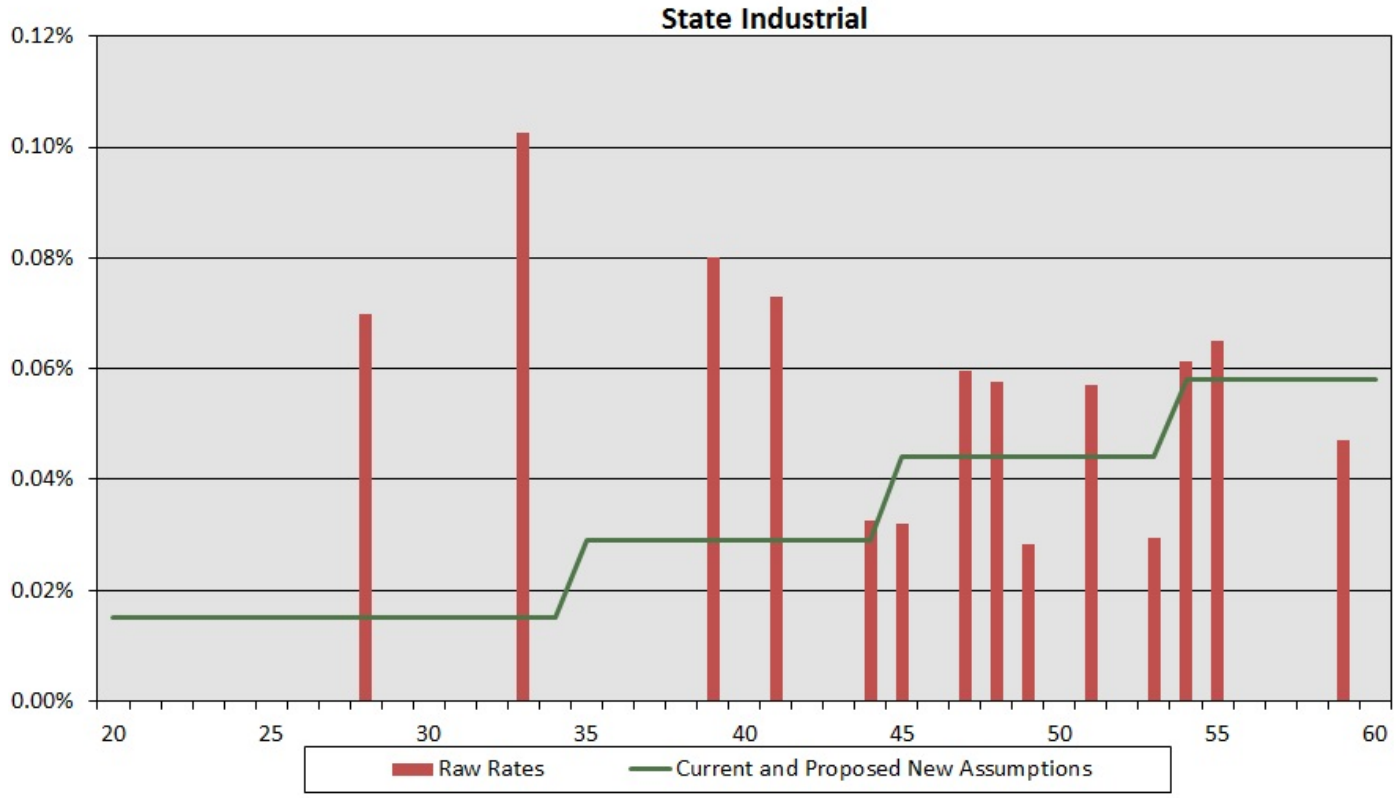
NON-INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

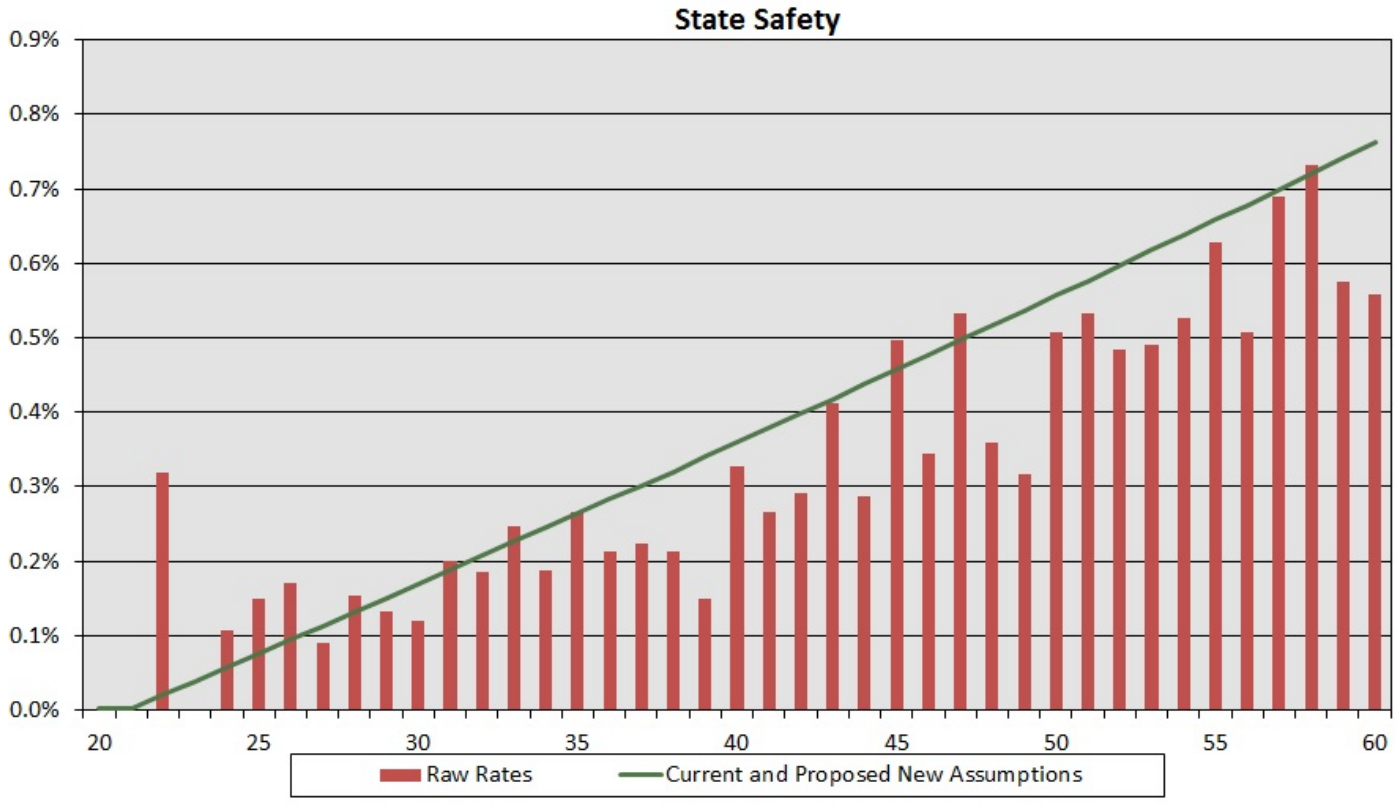


Appendix B - Summary Comparison of Assumptions (continued)

INDUSTRIAL DISABILITY RETIREMENT

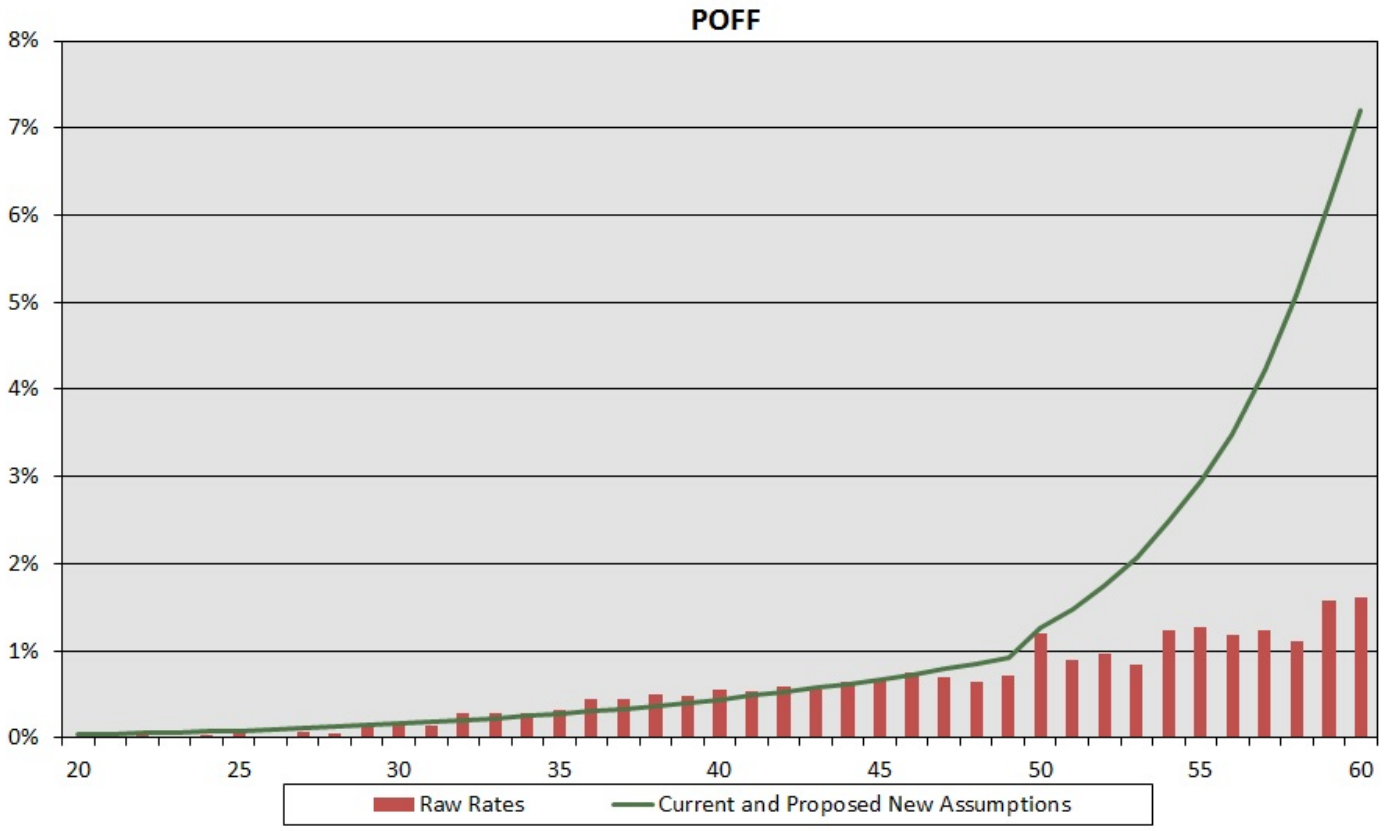
The following charts illustrate the current assumptions compared to the proposed assumptions for Industrial Disability.

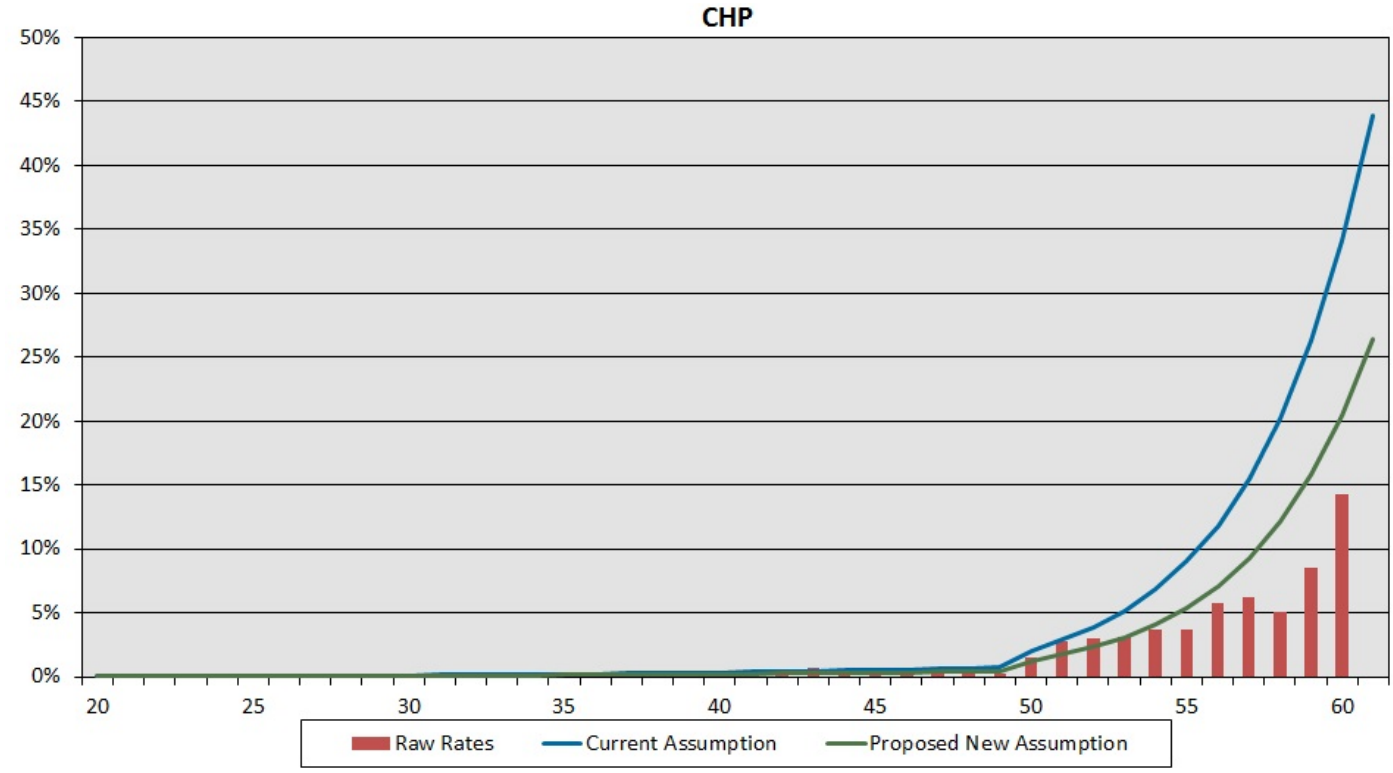




Appendix B - Summary Comparison of Assumptions (continued)

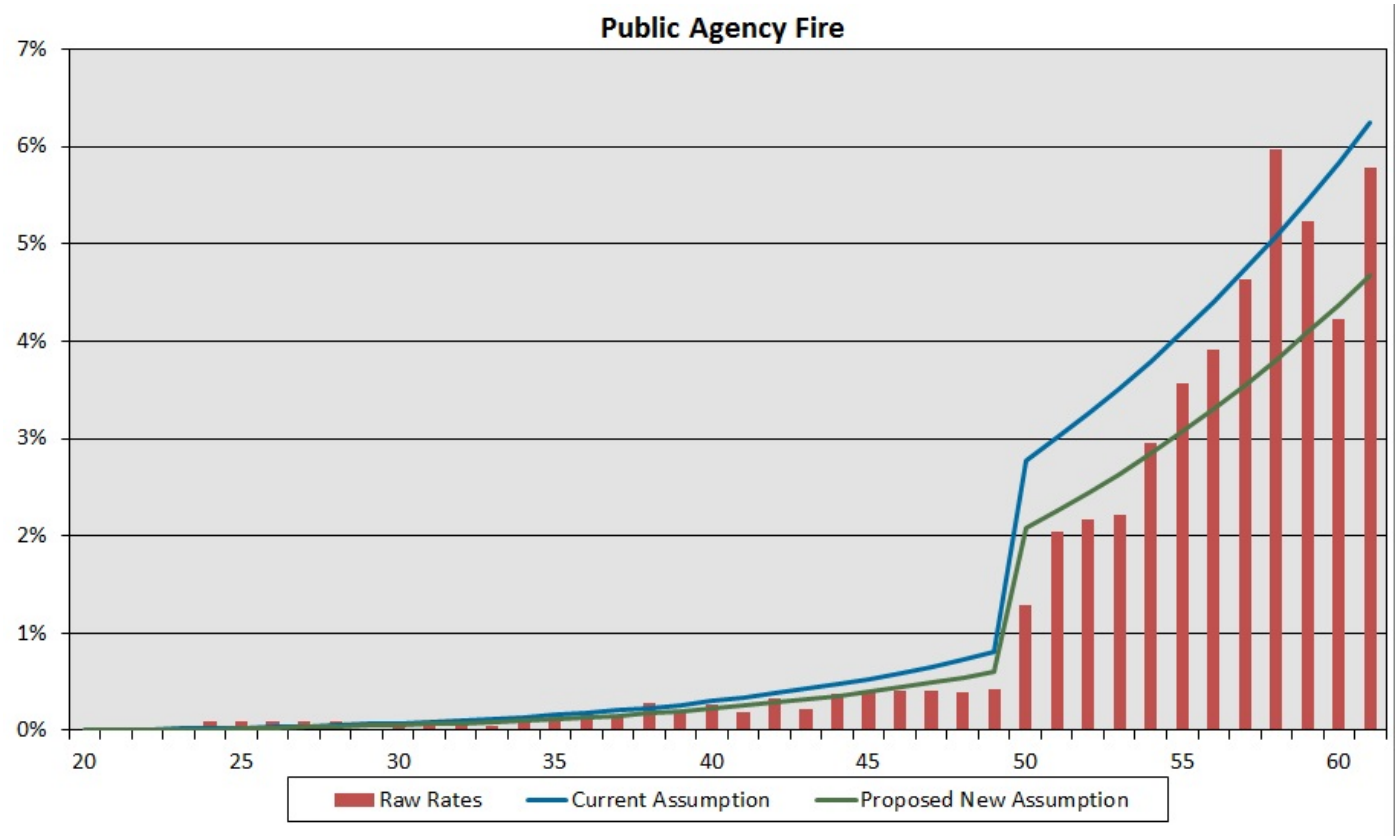
INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

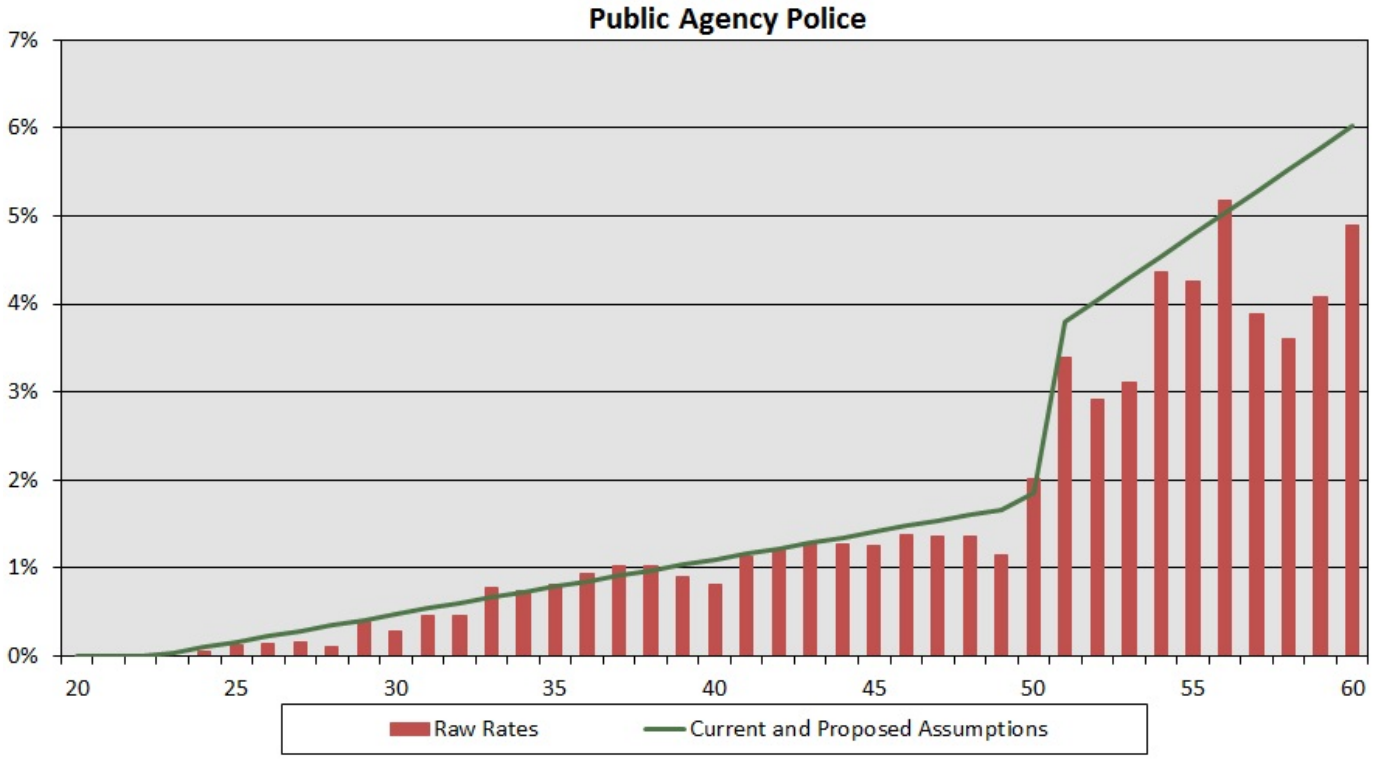




Appendix B - Summary Comparison of Assumptions (continued)

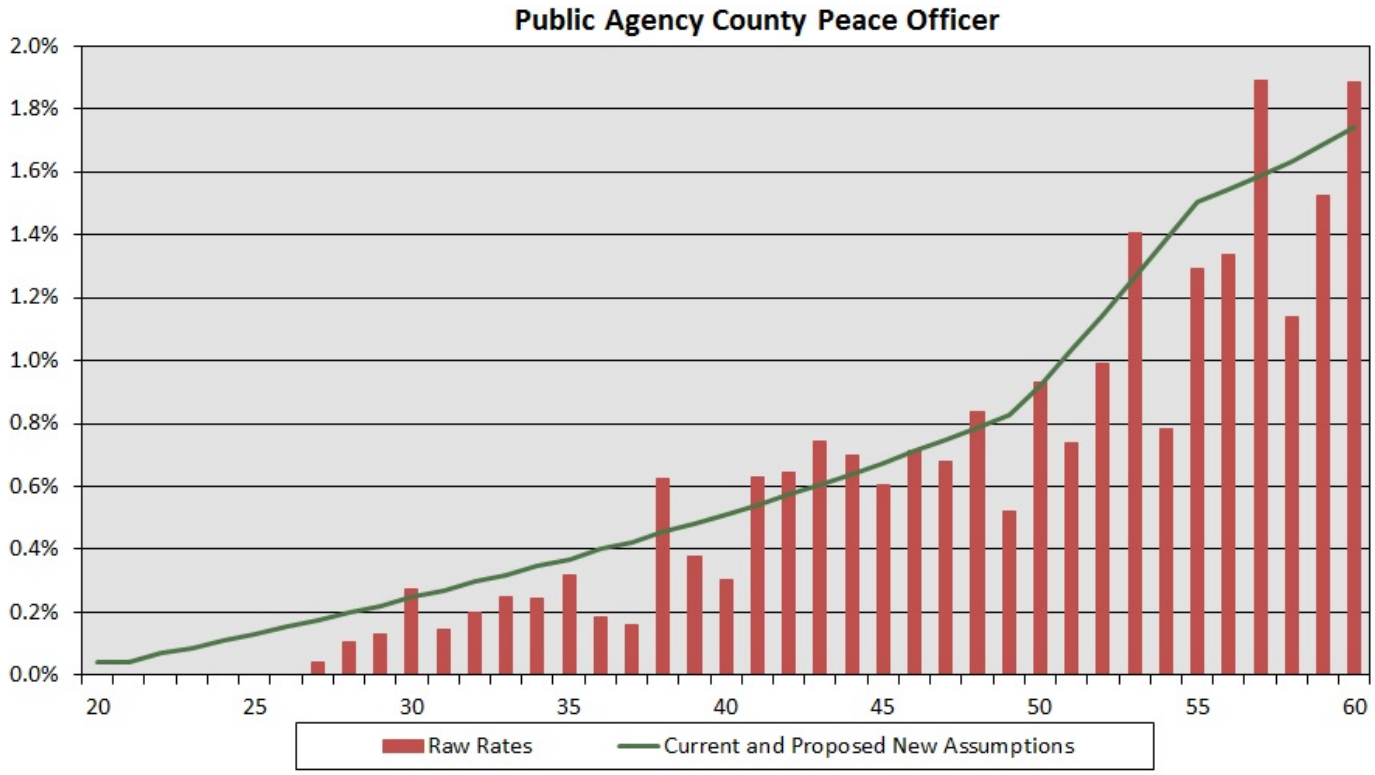
INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)





Appendix B - Summary Comparison of Assumptions (continued)

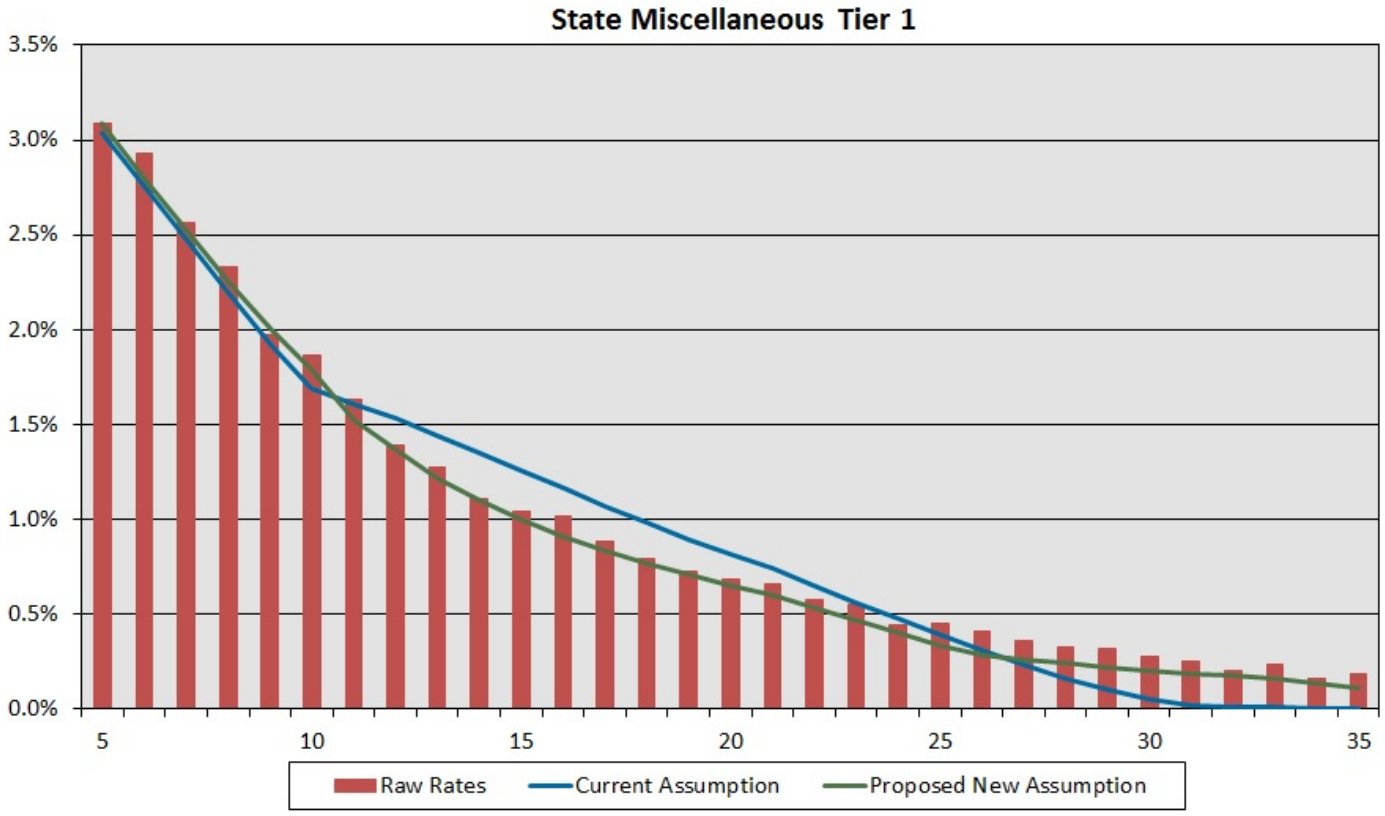
INDUSTRIAL DISABILITY RETIREMENT (CONTINUED)

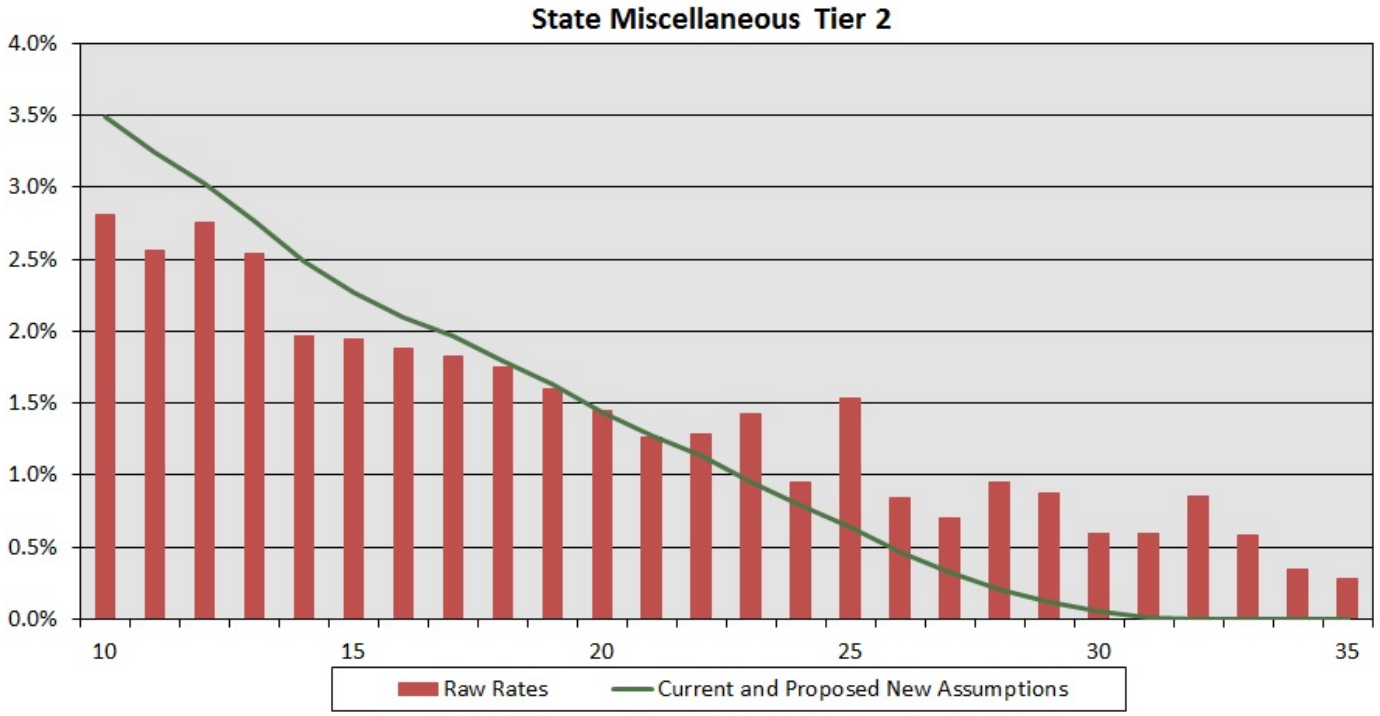


Appendix B - Summary Comparison of Assumptions (continued)

TERMINATIONS WITH VESTED BENEFITS

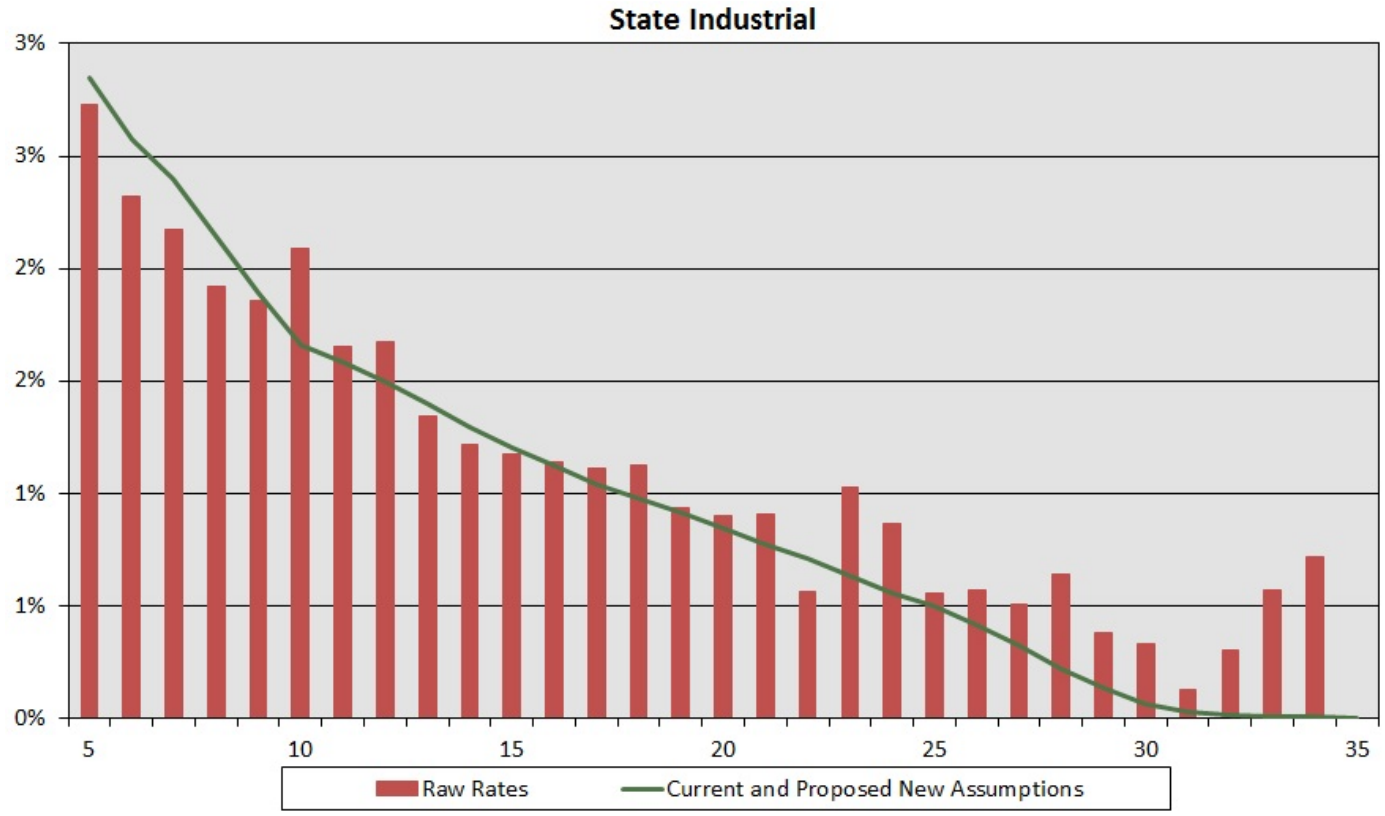
The following charts illustrate the current assumptions compared to the proposed assumptions for Vested Terminations.

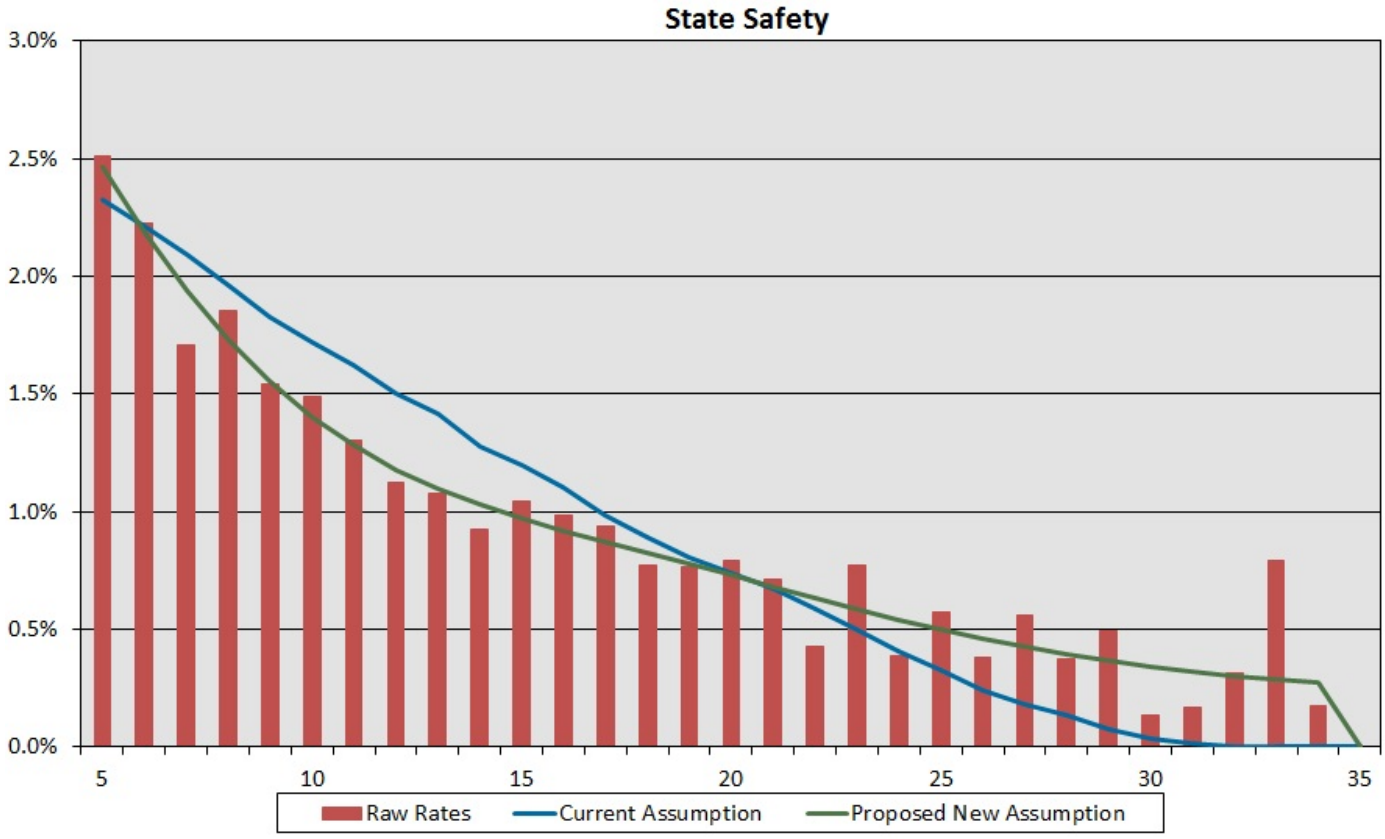




Appendix B - Summary Comparison of Assumptions (continued)

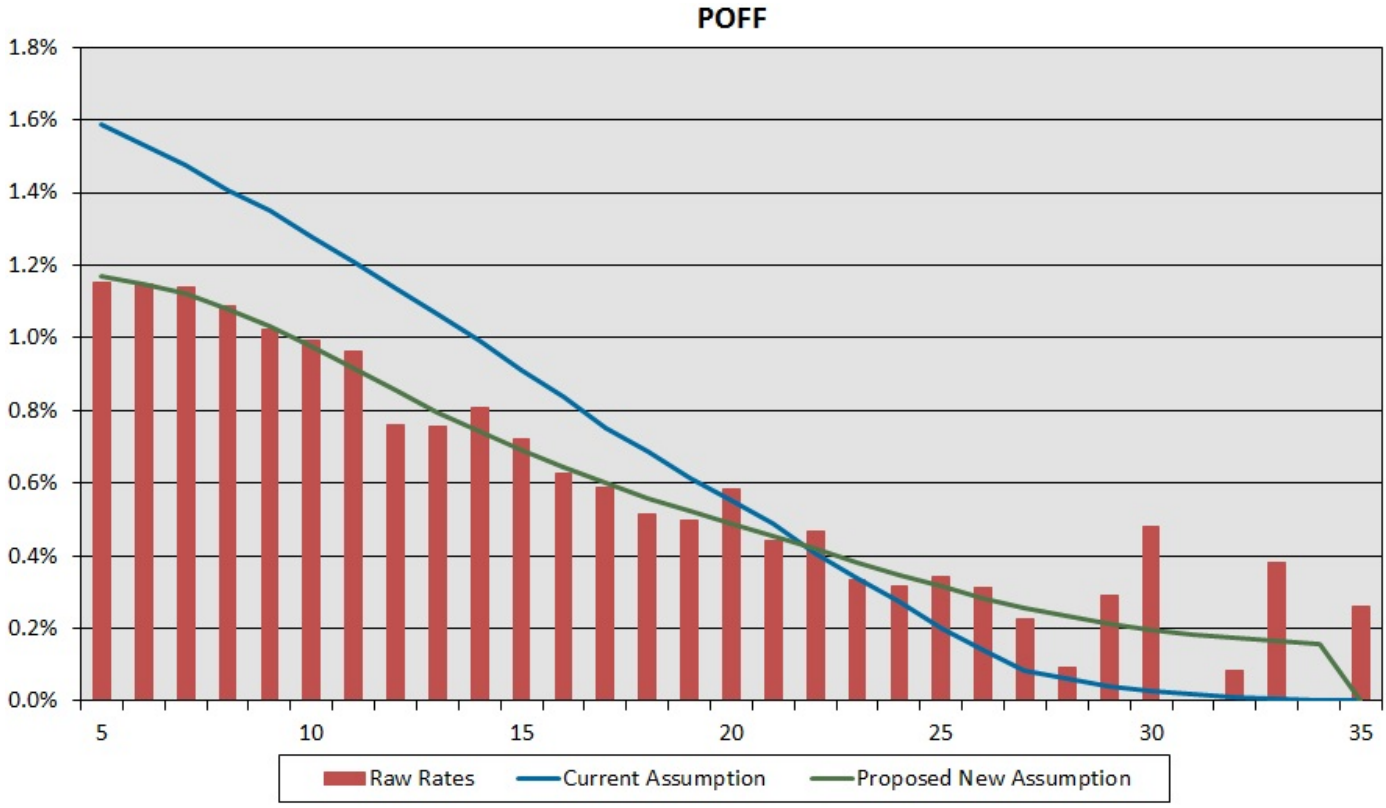
TERMINATIONS WITH VESTED BENEFITS (CONTINUED)

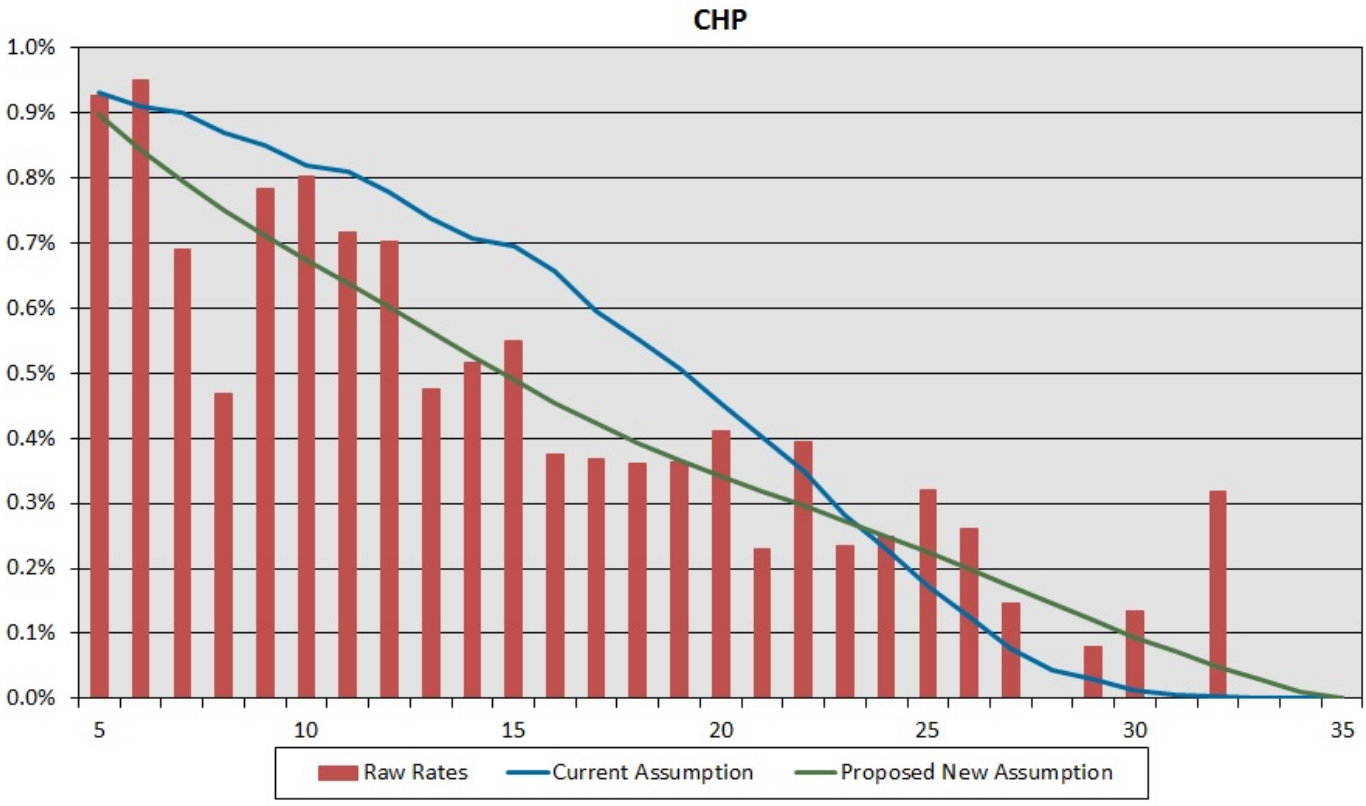




Appendix B - Summary Comparison of Assumptions (continued)

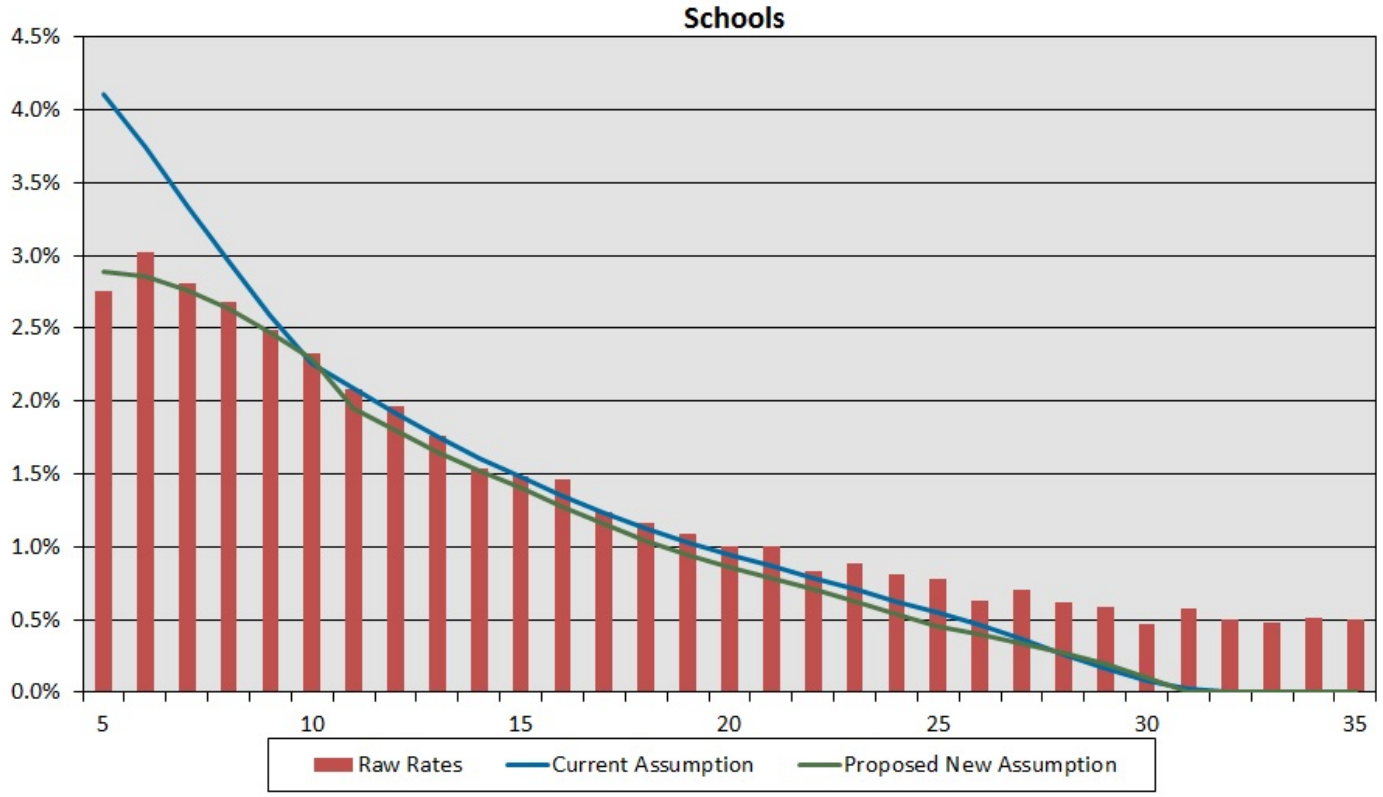
TERMINATIONS WITH VESTED BENEFITS (CONTINUED)

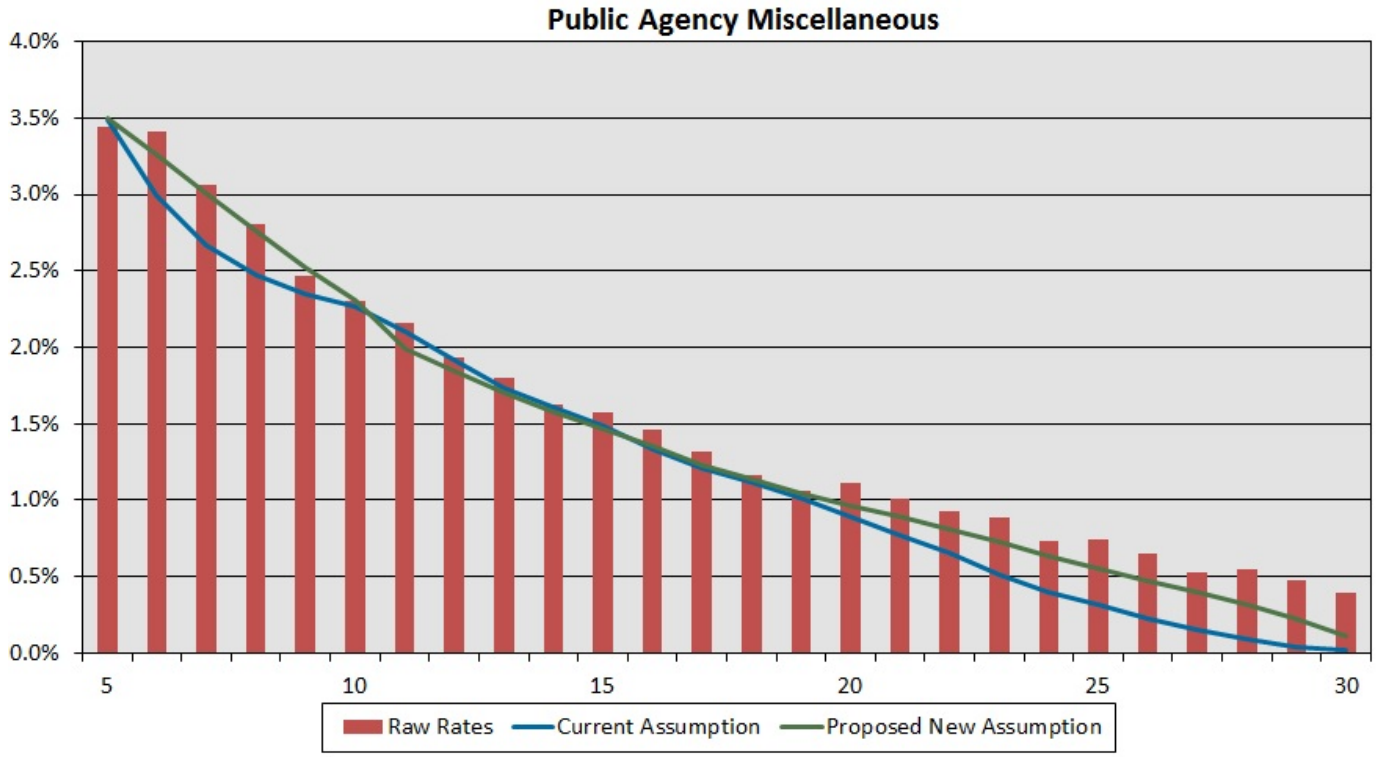




Appendix B - Summary Comparison of Assumptions (continued)

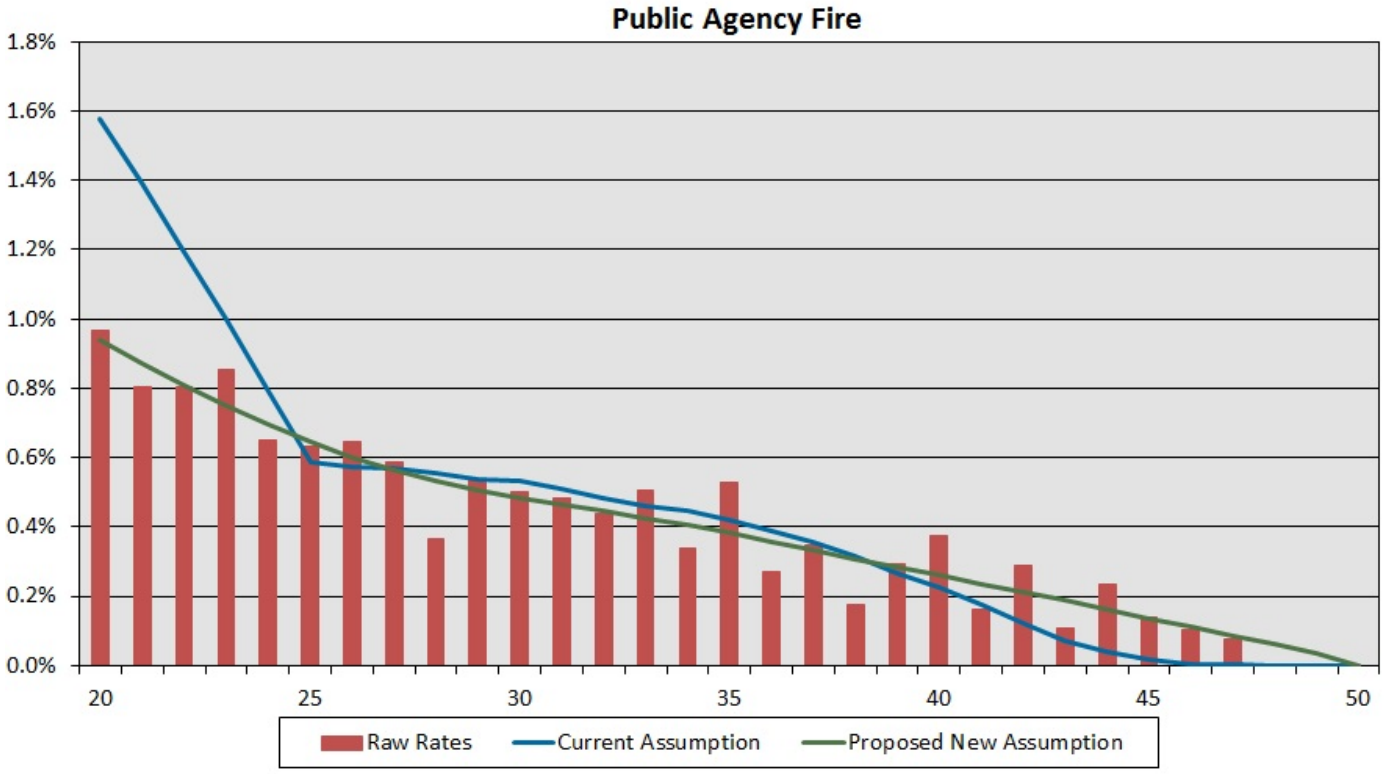
TERMINATIONS WITH VESTED BENEFITS (CONTINUED)

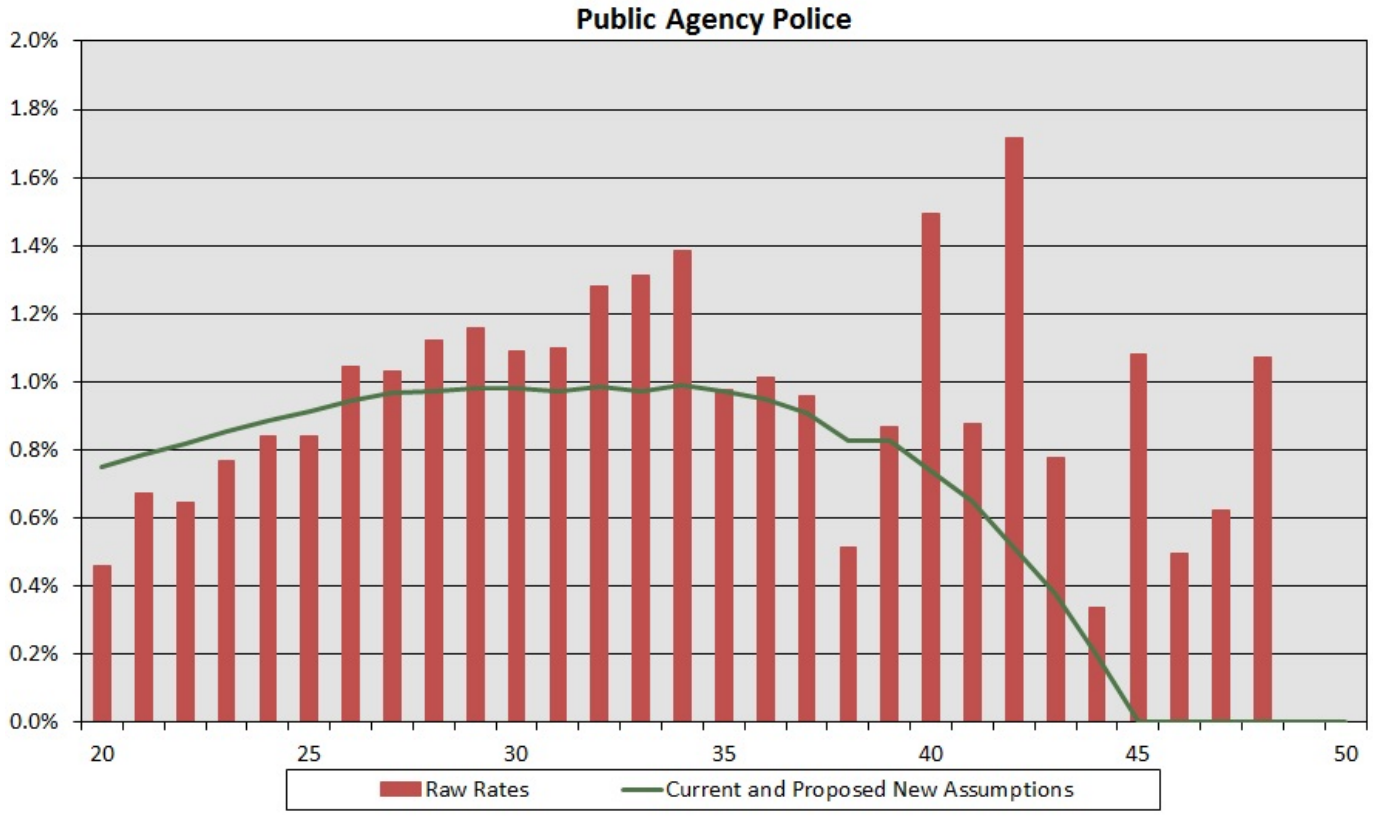




Appendix B - Summary Comparison of Assumptions (continued)

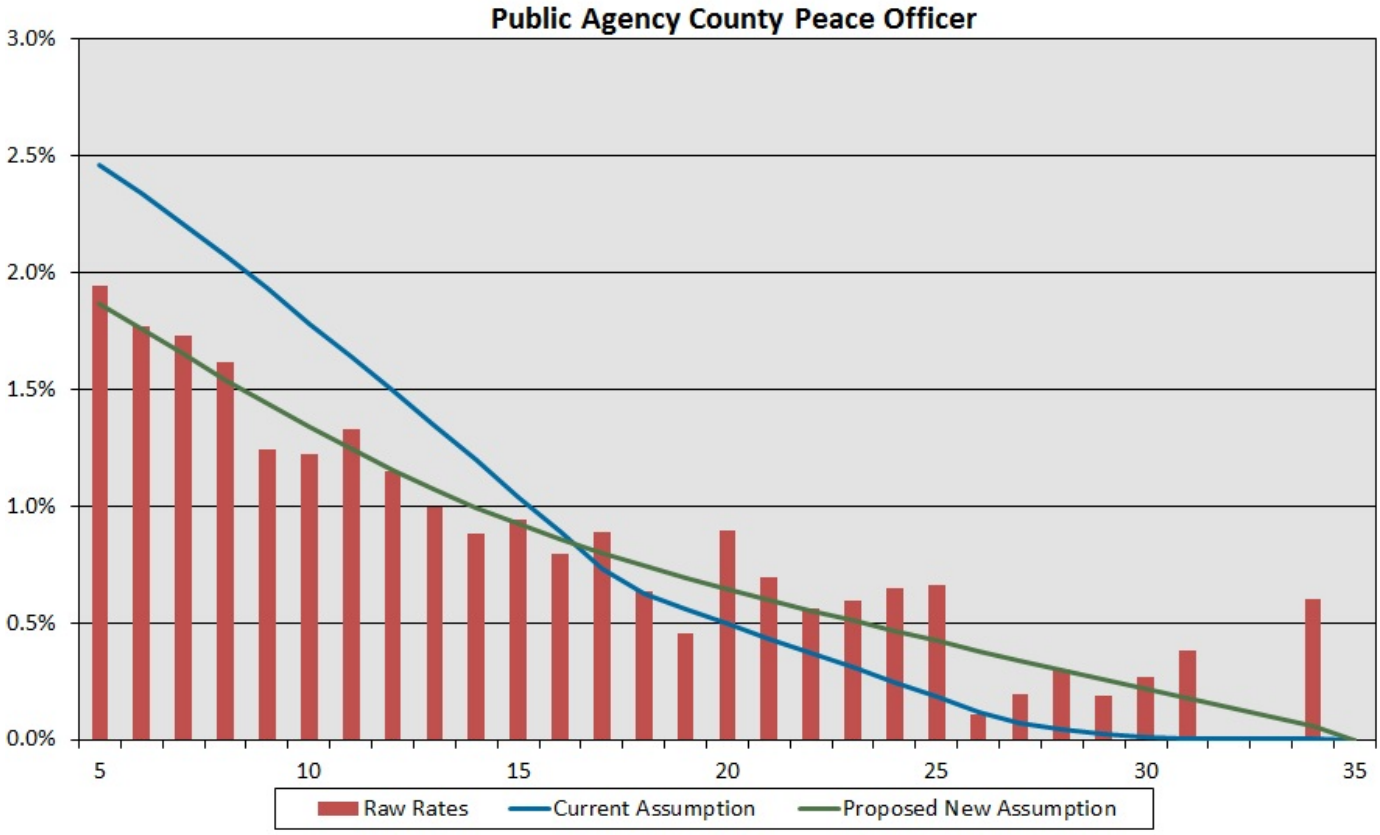
TERMINATIONS WITH VESTED BENEFITS (CONTINUED)





Appendix B - Summary Comparison of Assumptions (continued)

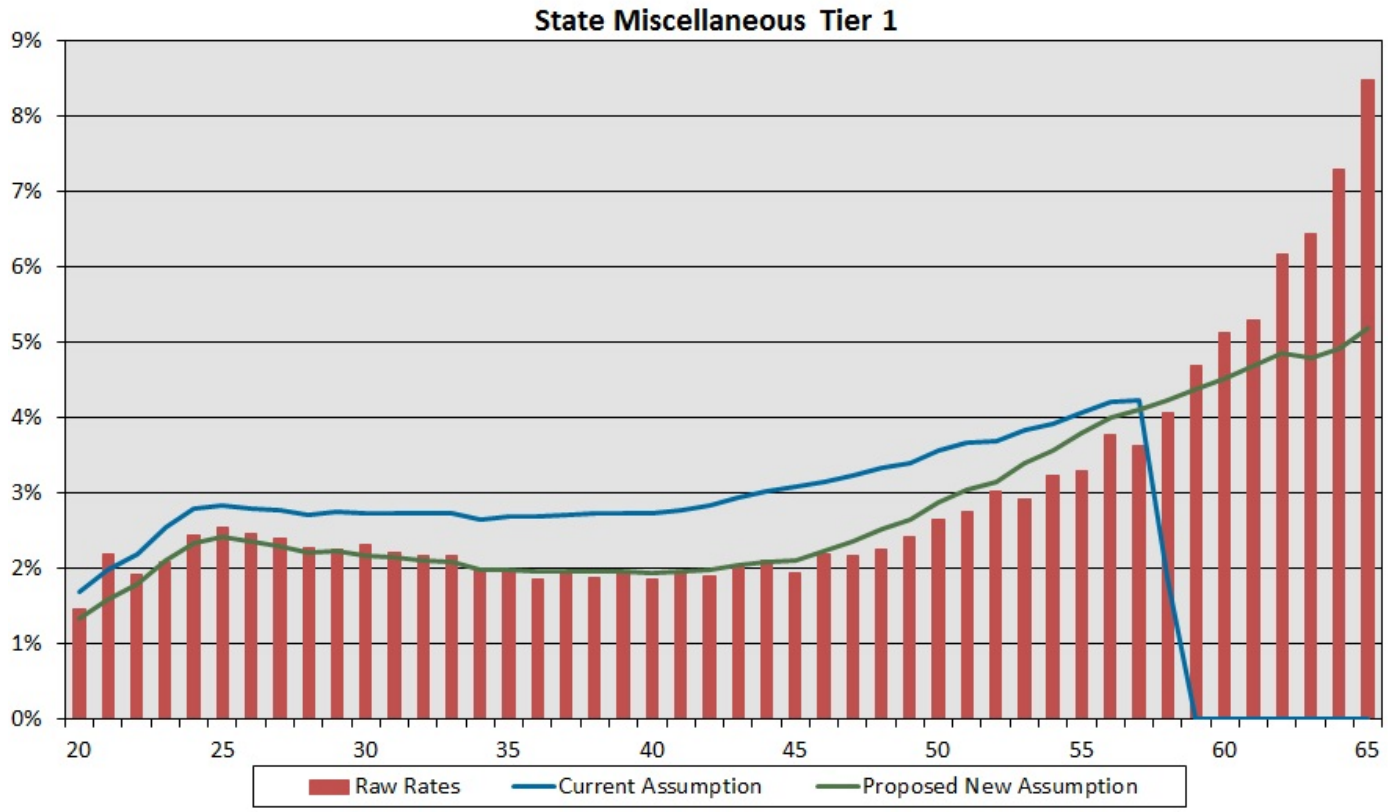
TERMINATIONS WITH VESTED BENEFITS (CONTINUED)

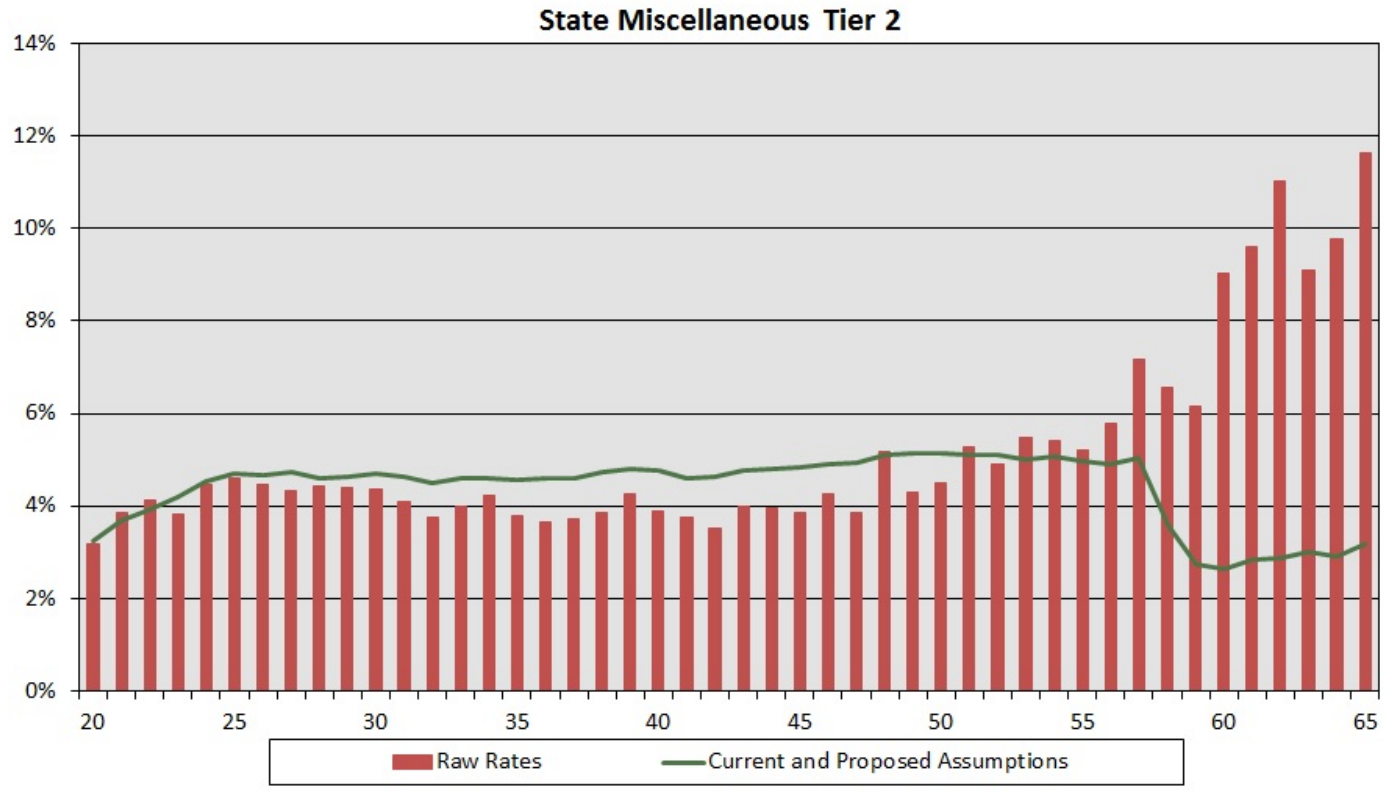


Appendix B - Summary Comparison of Assumptions (continued)

TERMINATIONS WITH REFUNDS

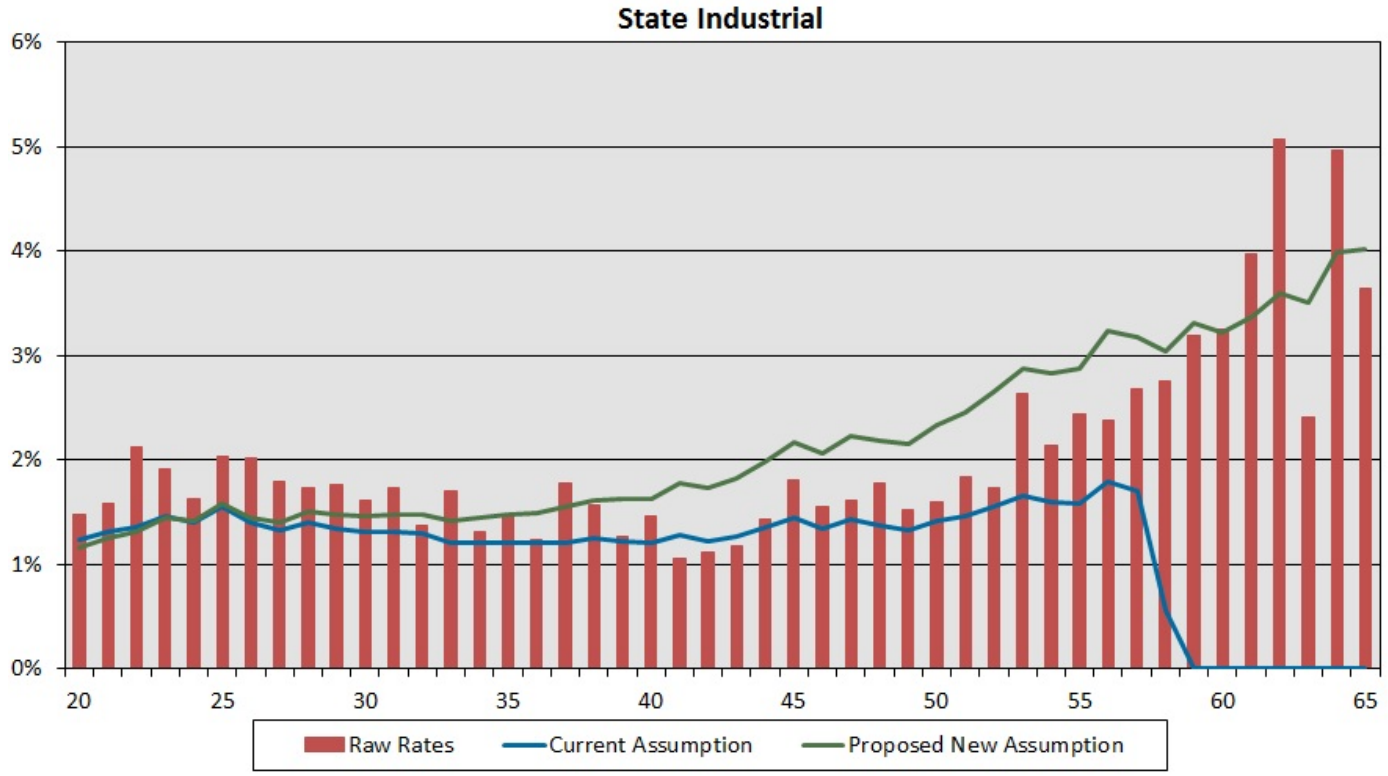
The following charts illustrate the current assumptions compared to the proposed assumptions for Vested Refunds.

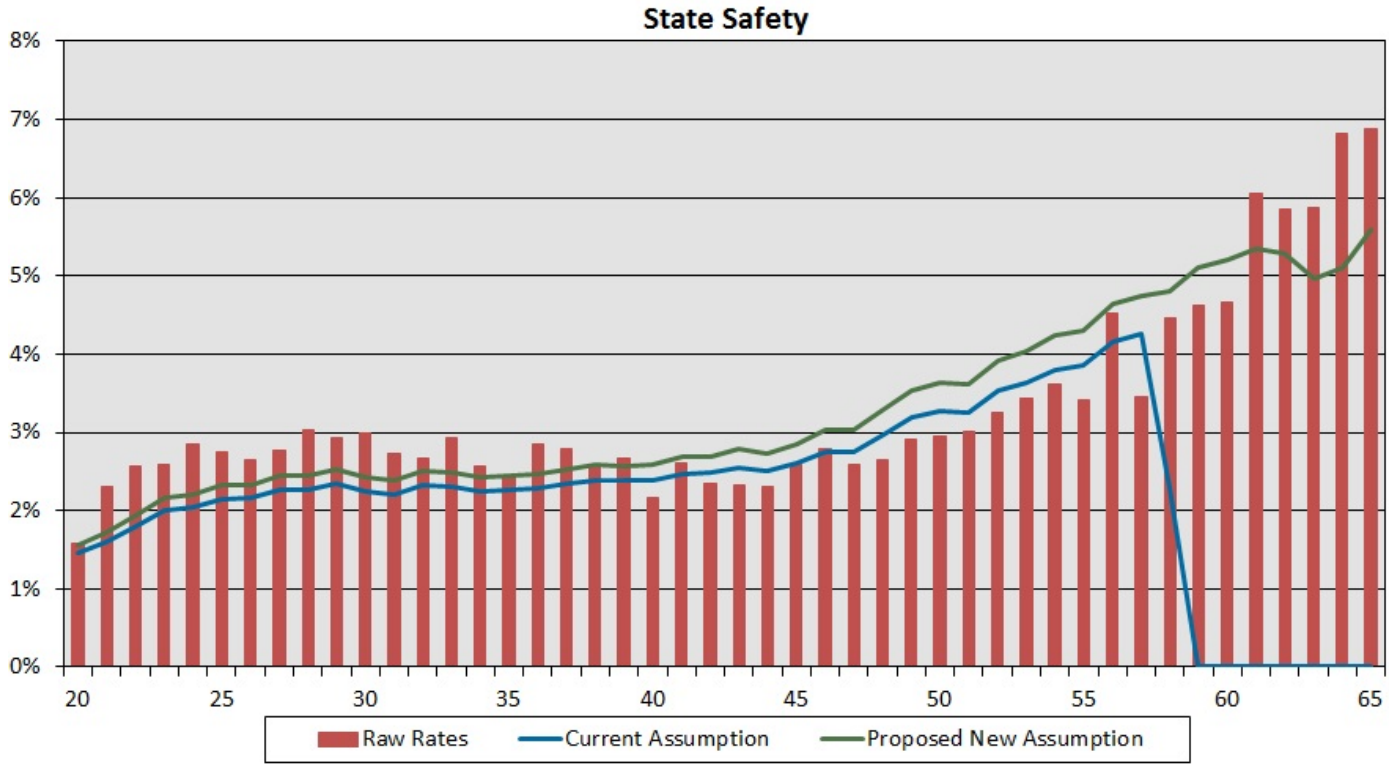




Appendix B - Summary Comparison of Assumptions (continued)

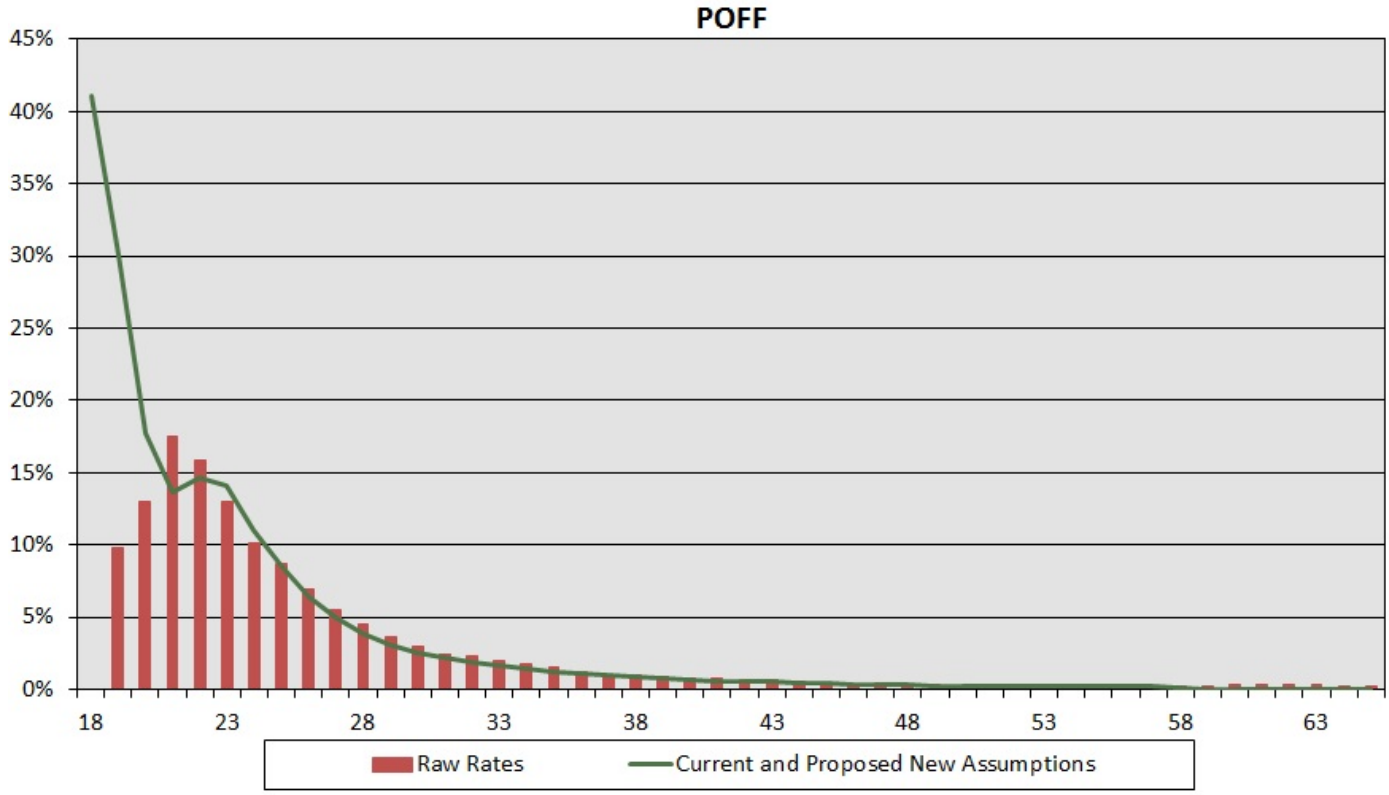
TERMINATIONS WITH REFUNDS (CONTINUED)

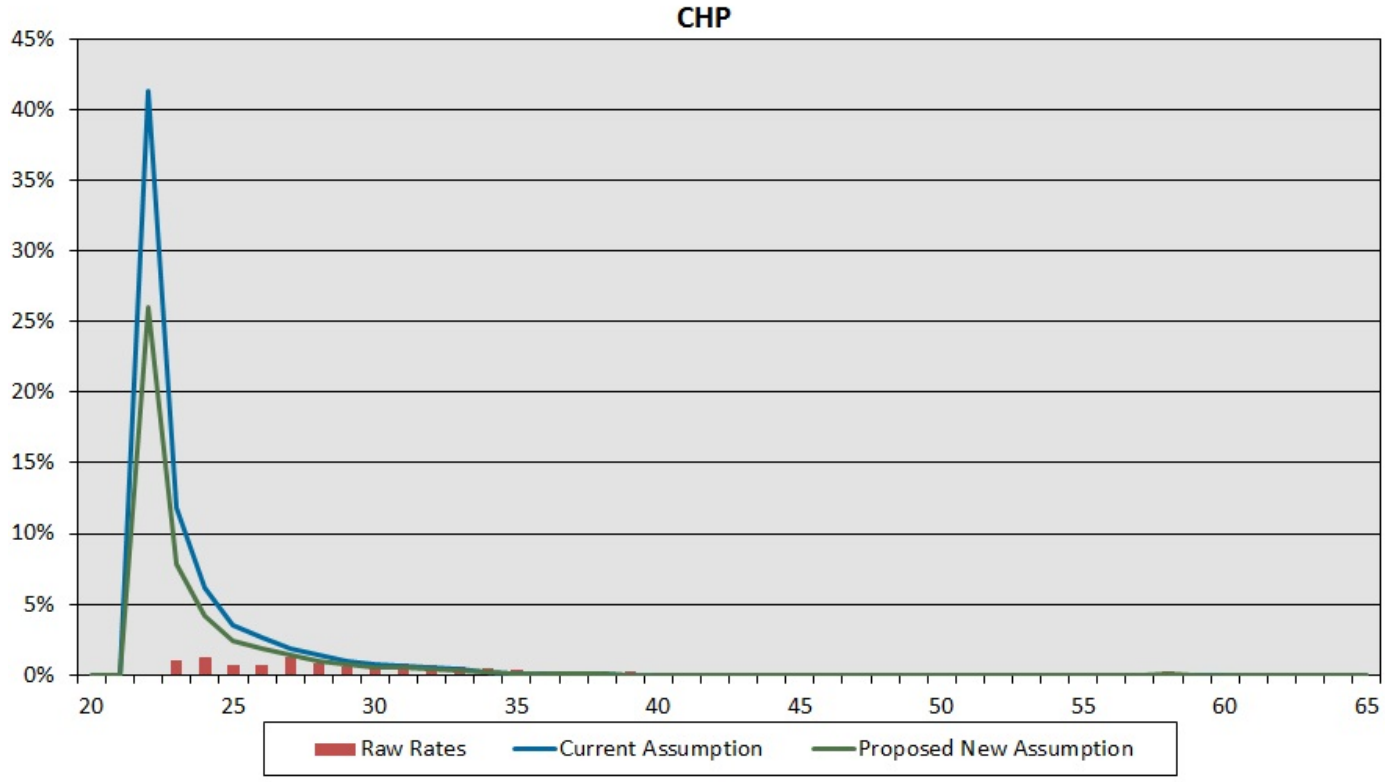




Appendix B - Summary Comparison of Assumptions (continued)

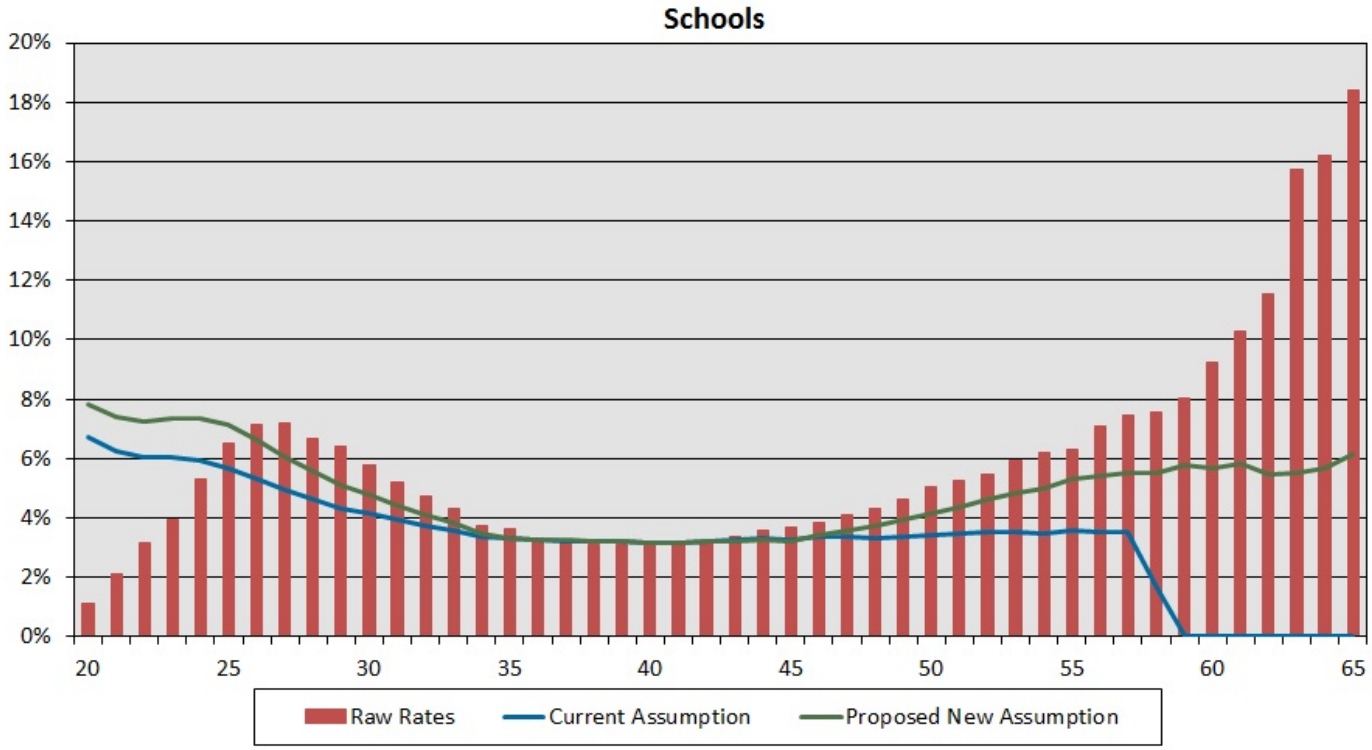
TERMINATIONS WITH REFUNDS (CONTINUED)

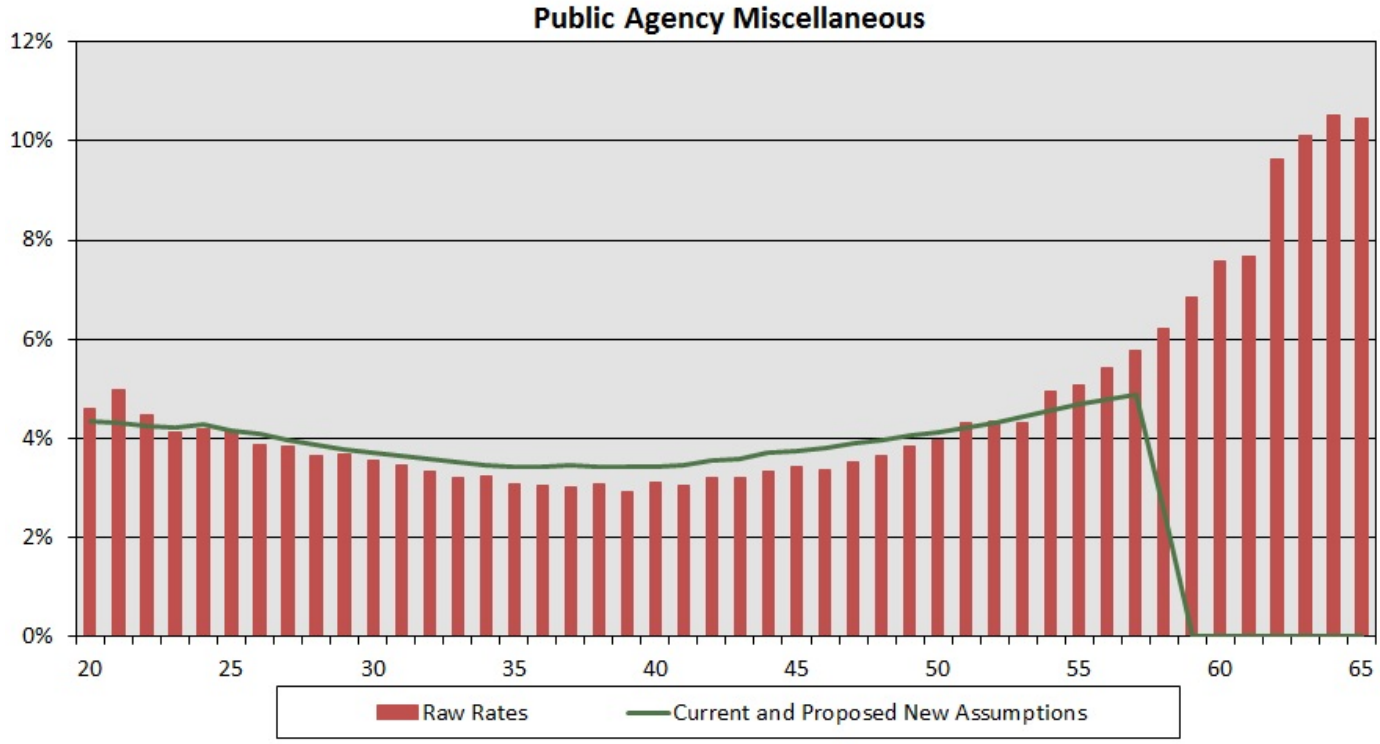




Appendix B - Summary Comparison of Assumptions (continued)

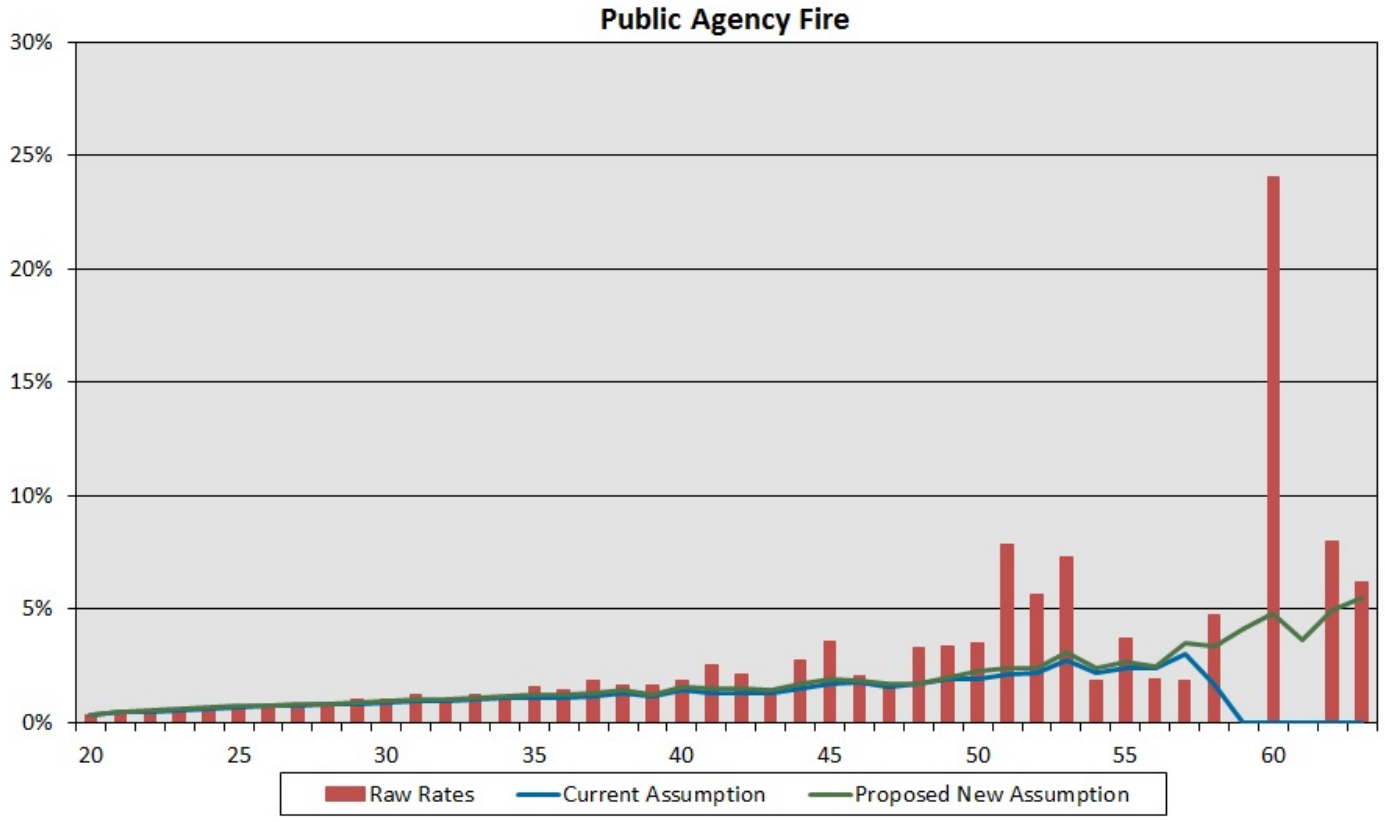
TERMINATIONS WITH REFUNDS (CONTINUED)

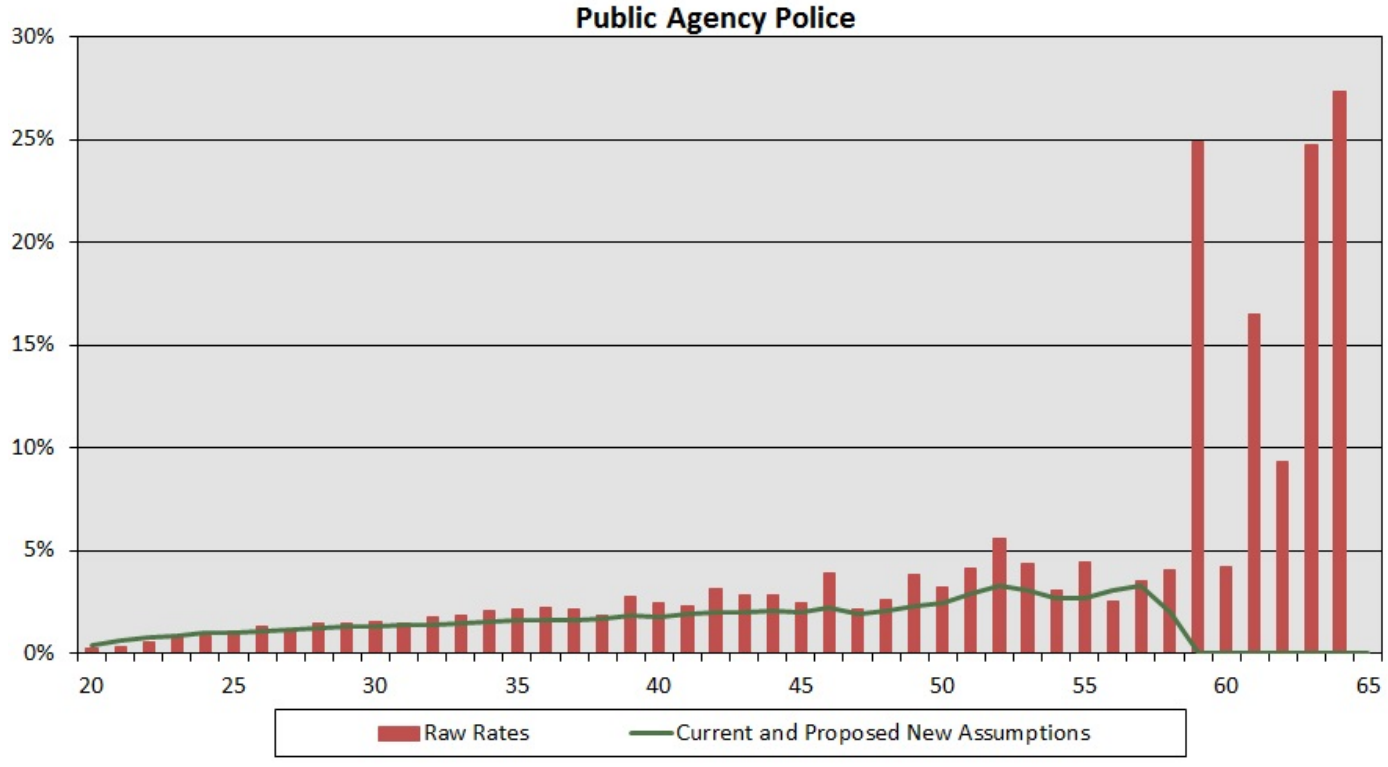




Appendix B - Summary Comparison of Assumptions (continued)

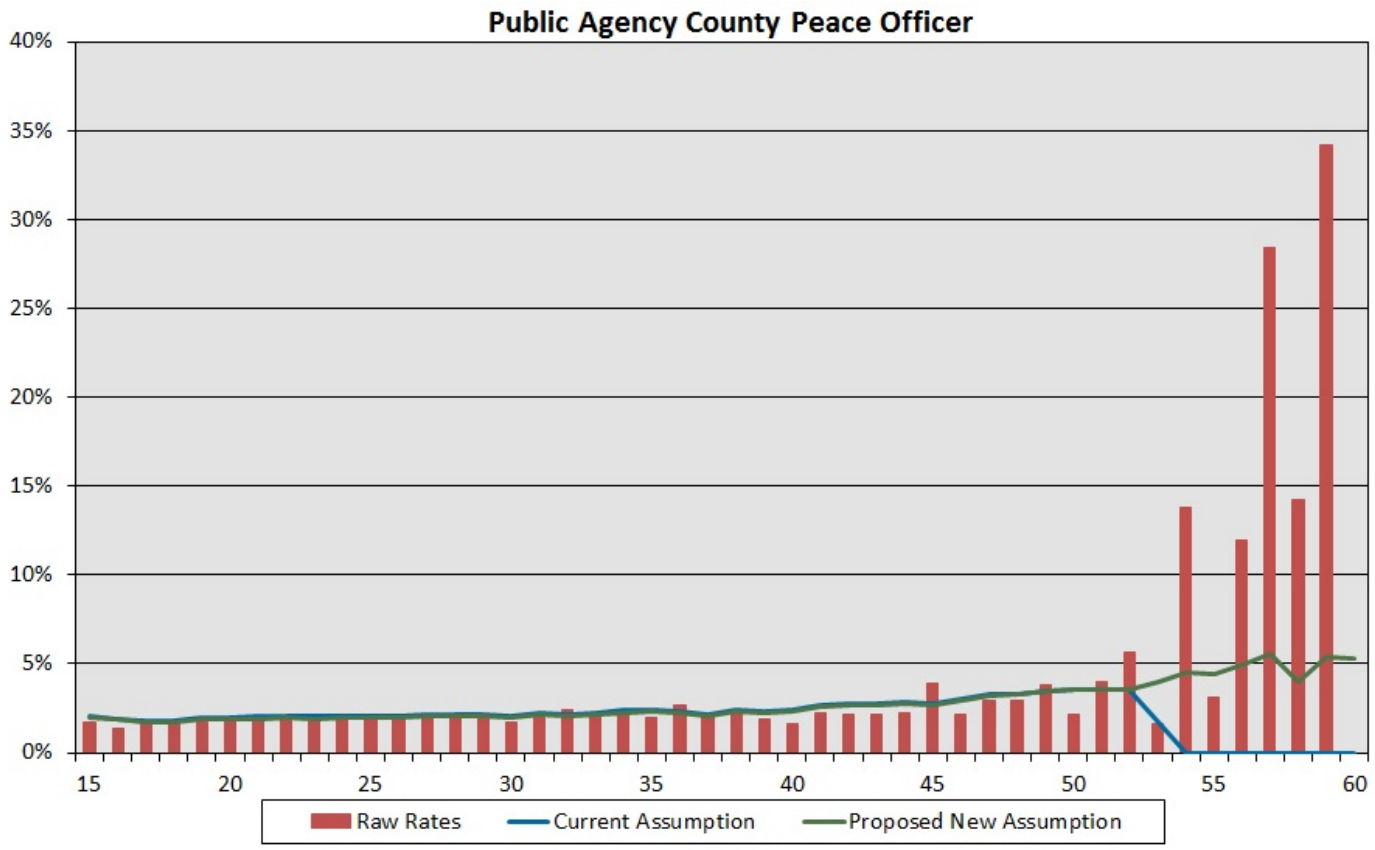
TERMINATIONS WITH REFUNDS (CONTINUED)



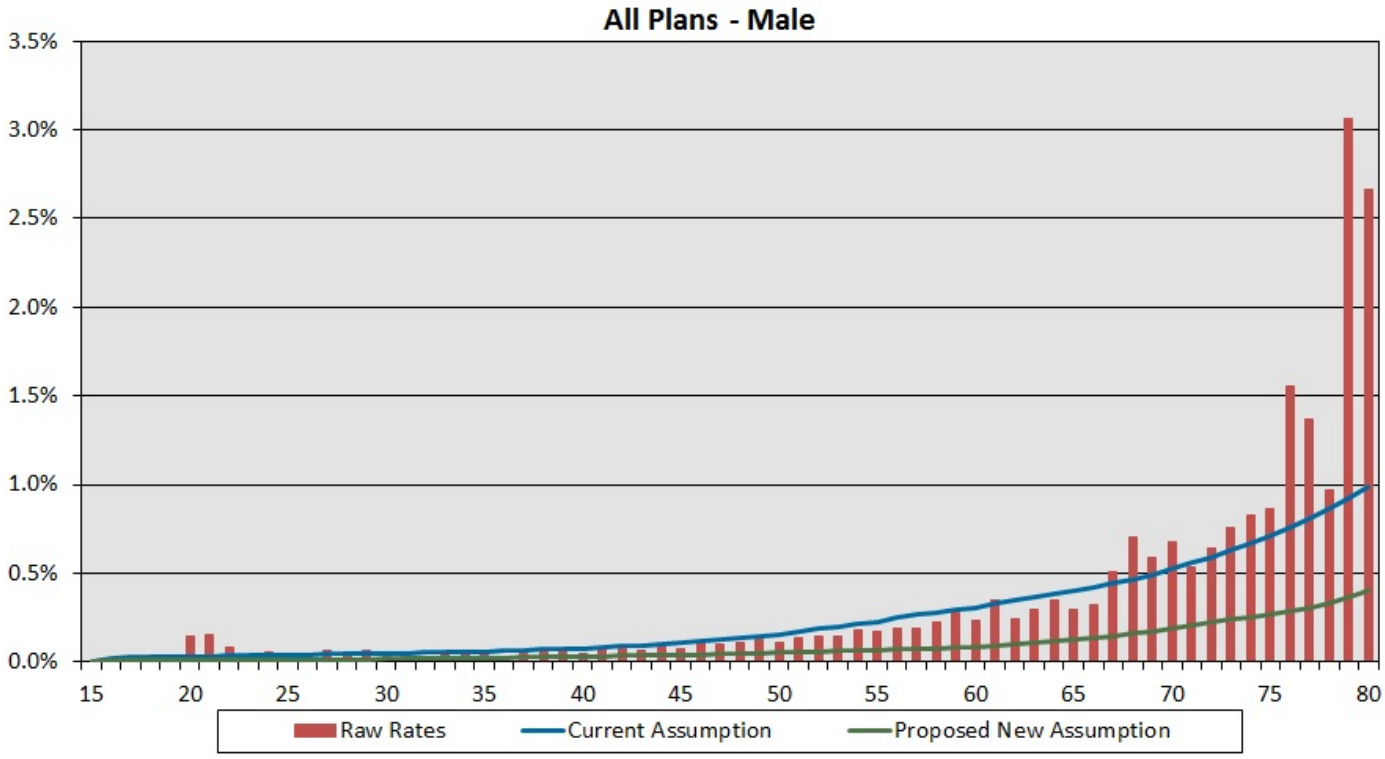


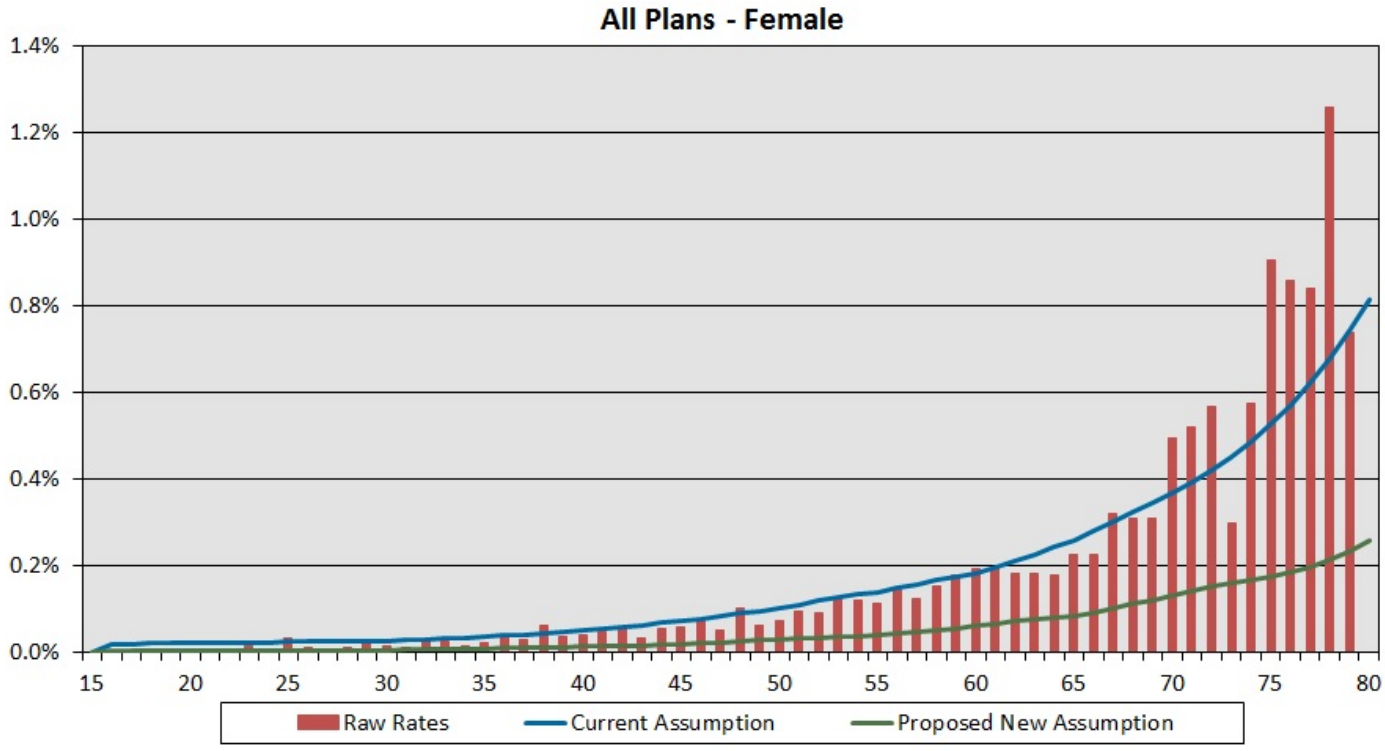
Appendix B - Summary Comparison of Assumptions (continued)

TERMINATIONS WITH REFUNDS (CONTINUED)



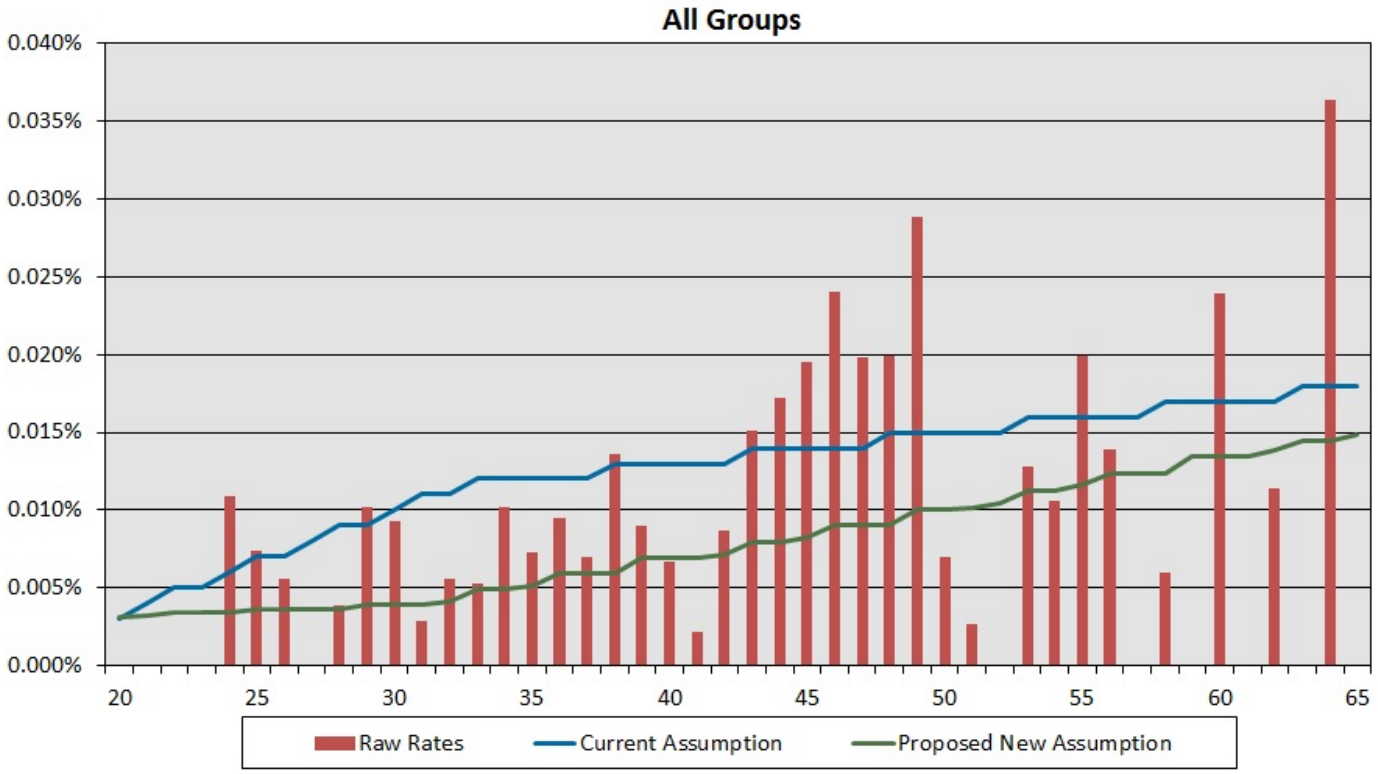
PRE-RETIREMENT MORTALITY - NON-INDUSTRIAL RELATED





Appendix B - Summary Comparison of Assumptions (continued)

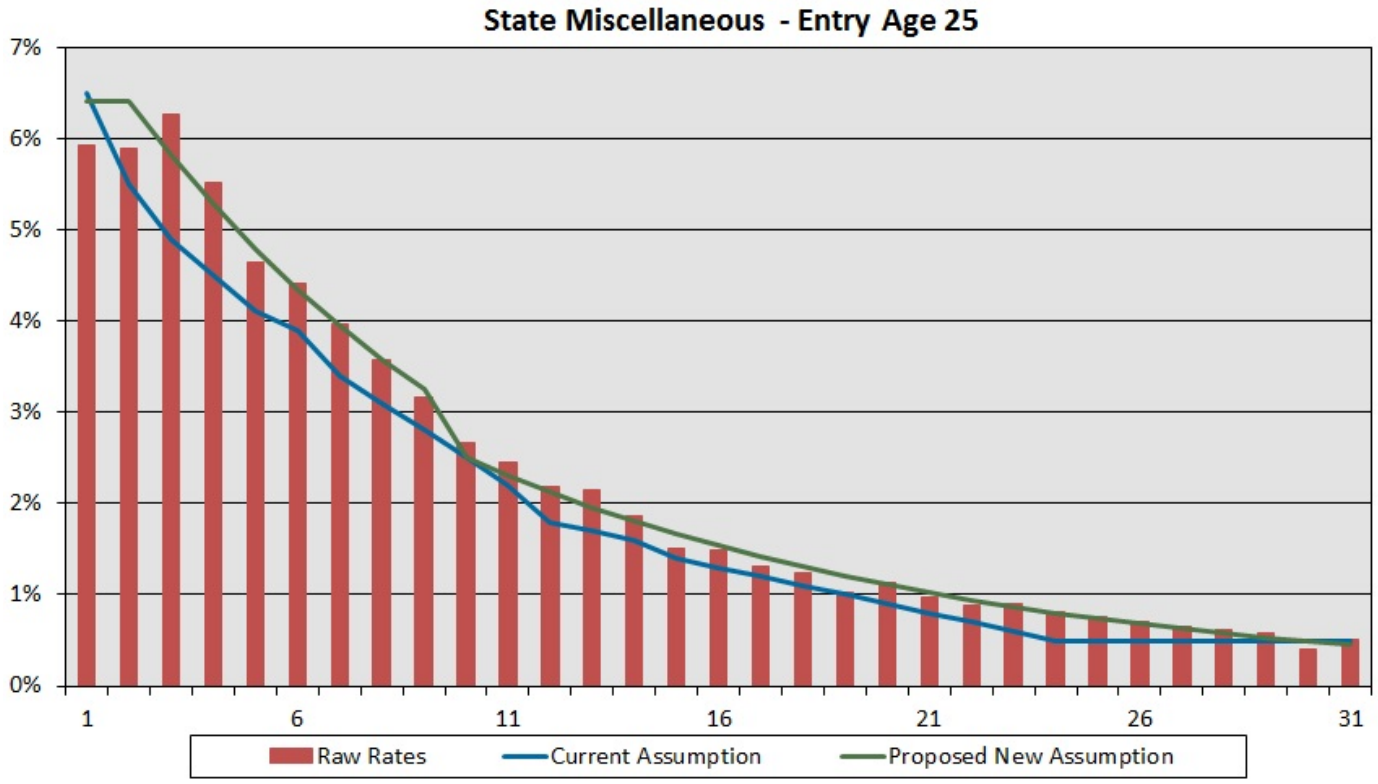
PRE-RETIREMENT MORTALITY - INDUSTRIAL RELATED

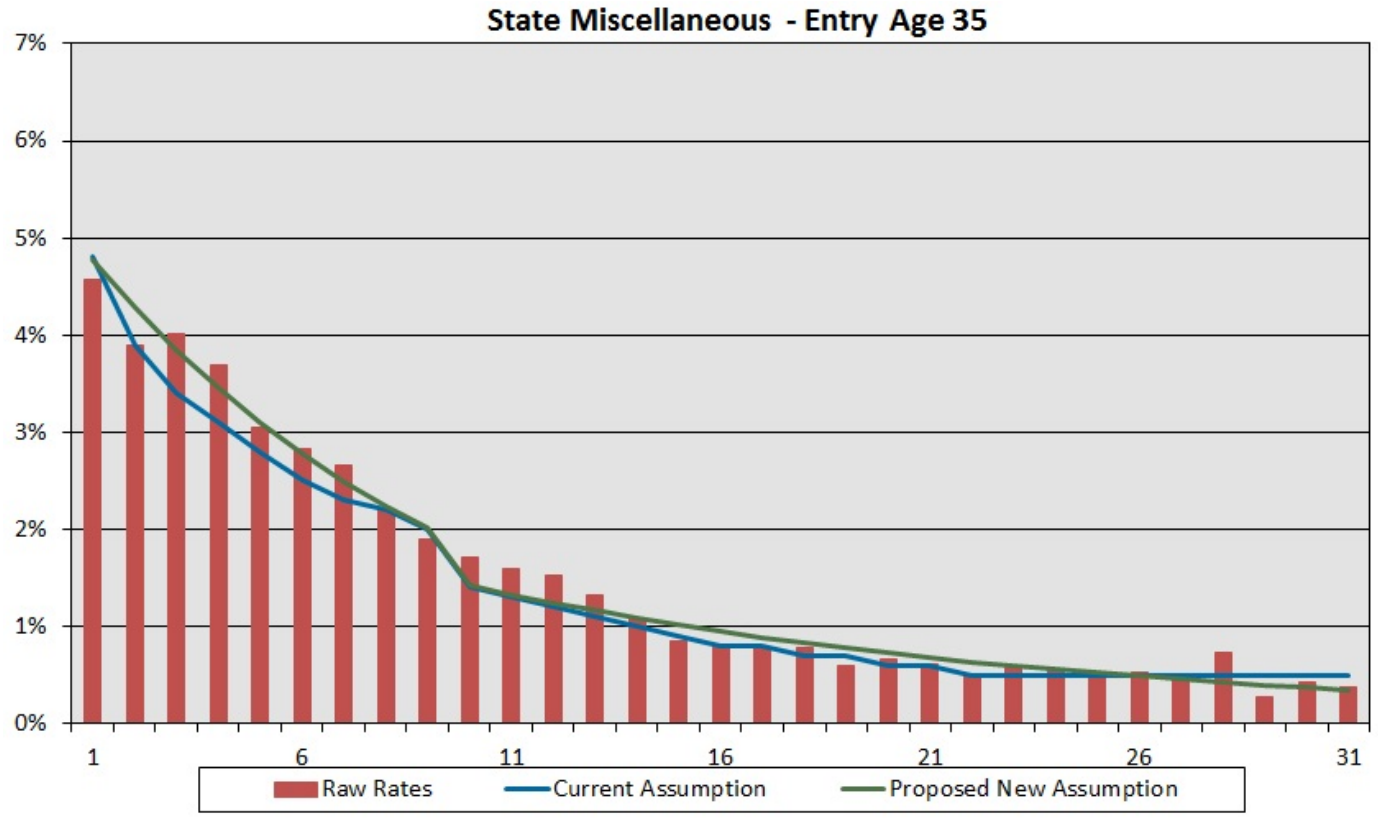


Appendix B - Summary Comparison of Assumptions (continued)

SALARY INCREASE

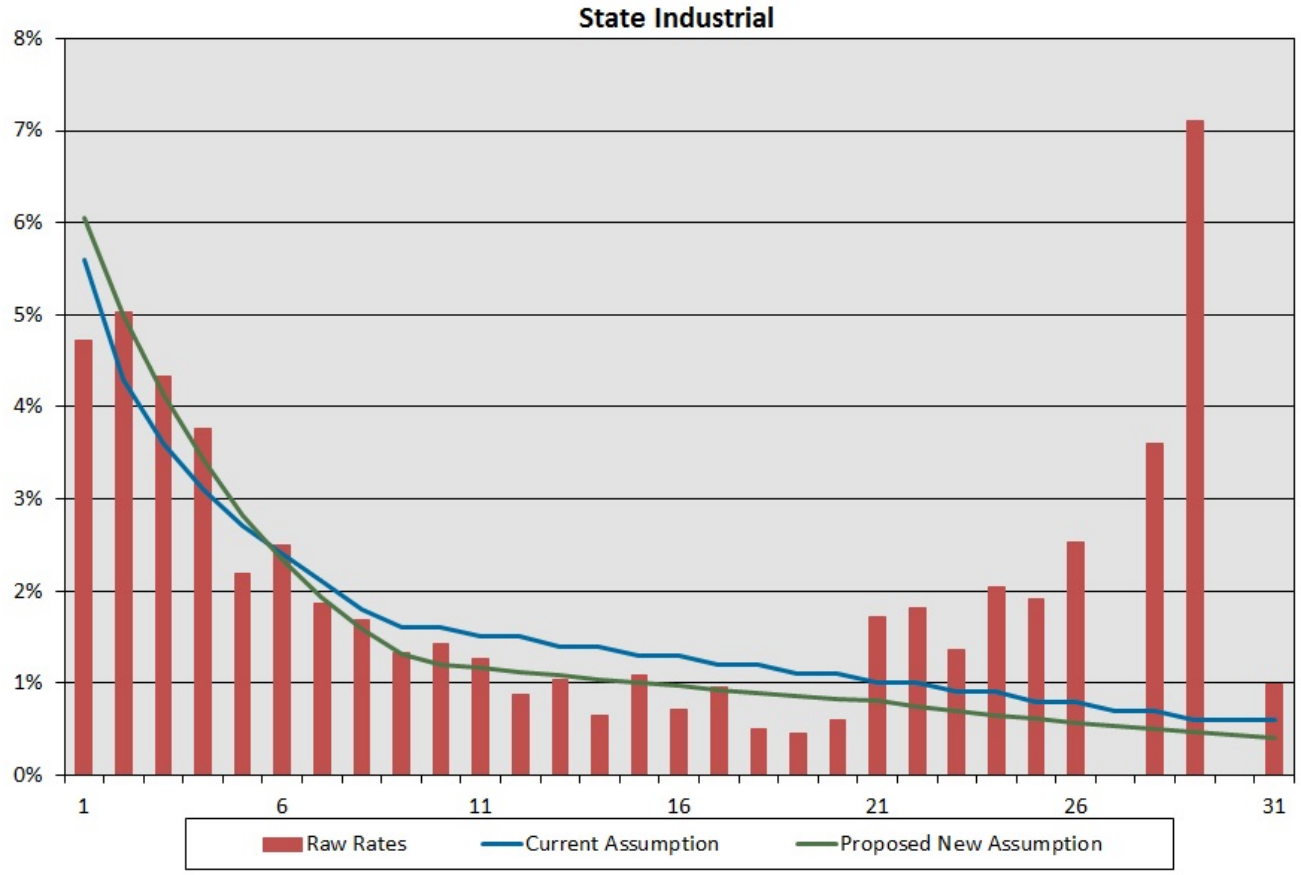
The following charts illustrate the current assumptions compared to the proposed assumptions for Salary Increase.

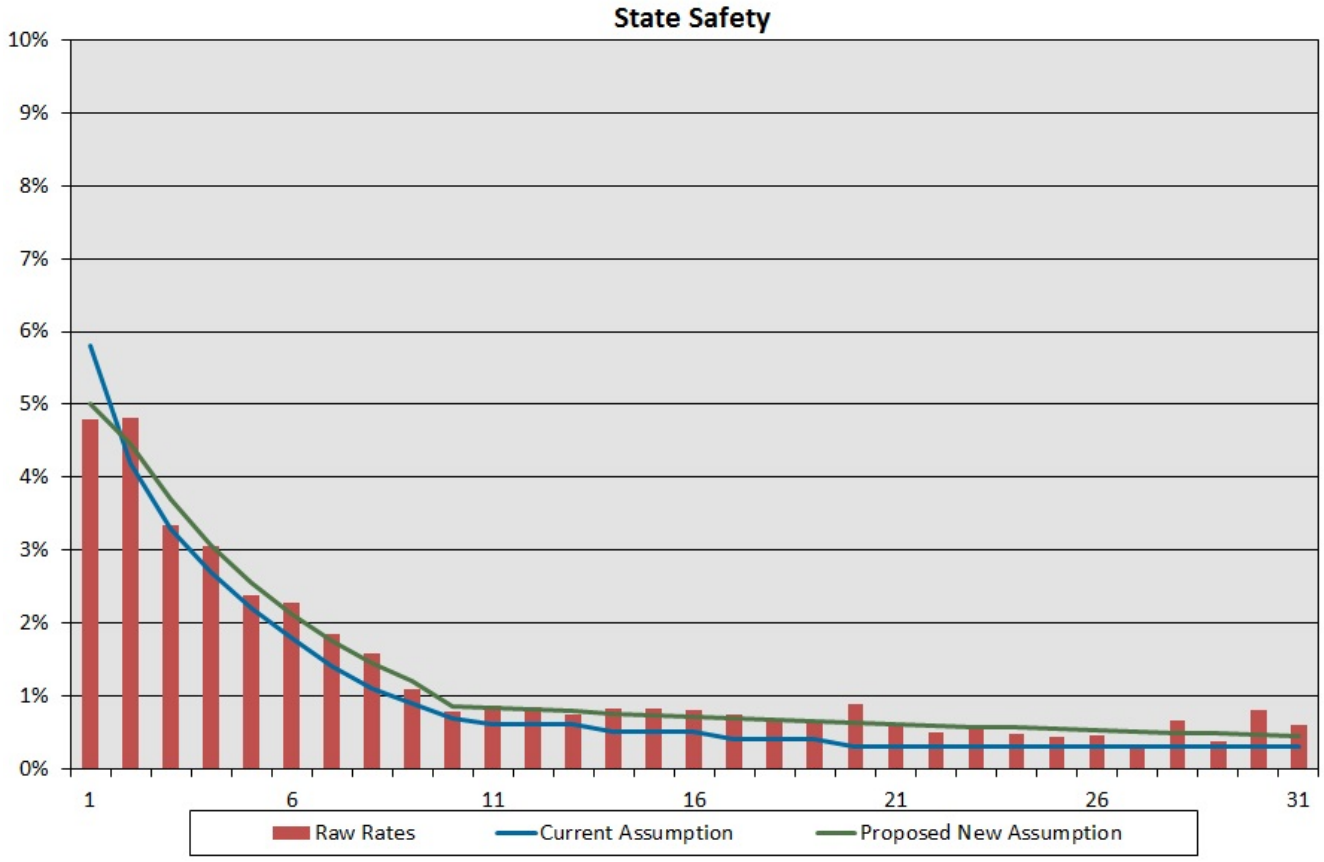




Appendix B - Summary Comparison of Assumptions (continued)

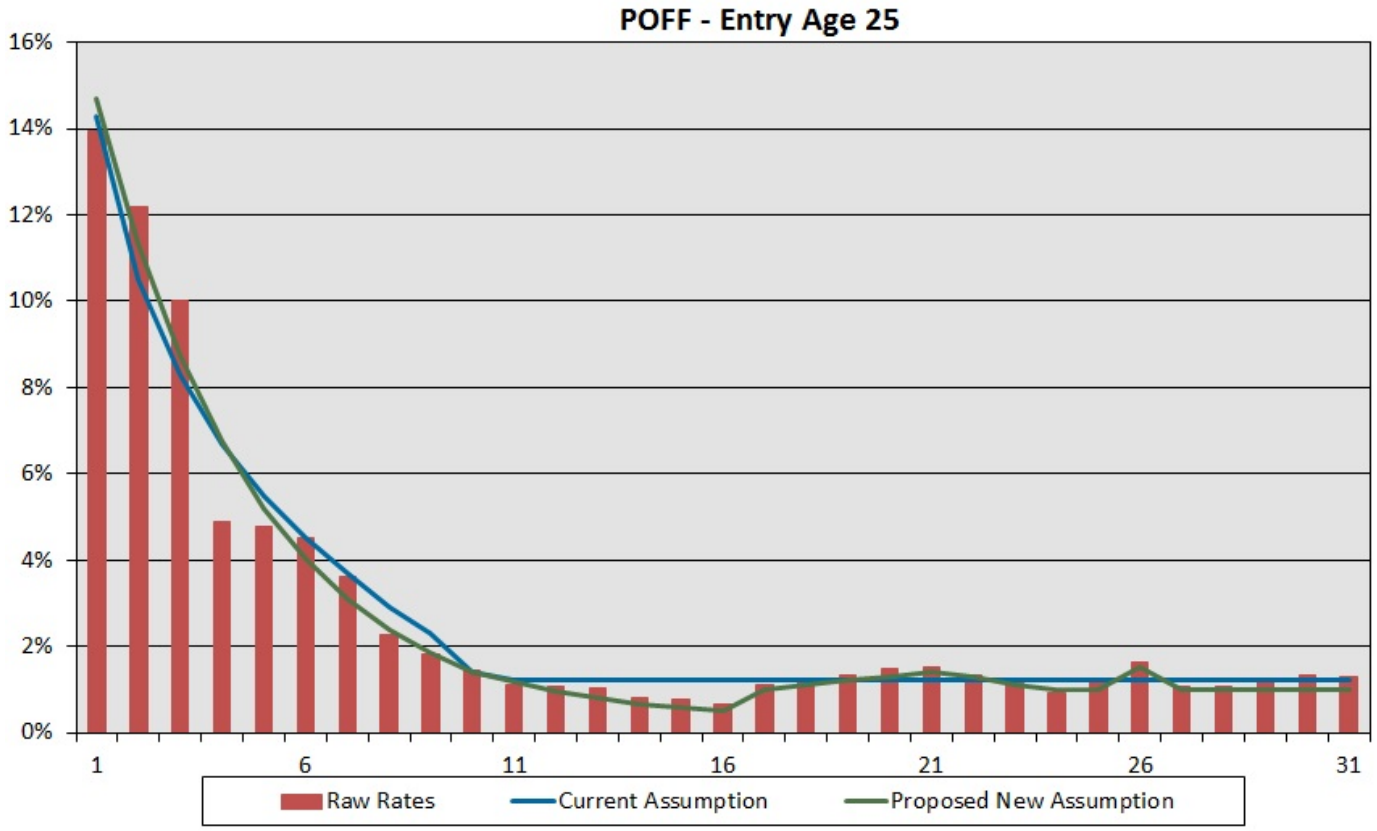
SALARY INCREASE (CONTINUED)

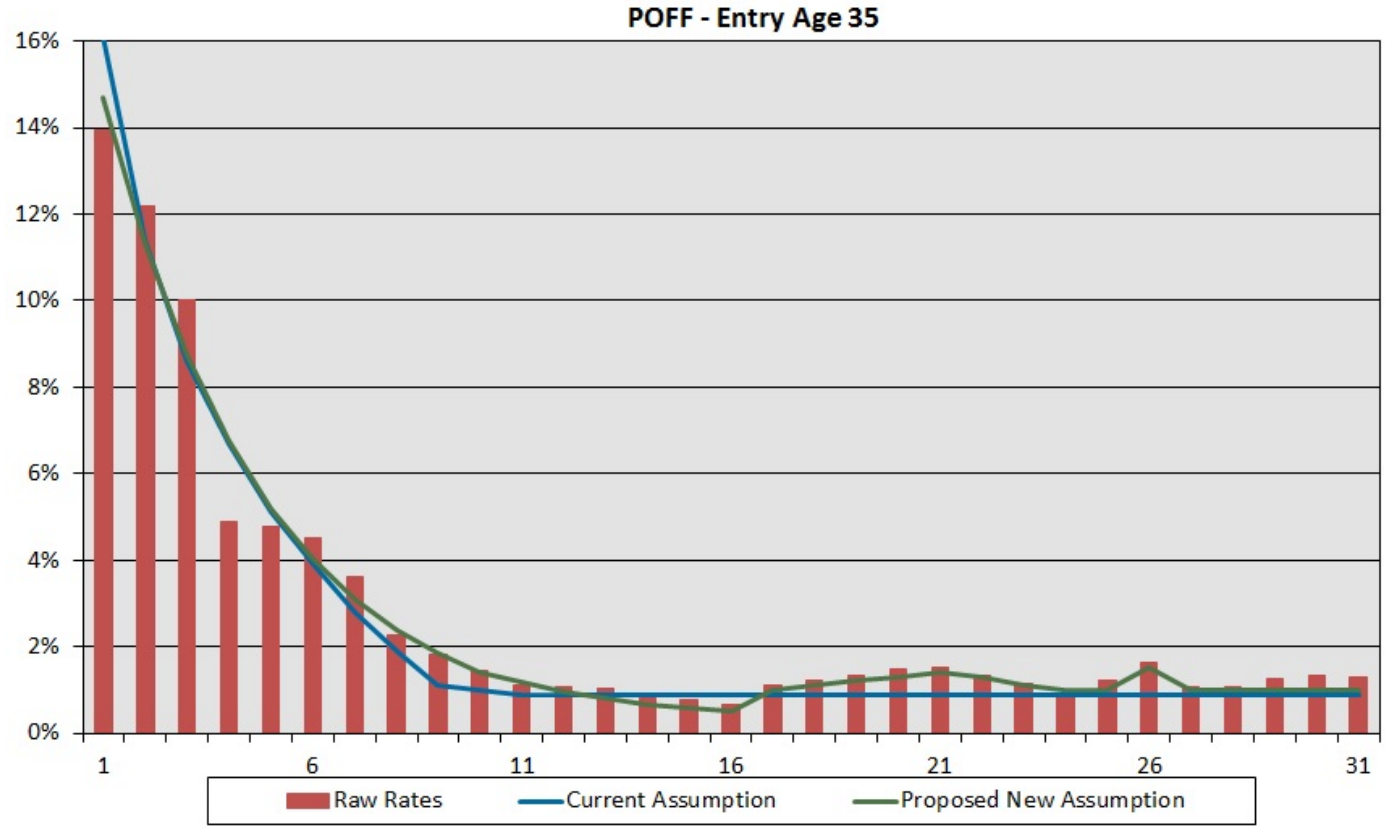




Appendix B - Summary Comparison of Assumptions (continued)

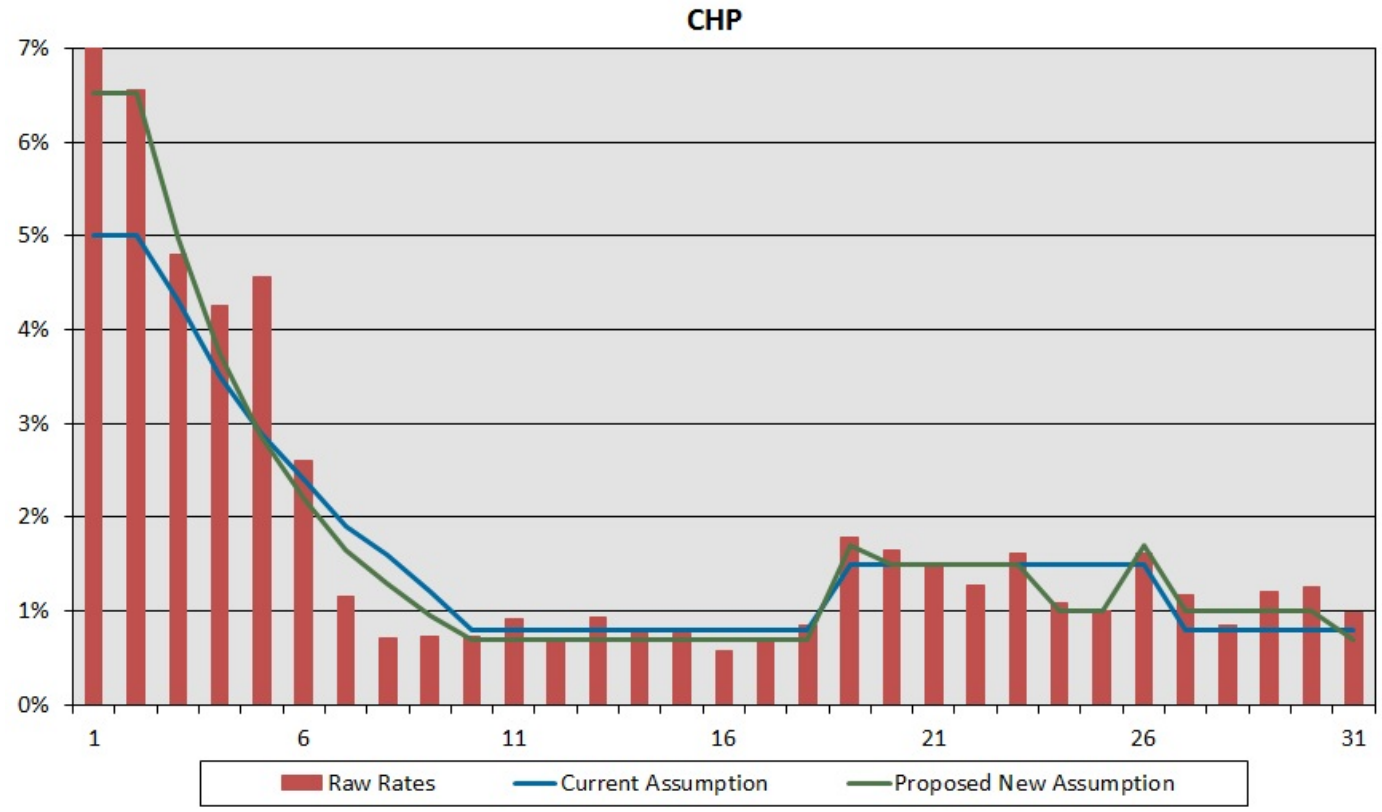
SALARY INCREASE (CONTINUED)

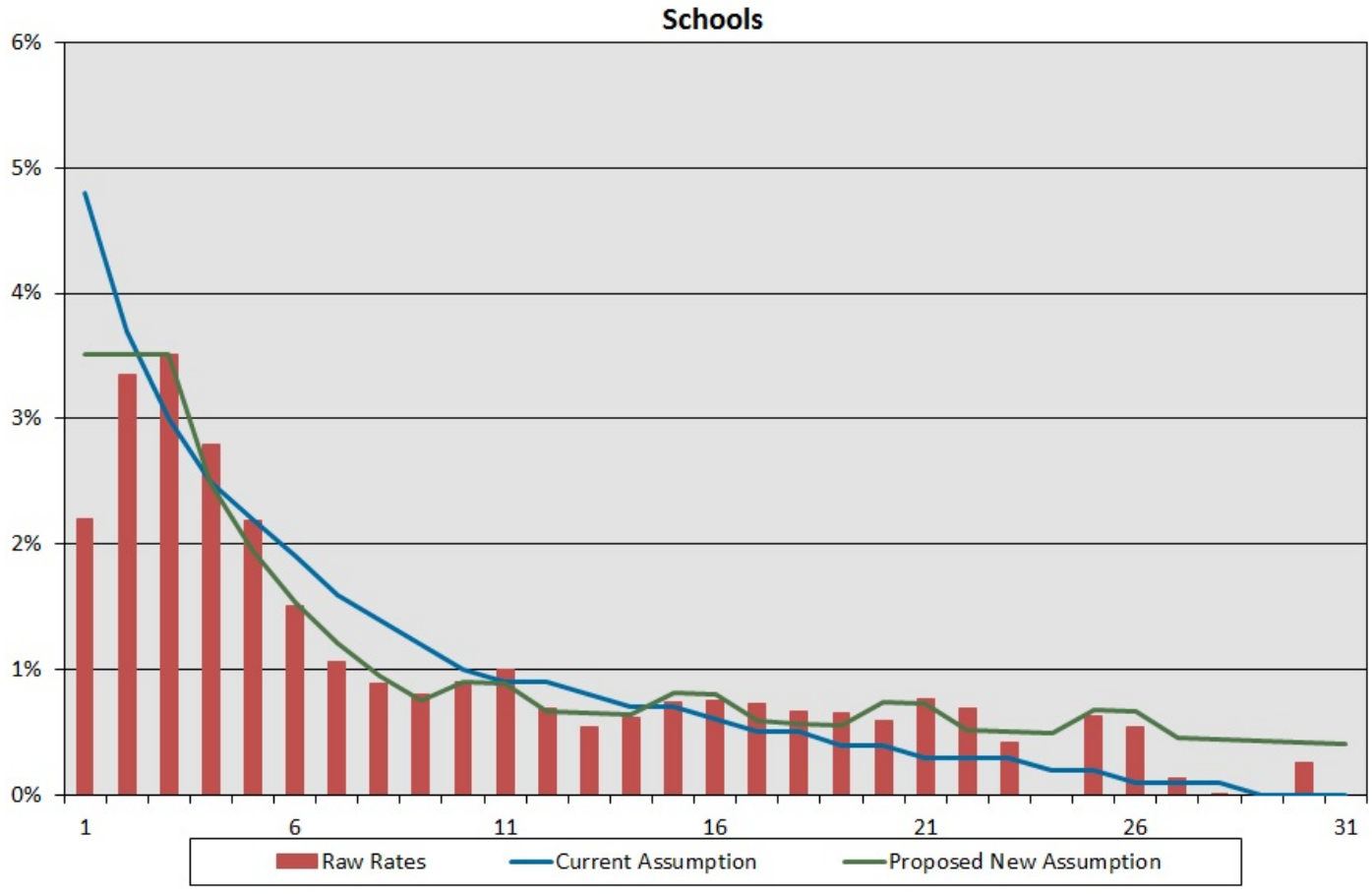




Appendix B - Summary Comparison of Assumptions (continued)

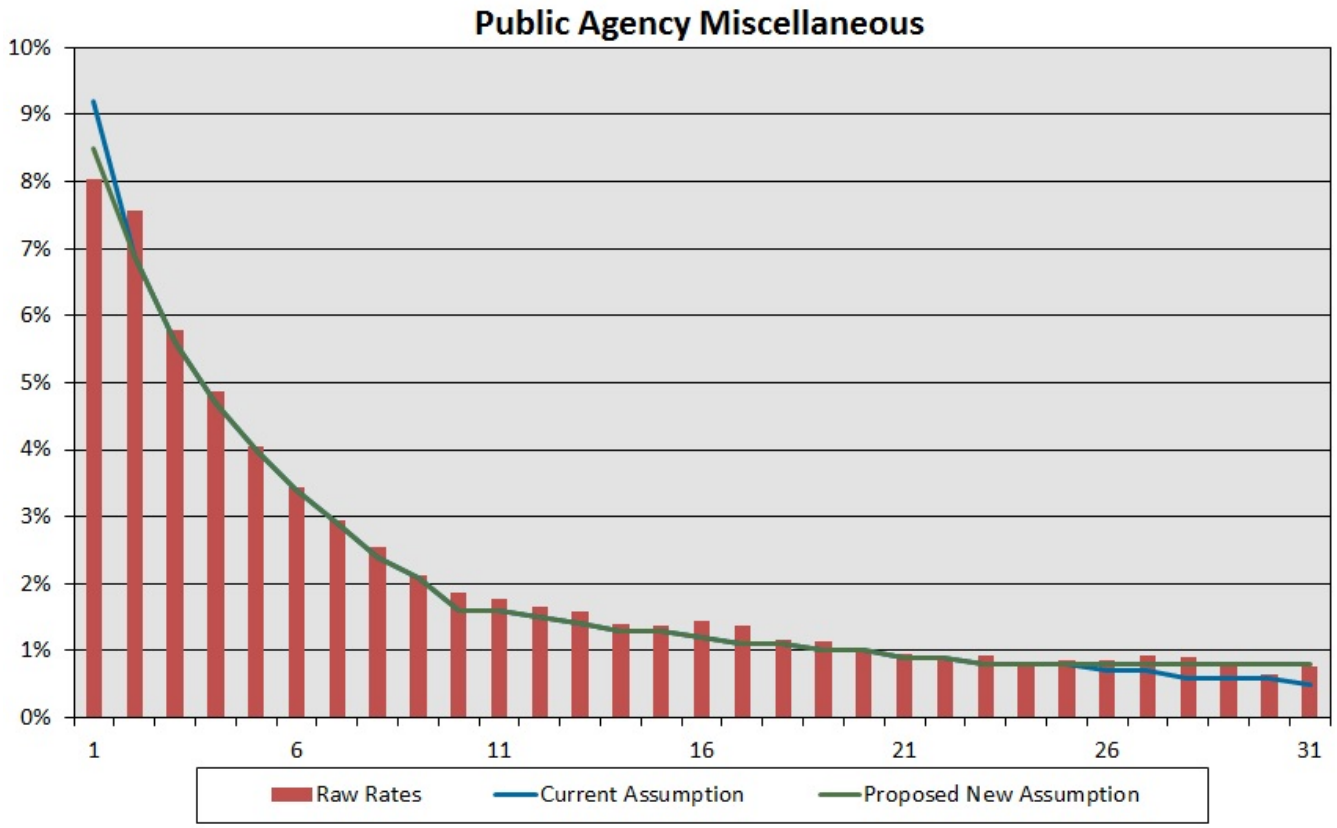
SALARY INCREASE (CONTINUED)

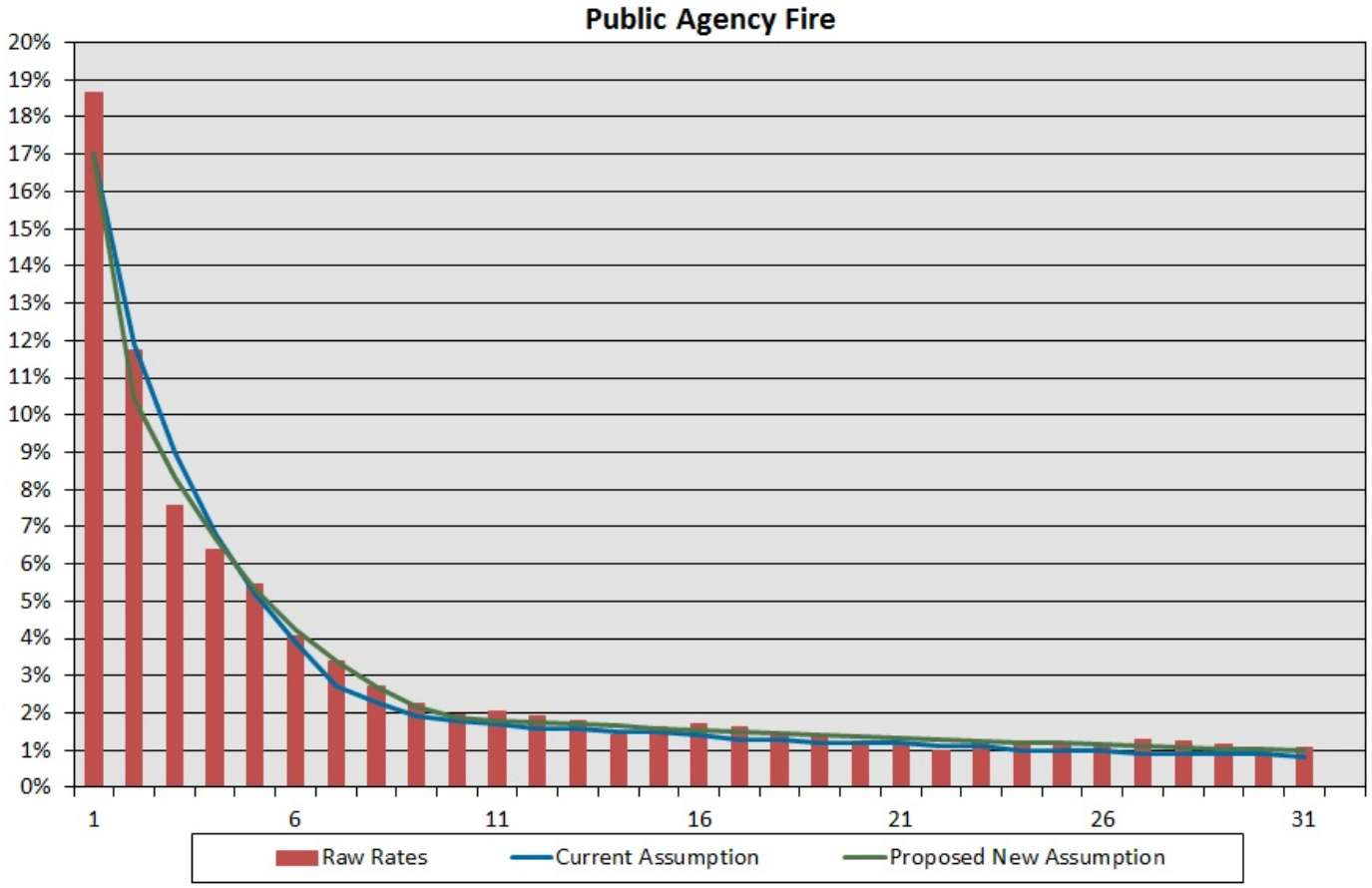




Appendix B - Summary Comparison of Assumptions (continued)

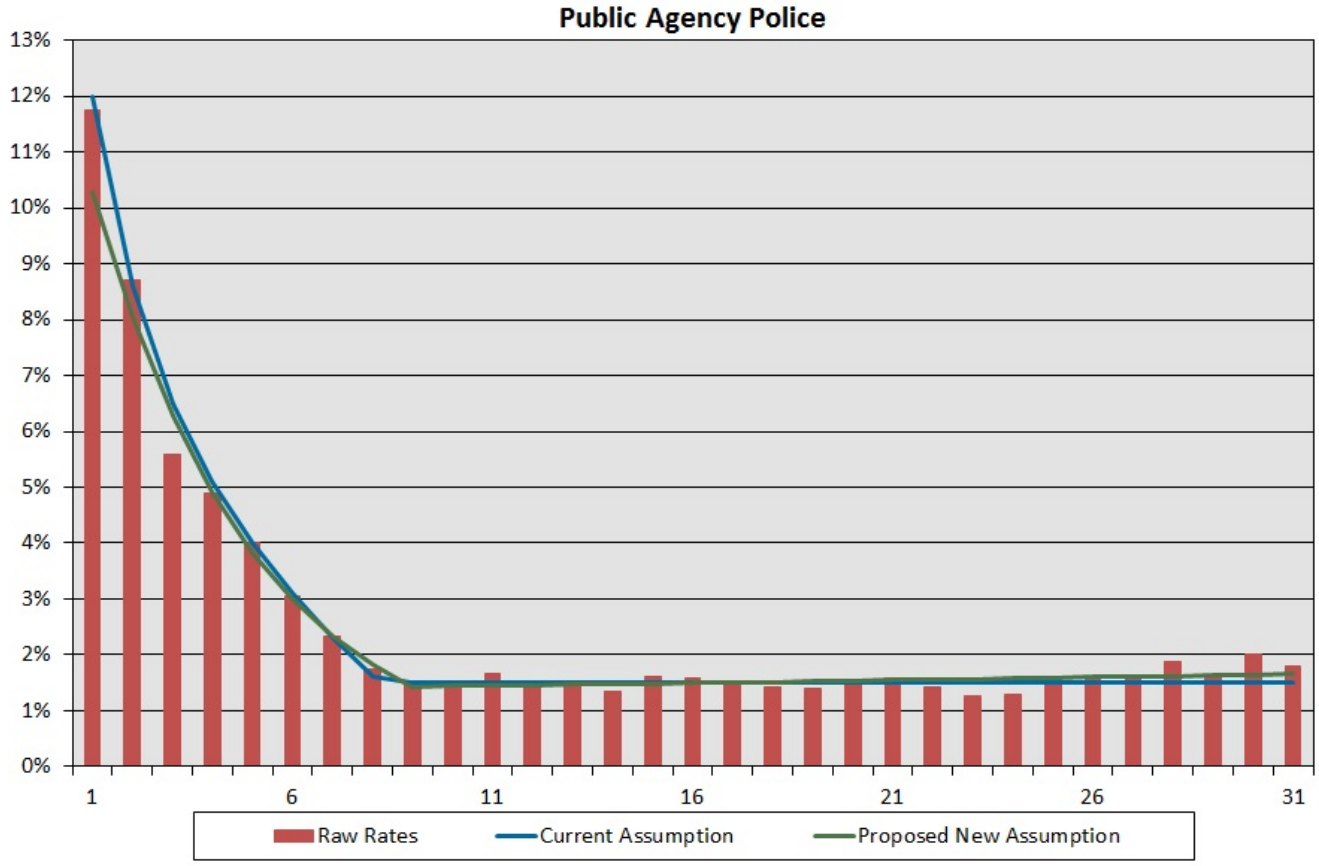
SALARY INCREASE (CONTINUED)

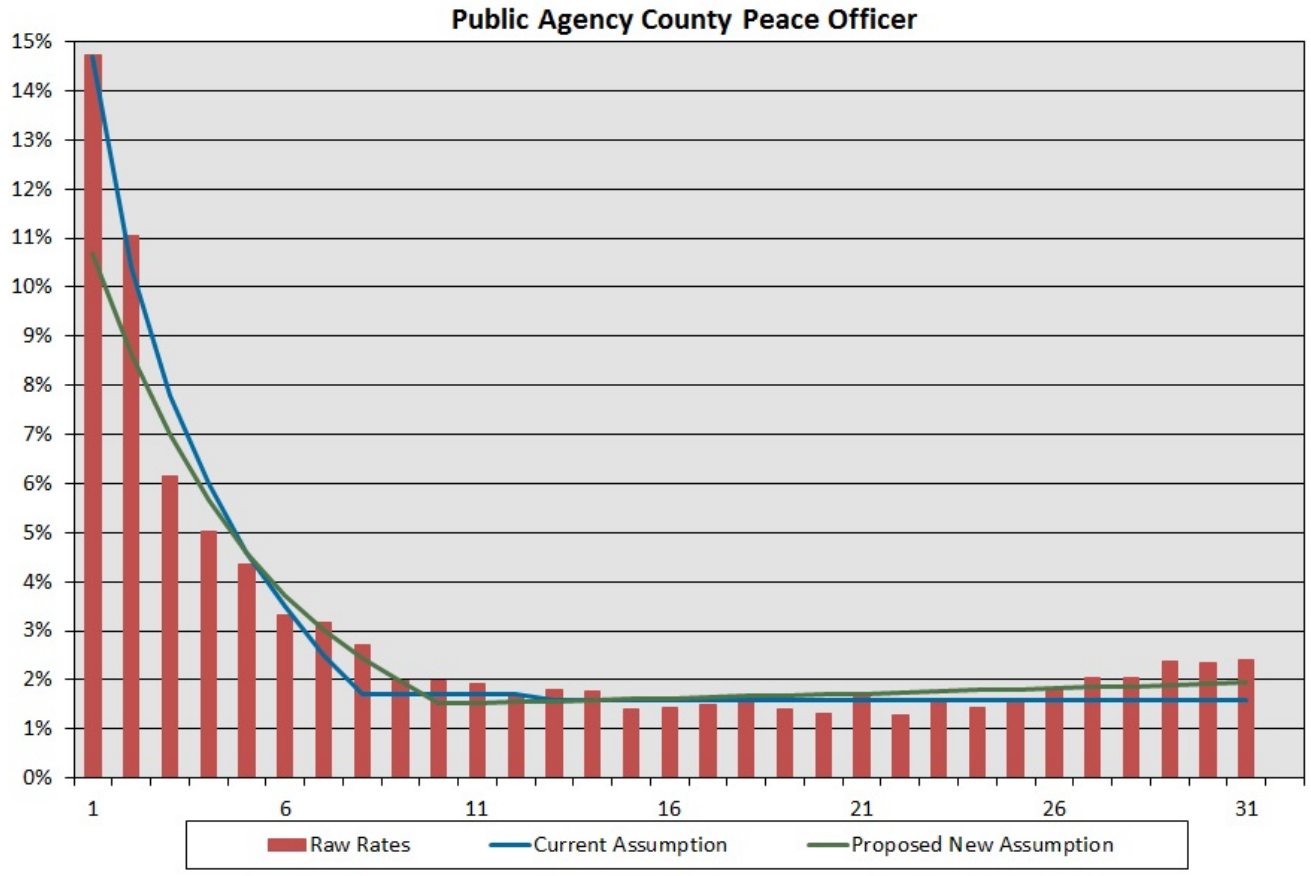




Appendix B - Summary Comparison of Assumptions (continued)

SALARY INCREASE (CONTINUED)





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