

Introduction

The study that follows was conducted by David Kays of ACUFF Associates for the SOA Retirement Systems Research Committee and the SOA Mortality Projection Workgroup. The purpose of the study was to provide quantitative information illustrating the impact of reflecting mortality improvement using a “Generational Approach” in the actuarial valuations of defined benefit pension plans versus reflecting mortality improvement by more traditional methods.

Background on Mortality Improvement

Results in the study were tested using mortality improvement Scale AA, and, to test the impact of a high mortality improvement scale, a 2% per year mortality improvement scale. Scale AA was developed at the time that the 1994 Group Annuity Reserving Mortality Table was developed. The Society of Actuaries Group Annuity Valuation Task Force recommended that mortality improvement be built into reserving mortality assumptions. For this purpose they developed the AA projection factors (TSA XLVII).

The AA projection factors were based on observed mortality improvement between 1977 and 1993 in the United States Social Security System and Civil Service Retirement System (CSRS) data. The method used was a least squares best fit trend through the logarithms of the observed mortality rates for each age.

Future mortality improvement is an open issue and, in setting the level of future mortality improvement, the practicing actuary must make his or her best evaluation. (In many cases, the practicing actuary cannot readily verify if mortality improvement is occurring.) The reader should note the following:

- Scale AA varies by age and sex, and for most ages over 60 and under 90, anticipates improvement rates of between 1.5% and .5% per year.

The AA table was subject to constraints. For example, mortality improvement factors of .5% were used when experience-based factors for ages younger than age 85 were less than .5% . This affected mortality improvement experience for females between ages 58 and 69. Also, there was little data on mortality improvement at the older ages (above 92) and the mortality improvement rates were graded into a value of 0.1% at age 100.

- In developing the RP 2000 table, the Retirement Plans Experience Committee selected mortality improvement factors to project the results from 1992 (the average year of the experience) to 2000. The RPEC selected a 1 % annual mortality improvement for males and no mortality improvement for females. These assumptions were selected because the RP 2000 data showed lower mortality improvement from 1990 to 1994 than the data used by the Group Annuity Valuation Task Force.

Summaries of mortality improvement rates for Civil Service Retirement System and Federal Employees Retirement System non-disability retirements over the 30-year period ending in 2003 are shown in the table on the next page.

Annual Rates of Mortality Improvement

Non-Disability Retirement

	Male				
	<u>1979-83</u>	<u>1984-88</u>	<u>1989-93</u>	<u>1994-98</u>	<u>1999-03</u>
	1974-78	1979-83	1984-88	1989-93	1994-98
55-57	0.056	0.013	0.017	0.006	0.001
58-60	0.041	0.012	0.018	0.012	0.017
61-63	0.037	0.006	0.013	0.017	0.023
64-66	0.040	0.008	0.009	0.013	0.023
67-69	0.028	0.020	0.014	0.007	0.024
70-72	0.027	0.015	0.015	0.015	0.012
73-75	0.025	0.010	0.022	0.012	0.010
76-78	0.017	0.013	0.020	0.017	0.007
79-81	0.015	0.008	0.013	0.020	0.010
82-84	0.014	0.006	0.012	0.014	0.010
85-87	0.012	0.002	0.006	0.012	0.006
88-90	0.007	-0.002	0.007	0.009	-0.001
91-93	0.020	-0.004	0.001	0.007	-0.004
94-96	0.013	-0.001	0.000	0.000	-0.004
97-99	-0.001	0.017	-0.006	-0.005	-0.003
100-102	0.002	-0.012	0.033	-0.016	0.001
103-105	-0.077	-0.054	0.088	0.000	0.005
Weight Avg.	0.022	0.009	0.013	0.013	0.010

	Female				
	<u>1979-83</u>	<u>1984-88</u>	<u>1989-93</u>	<u>1994-98</u>	<u>1999-03</u>
	1974-78	1979-83	1984-88	1989-93	1994-98
55-57	0.055	-0.001	0.037	-0.018	0.009
58-60	0.035	-0.017	0.017	0.022	-0.007
61-63	0.041	-0.027	0.009	-0.016	0.004
64-66	0.024	-0.003	-0.005	-0.003	0.007
67-69	0.001	0.014	-0.002	0.002	0.009
70-72	0.011	0.007	-0.004	0.014	-0.007
73-75	0.016	0.002	0.006	0.008	-0.003
76-78	0.018	0.002	0.009	0.012	0.002
79-81	0.027	-0.005	0.011	0.009	0.005
82-84	0.034	-0.007	0.013	0.007	0.004
85-87	0.031	0.000	0.013	0.002	0.001
88-90	0.042	-0.004	-0.001	0.004	0.002
91-93	0.029	-0.003	-0.004	0.006	-0.010
94-96	0.010	0.019	-0.010	0.008	-0.013
97-99	0.009	0.031	-0.018	0.000	-0.009
100-102	-0.043	0.017	0.031	-0.006	-0.015
103-105	0.016	-0.055	0.057	0.001	0.018
Weight Avg.	0.023	0.000	0.005	0.006	-0.001

The annual rates shown here are one minus the fifth root of the ratio of the average mortality rate over a five year period to the average mortality rate over the preceding five-year period. The weighted average rate is the average of the mortality improvement rates for all ages weighted by deaths. Mortality rates are based on numbers of lives.

Impact of Mortality Table Projection Scales on Defined Benefit Pension Plan Valuations By David F. Kays A.S.A. , M.A.A.A.

A. Purpose

The purpose of this study is to provide quantitative information illustrating the impact of various techniques of reflecting mortality improvement on defined benefit pension plan contribution rates, actuarial liabilities, and SFAS 87 pension expense (Financial Accounting Standards Board Statement of Financial Account Standards No. 87).

B. Techniques

- Actuarial valuations were performed using generational mortality projections.
- Actuarial valuations were performed using various projected and unprojected static mortality tables.

C. Census Data

Two 30-year census datasets were developed as follows:

- The datasets were developed using the 1994 Uninsured Pensioner Mortality (UP-94) Table with generational mortality projections using (1) mortality improvement Scale AA and (2) a 2% per year mortality improvement assumption.
- The actuarial valuations performed on these two datasets using the corresponding mortality improvement scale applied on a generational basis have no actuarial experience gains or losses.

D. Author's Main Observations

Assuming a defined benefit pension plan population exhibits mortality patterns similar to those used in this study, this study shows that (all other factors remaining equal), the assets will accumulate to a relatively level percentage of "ideal" assets over 30 years (otherwise the assets tend to diverge) only if:

- The valuation mortality table is updated periodically.
- When the mortality table is changed, the table is at least projected to the valuation date by the appropriate mortality improvement scales.
- The stronger the mortality improvement the larger the difference between assets and "ideal" assets.

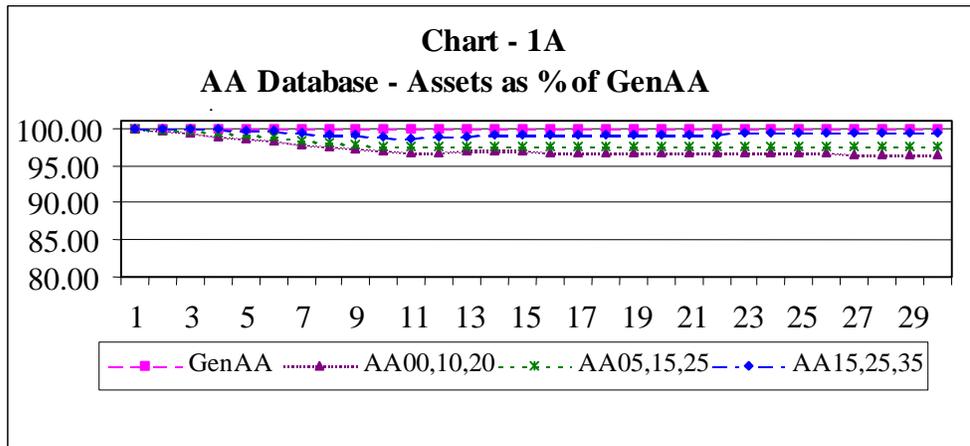
“Ideal” assets mean those assets produced using the funding method and generational mortality techniques.

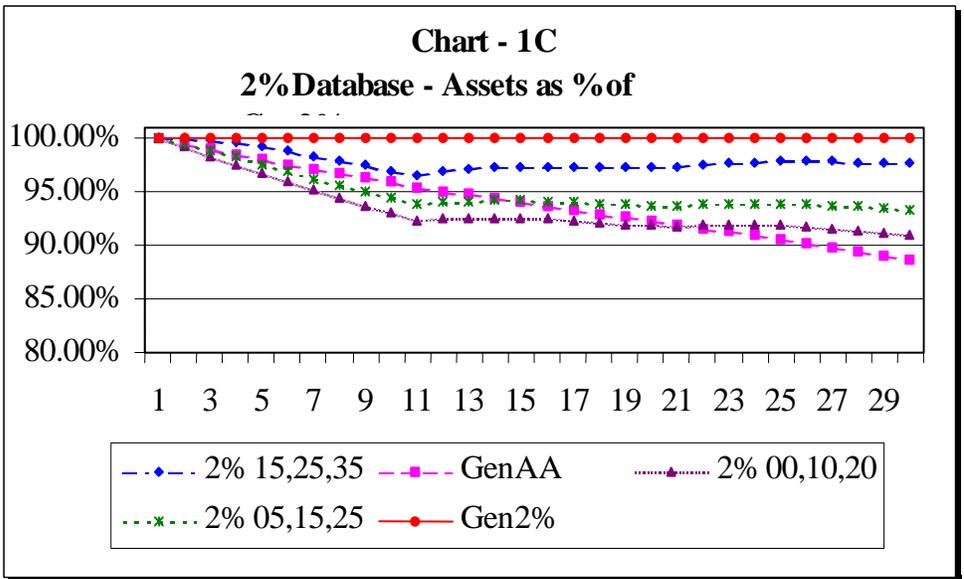
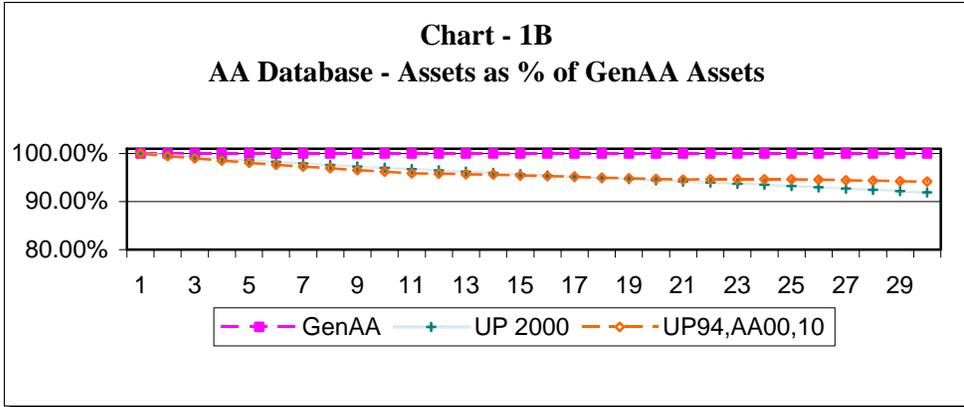
The 10 year amortization due to change of assumptions in concert with changing mortality assumption that match or project the mortality past the valuation date is an important principal to help the assets to maintain at a level percentage of “ideal” assets.

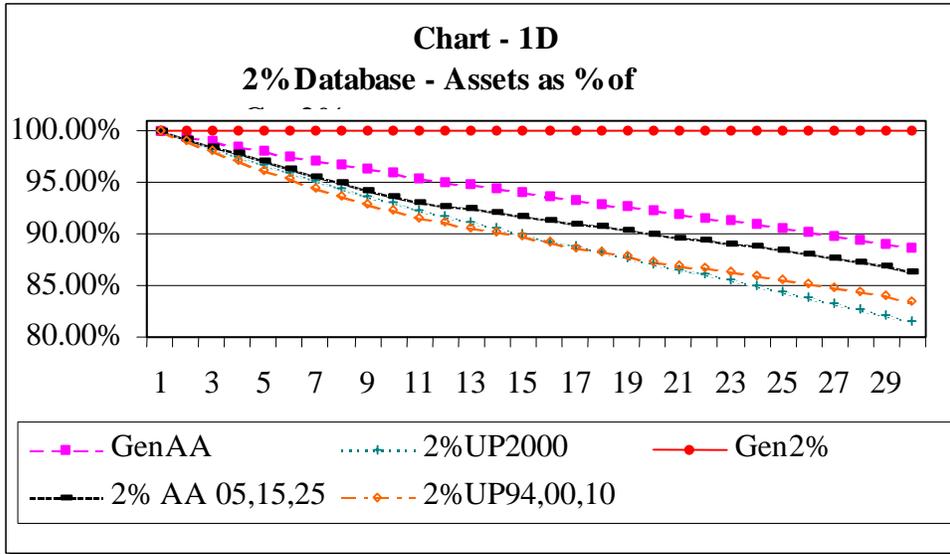
We leave it up to the pension actuary as to what level of “ideal” assets should a plan accumulate to be considered adequate or “actuarially sound”.

It may be appropriate to project the mortality table past the valuation date to obtain an asset accumulation close to one arising from the use of generational mortality improvement projections. The number of years for this group seems to be around 15. We suggest that each population would have its own best number of years to project past the valuation date. This technique could be particularly useful for the pension actuary who does not have access to actuarial valuation software that incorporates generational techniques. (Charts 1A, 1B, 1C, and 1D below. Further descriptions of scenarios referred to in the charts may be found in Appendix B.)

Even if generational mortality projection is used for the actuarial valuation, mortality tables and mortality improvement scales should be reevaluated as new mortality studies and improvement scales become available. See GenAA run under the 2% databases.







The next section offers the background and our key observations. Additional charts and tables not exhibited or discussed in the body of the report are located in the appendixes for further study by the reader.

II. Background and Key Observations

A. Background

This paper discusses and illustrates the impact of using generational mortality projections compared to using static mortality tables for the actuarial valuation of a defined benefit pension plan. The projected unit credit funding method was used for the purpose of developing contributions to the plan and the associated assets. The initial asset value was set at 90% of the initial actuarial liability¹ using the static table UP2000.

For purposes of consistency and clarity through out the report, the actuarial terminology chosen for this report is that used by SFAS 87:

1. Actuarial Liability is the Projected Benefit Obligation (PBO)
2. Normal Cost is the Service Cost (SC)
3. Actuarial Present Value of Accumulated Benefits is Accumulated Benefit Obligation (ABO)

Two sets of 30 year censuses were projected assuming that the mortality experience would follow the UP-94 Mortality Table projected using Scale AA to 1/1/2000² with, for dataset AA, Scale AA improvement thereafter and, for the 2% dataset, 2% mortality improvement per year thereafter. Annual actuarial valuations were performed using the two data sets with different techniques of reflecting mortality improvements. This study uses several mortality assumption scenarios:

- 1) One static mortality table for the entire forecast period.
- 2) Changing mortality tables at year 10 and year 20 with the mortality improvement not projected beyond the year of change. This brings the mortality table up-to-date at the assumption change date.
- 3) Initial mortality tables at year 0 and changing the mortality tables at year 10 and 20. Tables include future mortality improvement projected beyond the valuation year of change (5 and 15 years beyond the valuation date).
- 4) Using generational mortality projection over the entire forecast period.

Generally, all valuation scenarios using the 2% per year mortality improvement scale were run on the set of censuses generated using 2% generational improvement. Similarly, the scenarios using the Scale AA were run on the experience databases projected using Scale AA. The exceptions are the following scenarios using Scale AA that were run on the 2% mortality improvement dataset.

- 1) Generational techniques using the Scale AA mortality projections, but on the databases generated using the 2% Scale, which are denoted by 2%GenAA.

¹ Based on the UP-94 mortality table projected to the first valuation date using scale AA

² The first valuation date in the study

- 2) Static tables projected by Scale AA to year 5 used at valuations 0 through 9, projected to year 15 used for valuation years 10 through 19 and projected to year 25 for valuation year 20 through 29, which are denoted by 2%AA,05,15,25.

(See appendixes for a more complete description of the datasets and mortality assumption scenarios, and the associated notation).

The only experience gains or losses that occurred at the various actuarial valuation dates were due to mortality differences between the assumed table and the corresponding generational database. There were no gains or losses due to other demographic actuarial assumptions or economic actuarial assumptions. For funding purposes, the actuarial experience gains or losses were amortized over 5 years. The actuarial losses due to changes of mortality assumptions were amortized over 10 years, except in the first valuation where the initial unfunded actuarial accrued liabilities were amortized over 30 years. The asset value for initial year of all runs was set at 90% of the PBO using the static table mortality table of up2000. Accumulated actuarial losses (experience gains and losses plus increases in the accrued liability for assumption changes after the first valuation date) was never greater than 10% of the projected benefit obligation (PBO)³. Therefore, the SFAS 87 expense never had a component that amortized the actuarial gains or losses.

B. Key Observations

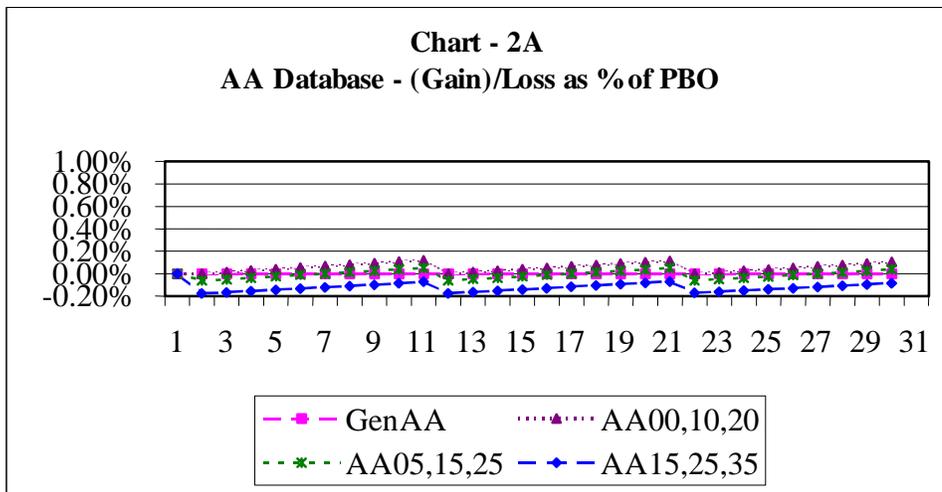
- 1) Asset accumulation (Charts 1A, 1B, 1C, and 1D, pages 2, 3 & 4):
 - a) The asset accumulation as a percentage of the asset value (ideal assets) developed using generational projections where the projection scale matches the scale used in the dataset, after initially declining tend to level off during the 29-year period. And are always less than 100% of the ideal assets for the following scenarios:
 - i) The mortality table is changed every 10 years using the current mortality tables as of the date of the valuation.
 - ii) The mortality table is changed every 10 years using mortality tables that are projected beyond the valuation date by the same mortality improvement scale used to construct the dataset.
 - b) The asset accumulations as a percentage of the ideal assets tend to diverge during the 29 years period as a percentage of ideal assets and are always less than 100% for the following scenarios.
 - i) The mortality table is unchanged for the entire 29-year period.
 - ii) The mortality table is changed every 10 years. It is not the current table, but one that matches a previous valuation date.

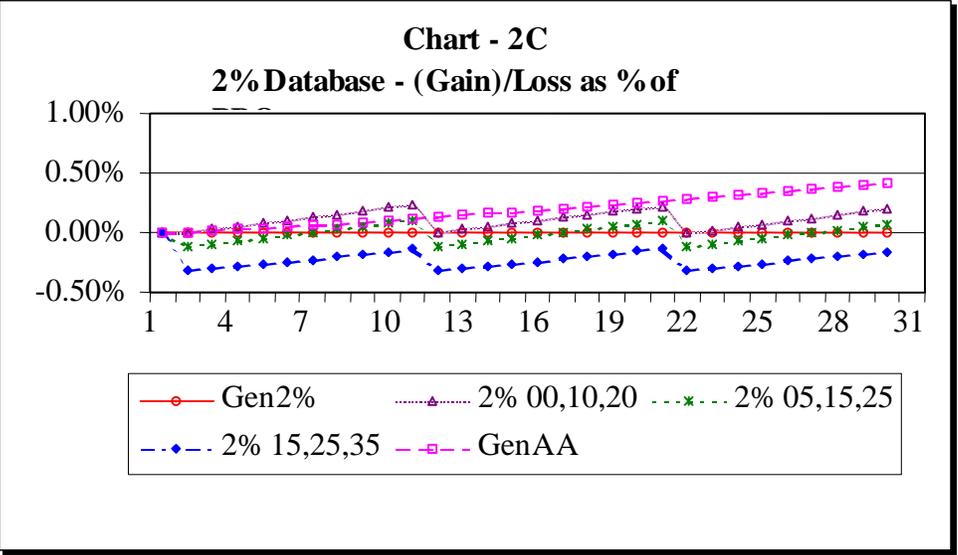
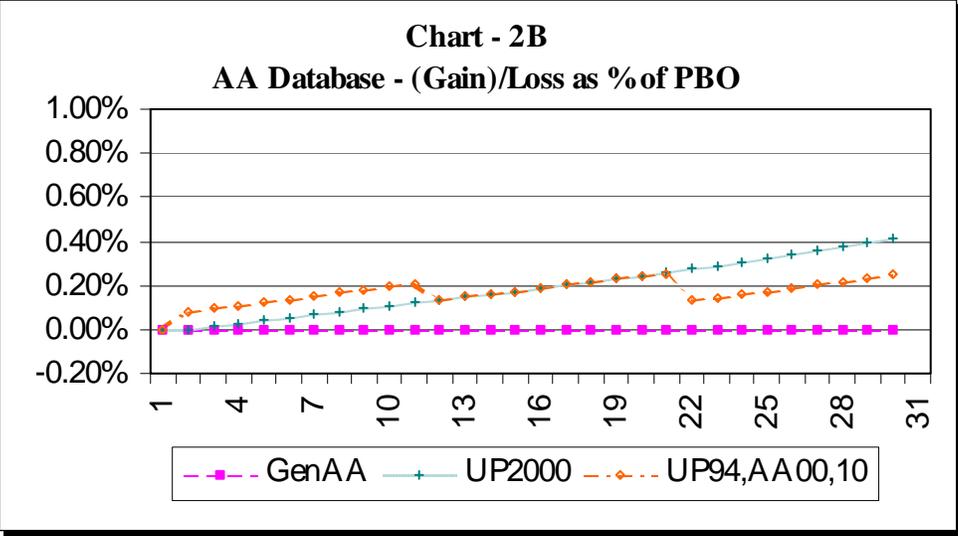
³ For this study the assumption changes that were implemented as of the first valuation date, including the change to generational mortality projection were not included in SFAS 87 accumulated gains and losses for the 10% test and were amortized over 15 years with the initial unfunded liability. Had they been included in the accumulated losses, the 10% test still would have been met.

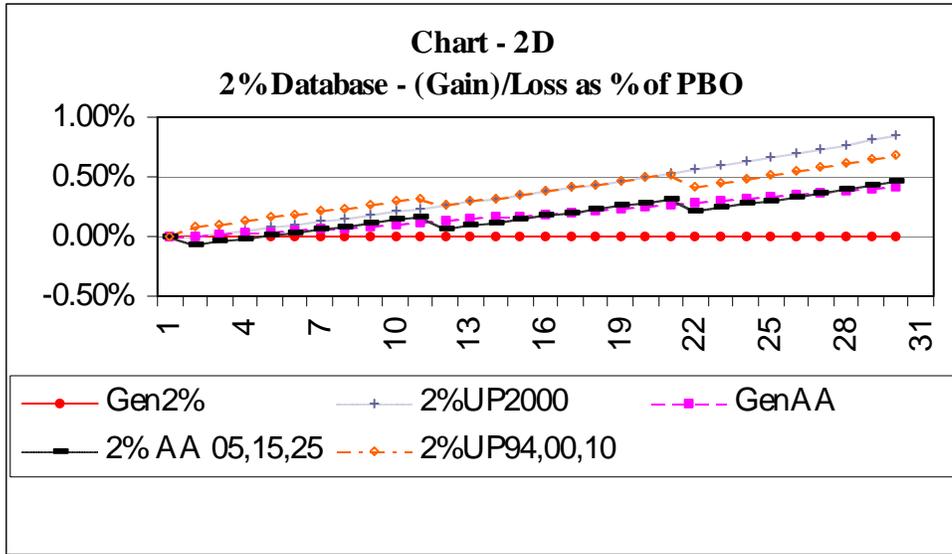
iii) Generational projections are used but the improvement scale is less than the one used to construct the dataset.

2) A review of the charts on the next two pages that illustrate yearly experience (gain)/loss as a percentage of PBO (Charts 2A, 2B, 2C, and 2D) show why the divergence and convergence of the asset values occur.

- a) For the scenarios that have consistent gain or at some point in time have zero gains or losses (mortality for valuation year matches generational mortality) e.g. “00,10,20”, “05,15,25” and “15,25,35”, the asset values converge to a constant percentage of the ideal asset value.
- b) For the scenarios that show consistent losses, the assets as a percentage of the ideal asset value continue to diverge.
- c) These charts show scenarios that have at least one year with no experience gains or losses (the mortality tables match the data at some point or is always beyond the table). The contributions due to five year amortization of the mortality loss and 10 year amortization of the change of assumptions are large enough to keep the assets as a constant percentage of the ideal assets. While the diverging asset values, a shorter amortization periods may help to develop larger assets be closer to the ideal asset values. Under the amortization periods used, it seems that the scenarios with consistent losses, the asset values do not have time to catch up and continue to fall behind the ideal asset values.





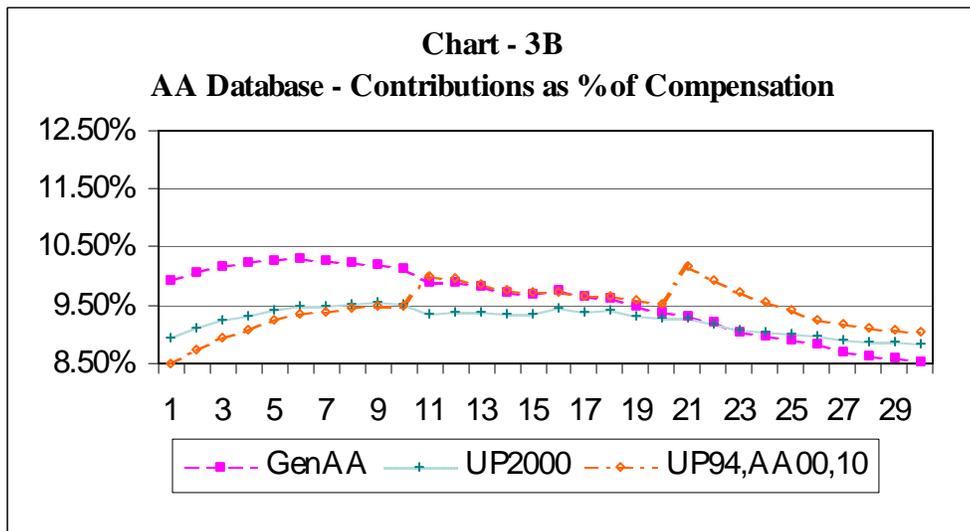
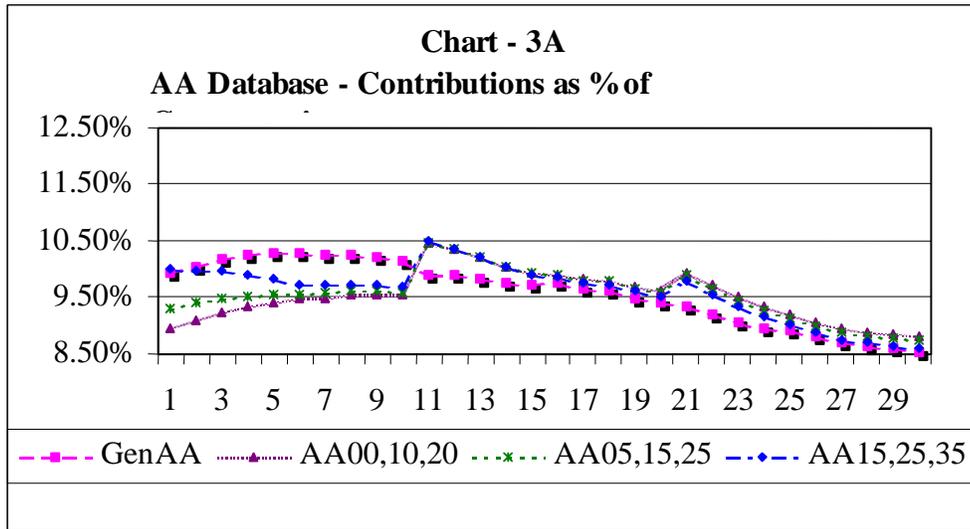


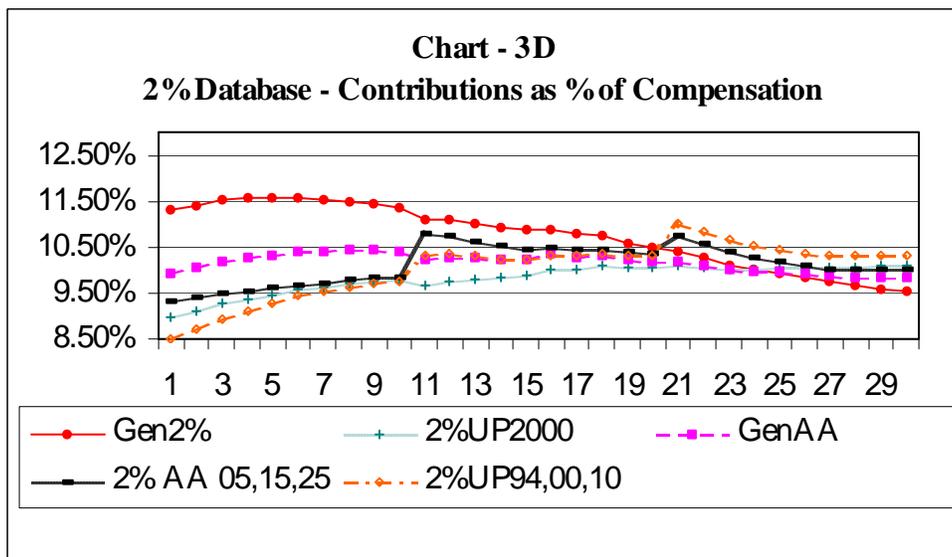
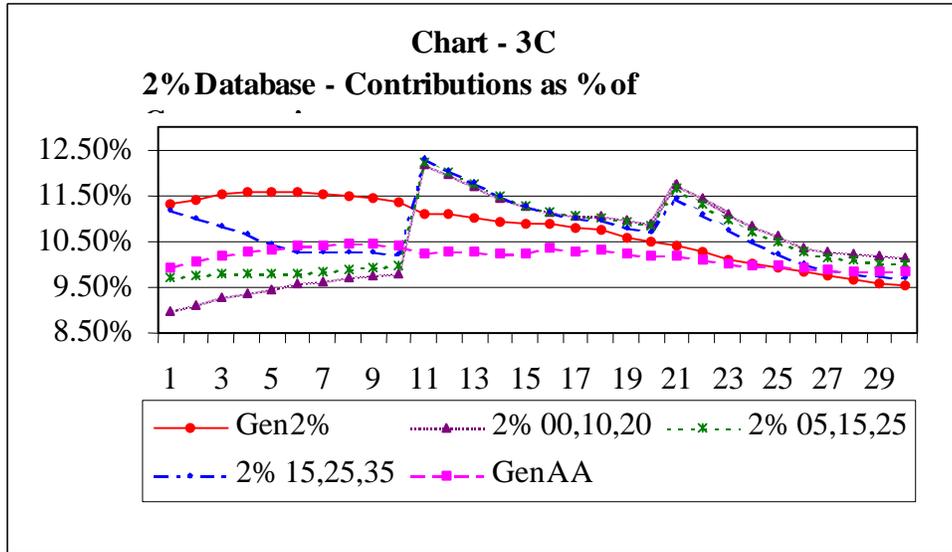
- 3) A review of the contribution patterns charts, which illustrate contributions as a percentage of compensation (Charts 3A, 3B, 3C, and 3D) helps explain why the assets as a percentage of ideal assets decline for 10 years and stays level, or continues to decline thereafter.
- a) For the asset patterns that become level:
 - i) The generational contribution is larger than all other contribution scenarios during the first 10 years because the sum of the service cost and amortization of the 1/1/2000 unfunded are initially larger than the other scenarios⁴, and the amortization of the experience losses under the other scenarios is not large enough to make up the difference
 - ii) At year 10 and 20, the amortization of the change of the mortality assumption over 10 years is large enough so that those contributions are larger than the generational contribution,
 - b) For the scenarios that assets continue to diverge as percentage of ideal generational assets:
 - i) As explained in a) above, the generational contribution is larger than all other contribution scenarios during the first 10 years.
 - ii) Amortization of the change of the mortality assumption over 10 years at year 10 and 20, plus the service cost is less than the generational contribution.
 - iii) The 5 year amortization of the consistent mortality losses is not large enough to match the generational contribution and the plan continues to lag behind.
 - iv) The mortality scenarios that does not match the data at any point for the current valuation date or future valuation dates cause the contributions to be too small to keep the assets as a constant

⁴ For the 10-year forward update scenario, the amortization contribution starts out slightly higher than the generational projection, but ends the 10-year period lower due to amortization of experience gains.

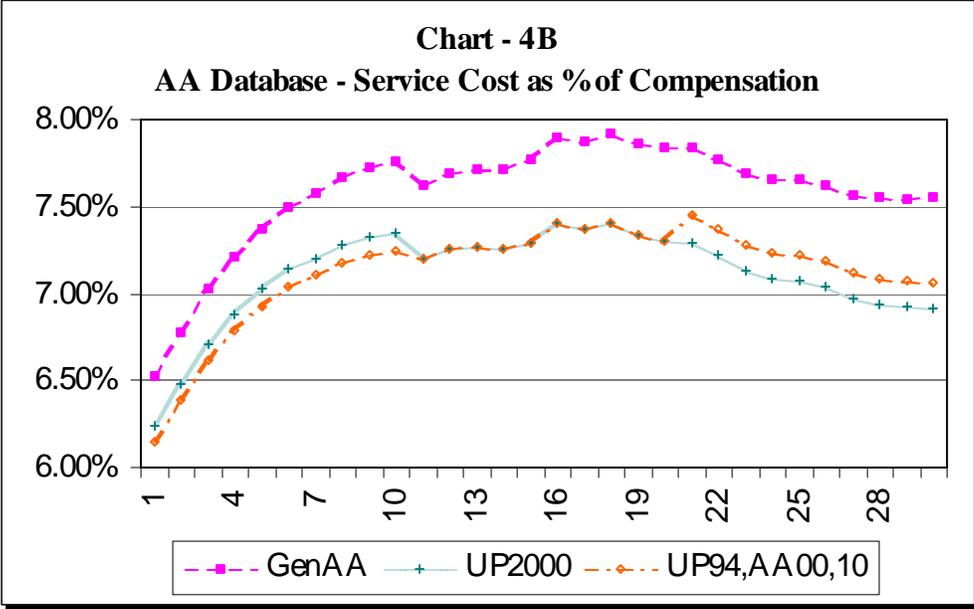
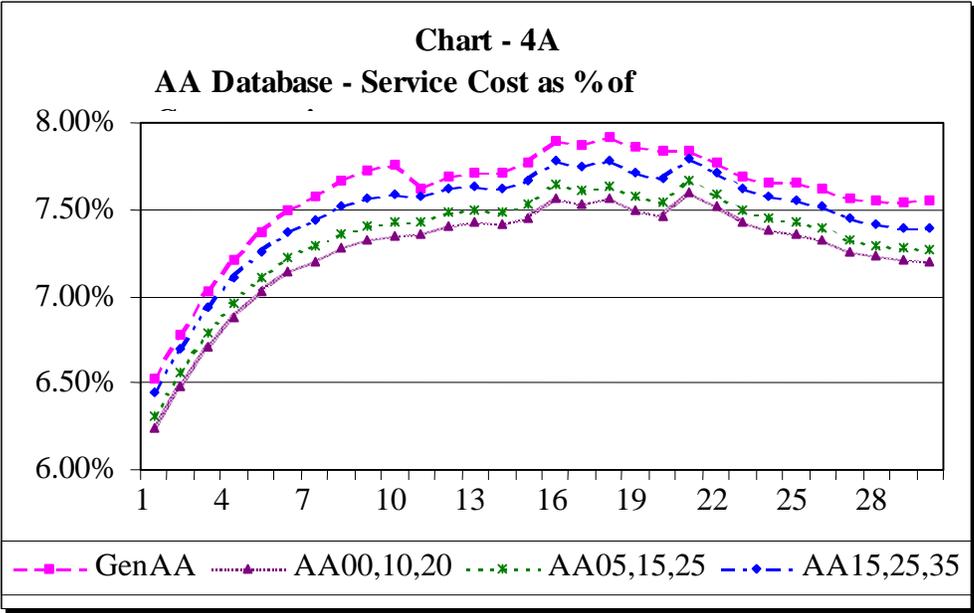
percentage of the ideal assets. Therefore, the assets continue to diverge from the ideal generational assets.

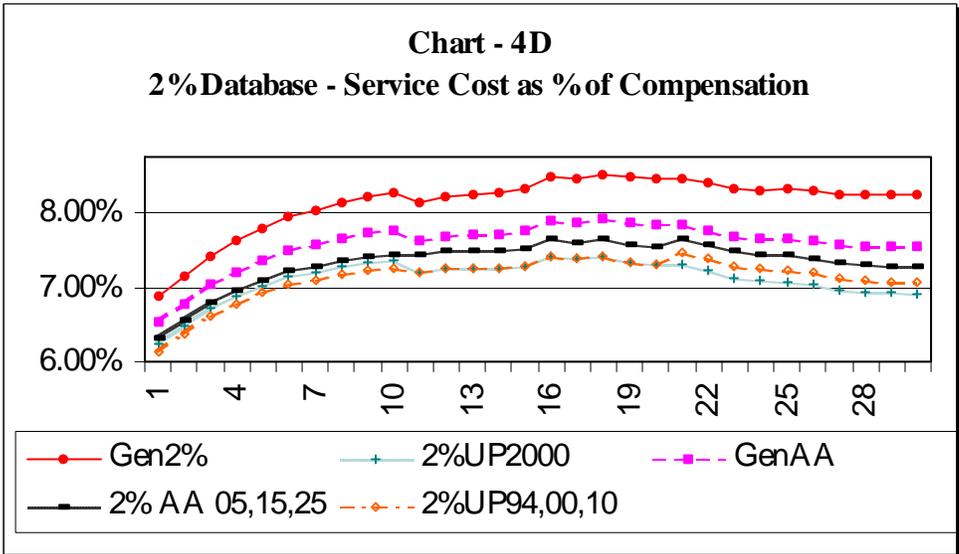
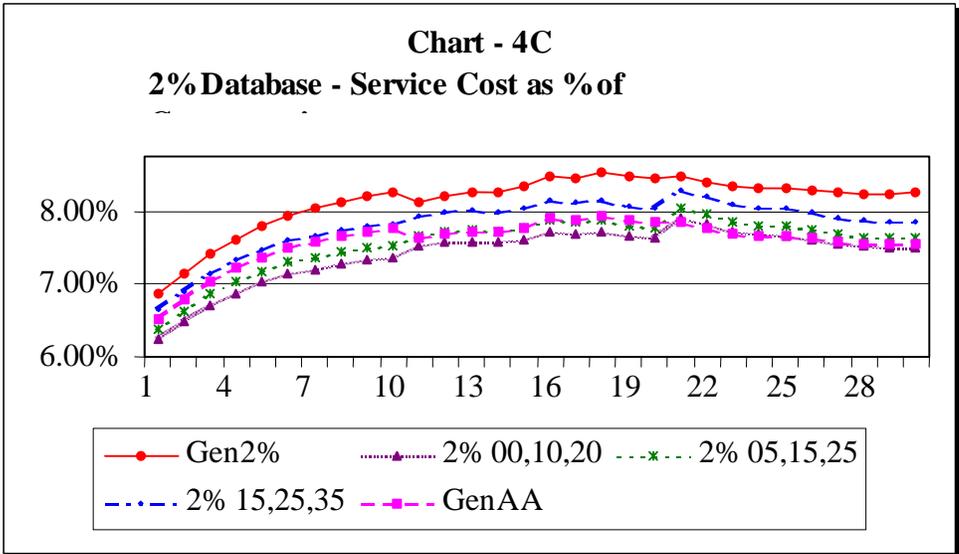
- v) In the last 10 years of the study scenario that have consistent mortality loss (UP2000, genAA on the 2% datasets, up94, 00,10), the contribution becomes larger then the generational contribution because of the amortization of the losses, this is not large enough to level off the assets as a percentage of ideal assets but could in years beyond the 30 years which was not part of the study.





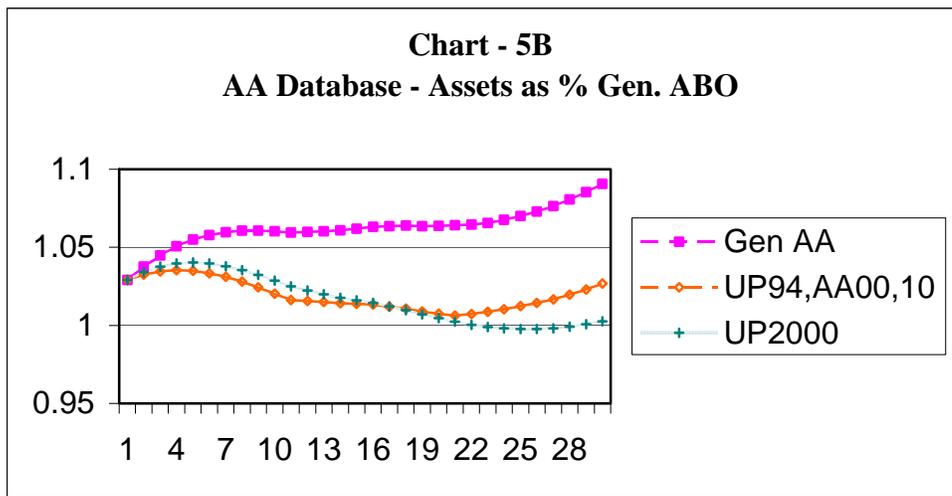
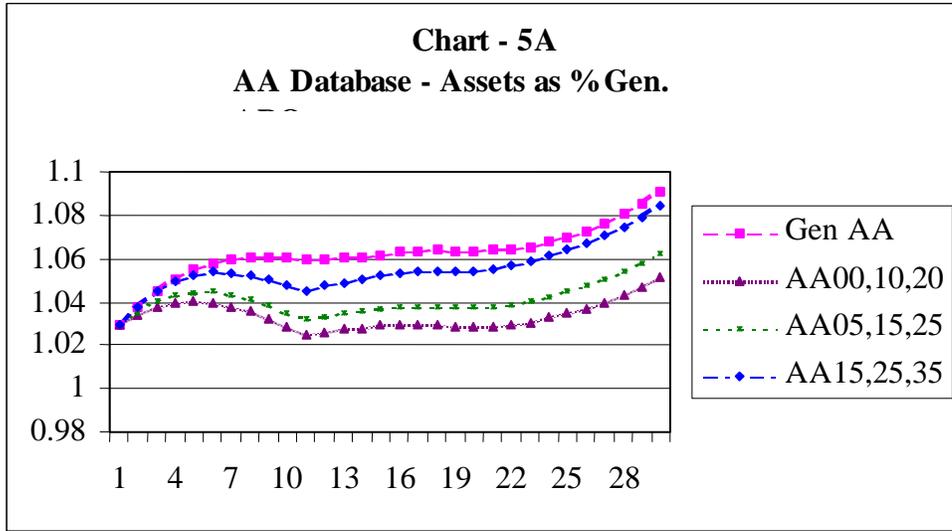
c) The ranking of service cost as a percentage of compensation (Charts 4A, 4B, 4C, and 4D) for each scenario is constant throughout the 30 year period except for the scenario when the mortality table is unchanged through out the study compared to the scenario when the change lags 10years (UP2000 compared to UP 94,00,10). As losses arise due to assumption updates and experience losses, by year 29, the ranking of contributions as a percentage of compensation is reversed with the scenario with the lowest service cost having the highest contribution rate and the scenario with the highest service cost having the lowest contribution rate.

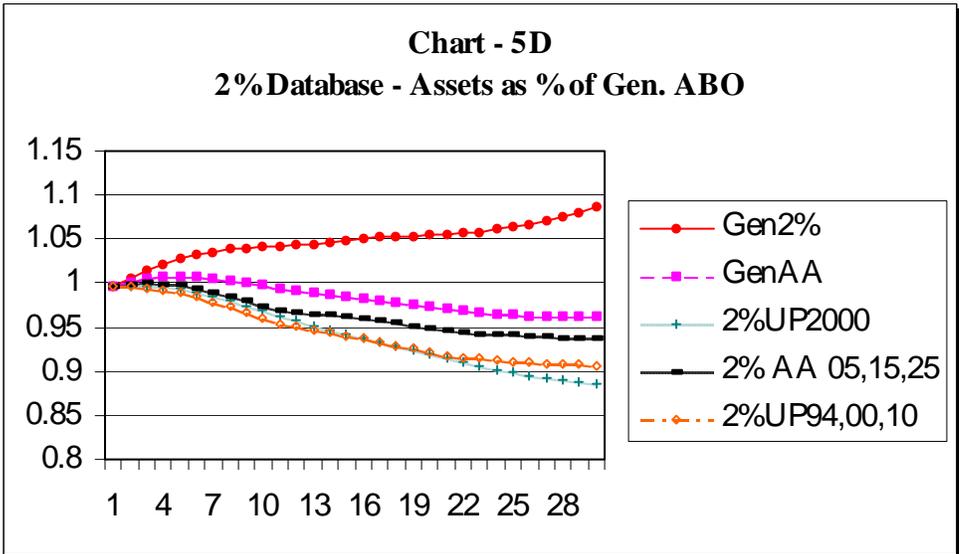
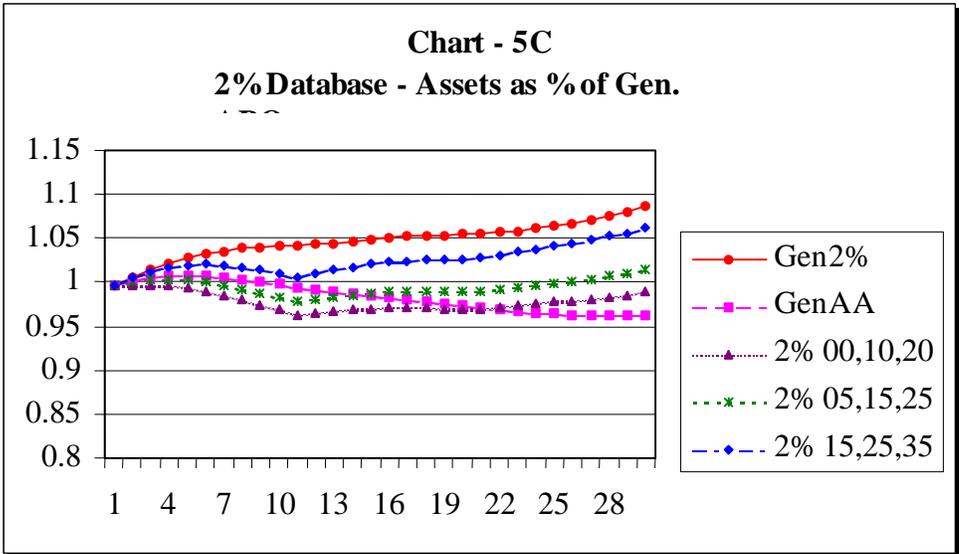




- 4) One measure of adequate asset accumulation is the ability of the assets to cover the accumulation benefit obligation (ABO) or the present value of accrued benefits. Assuming the generational ABO using the database projection scale is the “ideal” ABO in the long-run and keeping in mind that the plan started in a well-funded position and that contributions are designed to fund the PBO, a review of the charts labeled “Assets, as % of Gen. ABO” supports the following observations. (Charts 5A, 5B, 5C, and 5D).
- a) Generally, all scenarios under the AA scale databases had adequate asset value compared to the generational ABO.
 - b) For the 2% databases, only the two scenarios that projected the mortality table past the valuation change date by the 2% scale had asset values adequate to cover the generational ABO.

- c) The stronger the mortality improvement, the less likely assets will adequately cover the ABO. Under low mortality improvement experience, assets will generally be larger than ABO.





- 5) The following are some observations about SFAS 87 expense and the associated accrued/prepaid cost. Since the accumulated losses due to experience losses and assumption changes were never more than 10% of the Projected Benefit Obligation (PBO), the SFAS 87 expense never had a component for amortization of these losses.
- a) For most scenarios, SFAS 87 expense was larger than the contribution for the first 15 years as shown on the charts labeled “FAS Expense as % of Contributions” (Charts 6A, 6B, 6C, and 6D) because the unfunded liability in the starting valuation was amortized over 30 years for funding and 15 years for expense.
 - b) For all scenarios, the SFAS 87 expense was less than the contribution for the final 15 years.

Chart - 6A
AA Database - FAS Expense as % of

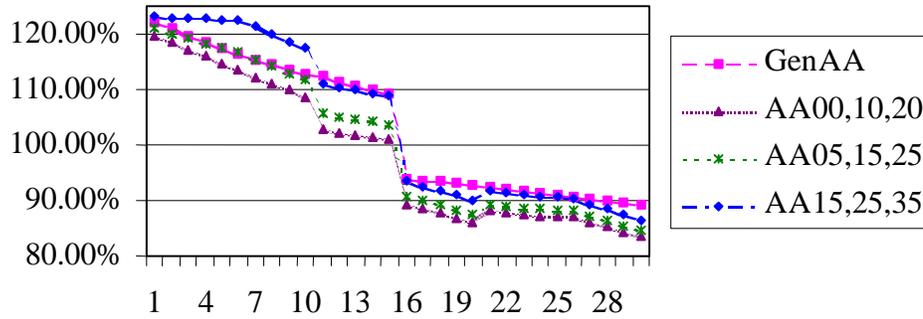
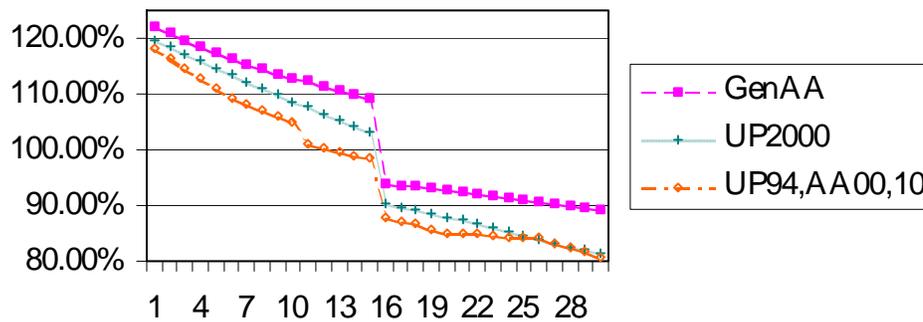
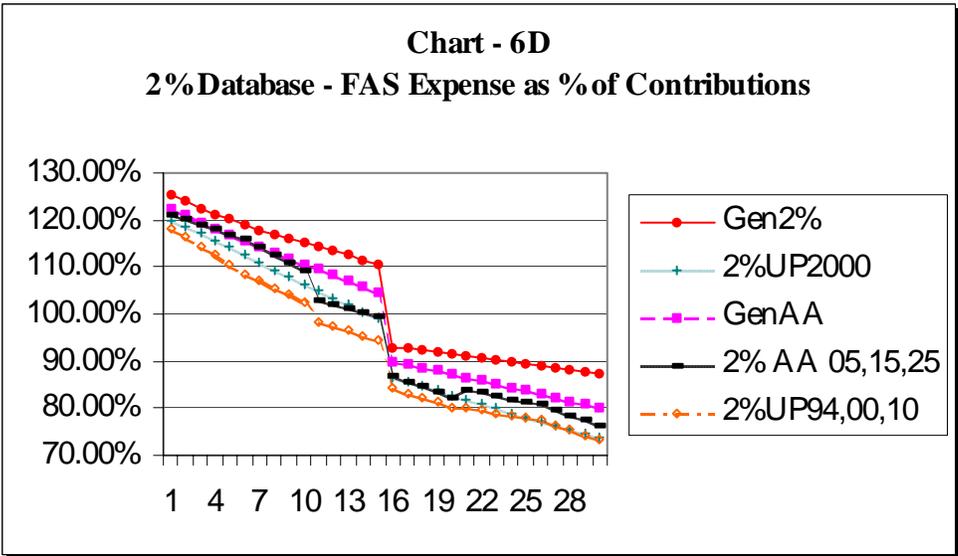
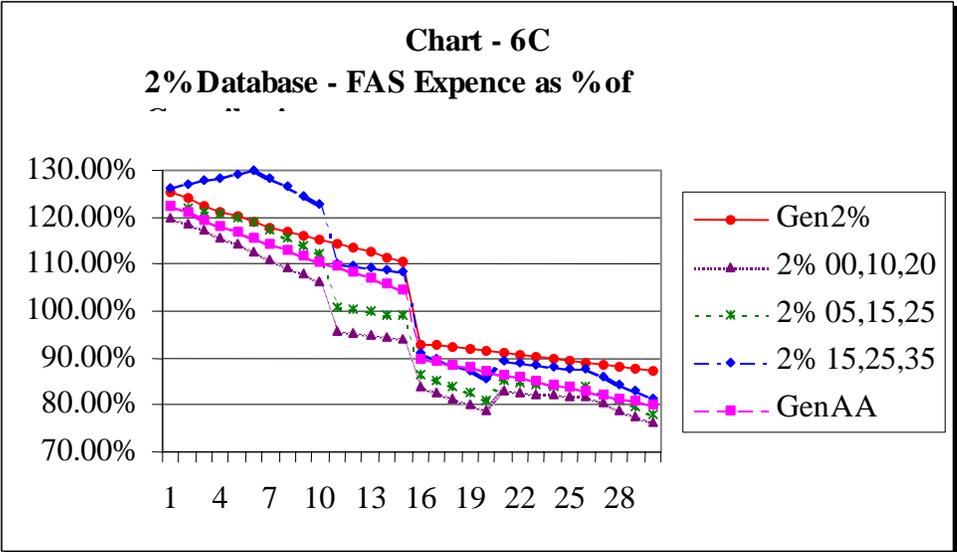


Chart - 6B
AA Database - FAS Expense as % of Contributions





- c) This developed an accrued pension cost (Charts 7A, 7B, 7C, and 7D, on page 32) over the 15 years, then the accrued started to decrease as the contribution became larger than the SFAS 87 expense and then developed a prepaid pension cost for all scenarios except for 2 scenarios – matching generational tables and mortality table assumptions projected 15 years past the change valuation date. The prepaid/accrued cost would become zero after 30 years for the generational assumption scenario, since there were no gains or losses, and amortization of the unfunded would be completed.
- d) The resulting prepaid after the first year unfunded has been paid off equals principal payments contributed to date towards the total aggregate SFAS

- 87 losses⁵. The scenarios using mortality tables that generate the highest mortality losses, or are further from the actual experience, generated the largest prepaid. This occurs because the FAS 87 expense has the lowest percentage of the contributions.
- e) This seems somewhat contrary to common sense to have a prepaid when the assets are less than the ideal assets and seems to have some relationship to the unfunded actuarial accrued liability.

This leads to the following conclusions by the author based on the above observations:

- Periodically updating the mortality table assumption to reflect current mortality levels with or without mortality scale projections or using mortality projected beyond the valuation date may accumulate assets closer to the ideal assets.
- Consistently using mortality tables that are not current will eventually accumulate to assets less than ideal.
- Based on the scenario using the Scale AA generational projection on the 2% database, the mortality tables and projection scales should also be reevaluated as new mortality studies and projection scales become available. These observations also imply that the mortality tables and projection scales should be appropriate for the population being valued because inadequate assets could accumulate or the cash contributions to the fund by the plan sponsor may be higher than necessary.
- The number of years for the amortization periods for change of assumption and actuarial loss are important to adjust contributions to keep assets from consisting diverging from the ideal. In particular the 10 year amortization period for change of assumptions corresponds to when the study changed assumptions.
- The stronger the mortality change, the greater the difference between accumulated assets and ideal assets if mortality assumptions are not updated on a regular basis.
- A good technique to approximate generational mortality techniques is to use static mortality tables that are projected beyond the valuation date.

⁵ Losses due to changes in assumptions on the first valuation date were amortized over 15 years.

III. Comprehensive Section

A. Purpose of the Study

The Society of Actuaries Committee on Retirement System Research (the “Committee”) wanted to provide practicing pension actuaries an understanding of the impact of projecting mortality improvement on pension funding and benefit security under various approaches used by pension actuaries to reflect mortality improvement. The purpose of the study is not to draw conclusions on how the pension actuary should value a defined benefit pension plan, but to provide information so that the actuary can draw his own conclusions in relation to a plan.

B. Introduction

The actuarial literature and the popular press have published articles about the impact of future mortality improvement on society and social insurance programs such as Medicare and Social Security. This paper looks at the impact of future mortality improvement on defined benefit pension funding in the private and public sectors.

Several mortality tables developed by the Society of Actuaries for use in pension plan valuations (e.g. UP-94 and RP-2000 Tables) have an associated projection scale (e.g. Scale AA) for reflecting future mortality improvement.

At the time of this writing, prevailing practice among pension actuaries is not to use generational mortality projections or static mortality tables with improvements projected past the valuation date. (Antidotal evidence only no study has been performed to verify this.)

C. Census Data Methodology

The Project Oversight Group (POG) provided the census data for 5000 active employees with date of birth, date of hire, gender, and annual compensation and 5000 inactive participants with date of birth, gender, and retirement benefit amount.

Since the data was heavily weighted toward males (83% male/17% female for actives and 75% male/25% female for inactives), the genders were randomly changed to make the initial active population approximately 50% male/50% female. The resulting inactive population was 45% male/55% female. The purpose was to insure that the initial data set was gender balanced. .

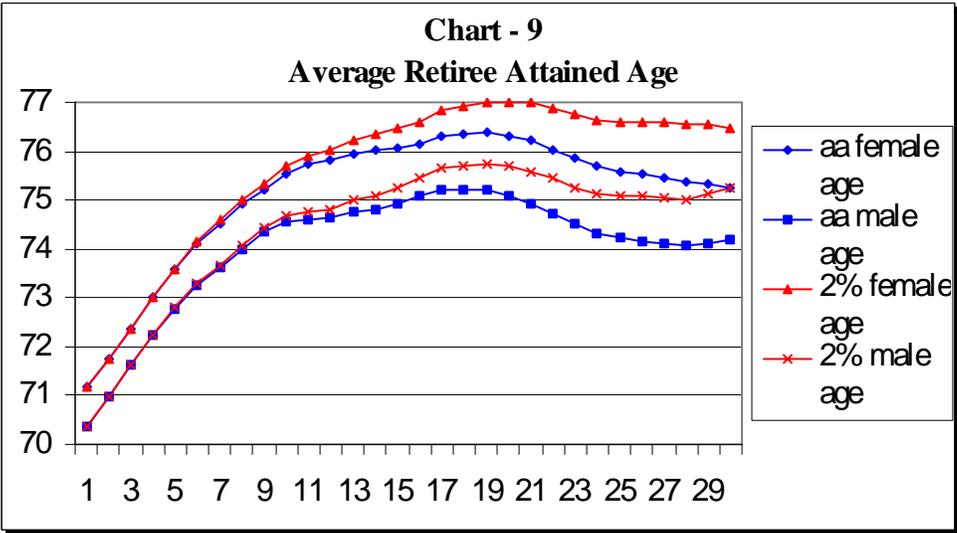
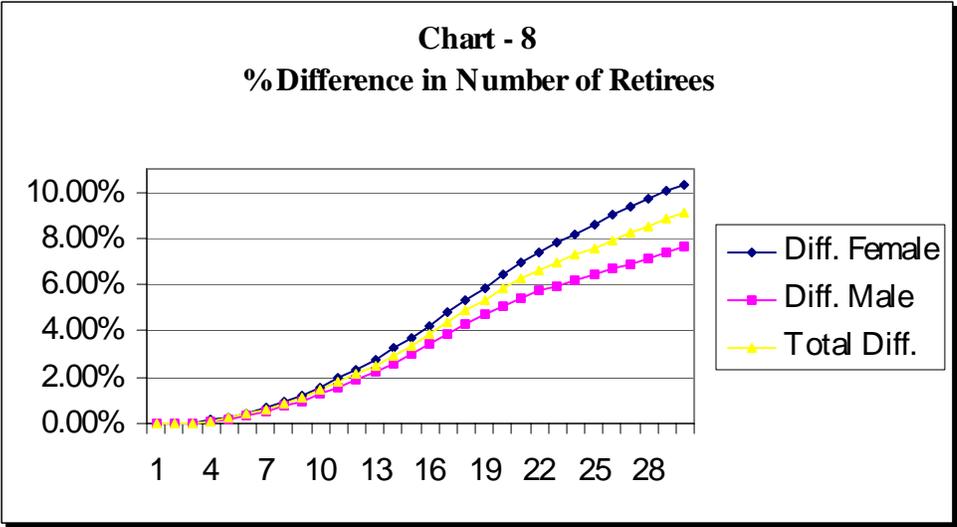
Two sets of 30 year censuses were projected. The termination, mortality, and new entrants assumptions were provided by the POG. The active population remained

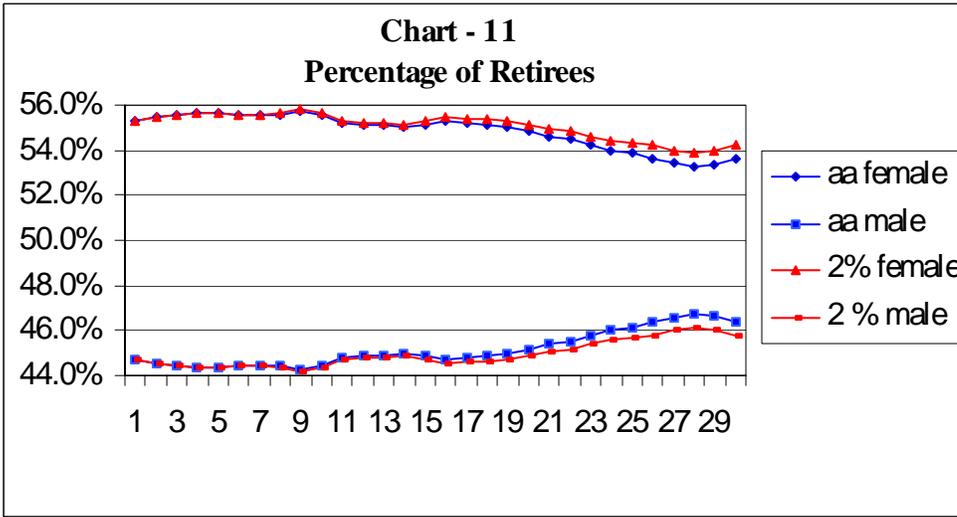
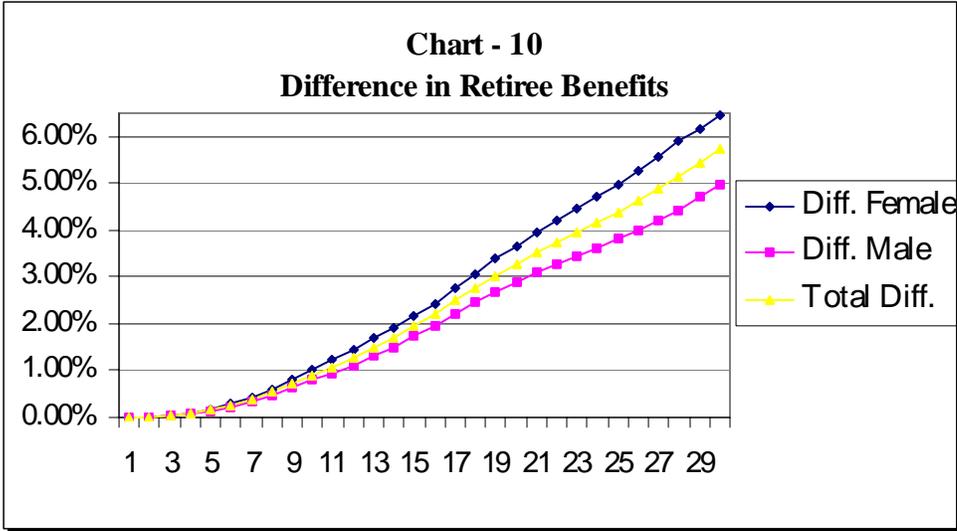
at 5000 employees. The inactive population increased for new inactives and decreased because of mortality. One database set used the UP-94 Table projected to year 2000 using Scale AA ([UP-94@2000](#)) with further projection for next 29 years using Scale AA (AA database), while the second dataset UP-94@2000 mortality used a constant 2% per year mortality improvement scale for projecting (2% database).

See Appendix A for more details on how the censuses were projected.

The 2% dataset and the AA dataset have the following different demographic characteristics:

- 1) The active populations under both databases show no significant differences as to attained ages, male/female ratios, or total covered payroll.
- 2) The terminated vested population shows no significant difference as to average attained age, male/female ratio, or deferred vested benefits.
- 3) The retiree populations projected under the two experience databases have significant differences:
 - a) The difference in number of retirees gradually increases over time with the 2% database having more retirees. At the end of the 29-year period, the 2% database has approximately 9% more retirees than the AA database – 10% more females and 8% more males. (Chart 8)
 - b) At the end of the 29-year period, the average attained age of retirees under the 2% database is approximately 1.25 years older for females than under the AA database and 1 year older for males. (Chart 9)
 - c) The difference in total retirement benefits after the 29-year period is over 5% greater for the 2% database. (Chart 10)
 - d) These differences are expected because the 2% scale projects lower future mortality rates than Scale AA; thus, resulting in more retirees with a higher average age. The total benefit amount only increases by 5% compared to the 9% increase in the number of retirees because more retirees who retired earlier with a lesser benefit are still alive under the 2% scale.
 - e) The ratio between male and female retirees is similar, but the percentage of males is greater at the end of the 29-year period under the AA dataset than under the 2% dataset because at certain ages males have a higher rate of improvement under Scale AA. (Chart 11)
 - f) Macaulay duration's as of January 1, 2000 for various liability measures and various demographic subgroups may be found in Appendix C.





D. Plan Provisions and Actuarial Assumptions

The POG provided a plan design with a fairly representative level of benefits and a fairly typical set of actuarial assumptions.

The plan provisions are:

- The benefit formula is 1.5% times years of service times final 5 year average compensation. It is payable on an unreduced basis at normal retirement date.
- Normal retirement date is the first of the month following attainment of age 63.
- Participants are 100% vested after 5 years of service.
- No death benefits are available.
- Form of benefit is straight life only.

The actuarial assumptions are:

- Interest rate is 8% compounded annually.
- Salary scale is 5% compounded annually.
- No limits on benefits or salary are used.
- The termination table is shown in Appendix E.
- Six sets of mortality assumptions were used on the 30 year dataset generated by Scale AA.
- Eight sets of mortality assumptions were used on the 30 year dataset generated by scale 2%.

See Appendix B and Appendix E for more complete descriptions of the actuarial assumptions.

The actuarial funding methods used are:

- Projected unit credit (PUC)
- Initial asset values for all scenarios were set at 90% of the PUC actuarial accrued liability using UP2000.
- Initial unfunded accrued liability
 - (1) For funding, amortized over 30 years.
 - (2) For SFAS 87 expense, the transition obligation was expensed over 15 years; this is 2.5 years more than the expected working lifetime of the actives.
- Change of Actuarial Assumptions
 - (1) For funding, amortized over 10 year, except for changes in assumptions occurring at the first valuation date, which are incorporated in the initial unfunded accrued liability and amortized over 30 years
 - (2) For SFAS 87, no amortization because the total sum of all gains and losses never exceeded 10% of PBO during the 29-year period⁶.
Actuarial experience gains and losses
 - (1) For funding, amortized over 5 years.
 - (2) For SFAS 87, no amortization because the total sum of all gains and losses never exceeded 10% of PBO during the 29-year period.
- IRS maximum funding requirements or limitations on compensation or benefits were disregarded.
- The software valuation program used was Lynchval, which was supplied by Lynchval Systems Worldwide, Inc. This actuarial valuation

⁶ For this study the assumption changes that were implemented as of the first valuation date, including the change to generational mortality projection were not included in SFAS 87 accumulated gains and losses for the 10% test and were amortized over 15 years with the initial unfunded liability. Had they been included in the accumulated losses, the 10% test still would have been met.

program was used with generational projection incorporated. No special programming was performed except for output of results. Very small actuarial losses occurred from the program when an active record becomes terminated vested. The loss was less than .0005% of PBO.

E. Results

1. Introduction

The best way for the reader to draw his own conclusions is to review the charts comparing various scenarios to the results using the generational projection on the corresponding datasets. The key charts were discussed previously. Each database set has two charts and includes the following scenarios:

- 1) Actuarial results of changing static tables every 10 years, but to a table reflective of mortality rates at an earlier date. These tables show consistent actuarial mortality losses.
- 2) Actuarial results of changing static tables every 10 years to a current table with or without projection beyond the valuation date to estimate future mortality improvement.

The following is a description of the various mortality assumption scenarios used in the actuarial valuations:

- 1) For AA database
 - a) UP2000⁷ for the entire period.
 - b) UP-94 for the first 10 years, UP2000 for the next 10 years, and AA2010 for the final 10 years (“UP94,AA00,10”). This represents the scenario where the mortality assumption constantly lags behind the data.
 - c) UP2000 for the first 10 years, AA2010 for the next 10 years, and AA2020 for the final 10 years (“AA00,10,20”). This represents the scenario where mortality tables are periodically changed to a current table.
 - d) Generational AA for the entire period (“GenAA”). This represents the scenario where assumptions match the actual experience.
- 2) For 2% database
 - a) UP2000 for the entire period.
 - b) UP-94 for the first 10 years, UP2000 (is this with scale AA or 2% scale?) for the next 10 years, and 2%2010 for the final 10 years (“UP94,2%00,10”). This represents the scenario where mortality consistently lags behind the data.
 - c) UP2000 for the first 10 years, 2%2010 for the next 10 years, and 2%2020 for the final 10 years (“2%00,10,20”). This represents the scenario where mortality tables are periodically changed to a current table.

⁷ See appendix B for further definitions.

- d) Generational using 2% per year mortality improvement for the entire period (Gen 2%). This represents, the scenario where assumptions match the actual experience.
 - e) Generational using AA scale for the entire period (2%GenAA) This represents the scenario using generational projection, but where the actuarial assumptions do not match the actual experience.
- 3) One method to approximate generational mortality using static tables is to project static tables beyond the valuation date. Two scenarios under each database were based on projecting UP2000 beyond the initial valuation date. One scenario projected UP2000 5 years beyond the initial valuation date and updated every 10 years to a table with a 5-year projection. Another scenario projected UP2000 15 years beyond the initial valuation date and updated every 10 years to a table with a 15-year projection.
- a) The 5 year forward projection scenarios are AA05,15,25 and 2%05,15,25.
 - b) The 15 year forward projection scenarios are AA15,25,35 and 2%15,25,35.

2. Gains and Losses

Reviewing the actuarial gain and loss patterns will help the reader understand the funding, asset accumulation, and SFAS87 results. In Charts 2A-D on pages 6, 7, 8 & 9 a graphical view of each year's experience gains/losses is presented for each database. The charts show gain/loss as a percentage of valuation PBO for that scenario not the "ideal" PBO. The scenarios that produce the best results are those that at some point in time during the 10 year period have an experience gain or at least one year with no experience gains or losses. Those that produce consistent losses produce the worst results.

These charts do not show the actuarial loss due to changes of assumptions. A review of the SFAS 87 accumulated loss/(gain) as % of PBO charts (Charts 12A, 12B, 12C, and 12D) shows the accumulation of the experience and assumption change gains/losses as percentage of PBO for purposes of SFAS 87. These SFAS 87 gains/losses are never amortized because they fall within the FAS 87 accumulated gain/loss corridor (10% of the PBO) .

Chart - 12A
AA Database - SFAS Loss/(Gain) as % of

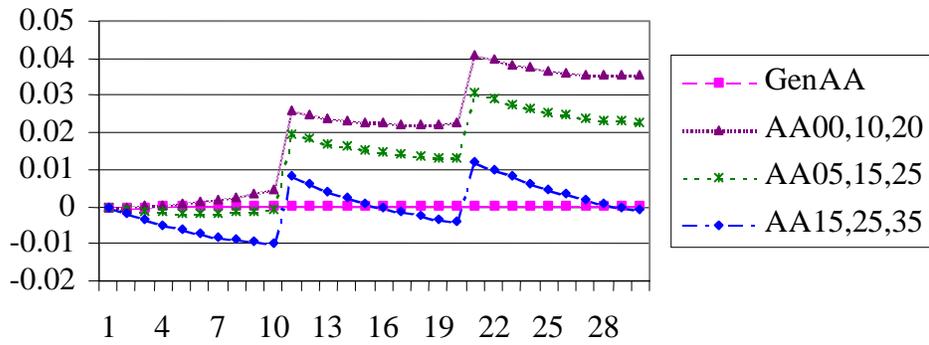
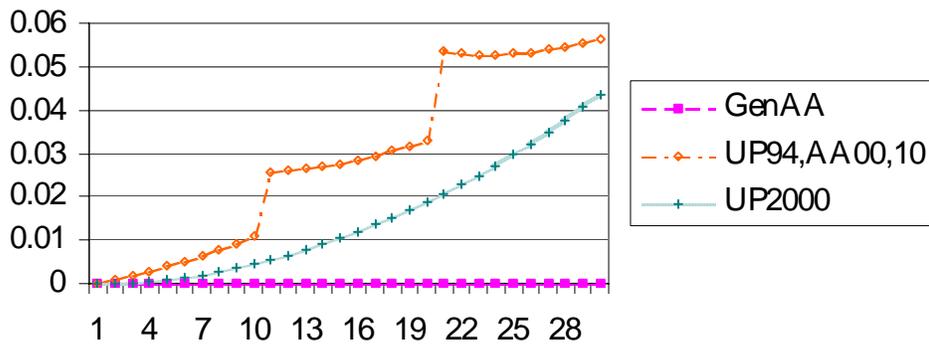
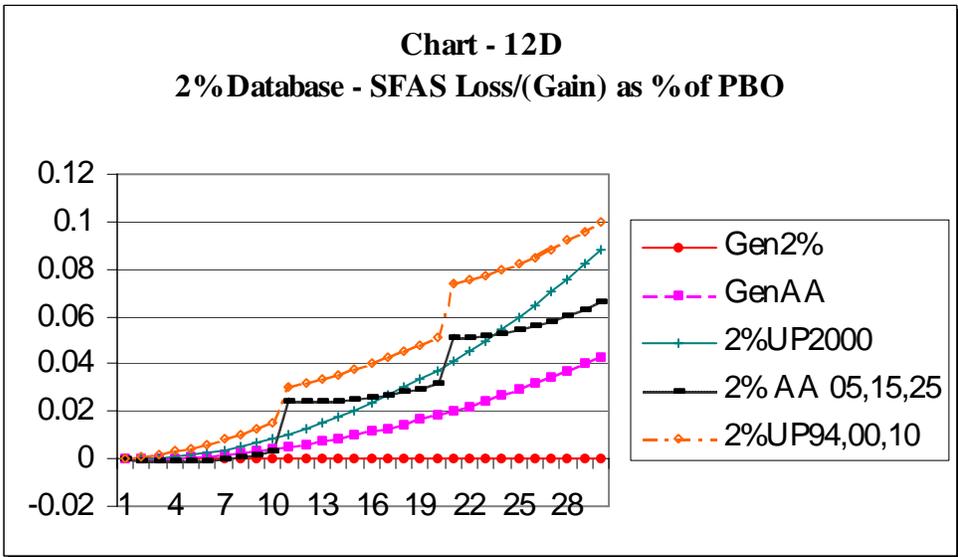
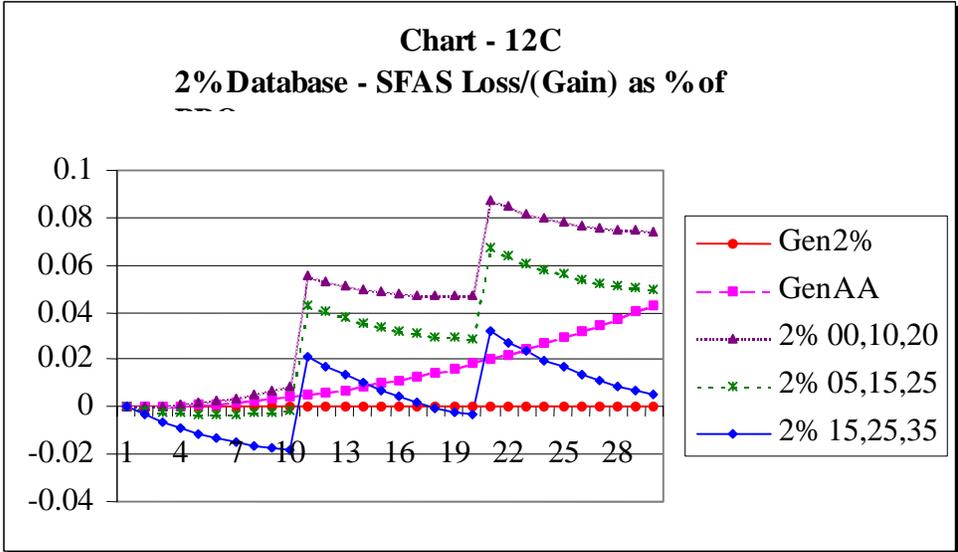


Chart - 12B
AA Database - SFAS Loss/(Gain) as % of PBO





The only scenario that closely matches the generational scenarios is the scenario that projects 15 years in the future. The combination of actuarial losses due to changes in assumptions and experience gains over the 29-year period net to approximately zero (Charts 12A and 12C). This feature of the 15 year forward projection is very important in understanding why, for these particular databases, these scenarios closely follow the generational.

3. Contributions and Service Cost

Contributions are the combination of the service cost⁸ plus 30 year amortization of the unfunded actuarial liability at the start of the forecast period plus 5 year amortization of experience gains/losses plus 10 year amortization of changes in actuarial assumptions.

- 1) The ranking of service costs as a percentage of compensation for each scenario from lowest to highest generally remains consistent throughout the entire 29-year period except for the UP2000 and update to lagged mortality scenarios (94,00,10). As expected, the scenarios with the lowest valuation mortality rates have the highest service costs. (Charts 4A, 4B, 4C, and 4D, pages 10, 12 & 13)
- 2) The contribution rates at the beginning of the 29-year period were ranked similarly to the service cost as a percentage of compensation, with the lowest expected mortality producing the highest contributions as a percentage of compensation. (Charts 3A, 3B, 3C, and 3D, pages 8, 10 & 11)
 - a) The variation between the scenarios was greater than the variations between the service costs because of the amortization of the first-year unfunded liabilities.
 - b) Contributions as a percentage of compensation begin to converge, but at each assumption change, they start to diverge again.
 - c) In the final 10 years, the ranking of contributions as a percentage of compensation reversed order because of the impact of amortization of experience and change of assumptions losses and
 - d) Over time, the difference in amortization payments exceeded the differences in service cost plus amortization of the first-year UAAL's resulting in larger contributions.

This seems consistent with conventional wisdom, the more that is contributed early in the pension plan history, the less that has to be contributed later.

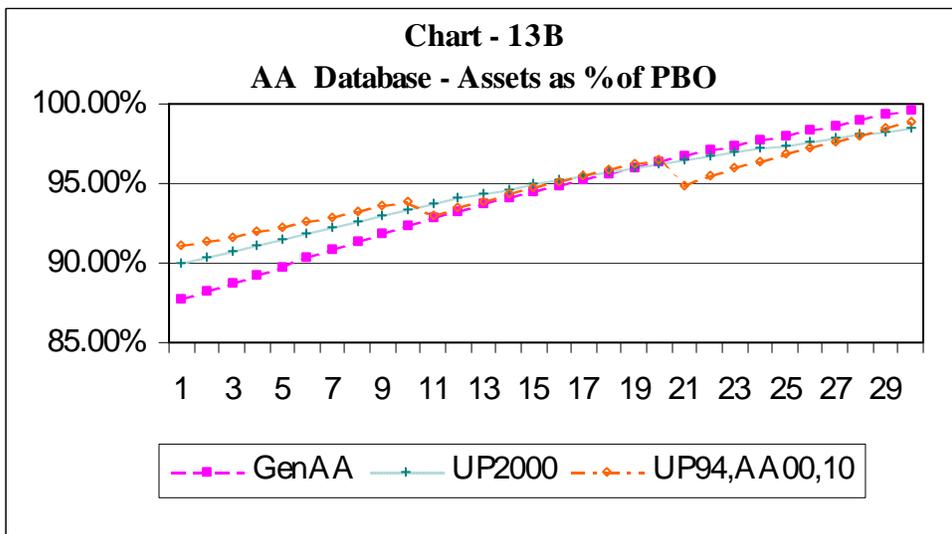
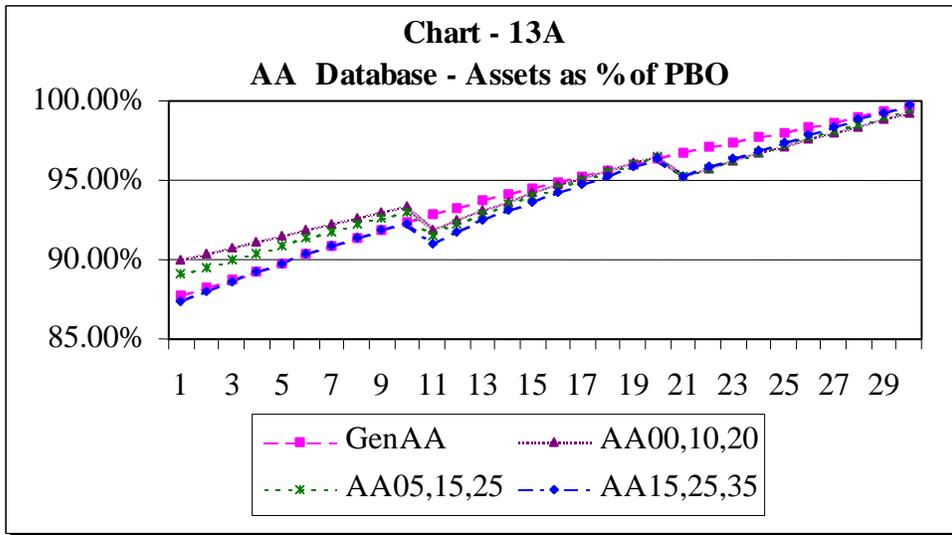
4. Asset Accumulation

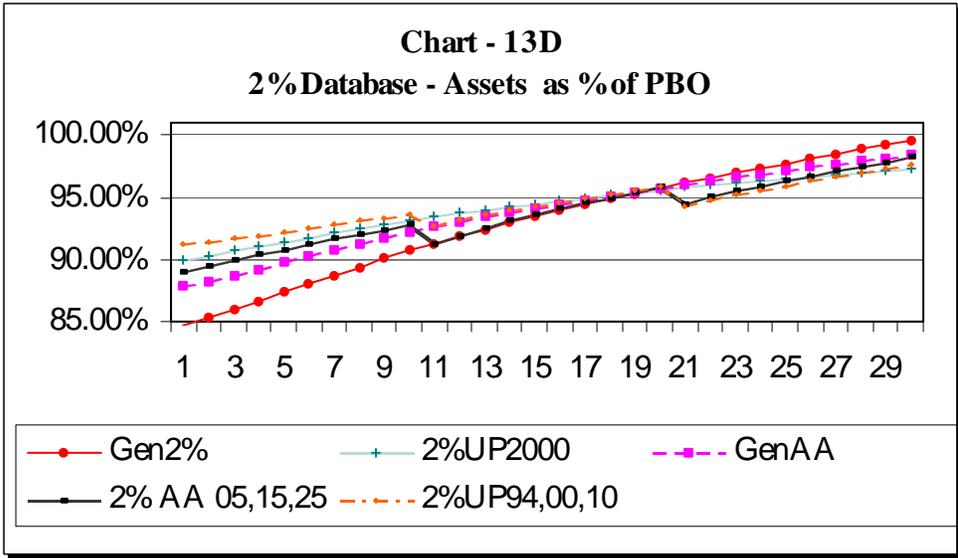
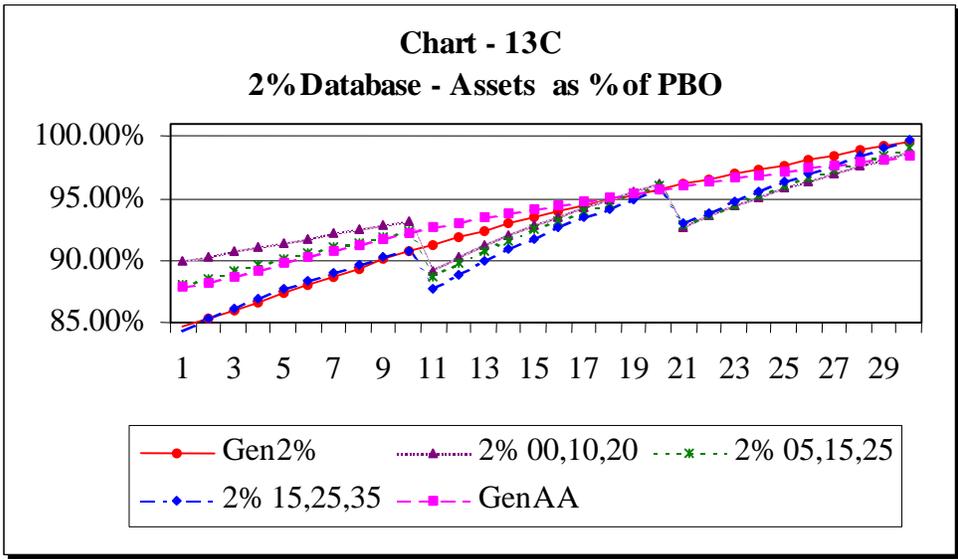
The ideal asset accumulation would be the assets developed using generational projections on the corresponding database e.g. Gen2% scenario on the 2% database (Charts 1A, 1B, 1C, and 1D pages 2, 3 & 4)

- 1) For both databases using UP2000 for the entire 29 years, changing mortality tables late or using a stronger or weaker generational table that does not match the underlying experience produces asset accumulations that decrease as a percentage of the ideal asset for the entire 29 years.
- 2) Under the above scenarios, amortization of actuarial losses over 5 years and amortizing change of assumptions losses over 10 years are **not** strong enough to stop the divergence of the assets on both dataset scenarios.

⁸ Normal cost, which in this study equals the FAS 87 service cost.

- 3) Periodically updating the mortality to a current table results in assets that decrease as a percentage of the ideal assets for the first 10 years then level off as a percentage of the ideal assets for the remaining 19 years.
- a) For AA database, assets become 96-97% of GenAA assets.
 - b) For the 2% database, assets become 91-93% of Gen2% assets.
 - c) Amortizing actuarial losses over 5 years and change of assumption losses over 10 years seems to be strong enough to stop the decrease of the assets relative to the generational scenarios under both datasets.
- 4) For the amortization periods upon which the study was based, the scenarios that have the largest mortality experience losses have the largest actuarial unfunded liability as a percentage of PBO at the end of the 29-year period. See charts 13A,B, C and D labeled "Assets as % of PBO."



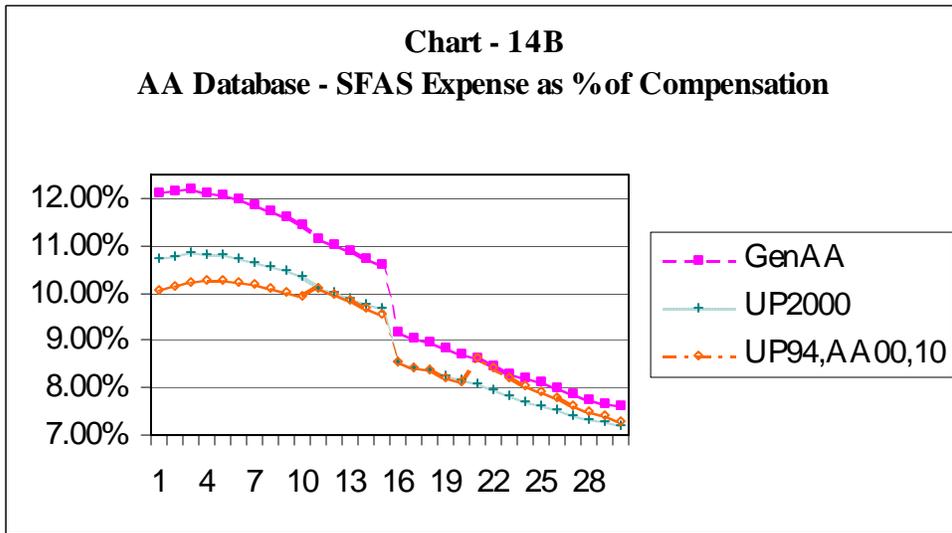
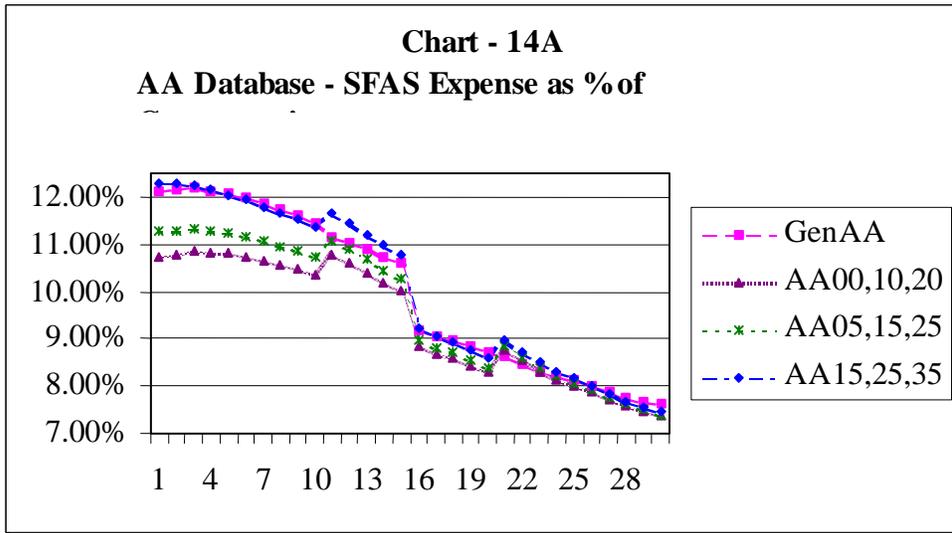


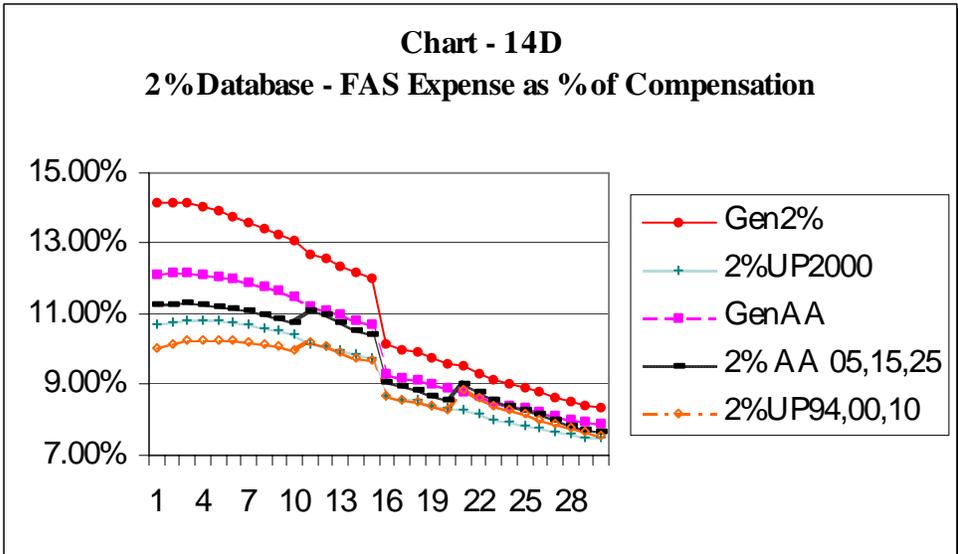
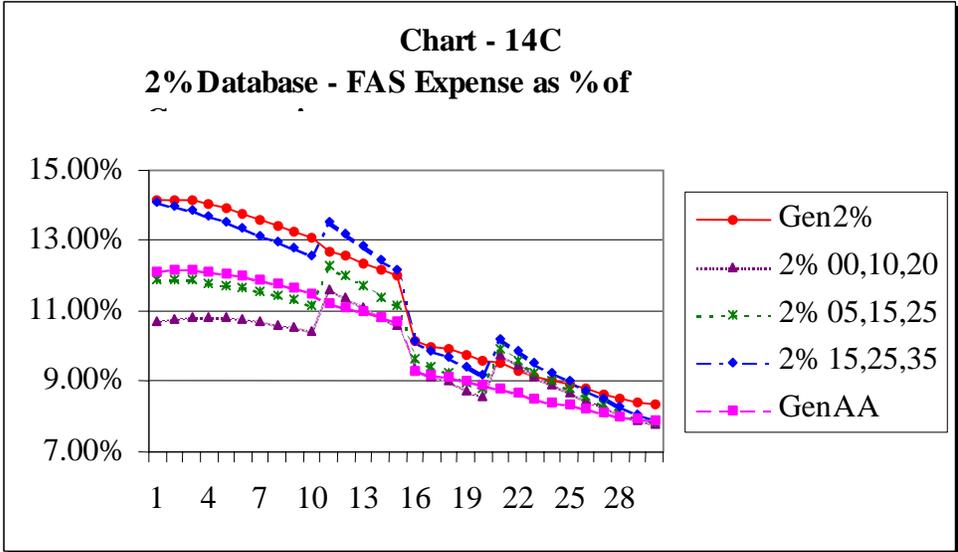
5. SFAS 87 Results

The SFAS 87 expense is determined by adding the service cost plus interest on the PBO plus an amount equal to initial unfunded divided by the expected working lifetime of the active group plus an amortization payment on actuarial gain/loss based on the working lifetime of the group minus the expected return on assets. The amortization payments are without interest. The plan sponsor has a great deal of latitude in determining amortization of the actuarial gains/losses. The standard is that no recognition has to be made until the aggregate loss is

more than 10% of the greater of PBO or assets. The excess is then amortized over the working lifetime. Over the 29-year period, no amortization of the gain or loss had to be recognized because of this criteria.

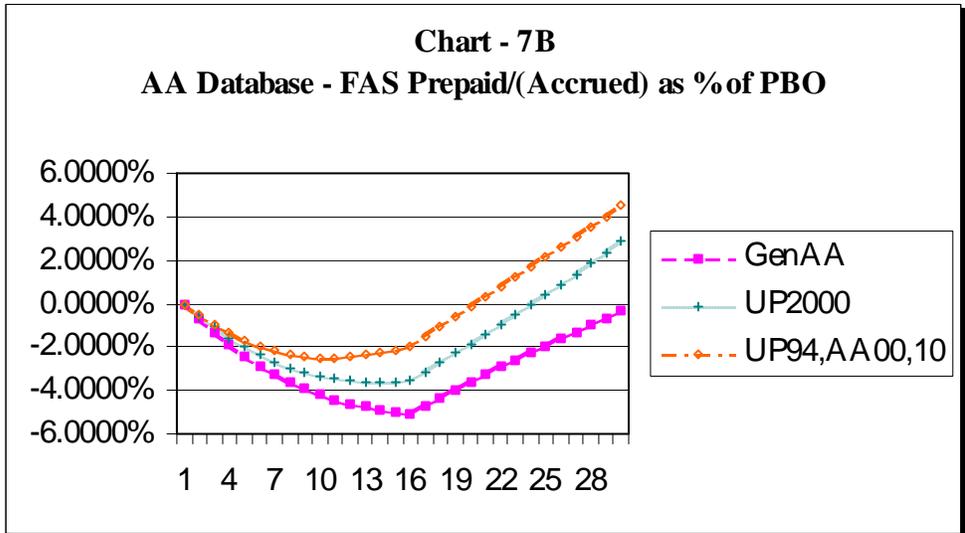
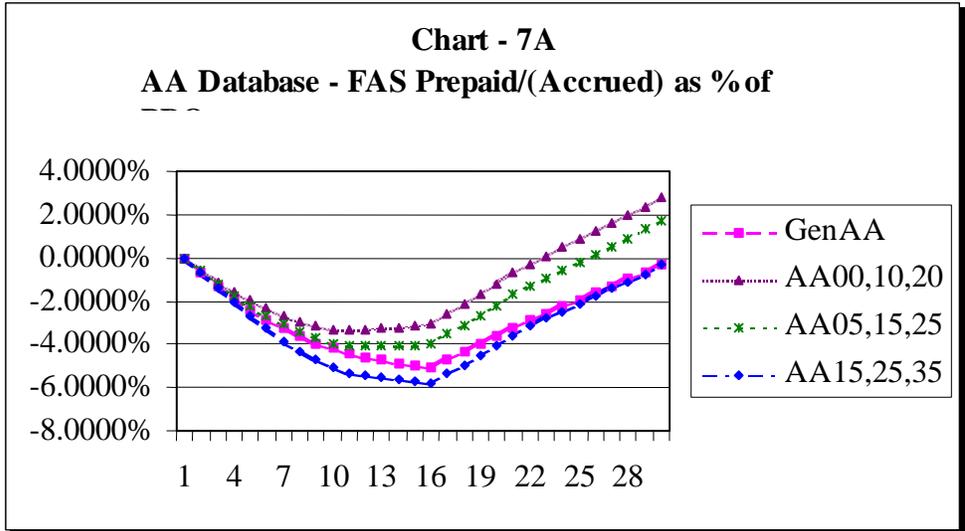
- 1) Generally speaking, the SFAS 87 expense is ranked similarly to service cost as a percentage of compensation; that is, the lowest mortality has the highest SFAS 87 expense. (Charts 14A, 14B, 14C, and 14D)

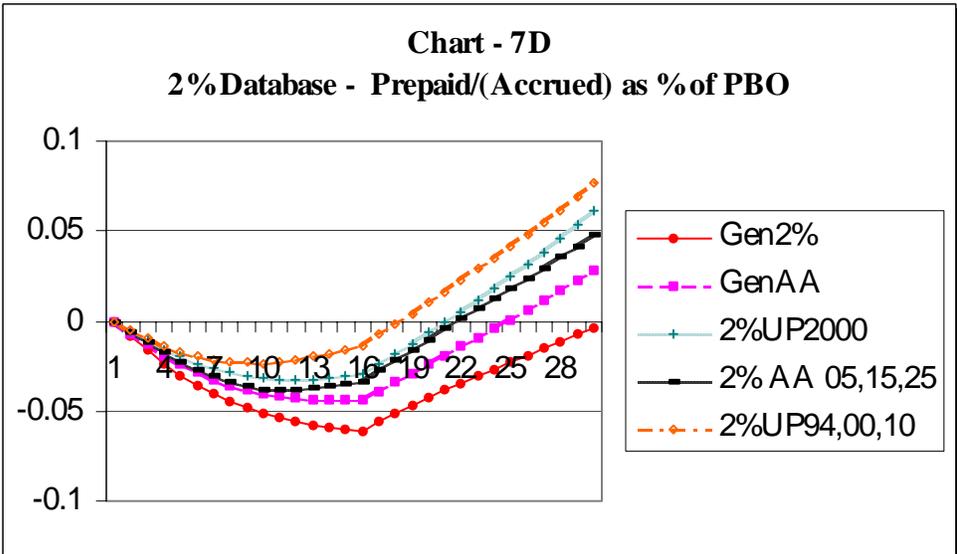
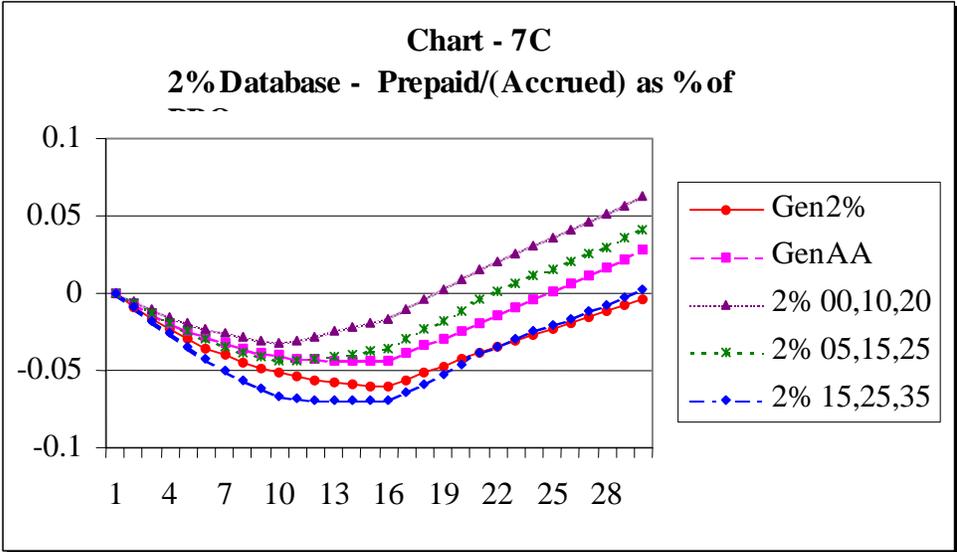




- a) Unlike the contributions, generally the ranking held throughout the period except for the assumptions that project mortality 15 years forward (AA15,25,35 and 2%15,25,35) after the first few years of change of assumptions.
- b) The difference between the interest PBO (see PBO charts 15A and 15C) and on the assets in the FAS87 expense formula is not large enough to change the ranking of the expense except for assumptions that project mortality 15 years forward (AA15,25,35 and 2%15,25,35).
- c) The SFAS 87 expense initially was between 115% and 130% of the corresponding contribution amount and in most cases did not drop below

- 100% until after the 15 year amortization of the initial transition obligation is completed. (Charts 6A, 6B, 6C, and 6D, pages 16 & 17)
- d) By the end of the 29-year period, the SFAS 87 expense ranged between 70% and 95% of contributions.
- 2) Since the initial SFAS 87 expense is larger than the contributions, an accrued expense develops. (Charts 7A, 7B, 7C, and 7D)





- a) Gradually as contributions become larger than the SFAS 87 expense, a prepaid occurs.
- b) Prepaid is equal to portion of FAS 87 losses funded to date, net of remaining 30-year amortization principal payments for 1/1/2000 UAAL. The larger the mortality loss, the greater the prepaid.
 - i) Under a scenario with an unfunded liability, a prepaid may exist.
 - ii) Mortality scenarios with smaller experience losses and smaller unfunded liabilities have a smaller prepaid.

Developing a larger prepaid with a smaller contribution seems counterintuitive. The SFAS 87 method never recognizes the actuarial losses, but the funding method does. SFAS 87 does not expense the unfunded portion due to actuarial loss; therefore, a prepaid exists.

6. Accumulation Benefit Obligation

One measure of the actuarial soundness of a pension plan is the ability of the assets to cover the ABO or present value of accrued benefits. Assuming the generational ABO using the database projection scale is the “ideal” ABO in the long-run, the following are observed: (Charts 5A, 5B, 5C, and 5D, pages 14 and 15).

- 1) Under the AA database, each scenario has assets that are at least equal to the GenAA ABO.
- 2) The mortality scenarios with the lowest mortality have develop assets that are less than a 2% surplus over the ABO for GENAA.
- 3) Under the 2% database, only the Gen2% and the projection of 15 years (2%15,25,35) scenarios generated enough assets to cover ABO. The other scenarios are as much as 10% short at the end of the 29-year period.
- 4) The greater the mortality assumption is from the experience, the less chance assets will be large enough to cover generational ABO.

7. Projected Benefit Obligation

The PBO is the actuarial present value of benefits based on service to the valuation date and salary increases to assumed retirement age. (See the charts labeled “PBO as % of GenPBO – Charts 15A, 15B, 15C, and 15D).

Chart - 15A
AA Database - PBO as % of Gen. PBO

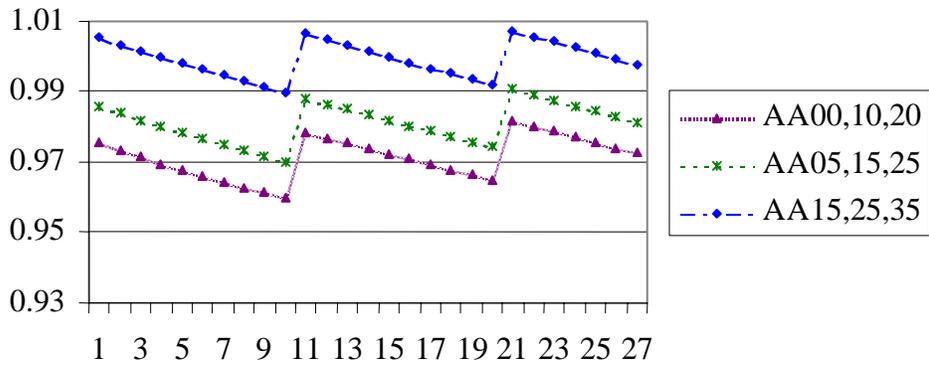
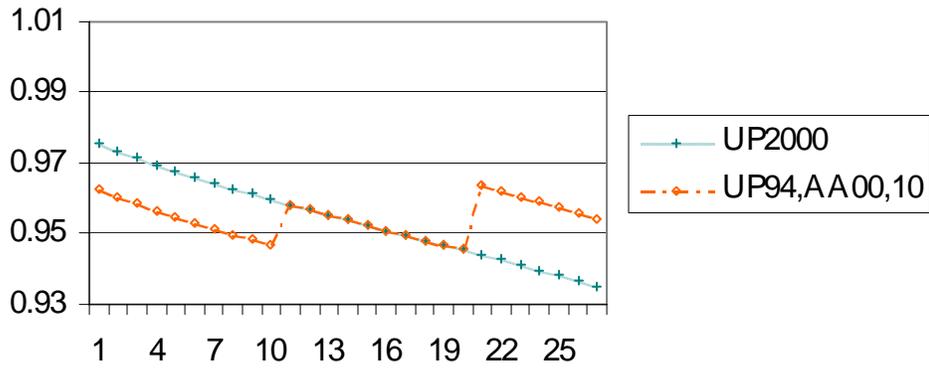
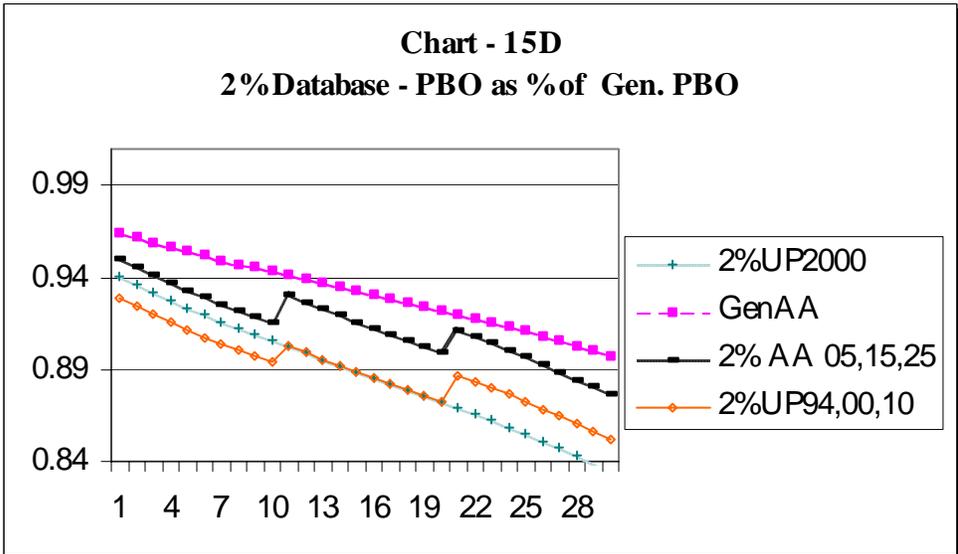
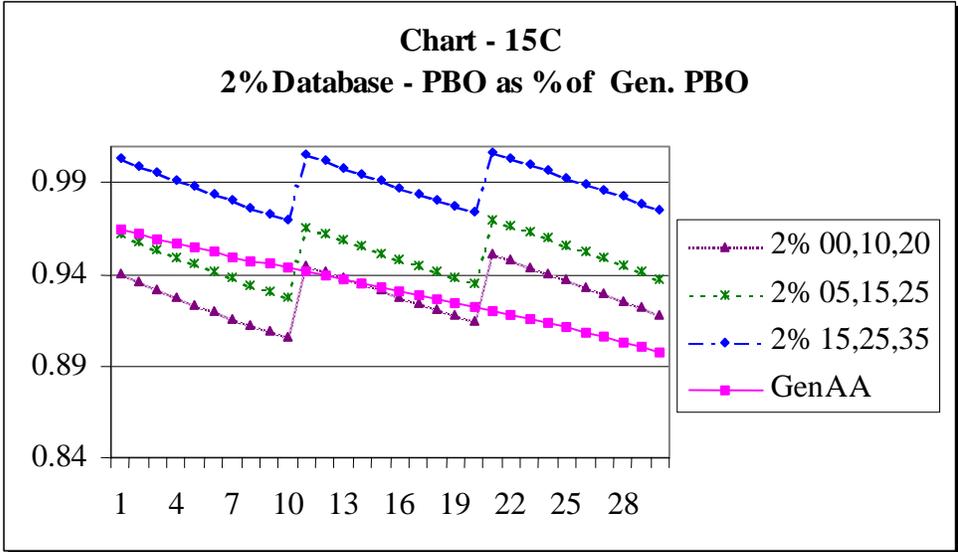


Chart - 15B
AA Database - PBO as % of Gen. PBO



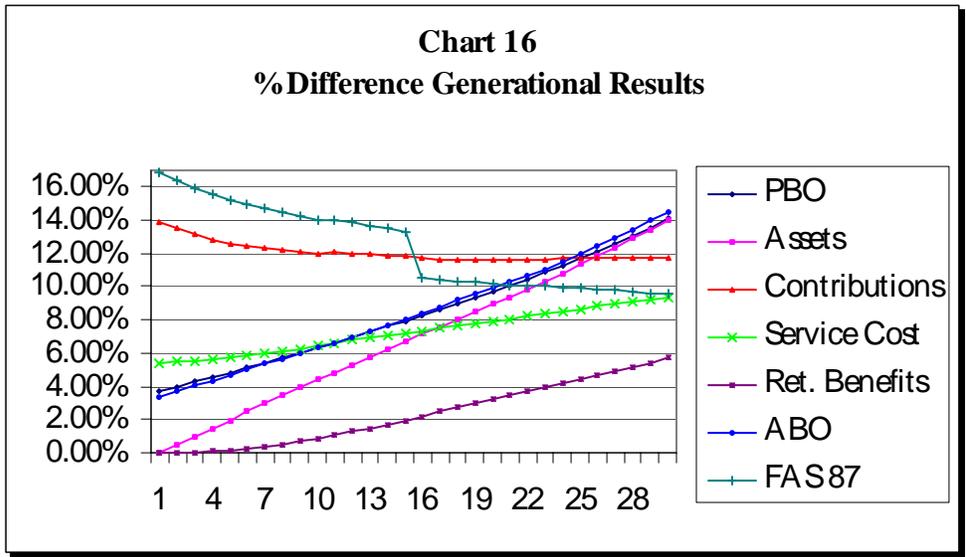


The static table scenario that comes closest to matching the generational scenario is the 15 year forecast. This helps explain why this scenario closely follows the generational asset accumulation, SFAS 87 prepaid, and ABO adequacy. The stronger the generational improvement (2% compared to AA), the longer the projection has to be match the PBO under generational mortality.

8. Comparison of Generational Results

When an actuary decides to use generational projection, two assumptions have to be made – what mortality table to use and what mortality projection scale to use. To provide the reader a comparison between the two projection scale

assumptions, the following charts show the generational results compared between 2% and Scale AA.



F. Conclusion

As to be expected, scenarios that projected mortality past the valuation date came closer to representing the generational results. Upon review of the contributions, asset accumulations, SFAS 87 expenses and prepaid/accrued, unfunded, and ABO adequacy, the 15 year forward projection scenarios come quite close to the generational results.

Defined benefit pension plans that experience consistent mortality improvements and do not adjust their mortality tables may develop inadequate assets. This study shows updating the mortality tables will help maintain the asset level at close to ideal level. In addition, generational projections are better but if the projection scales or mortality tables are not consistent with the experience, they can also lead to inadequate assets or plan sponsor funding levels that are too high

As stated earlier, the mortality tables, whether the actuary is using generational or static techniques, should be consistent with the group being valued.

IV. Additional Research or Considerations

In the process of doing the research and preparing the paper, several issues for additional research and consideration came to mind.

- Is there a relationship between the concentration of retiree lives and appropriate projection of static tables?
- It seems that choosing an appropriate post retirement mortality table is very important with regards to ensuring adequate assets, but how important are pre-retirement mortality tables?
- What SFAS 87 amortization techniques produce consistent results between unfunded/surplus and accrued/prepaid?
- Are there amortization periods for experience losses and change of assumptions that may be used that would help improve the level assets that depended more on the actual experience of the plan even if the plan did not follow improvement of mortality that generational approached would suggest.
- Are there techniques that would automatically be self correcting?

It would be interesting to know how practicing actuaries are changing mortality assumptions. This author suggests a survey to determine:

- 1) When the mortality assumptions were changed
- 2) What was the new mortality table
- 3) What was the size of the plan
- 4) Is there any correlation when mortality assumptions are changed with the release of new mortality tables and when a mortality table is prescribed by the federal law.

V. Acknowledgement and Thanks

I would like to thank Marilyn Oliver and the POG for their help and patience during the study and the preparation of this paper. In addition, I would like to recognize David Friedlander and Karen Gilmore of Lynchval Systems Worldwide, Inc for incorporating generational projection into their basic valuation system and providing assistance to ensure that our actuarial results were correct.

Finally, I thank the present and past staff of Acuff and Associates, Inc. for their patience and help, Lucian Acuff, for allowing staff time to work on this project; Marc Walls and Karen Rhodes for their database and computer actuarial valuation work; Keith Stewart for his assistance on computer matters; Brenda Lee, Emlee Woodard and Jennifer Duff for their assistance in the final preparation of the report; and finally Michael Guyton for his overall actuarial expertise and valuable comments.

Appendixes

Appendix A Methodology to Establish the Data Sets

Methodology and source data for developing the two sets of 30 year databases

The Project Oversight Group (POG) provided the census data:

- a) 5000 active employees with date of birth, date of hire, gender, and annual compensation
- b) 5000 inactives with date of birth, gender, and benefit amount
 - i) 521 deferred vested
 - ii) 4479 retirees
 - iii) Since the data was heavily weighted toward males (83% male/17% female for actives and 75% male/25% female for inactives), the genders were changed so that the initial active population was approximately 50% male/50% female in order to provide a balanced data set where mortality experience was not dominated by that of one sex or the other
 - iv) This was done by randomly reclassifying 40% of active males to females while preserving the original earnings per age group, earnings by service, and service per age group of the original male population.
 - v) The same percentage change was applied to the inactive male population. That is, 40% of inactive males were reclassified to females randomly while preserving the original average age of inactive males and average benefit for both terminated vested and retired males. The resulting initial gender ratio for the inactive population was 45% male/55% female.
- c) Two sets of 30 year databases were projected by the stochastic method. The termination, mortality, and new entrants assumptions were provided by the POG.
 - i) The stochastic method
 - (1) Each initial record was assigned a 'l' equal to 999,999.
 - (2) In each successive year, the 'l' was reduced by the expected withdrawal and mortality decrements.
 - (3) To maintain a stable active population, records for new entrants were assigned 'ls' based on termination, death, and retirement decrements.
 - (4) All resulting numbers were then divided by 999,999 to achieve the proper results.
 - ii) Generational mortality was used in each 30 year database
 - (1) UP1994 was brought forward to 2000 by Scale AA (UP2000)
 - (2) Two 30 year databases were projected from UP2000, one using Scale AA (AA database) and the other using a generational scale of 2% per year (2% database).
 - (3) Records with deferred benefits were created based on the withdrawal decrement assumptions and vesting schedule. To achieve minimum experience termination gains/losses and to keep the number of records manageable.
 - (a) For each projected year, one record for each year of birth was created setting the date of birth equal to January 1 to the closest year.

- (b) The 'ls' were summed for each year.
- (c) The deferred benefit was equal to the sum of he benefits divide by the sum of the 'ls'.
- (d) This technique duplicated the valuation program's methodology of using integral age equal to age nearest birth date.
- (4) No records with benefits were created based on mortality decrement assumptions because the plan does not include any pre-retirement death benefits.
- (5) New entrant records were added based on the new entrant assumptions.
- (6) When a record changed from active or deferred vested status to retired status, the 'l' was moved to retiree status in the calendar year they turned 63.
- (7) Compensation in successive years was increased by the assumed salary scale.
- (8) Compensation for years prior to the first valuation was reduced by the salary scale.
- (9) All records created with assumed dates were consistent with the techniques and methods used in the valuation program so that all gains and losses were minimized.

Appendix B Plan Provisions and Actuarial Assumptions and Methods

Plan provisions and actuarial assumptions and methods were provided by the POG. The main body of the report indicated that a typical plan design was used. The actuarial assumptions were designed so that the only actuarial gains and losses would be from mortality.

a) Plan Provisions

- i) The benefit formula is 1.5% times years of service times five- year average compensation.**
- iii) Normal retirement date is the first of the month following attainment of age 63.
100% vesting after 5 years of service.
No death benefits are available.
Form of benefit is straight life only.**

b) Actuarial assumptions

- Interest rate is 8% compounded annually.**
- Salary scale is 5% compounded annually.**
- No limits on benefits or salary are used.**
- The termination table is shown in the Appendix E – Demographic Assumption.**

Mortality tables used in the valuations are as follows:

- (1) Six sets of mortality assumptions were used on the 30 year database generated by Scale AA.**
 - (a) Static mortality tables using UP1994 projected to 2000 by Scale AA for the entire 30 year period: (UP2000).**
 - (b) Static mortality tables using UP2000 for the first 10 year period, projected to 2010 (AA2010) for the second 10 year period, and projected to 2020 (AA2020) for the third 10 year period (AA00,10,20).**
 - (c) Static mortality tables using UP1994 projected to 2005 by Scale AA (AA2005) for the first 10 year period, projected to 2015 (AA2015) for the second 10 year period, and projected to 2025 (AA2025) for the third 10 year period (AA05,15,25).**
 - (d) Static mortality tables using UP1994 projected to 2015 by Scale AA (AA2015) for the first 10 year period, projected to 2025 (AA2025) for the second 10 year period, and projected to 2035 (AA2035) for the third 10 year period (AA15,25,35).**
 - (e) Static mortality tables using UP1994 not projected for the first 10 year period, projected by Scale AA to 2000 (UP2000) for the second 10 year period, and projected by Scale AA to 2010 (AA2010) for the third 10 year period (94,AA00,10).**
 - (f) Generational table and techniques using UP1994 projected by AA to 2000 (UP2000) and generational AA thereafter (GenAA).**
- (2) Eight sets of mortality assumptions were used on the 30 year database generated by applying generational 2% scale for 30 years to UP2000.**
 - (a) Static mortality tables using UP1994 projected to 2000 by Scale AA for the entire 30 year period (2%UP2000).**

- (b) Static mortality tables using 2%UP2000 for the first 10 year period, projected to 2010 using 2% (2%2010) for the second 10 year period, and projected to 2020 using 2% (2%2020) for the third 10 year period (2%00,10,20).
- (c) Static mortality tables using 2%UP2000 projected to 2005 by scale 2% (2%2005) for the first 10 year period, projected to 2015 using 2% (2%2015) for the second 10 year period, and projected to 2025 using 2% (2%2025) for the third 10 year period (2%05,15,25).
- (d) Static mortality tables using 2%UP2000 projected to 2015 by scale 2% (2%2015) for the first 10 year period, projected to 2025 by scale 2% for the second 10 year period (2%2025), and projected to 2035 by scale 2% (2%2035) for the third 10 year period (2%15,25,35).
- (e) Static mortality tables using UP1994 not projected for the first 10 year period, projected by Scale AA to 2000 (2%UP2000) for the second 10 year period, and UP2000 projected to 2010 by 2% (2%2010) for the third 10 year period: (94,2%00,10).
- (f) Static mortality tables using UP2000 projected to 2005 by Scale AA (AA2005) for the first 10 year period, projected to 2015 (AA2015) for the second 10 year period, and projected to 2025 (AA2025) for the third 10 year period (2%AA05,15,25).
- (g) Generational table and techniques using UP1994 projected by AA to 2000 (UP2000) and generational AA thereafter (2%GenAA).
- (h) Generational table and techniques using UP1994 projected by AA to 2000 (UP2000) and generational by scale 2% thereafter: (Gen2%).

Appendix C – Numerical Results

**AA Database
Scenario UP2000**

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,231,812	1,091,275,729	982,148,156	109,127,573	31,925,334	934,166,358	38,237,189
01/01/2001	23,955,461	1,121,405,105	1,013,223,734	108,181,371	33,653,270	956,894,446	39,885,142
01/01/2002	25,788,853	1,156,760,567	1,049,458,129	107,302,438	35,527,828	985,586,046	41,648,219
01/01/2003	27,547,335	1,197,047,795	1,090,568,962	106,478,833	37,369,255	1,019,928,742	43,340,813
01/01/2004	29,252,967	1,242,475,115	1,136,794,778	105,680,336	39,201,397	1,060,406,353	44,982,565
01/01/2005	30,950,956	1,292,487,346	1,187,602,735	104,884,612	41,074,274	1,106,318,434	46,616,897
01/01/2006	32,508,424	1,346,977,312	1,242,917,653	104,059,659	42,854,770	1,157,674,718	48,108,369
01/01/2007	34,170,872	1,404,984,740	1,301,810,962	103,173,778	44,760,492	1,213,179,358	49,699,946
01/01/2008	35,808,279	1,467,009,031	1,364,788,659	102,220,371	46,661,162	1,273,628,016	51,261,080
01/01/2009	37,377,956	1,532,446,308	1,431,252,599	101,193,709	48,517,230	1,338,188,033	52,748,624
01/01/2010	38,032,643	1,600,162,268	1,500,072,234	100,090,034	49,482,940	1,405,373,000	53,315,017
01/01/2011	39,823,551	1,666,136,226	1,567,250,963	98,885,263	51,607,137	1,469,638,669	55,009,543
01/01/2012	41,628,606	1,734,213,645	1,636,631,208	97,582,437	53,771,409	1,535,944,272	56,710,372
01/01/2013	43,344,138	1,803,835,459	1,707,682,460	96,152,999	55,868,752	1,603,548,699	58,311,550
01/01/2014	45,512,350	1,873,967,847	1,779,378,346	94,589,501	58,442,774	1,671,034,450	60,354,681
01/01/2015	48,321,833	1,946,288,385	1,853,400,516	92,887,869	61,683,425	1,740,565,441	55,752,863
01/01/2016	50,338,544	2,023,691,045	1,932,643,615	91,047,430	64,163,932	1,816,199,113	57,622,338
01/01/2017	52,838,765	2,103,349,426	2,014,303,522	89,045,903	67,157,584	1,894,420,897	59,962,438
01/01/2018	54,676,614	2,187,073,713	2,100,200,792	86,872,922	69,525,248	1,977,682,529	61,626,448
01/01/2019	56,779,353	2,270,764,168	2,186,243,489	84,520,679	72,198,447	2,060,620,111	63,541,008
01/01/2020	59,127,223	2,354,847,605	2,272,878,806	81,968,799	75,158,414	2,143,760,290	65,684,727
01/01/2021	61,131,520	2,439,900,129	2,360,709,152	79,190,977	77,815,335	2,227,864,714	67,466,798
01/01/2022	63,051,079	2,523,483,979	2,447,321,859	76,162,120	80,431,066	2,309,673,166	69,144,049
01/01/2023	65,465,015	2,604,201,315	2,531,343,469	72,857,846	83,586,498	2,387,054,397	71,293,643
01/01/2024	68,282,272	2,684,228,458	2,614,968,466	69,259,992	87,192,304	2,462,674,885	73,823,072
01/01/2025	70,982,181	2,764,993,045	2,699,685,799	65,307,246	90,721,455	2,538,317,572	76,206,761
01/01/2026	73,592,342	2,844,953,160	2,783,976,618	60,976,542	94,205,240	2,611,772,136	78,470,465
01/01/2027	76,675,115	2,923,748,026	2,867,509,908	56,238,118	98,208,859	2,682,345,827	81,174,165
01/01/2028	80,023,321	3,003,832,719	2,952,801,267	51,031,453	102,520,141	2,752,946,227	84,105,837
01/01/2029	83,783,202	3,085,267,376	3,039,940,000	45,327,376	107,285,662	2,823,369,413	87,409,392

AA Database

Scenario AA00,10,20

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,231,812	1,091,275,729	982,148,156	109,127,573	31,925,334	934,166,358	38,237,189
01/01/2001	23,955,461	1,121,405,105	1,013,223,734	108,181,371	33,653,270	956,894,446	39,885,142
01/01/2002	25,788,853	1,156,760,567	1,049,458,129	107,302,438	35,527,828	985,586,046	41,648,219
01/01/2003	27,547,335	1,197,047,795	1,090,568,962	106,478,833	37,369,255	1,019,928,742	43,340,813
01/01/2004	29,252,967	1,242,475,115	1,136,794,778	105,680,336	39,201,397	1,060,406,353	44,982,565
01/01/2005	30,950,956	1,292,487,346	1,187,602,735	104,884,612	41,074,274	1,106,318,434	46,616,897
01/01/2006	32,508,424	1,346,977,312	1,242,917,653	104,059,659	42,854,770	1,157,674,718	48,108,369
01/01/2007	34,170,872	1,404,984,740	1,301,810,962	103,173,778	44,760,492	1,213,179,358	49,699,946
01/01/2008	35,808,279	1,467,009,031	1,364,788,659	102,220,371	46,661,162	1,273,628,016	51,261,080
01/01/2009	37,377,956	1,532,446,308	1,431,252,599	101,193,709	48,517,230	1,338,188,033	52,748,624
01/01/2010	38,859,888	1,633,733,465	1,500,072,234	133,661,230	55,313,283	1,434,650,044	56,827,958
01/01/2011	40,690,225	1,700,995,838	1,573,081,306	127,914,532	56,919,763	1,500,175,149	58,198,559
01/01/2012	42,531,877	1,770,404,477	1,648,240,605	122,163,872	58,538,515	1,567,782,963	59,580,158
01/01/2013	44,287,157	1,841,397,306	1,724,987,714	116,409,592	60,067,617	1,636,723,367	60,875,096
01/01/2014	46,502,120	1,912,947,336	1,802,266,885	110,680,451	62,054,655	1,705,584,625	62,631,728
01/01/2015	49,364,954	1,986,733,685	1,881,732,020	105,001,665	64,686,870	1,776,542,325	57,765,087
01/01/2016	51,422,412	2,065,654,916	1,966,245,084	99,409,832	67,073,967	1,853,671,817	59,375,198
01/01/2017	53,972,267	2,146,871,431	2,053,503,144	93,368,287	69,977,344	1,933,434,861	61,441,730
01/01/2018	55,848,147	2,232,191,907	2,145,356,143	86,835,764	72,234,880	2,018,289,989	62,795,008
01/01/2019	57,993,747	2,317,506,130	2,237,720,901	79,785,230	74,793,930	2,102,840,309	64,376,565
01/01/2020	61,566,293	2,448,778,449	2,331,069,894	117,708,556	80,596,528	2,228,931,149	70,982,978
01/01/2021	63,653,096	2,537,104,944	2,428,993,641	108,111,303	82,354,318	2,316,263,858	72,302,000
01/01/2022	65,658,448	2,624,001,282	2,525,608,090	98,393,192	84,028,312	2,401,296,102	73,529,904
01/01/2023	68,176,609	2,708,069,842	2,619,489,844	88,579,998	86,216,402	2,481,878,059	75,263,009
01/01/2024	71,108,834	2,791,494,991	2,712,796,454	78,698,536	88,818,674	2,560,696,375	77,404,717
01/01/2025	73,923,414	2,875,722,742	2,806,966,398	68,756,345	91,299,948	2,639,563,134	79,423,922
01/01/2026	76,644,216	2,959,206,633	2,900,418,158	58,788,476	94,494,578	2,716,240,827	81,347,294
01/01/2027	79,863,307	3,041,573,009	2,993,556,109	48,016,900	98,224,977	2,790,010,130	83,704,659
01/01/2028	83,360,982	3,125,314,155	3,088,947,282	36,366,873	102,269,919	2,863,840,824	86,270,332
01/01/2029	87,282,905	3,210,499,082	3,186,727,474	23,771,608	106,776,004	2,937,532,953	89,184,634

AA Database
Scenario AA05,15,25

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,495,026	1,102,694,390	982,148,156	120,546,234	33,202,839	943,712,046	40,175,141
01/01/2001	24,236,657	1,133,297,334	1,014,501,238	118,796,096	34,772,650	966,842,532	41,776,760
01/01/2002	26,088,137	1,169,146,983	1,051,957,215	117,189,769	36,480,362	995,966,828	43,499,734
01/01/2003	27,864,237	1,209,949,318	1,094,220,509	115,728,809	38,145,282	1,030,771,320	45,158,958
01/01/2004	29,586,344	1,255,912,689	1,141,514,475	114,398,214	39,790,284	1,071,742,207	46,774,617
01/01/2005	31,301,271	1,306,480,441	1,193,288,895	113,191,547	41,466,495	1,118,176,247	48,393,010
01/01/2006	32,874,229	1,361,545,605	1,249,450,926	112,094,680	43,214,536	1,170,084,235	49,878,219
01/01/2007	34,553,855	1,420,145,518	1,309,226,663	110,918,855	45,087,247	1,226,164,204	51,463,779
01/01/2008	36,207,674	1,482,781,118	1,373,124,371	109,656,747	46,951,872	1,287,216,368	53,016,630
01/01/2009	37,792,489	1,548,846,982	1,440,545,877	108,301,105	48,768,077	1,352,403,257	54,492,993
01/01/2010	39,251,102	1,649,747,514	1,510,359,821	139,387,693	55,329,740	1,448,634,006	58,438,533
01/01/2011	41,100,090	1,717,627,106	1,584,208,356	133,418,750	56,914,658	1,514,762,461	59,810,006
01/01/2012	42,959,087	1,787,673,418	1,660,252,714	127,420,705	58,509,702	1,582,994,047	61,189,159
01/01/2013	44,733,151	1,859,322,975	1,737,931,979	121,390,997	60,015,647	1,652,574,417	62,480,847
01/01/2014	46,970,245	1,931,551,939	1,816,194,721	115,357,218	61,982,603	1,722,094,424	64,235,238
01/01/2015	49,858,402	2,006,040,388	1,896,702,031	109,338,357	64,596,969	1,793,735,431	58,605,471
01/01/2016	51,935,174	2,085,689,396	1,982,322,795	103,366,601	66,939,491	1,871,581,714	60,204,502
01/01/2017	54,508,560	2,167,652,935	2,070,732,596	96,920,339	69,799,827	1,952,083,614	62,262,187
01/01/2018	56,402,450	2,253,739,427	2,163,786,434	89,952,993	72,005,044	2,037,703,387	63,598,689
01/01/2019	58,568,352	2,339,833,376	2,257,395,779	82,437,597	74,509,945	2,123,028,160	65,163,360
01/01/2020	62,121,342	2,470,511,886	2,352,034,778	118,477,108	80,161,521	2,248,671,379	71,599,510
01/01/2021	64,226,913	2,559,604,036	2,451,200,709	108,403,327	81,883,515	2,336,759,445	72,899,179
01/01/2022	66,251,721	2,647,275,591	2,549,120,921	98,154,670	83,519,353	2,422,546,909	74,104,095
01/01/2023	68,793,548	2,732,128,425	2,644,374,742	87,753,683	85,671,464	2,503,879,068	75,813,843
01/01/2024	71,751,936	2,816,349,280	2,739,127,206	77,222,074	88,237,900	2,583,447,781	77,929,702
01/01/2025	74,592,567	2,901,387,421	2,834,822,836	66,564,585	90,681,736	2,663,070,863	79,917,733
01/01/2026	77,338,506	2,985,695,472	2,929,884,899	55,810,573	93,808,811	2,740,504,682	81,803,352
01/01/2027	80,588,521	3,068,897,072	3,024,694,422	44,202,650	97,475,048	2,815,024,086	84,124,733
01/01/2028	84,120,096	3,153,492,758	3,121,826,731	31,666,027	101,457,299	2,889,612,723	86,653,378
01/01/2029	88,078,823	3,239,553,705	3,221,424,659	18,129,046	105,902,145	2,964,071,634	89,529,147

AA Database
Scenario AA15,25,35

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,992,495	1,124,445,281	982,148,156	142,297,125	35,632,383	961,923,870	43,862,740
01/01/2001	24,768,228	1,155,956,923	1,016,930,783	139,026,141	36,903,480	985,827,705	45,376,795
01/01/2002	26,654,057	1,192,754,777	1,056,711,953	136,042,824	38,295,871	1,015,783,135	47,023,958
01/01/2003	28,463,602	1,234,545,248	1,101,171,135	133,374,113	39,626,963	1,051,474,191	48,620,006
01/01/2004	30,217,004	1,281,536,677	1,150,502,832	131,033,845	40,917,814	1,093,391,575	50,186,187
01/01/2005	31,964,077	1,333,169,667	1,204,123,850	129,045,817	42,221,597	1,140,826,790	51,774,217
01/01/2006	33,566,430	1,389,337,572	1,261,907,779	127,429,792	43,907,276	1,193,792,562	53,247,288
01/01/2007	35,278,635	1,449,073,230	1,323,372,805	125,700,424	45,716,470	1,250,975,343	54,821,144
01/01/2008	36,963,600	1,512,880,649	1,389,031,427	123,849,222	47,511,867	1,313,184,128	56,358,013
01/01/2009	38,577,168	1,580,151,356	1,458,285,493	121,865,864	49,251,616	1,379,572,230	57,812,912
01/01/2010	39,990,510	1,680,279,839	1,530,002,146	150,277,694	55,359,081	1,475,330,763	61,499,200
01/01/2011	41,874,755	1,749,341,229	1,605,451,408	143,889,821	56,902,870	1,542,614,520	62,872,416
01/01/2012	43,766,608	1,820,608,444	1,683,183,422	137,425,022	58,452,858	1,612,040,389	64,247,085
01/01/2013	45,576,147	1,893,515,398	1,762,640,300	130,875,099	59,914,696	1,682,846,131	65,532,630
01/01/2014	47,855,099	1,967,044,028	1,842,778,758	124,265,271	61,843,445	1,753,627,182	67,282,796
01/01/2015	50,791,300	2,042,876,654	1,925,273,632	117,603,022	64,424,066	1,826,576,264	60,199,542
01/01/2016	52,904,661	2,123,919,774	2,013,007,220	110,912,553	66,681,582	1,905,795,456	61,777,665
01/01/2017	55,522,630	2,207,314,776	2,103,613,866	103,700,910	69,459,879	1,987,713,013	63,818,703
01/01/2018	57,450,609	2,294,870,490	2,198,958,258	95,912,232	71,565,726	2,074,799,225	65,123,588
01/01/2019	59,654,950	2,382,460,945	2,294,942,031	87,518,914	73,967,954	2,161,610,412	66,656,463
01/01/2020	63,169,359	2,511,962,031	2,392,042,739	119,919,292	79,329,041	2,286,358,364	72,762,902
01/01/2021	65,310,370	2,602,523,861	2,493,576,827	108,947,034	80,984,123	2,375,896,739	74,026,133
01/01/2022	67,371,844	2,691,684,037	2,593,987,736	97,696,301	82,548,437	2,463,135,247	75,187,548
01/01/2023	69,958,306	2,778,043,005	2,691,859,986	86,183,019	84,632,760	2,545,909,370	76,852,947
01/01/2024	72,966,099	2,863,792,502	2,789,372,566	74,419,935	87,131,603	2,626,921,411	78,919,694
01/01/2025	75,855,876	2,950,387,171	2,887,981,528	62,405,643	89,504,411	2,707,999,271	80,848,327
01/01/2026	78,649,250	3,036,277,853	2,986,118,961	50,158,892	92,502,020	2,786,887,653	82,661,961
01/01/2027	81,957,548	3,121,083,328	3,084,120,419	36,962,910	96,044,951	2,862,850,643	84,914,581
01/01/2028	85,553,002	3,207,319,455	3,184,576,710	22,742,744	99,906,539	2,938,897,730	87,372,421
01/01/2029	89,581,144	3,295,061,672	3,287,643,877	7,417,795	104,233,336	3,014,831,948	90,174,568

AA Database
Scenario Gen AA

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	23,245,138	1,118,605,765	982,148,156	136,457,609	35,366,317	954,390,227	43,258,920
01/01/2001	25,066,406	1,151,935,618	1,016,664,716	135,270,901	37,192,059	979,831,256	44,985,252
01/01/2002	27,002,744	1,190,695,292	1,056,713,180	133,982,112	39,132,202	1,011,447,511	46,818,487
01/01/2003	28,867,899	1,234,598,446	1,102,008,791	132,589,655	41,001,973	1,048,937,030	48,572,246
01/01/2004	30,684,731	1,283,859,709	1,152,782,511	131,077,198	42,822,423	1,092,799,684	50,268,081
01/01/2005	32,501,530	1,337,930,358	1,208,490,512	129,439,845	44,642,769	1,142,340,530	51,953,892
01/01/2006	34,182,703	1,396,712,359	1,269,044,947	127,667,412	46,322,879	1,197,584,765	53,493,270
01/01/2007	35,978,609	1,459,250,855	1,333,496,550	125,754,305	48,118,406	1,257,231,760	55,136,127
01/01/2008	37,754,835	1,526,055,994	1,402,367,008	123,688,986	49,893,555	1,322,099,667	56,747,128
01/01/2009	39,466,750	1,596,529,151	1,475,069,609	121,459,543	51,605,399	1,391,352,167	58,280,688
01/01/2010	40,240,761	1,669,540,276	1,550,482,773	119,057,503	52,380,833	1,463,488,693	58,862,535
01/01/2011	42,208,170	1,741,048,649	1,624,592,237	116,456,412	54,348,432	1,532,888,489	60,621,857
01/01/2012	44,189,269	1,814,956,444	1,701,301,079	113,655,365	56,331,792	1,604,614,570	62,378,873
01/01/2013	46,095,048	1,890,705,701	1,780,086,304	110,619,397	58,237,569	1,677,915,405	64,041,773
01/01/2014	48,475,800	1,967,283,103	1,859,943,314	107,339,788	60,618,121	1,751,387,946	66,160,157
01/01/2015	51,520,899	2,046,383,452	1,942,586,029	103,797,422	63,661,449	1,827,235,580	59,824,693
01/01/2016	53,748,710	2,130,923,018	2,030,941,993	99,981,025	65,890,757	1,909,572,752	61,747,192
01/01/2017	56,493,125	2,218,051,282	2,122,192,596	95,858,687	68,634,803	1,994,836,628	64,161,820
01/01/2018	58,554,812	2,309,595,453	2,218,198,209	91,397,244	70,695,842	2,085,516,516	65,866,592
01/01/2019	60,902,740	2,401,436,677	2,314,851,294	86,585,382	73,044,778	2,176,169,140	67,829,570
01/01/2020	63,524,510	2,494,012,499	2,412,621,568	81,390,931	75,668,549	2,267,327,965	70,035,785
01/01/2021	65,792,870	2,587,916,318	2,512,141,470	75,774,848	77,935,987	2,359,781,204	71,854,858
01/01/2022	67,992,100	2,680,693,341	2,610,989,415	69,703,926	80,132,458	2,450,195,692	73,568,414
01/01/2023	70,724,167	2,770,955,748	2,707,805,820	63,149,928	82,864,150	2,536,413,606	75,776,161
01/01/2024	73,885,842	2,860,904,881	2,804,825,457	56,079,423	86,025,849	2,621,139,767	78,372,196
01/01/2025	76,940,890	2,952,000,945	2,903,564,896	48,436,049	89,078,273	2,706,203,111	80,815,774
01/01/2026	79,909,580	3,042,706,937	3,002,522,861	40,184,076	92,045,422	2,789,355,040	83,124,306
01/01/2027	83,406,706	3,132,653,713	3,101,380,033	31,273,680	95,542,676	2,869,865,332	85,908,600
01/01/2028	87,205,638	3,224,365,951	3,202,714,819	21,651,132	99,341,980	2,950,746,545	88,937,729
01/01/2029	91,453,288	3,317,935,853	3,306,668,474	11,267,378	103,590,383	3,031,811,835	92,354,678

AA Database
Scenario UP94, AA00, 10

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	21,902,827	1,077,085,174	982,148,156	94,937,018	30,335,839	922,317,182	35,826,923
01/01/2001	23,604,058	1,106,629,154	1,011,634,239	94,994,915	32,261,465	944,548,425	37,532,786
01/01/2002	25,414,921	1,141,373,705	1,046,349,670	95,024,035	34,344,557	972,705,559	39,345,978
01/01/2003	27,151,450	1,181,023,996	1,086,028,556	94,995,440	36,406,460	1,006,477,571	41,080,220
01/01/2004	28,836,566	1,225,788,351	1,130,928,345	94,860,007	38,472,255	1,046,345,345	42,754,501
01/01/2005	30,513,448	1,275,113,474	1,180,537,844	94,575,630	40,590,569	1,091,611,966	44,408,633
01/01/2006	32,051,613	1,328,891,903	1,234,803,865	94,088,038	42,411,132	1,142,285,823	45,907,790
01/01/2007	33,692,640	1,386,166,380	1,292,604,434	93,561,946	44,357,579	1,197,078,715	47,506,731
01/01/2008	35,309,596	1,447,434,468	1,354,442,695	92,991,773	46,302,804	1,256,780,708	49,078,072
01/01/2009	36,860,419	1,512,094,103	1,419,720,600	92,373,503	48,208,188	1,320,565,046	50,579,434
01/01/2010	38,032,643	1,600,162,268	1,487,308,633	112,853,635	52,914,508	1,405,373,000	53,390,068
01/01/2011	39,823,551	1,666,136,226	1,556,897,842	109,238,385	54,759,225	1,469,638,669	54,891,756
01/01/2012	41,628,606	1,734,213,645	1,628,601,925	105,611,721	56,630,289	1,535,944,272	56,406,678
01/01/2013	43,344,138	1,803,835,459	1,701,869,714	101,965,745	58,420,197	1,603,548,699	57,830,532
01/01/2014	45,512,350	1,873,967,847	1,775,652,026	98,315,821	60,671,880	1,671,034,450	59,706,750
01/01/2015	48,321,833	1,946,288,385	1,851,605,197	94,683,188	63,574,817	1,740,565,441	55,896,488
01/01/2016	50,338,544	2,023,691,045	1,932,596,062	91,094,983	66,055,324	1,816,199,113	57,626,143
01/01/2017	52,838,765	2,103,349,426	2,016,143,557	87,205,869	69,048,976	1,894,420,897	59,815,235
01/01/2018	54,676,614	2,187,073,713	2,104,079,421	82,994,292	71,416,640	1,977,682,529	61,316,158
01/01/2019	56,779,353	2,270,764,168	2,192,323,800	78,440,367	74,089,839	2,060,620,111	63,054,583
01/01/2020	60,391,673	2,403,240,319	2,281,336,934	121,903,385	82,374,294	2,187,611,492	70,143,944
01/01/2021	62,438,749	2,489,972,668	2,377,059,811	112,912,856	84,208,407	2,273,371,967	71,471,778
01/01/2022	64,402,844	2,575,255,686	2,471,373,643	103,882,043	85,963,558	2,356,833,441	72,713,407
01/01/2023	66,870,855	2,657,692,132	2,562,851,887	94,840,245	88,227,745	2,435,855,607	74,458,075
01/01/2024	69,747,715	2,739,461,983	2,653,638,804	85,823,179	90,905,754	2,513,114,817	76,613,570
01/01/2025	72,507,110	2,822,003,171	2,745,163,215	76,839,956	93,465,636	2,590,409,865	78,654,307
01/01/2026	75,174,664	2,903,771,372	2,835,836,409	67,934,963	96,801,036	2,665,516,327	80,609,461
01/01/2027	78,328,189	2,984,398,929	2,926,114,279	58,284,650	100,664,717	2,737,727,483	82,990,961
01/01/2028	81,753,979	3,066,360,375	3,018,549,845	47,810,530	104,839,693	2,809,983,383	85,578,821
01/01/2029	85,597,926	3,149,720,331	3,113,268,016	36,452,315	109,472,591	2,882,082,089	88,514,111

2% Database
Scenario UP2000

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,231,812	1,091,275,729	982,148,156	109,127,573	31,925,334	934,166,358	38,237,189
01/01/2001	23,955,461	1,121,405,105	1,013,223,733	108,181,372	33,653,270	956,894,446	39,885,142
01/01/2002	25,789,098	1,156,888,669	1,049,449,421	107,439,248	35,562,339	985,712,184	41,659,410
01/01/2003	27,548,125	1,197,435,288	1,090,556,489	106,878,799	37,476,060	1,020,310,139	43,373,601
01/01/2004	29,254,630	1,243,258,304	1,136,800,713	106,457,591	39,422,107	1,061,177,144	45,046,409
01/01/2005	30,953,809	1,293,808,611	1,187,670,314	106,138,296	41,454,788	1,107,618,941	46,720,044
01/01/2006	32,512,708	1,348,986,643	1,243,115,693	105,870,950	43,445,838	1,159,653,230	48,257,556
01/01/2007	34,176,844	1,407,839,004	1,302,238,417	105,600,587	45,583,817	1,215,991,488	49,900,063
01/01/2008	35,816,187	1,470,875,317	1,365,546,638	105,328,678	47,741,445	1,277,440,404	51,517,653
01/01/2009	37,387,973	1,537,501,108	1,432,444,486	105,056,622	49,881,889	1,343,177,543	53,067,674
01/01/2010	38,043,227	1,606,591,170	1,501,803,492	104,787,678	51,160,496	1,411,726,693	53,701,413
01/01/2011	39,835,951	1,674,123,780	1,569,622,371	104,501,408	53,630,808	1,477,540,037	55,471,235
01/01/2012	41,643,086	1,743,953,440	1,639,750,491	104,202,949	56,175,085	1,545,586,952	57,254,493
01/01/2013	43,359,772	1,815,524,907	1,711,659,832	103,865,076	58,685,937	1,615,130,103	58,944,149
01/01/2014	45,530,170	1,887,807,248	1,784,320,123	103,487,125	61,710,918	1,684,752,225	61,084,312
01/01/2015	48,344,489	1,962,477,118	1,859,418,374	103,058,744	65,440,142	1,756,616,243	56,589,188
01/01/2016	50,363,505	2,042,448,336	1,939,862,724	102,585,612	68,443,412	1,834,804,147	58,570,354
01/01/2017	52,867,823	2,124,894,405	2,022,840,781	102,053,624	72,000,846	1,915,799,435	61,032,113
01/01/2018	54,707,515	2,211,632,289	2,110,184,690	101,447,599	74,968,798	2,002,064,899	62,823,323
01/01/2019	56,812,893	2,298,563,210	2,197,788,800	100,774,409	78,284,702	2,088,233,958	64,874,846
01/01/2020	59,163,683	2,386,122,741	2,286,105,291	100,017,450	81,932,731	2,174,843,439	67,165,079
01/01/2021	61,169,531	2,474,897,909	2,375,742,071	99,155,838	85,323,156	2,262,667,579	69,101,998
01/01/2022	63,088,817	2,562,455,409	2,464,282,900	98,172,509	88,719,324	2,348,448,975	70,942,618
01/01/2023	65,503,976	2,647,396,604	2,550,347,301	97,049,303	92,710,053	2,430,050,987	73,267,921
01/01/2024	68,324,293	2,731,910,717	2,636,148,374	95,762,343	97,204,142	2,510,155,680	75,985,281
01/01/2025	71,025,459	2,817,460,769	2,723,185,604	94,275,165	101,678,235	2,590,584,210	78,567,472
01/01/2026	73,635,284	2,902,498,650	2,809,935,325	92,563,325	106,164,701	2,669,117,281	81,040,350
01/01/2027	76,718,034	2,986,650,125	2,896,067,099	90,583,026	111,227,616	2,745,047,229	83,964,676
01/01/2028	80,066,152	3,072,393,318	2,984,100,133	88,293,184	116,659,430	2,821,305,793	87,129,607
01/01/2029	83,827,309	3,159,773,711	3,074,115,460	85,658,250	122,609,506	2,897,671,437	90,679,969

2% Database
Scenario 00,10,20

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,231,812	1,091,275,729	982,148,156	109,127,573	31,925,334	934,166,358	38,237,189
01/01/2001	23,955,461	1,121,405,105	1,013,223,733	108,181,372	33,653,270	956,894,446	39,885,142
01/01/2002	25,789,098	1,156,888,669	1,049,449,421	107,439,248	35,562,339	985,712,184	41,659,410
01/01/2003	27,548,125	1,197,435,288	1,090,556,489	106,878,799	37,476,060	1,020,310,139	43,373,601
01/01/2004	29,254,630	1,243,258,304	1,136,800,713	106,457,591	39,422,107	1,061,177,144	45,046,409
01/01/2005	30,953,809	1,293,808,611	1,187,670,314	106,138,296	41,454,788	1,107,618,941	46,720,044
01/01/2006	32,512,708	1,348,986,643	1,243,115,693	105,870,950	43,445,838	1,159,653,230	48,257,556
01/01/2007	34,176,844	1,407,839,004	1,302,238,417	105,600,587	45,583,817	1,215,991,488	49,900,063
01/01/2008	35,816,187	1,470,875,317	1,365,546,638	105,328,678	47,741,445	1,277,440,404	51,517,653
01/01/2009	37,387,973	1,537,501,108	1,432,444,486	105,056,622	49,881,889	1,343,177,543	53,067,674
01/01/2010	39,687,149	1,683,210,960	1,501,803,492	181,407,467	64,223,025	1,479,857,690	61,474,918
01/01/2011	41,557,340	1,754,082,673	1,582,684,901	171,397,773	65,660,181	1,548,947,065	62,544,333
01/01/2012	43,440,379	1,827,364,327	1,665,887,396	161,476,931	67,111,706	1,620,380,375	63,633,705
01/01/2013	45,233,374	1,902,499,985	1,750,824,310	151,675,675	68,470,133	1,693,411,851	64,642,599
01/01/2014	47,495,883	1,978,461,221	1,836,401,956	142,059,265	70,296,694	1,766,617,370	66,135,796
01/01/2015	50,421,968	2,056,942,210	1,924,252,530	132,689,680	72,783,489	1,842,196,997	61,037,142
01/01/2016	52,524,376	2,140,875,125	2,017,226,960	123,648,165	75,559,938	1,924,287,994	62,416,229
01/01/2017	55,130,254	2,227,404,383	2,113,510,681	113,893,702	78,896,916	2,009,320,544	64,241,750
01/01/2018	57,048,086	2,318,361,633	2,215,004,253	103,357,380	81,607,926	2,099,791,304	65,316,677
01/01/2019	59,241,805	2,409,622,302	2,317,633,055	91,989,247	84,662,419	2,190,261,166	66,600,945
01/01/2020	64,015,850	2,611,236,919	2,421,914,804	189,322,115	95,284,337	2,382,544,410	79,161,619
01/01/2021	66,188,532	2,708,983,455	2,535,767,951	173,215,504	96,783,611	2,479,244,963	80,045,773
01/01/2022	68,275,483	2,805,730,874	2,648,571,305	157,159,569	98,192,490	2,574,043,639	80,848,248
01/01/2023	70,895,620	2,900,079,355	2,758,851,946	141,227,409	100,134,702	2,664,755,473	82,193,813
01/01/2024	73,947,664	2,994,254,420	2,868,758,040	125,496,380	102,507,193	2,754,129,943	83,987,374
01/01/2025	76,876,500	3,089,740,331	2,979,707,095	110,033,236	104,752,376	2,844,032,050	85,679,159
01/01/2026	79,708,877	3,184,987,888	3,090,052,675	94,935,213	108,576,332	2,932,194,145	87,303,694
01/01/2027	83,055,602	3,279,627,643	3,201,005,469	78,622,174	112,994,434	3,017,889,806	89,345,376
01/01/2028	86,691,164	3,376,185,802	3,315,200,390	60,985,412	117,782,149	3,104,136,090	91,569,997
01/01/2029	90,769,852	3,474,743,147	3,432,826,457	41,916,691	123,096,481	3,190,730,916	94,123,187

2% Database
Scenario 05,15,25

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,741,670	1,116,016,253	982,148,156	133,868,097	34,632,830	955,286,789	42,375,658
01/01/2001	24,501,624	1,147,290,027	1,015,931,228	131,358,799	36,060,281	979,009,219	43,934,868
01/01/2002	26,372,856	1,183,979,233	1,054,780,527	129,198,705	37,653,471	1,008,900,047	45,633,292
01/01/2003	28,167,969	1,225,794,394	1,098,405,216	127,389,178	39,231,987	1,044,650,548	47,283,643
01/01/2004	29,909,179	1,272,946,788	1,147,033,266	125,913,522	40,822,229	1,086,752,421	48,906,801
01/01/2005	31,643,181	1,324,885,266	1,200,121,593	124,763,672	42,478,620	1,134,506,377	50,548,815
01/01/2006	33,234,487	1,381,509,132	1,257,586,906	123,922,225	44,405,658	1,187,930,717	52,072,805
01/01/2007	34,933,241	1,441,861,492	1,318,827,148	123,034,344	46,475,001	1,245,726,321	53,700,529
01/01/2008	36,606,499	1,506,452,113	1,384,353,652	122,098,461	48,555,986	1,308,705,113	55,298,916
01/01/2009	38,210,713	1,574,683,702	1,453,570,602	121,113,100	50,610,776	1,376,036,087	56,824,301
01/01/2010	40,458,852	1,719,929,702	1,525,348,585	194,581,117	64,459,579	1,512,592,226	64,949,882
01/01/2011	42,365,428	1,792,415,346	1,608,350,154	184,065,191	65,841,552	1,583,265,763	66,015,184
01/01/2012	44,284,096	1,867,366,118	1,693,787,241	173,578,877	67,233,030	1,656,337,269	67,094,946
01/01/2013	46,112,920	1,944,225,806	1,781,077,466	163,148,340	68,528,120	1,731,056,992	68,089,327
01/01/2014	48,418,719	2,021,967,282	1,869,133,352	152,833,929	70,296,107	1,805,997,697	69,569,973
01/01/2015	51,397,368	2,102,293,042	1,959,601,851	142,691,191	72,731,411	1,883,377,018	72,812,663
01/01/2016	53,538,961	2,188,144,221	2,055,352,148	132,792,073	75,399,294	1,967,358,596	75,162,327
01/01/2017	56,192,596	2,276,651,849	2,154,525,240	122,126,609	78,630,708	2,054,347,808	78,962,725
01/01/2018	58,147,099	2,369,654,899	2,259,033,769	110,621,129	81,218,971	2,146,857,756	81,996,790
01/01/2019	60,382,292	2,463,016,912	2,364,795,979	98,220,933	84,148,695	2,239,415,389	85,239,966
01/01/2020	65,103,305	2,663,772,964	2,472,337,037	191,435,928	94,409,748	2,431,178,890	90,418,179
01/01/2021	67,313,307	2,763,651,740	2,589,349,374	174,302,366	95,827,902	2,529,990,711	93,257,496
01/01/2022	69,437,713	2,862,587,696	2,705,483,532	157,104,164	97,151,023	2,626,939,608	96,006,046
01/01/2023	72,103,712	2,959,181,024	2,819,275,683	139,905,342	99,011,466	2,719,829,983	98,296,139
01/01/2024	75,207,643	3,055,665,557	2,932,892,440	122,773,117	101,304,198	2,811,426,643	100,029,492
01/01/2025	78,187,410	3,153,530,630	3,047,769,251	105,761,379	103,464,522	2,903,604,820	102,648,321
01/01/2026	81,069,496	3,251,226,856	3,162,271,949	88,954,907	107,135,976	2,994,085,989	105,185,888
01/01/2027	84,475,298	3,348,385,655	3,277,561,929	70,823,726	111,405,026	3,082,139,199	107,141,196
01/01/2028	88,175,207	3,447,543,974	3,396,291,959	51,252,015	116,043,137	3,170,800,750	108,275,368
01/01/2029	92,324,981	3,548,790,404	3,518,666,339	30,124,065	121,208,942	3,259,872,809	109,734,906

2% Database
Scenario 15,25,35

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	23,699,394	1,163,288,759	982,148,156	181,140,603	39,789,649	995,760,219	50,266,682
01/01/2001	25,527,672	1,196,773,916	1,021,088,048	175,685,868	40,652,234	1,021,411,554	51,658,581
01/01/2002	27,469,667	1,235,792,091	1,064,941,846	170,850,245	41,651,029	1,053,381,784	53,213,727
01/01/2003	29,332,733	1,280,057,022	1,113,376,997	166,680,025	42,598,205	1,091,363,546	54,743,175
01/01/2004	31,139,261	1,329,776,249	1,166,569,007	163,207,241	43,517,689	1,135,854,135	56,271,880
01/01/2005	32,938,832	1,384,394,968	1,223,915,653	160,479,315	44,464,186	1,186,144,997	57,853,218
01/01/2006	34,591,091	1,443,810,544	1,285,270,057	158,540,487	46,267,697	1,242,255,785	59,350,370
01/01/2007	36,355,035	1,507,059,595	1,350,586,990	156,472,605	48,204,811	1,302,867,516	60,948,883
01/01/2008	38,092,131	1,574,652,532	1,420,384,091	154,268,441	50,138,435	1,368,802,461	62,509,646
01/01/2009	39,757,325	1,645,987,141	1,494,065,925	151,921,216	52,028,870	1,439,213,906	63,987,063
01/01/2010	41,904,253	1,790,125,521	1,570,501,627	219,623,894	64,895,210	1,575,326,927	71,550,205
01/01/2011	43,879,014	1,865,723,031	1,657,551,071	208,171,960	66,173,936	1,649,056,275	72,608,811
01/01/2012	45,864,410	1,943,893,106	1,747,256,615	196,636,491	67,453,098	1,725,288,904	73,671,370
01/01/2013	47,760,359	2,024,079,332	1,839,044,459	185,034,873	68,629,823	1,803,267,809	74,639,189
01/01/2014	50,147,335	2,105,257,076	1,931,839,406	173,417,670	70,288,438	1,881,559,952	76,096,789
01/01/2015	53,224,626	2,189,144,840	2,027,316,720	161,828,120	72,627,742	1,962,416,368	66,170,876
01/01/2016	55,439,690	2,278,700,970	2,128,380,537	150,320,433	75,088,271	2,050,050,711	67,465,325
01/01/2017	58,182,930	2,371,031,927	2,233,084,877	137,947,050	78,117,999	2,140,822,300	69,218,694
01/01/2018	60,206,102	2,467,991,043	2,343,365,468	124,625,574	80,472,194	2,237,275,899	70,176,148
01/01/2019	62,518,982	2,565,420,266	2,455,127,436	110,292,830	83,164,223	2,333,875,338	71,342,408
01/01/2020	67,134,693	2,764,228,829	2,568,910,539	195,318,290	92,718,673	2,524,347,628	82,760,156
01/01/2021	69,414,334	2,868,225,876	2,691,957,681	176,268,196	93,986,280	2,627,238,886	83,515,789
01/01/2022	71,608,574	2,971,393,354	2,814,458,882	156,934,472	95,150,443	2,728,348,146	84,163,331
01/01/2023	74,360,155	3,072,331,733	2,934,968,481	137,363,252	96,859,641	2,825,460,102	85,349,216
01/01/2024	77,560,960	3,173,290,798	3,055,688,837	117,601,961	99,004,980	2,921,368,702	86,969,117
01/01/2025	80,635,765	3,275,769,560	3,178,090,143	97,679,417	101,008,309	3,017,968,574	88,450,118
01/01/2026	83,610,522	3,378,218,531	3,300,562,301	77,656,230	104,390,455	3,112,961,016	89,823,021
01/01/2027	87,126,578	3,480,270,661	3,424,169,987	56,100,674	108,376,144	3,205,606,403	91,614,632
01/01/2028	90,946,598	3,584,482,984	3,551,599,781	32,883,204	112,729,174	3,298,977,155	93,577,255
01/01/2029	95,229,074	3,690,958,502	3,683,084,823	7,873,679	117,611,057	3,392,883,181	95,858,969

2% Database
Scenario Gen 2%

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	24,500,026	1,159,674,936	982,148,156	177,526,780	40,269,274	986,613,707	50,537,287
01/01/2001	26,438,113	1,197,546,062	1,021,567,673	175,978,388	42,212,048	1,016,023,466	52,351,502
01/01/2002	28,499,916	1,241,318,241	1,067,019,655	174,298,587	44,277,824	1,052,088,338	54,278,922
01/01/2003	30,492,927	1,290,731,611	1,118,247,827	172,483,785	46,275,649	1,094,538,614	56,126,749
01/01/2004	32,444,502	1,346,021,720	1,175,506,947	170,514,772	48,230,982	1,143,907,939	57,920,803
01/01/2005	34,402,439	1,406,666,083	1,238,281,922	168,384,161	50,192,598	1,199,524,764	59,708,290
01/01/2006	36,230,361	1,472,592,904	1,306,514,040	166,078,864	52,019,371	1,261,448,758	61,351,789
01/01/2007	38,180,739	1,542,872,467	1,379,282,165	163,590,302	53,969,318	1,328,392,875	63,103,082
01/01/2008	40,119,238	1,618,043,003	1,457,139,388	160,903,616	55,906,677	1,401,216,063	64,826,646
01/01/2009	41,999,886	1,697,533,120	1,539,529,887	158,003,232	57,787,265	1,479,101,061	66,475,263
01/01/2010	42,912,246	1,780,237,648	1,625,361,102	154,876,546	58,701,064	1,560,559,000	67,137,488
01/01/2011	45,075,983	1,862,097,650	1,710,605,158	151,492,492	60,864,929	1,639,880,436	69,030,501
01/01/2012	47,260,439	1,947,092,667	1,799,246,022	147,846,645	63,051,780	1,722,249,678	70,923,289
01/01/2013	49,370,413	2,034,689,152	1,890,791,700	143,897,452	65,161,690	1,806,934,308	72,717,328
01/01/2014	51,986,096	2,123,890,077	1,984,258,295	139,631,782	67,777,134	1,892,520,929	74,991,757
01/01/2015	55,311,354	2,216,442,032	2,081,417,816	135,024,216	71,100,513	1,981,289,843	66,113,292
01/01/2016	57,776,927	2,315,340,474	2,185,282,492	130,057,982	73,567,676	2,077,507,327	68,181,566
01/01/2017	60,799,625	2,417,712,183	2,293,018,394	124,693,788	76,589,927	2,177,547,872	70,775,128
01/01/2018	63,109,097	2,525,456,266	2,406,565,595	118,890,671	78,898,714	2,284,010,155	72,620,351
01/01/2019	65,730,587	2,634,440,114	2,521,810,093	112,630,022	81,521,182	2,391,356,406	74,740,989
01/01/2020	68,648,467	2,745,156,188	2,639,284,767	105,871,421	84,441,231	2,500,179,528	77,118,181
01/01/2021	71,202,738	2,858,249,912	2,759,684,405	98,565,507	86,994,537	2,611,324,537	79,087,979
01/01/2022	73,691,894	2,971,281,237	2,880,612,002	90,669,236	89,480,781	2,721,416,519	80,945,433
01/01/2023	76,758,656	3,082,888,208	3,000,744,189	82,144,019	92,547,154	2,828,261,792	83,330,177
01/01/2024	80,293,996	3,195,359,006	3,122,414,115	72,944,891	96,082,529	2,934,683,873	86,129,588
01/01/2025	83,723,782	3,310,233,563	3,247,230,991	63,002,572	99,509,567	3,042,614,013	88,763,988
01/01/2026	87,071,033	3,426,003,090	3,373,735,674	52,267,416	102,855,137	3,149,776,573	91,252,426
01/01/2027	90,990,724	3,542,337,226	3,501,661,912	40,675,314	106,774,907	3,255,453,201	94,244,749
01/01/2028	95,244,504	3,661,846,039	3,633,689,823	28,156,216	111,028,921	3,362,764,471	97,497,001
01/01/2029	99,995,481	3,784,686,924	3,770,041,815	14,645,108	115,780,639	3,471,558,586	101,167,090

**2% Database
Scenario Gen AA**

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	23,245,138	1,118,605,765	982,148,156	136,457,609	35,366,317	954,390,227	43,258,920
01/01/2001	25,066,406	1,151,935,618	1,016,664,716	135,270,902	37,192,059	979,831,256	44,985,252
01/01/2002	27,002,995	1,190,825,479	1,056,704,472	134,121,007	39,167,240	1,011,575,655	46,829,850
01/01/2003	28,868,707	1,234,993,010	1,101,996,845	132,996,165	41,110,524	1,049,325,246	48,605,574
01/01/2004	30,686,431	1,284,658,722	1,152,790,762	131,867,960	43,046,944	1,093,585,778	50,333,042
01/01/2005	32,504,445	1,339,280,861	1,208,564,404	130,716,458	45,030,153	1,143,669,388	52,058,936
01/01/2006	34,187,082	1,398,769,982	1,269,256,675	129,513,307	46,925,021	1,199,610,223	53,645,321
01/01/2007	35,984,717	1,462,179,037	1,333,949,861	128,229,176	48,957,748	1,260,115,927	55,340,225
01/01/2008	37,762,924	1,530,029,467	1,403,168,929	126,860,539	50,995,512	1,326,016,783	57,008,941
01/01/2009	39,476,995	1,601,733,107	1,476,330,627	125,402,480	52,998,051	1,396,487,777	58,606,367
01/01/2010	40,251,574	1,676,170,082	1,552,316,687	123,853,395	54,093,265	1,470,039,652	59,257,020
01/01/2011	42,220,861	1,749,299,618	1,627,109,390	122,190,227	56,414,445	1,541,048,980	61,093,253
01/01/2012	44,204,096	1,825,034,037	1,704,620,109	120,413,928	58,785,719	1,614,590,069	62,934,384
01/01/2013	46,111,082	1,902,820,046	1,784,329,653	118,490,392	61,113,199	1,689,915,994	64,687,487
01/01/2014	48,494,111	1,981,648,667	1,865,230,793	116,417,874	63,953,231	1,765,625,321	66,904,715
01/01/2015	51,544,197	2,063,214,319	1,949,044,211	114,170,108	67,493,749	1,843,921,005	60,677,806
01/01/2016	53,774,368	2,150,454,668	2,038,712,235	111,742,432	70,254,391	1,928,943,715	62,713,763
01/01/2017	56,523,011	2,240,520,117	2,131,409,232	109,110,885	73,570,822	2,017,129,669	65,251,881
01/01/2018	58,586,586	2,335,245,485	2,229,008,595	106,236,890	76,240,496	2,110,980,214	67,085,538
01/01/2019	60,937,227	2,430,514,949	2,327,390,315	103,124,635	79,240,403	2,205,051,335	69,187,197
01/01/2020	63,562,023	2,526,776,318	2,427,030,628	99,745,690	82,560,550	2,299,888,222	71,541,678
01/01/2021	65,831,974	2,624,635,667	2,528,569,255	96,066,412	85,569,681	2,396,293,526	73,517,287
01/01/2022	68,030,933	2,721,644,999	2,629,582,782	92,062,216	88,554,852	2,490,939,131	75,395,910
01/01/2023	70,764,305	2,816,417,399	2,728,706,702	87,710,696	92,130,378	2,581,663,353	77,781,161
01/01/2024	73,929,170	2,911,169,478	2,828,196,853	82,972,625	96,188,982	2,671,189,039	80,566,980
01/01/2025	76,985,532	3,007,401,098	2,929,582,802	77,818,296	100,195,428	2,761,387,720	83,210,995
01/01/2026	79,953,832	3,103,570,118	3,031,361,491	72,208,627	104,174,362	2,850,002,735	85,730,522
01/01/2027	83,450,975	3,199,295,227	3,133,217,020	66,078,207	108,739,758	2,936,290,113	88,737,231
01/01/2028	87,249,911	3,297,126,506	3,237,734,189	59,392,317	113,668,056	3,023,289,034	92,001,297
01/01/2029	91,498,997	3,397,142,662	3,345,048,867	52,093,795	119,108,586	3,110,796,066	95,666,500

2% Database
Scenario AA05,15,25

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	22,495,026	1,102,694,390	982,148,156	120,546,234	33,202,839	943,712,046	40,175,141
01/01/2001	24,236,657	1,133,297,334	1,014,501,238	118,796,096	34,772,650	966,842,532	41,776,760
01/01/2002	26,088,384	1,169,276,406	1,051,948,507	117,327,900	36,515,206	996,094,268	43,511,032
01/01/2003	27,865,034	1,210,340,822	1,094,208,368	116,132,453	38,253,071	1,031,156,665	45,192,046
01/01/2004	29,588,020	1,256,704,007	1,141,521,754	115,182,253	40,012,934	1,072,521,002	46,839,016
01/01/2005	31,304,146	1,307,815,438	1,193,359,865	114,455,573	41,850,194	1,119,490,279	48,497,007
01/01/2006	32,878,545	1,363,575,835	1,249,655,814	113,920,021	43,810,315	1,172,083,340	50,028,562
01/01/2007	34,559,872	1,423,029,435	1,309,666,225	113,363,210	45,916,729	1,229,005,570	51,665,345
01/01/2008	36,215,640	1,486,687,490	1,373,901,584	112,785,906	48,039,687	1,291,068,311	53,274,929
01/01/2009	37,802,577	1,553,954,009	1,441,766,069	112,187,940	50,141,554	1,357,444,355	54,814,028
01/01/2010	39,261,893	1,656,371,307	1,512,130,467	144,240,839	57,036,620	1,455,180,450	58,837,575
01/01/2011	41,112,736	1,725,855,763	1,586,651,628	139,204,134	58,973,796	1,522,902,474	60,285,482
01/01/2012	42,973,847	1,797,705,845	1,663,485,077	134,220,768	60,955,127	1,592,926,581	61,747,924
01/01/2013	44,749,094	1,871,361,673	1,742,073,227	129,288,446	62,880,850	1,664,501,964	63,128,585
01/01/2014	46,988,425	1,945,802,731	1,821,361,503	124,441,228	65,305,081	1,736,220,101	64,980,139
01/01/2015	49,881,507	2,022,707,728	1,903,017,228	119,690,500	68,414,191	1,810,260,932	59,456,747
01/01/2016	51,960,618	2,104,998,137	1,989,923,535	115,074,603	71,280,435	1,890,733,912	61,166,586
01/01/2017	54,538,174	2,189,827,725	2,079,743,479	110,084,246	74,705,066	1,974,087,306	63,344,914
01/01/2018	56,433,929	2,279,011,604	2,174,343,826	104,667,778	77,510,577	2,062,794,430	64,807,351
01/01/2019	58,602,506	2,368,435,966	2,269,622,445	98,813,520	80,657,814	2,151,440,374	66,507,588
01/01/2020	62,158,885	2,503,261,673	2,366,058,740	137,202,934	87,063,762	2,281,220,498	73,135,120
01/01/2021	64,266,032	2,596,245,422	2,467,222,827	129,022,595	89,523,240	2,373,197,037	74,587,839
01/01/2022	66,290,553	2,688,071,762	2,567,282,200	120,789,563	91,943,201	2,463,138,435	75,953,718
01/01/2023	68,833,646	2,777,342,000	2,664,810,423	112,531,577	94,934,064	2,548,884,699	77,836,173
01/01/2024	71,795,175	2,866,256,997	2,761,992,557	104,264,440	98,391,944	2,633,144,551	80,136,330
01/01/2025	74,637,087	2,956,303,927	2,860,285,124	96,018,803	101,783,911	2,717,776,623	82,318,592
01/01/2026	77,382,640	3,045,928,692	2,958,108,482	87,820,210	105,911,589	2,800,527,678	84,408,257
01/01/2027	80,632,645	3,134,741,470	3,055,840,997	78,900,473	110,634,585	2,880,657,555	86,944,682
01/01/2028	84,164,172	3,225,266,464	3,156,062,911	69,203,552	115,734,341	2,961,174,767	89,700,456
01/01/2029	88,124,255	3,317,559,958	3,258,910,171	58,649,787	121,359,801	3,041,862,428	92,816,238

2% Database
Scenario UP94,00,10

<u>Valuation Date</u>	<u>EOY Service Cost</u>	<u>Total PBO</u>	<u>Assets</u>	<u>Unfunded</u>	<u>EOY Contribution</u>	<u>Total ABO</u>	<u>SFAS 87 Expense</u>
01/01/2000	21,902,827	1,077,085,174	982,148,156	94,937,018	30,335,839	922,317,182	35,826,923
01/01/2001	23,604,058	1,106,629,154	1,011,634,238	94,994,916	32,261,466	944,548,425	37,532,786
01/01/2002	25,415,163	1,141,500,188	1,046,340,962	95,159,225	34,378,660	972,830,103	39,357,036
01/01/2003	27,152,232	1,181,406,572	1,086,015,674	95,390,898	36,512,058	1,006,854,128	41,112,638
01/01/2004	28,838,212	1,226,561,579	1,130,932,632	95,628,946	38,690,587	1,047,106,330	42,817,663
01/01/2005	30,516,273	1,276,417,913	1,180,601,266	95,816,646	40,967,178	1,092,895,905	44,510,739
01/01/2006	32,055,856	1,330,875,636	1,234,993,512	95,882,124	42,996,430	1,144,239,119	46,055,561
01/01/2007	33,698,557	1,388,984,335	1,293,017,054	95,967,281	45,173,364	1,199,855,055	47,705,074
01/01/2008	35,317,432	1,451,251,686	1,355,177,113	96,074,573	47,373,870	1,260,544,688	49,332,532
01/01/2009	36,870,348	1,517,084,992	1,420,877,824	96,207,168	49,562,060	1,325,491,442	50,896,056
01/01/2010	38,043,227	1,606,591,170	1,488,991,668	117,599,503	54,591,983	1,411,726,693	53,780,322
01/01/2011	39,835,951	1,674,123,780	1,559,217,088	114,906,692	56,784,668	1,477,540,037	55,357,621
01/01/2012	41,643,086	1,743,953,440	1,631,666,646	112,286,794	59,037,897	1,545,586,952	56,955,164
01/01/2013	43,359,772	1,815,524,907	1,705,792,091	109,732,817	61,243,769	1,615,130,103	58,467,532
01/01/2014	45,530,170	1,887,807,248	1,780,540,795	107,266,453	63,949,127	1,684,752,225	60,440,621
01/01/2015	48,344,489	1,962,477,118	1,857,574,909	104,902,209	67,343,593	1,756,616,243	56,736,665
01/01/2016	50,363,505	2,042,448,336	1,939,775,232	102,673,104	70,346,862	1,834,804,147	58,577,353
01/01/2017	52,867,823	2,124,894,405	2,024,649,739	100,244,665	73,904,296	1,915,799,435	60,887,396
01/01/2018	54,707,515	2,211,632,289	2,114,041,816	97,590,473	76,872,248	2,002,064,899	62,514,753
01/01/2019	56,812,893	2,298,563,210	2,203,857,947	94,705,263	80,188,152	2,088,233,958	64,389,314
01/01/2020	60,428,583	2,435,120,432	2,294,563,419	140,557,012	89,239,221	2,219,295,961	71,673,144
01/01/2021	62,477,220	2,525,644,709	2,392,183,340	133,461,370	91,811,965	2,308,845,354	73,154,129
01/01/2022	64,441,035	2,614,975,657	2,488,528,279	126,447,379	94,352,526	2,396,353,989	74,556,825
01/01/2023	66,910,288	2,701,715,333	2,582,165,513	119,549,820	97,456,795	2,479,676,211	76,474,274
01/01/2024	69,790,241	2,788,057,083	2,675,258,785	112,798,298	101,027,686	2,561,504,454	78,814,105
01/01/2025	72,550,904	2,875,475,282	2,769,248,392	106,226,890	104,537,031	2,643,676,814	81,049,055
01/01/2026	75,218,100	2,962,419,166	2,862,541,932	99,877,234	108,874,243	2,723,959,605	83,208,279
01/01/2027	78,371,607	3,048,507,590	2,955,591,777	92,915,812	113,796,148	2,801,631,122	85,804,872
01/01/2028	81,797,327	3,136,238,392	3,050,955,317	85,283,074	119,090,372	2,879,655,871	88,619,973
01/01/2029	85,642,583	3,225,661,421	3,148,750,001	76,911,421	124,906,156	2,957,814,148	91,795,497

Table 1
Macaulay Duration Results

Valuation Date Assumptions	January 1, 2000				January 1, 2029					
	Average Age	UP2000	Gen AA	Gen 2%	Average Age AA	UP2000 AA	GEN AA	Average Age 2%	UP 2000 2%	Gen 2%
Female Retiree	71.16	6.998	7.110	7.531	75.24	6.210	6.515	76.49	6.152	7.618
Male Retiree	70.37	6.399	6.590	6.929	74.21	5.634	6.164	75.23	5.585	7.150
Total Retiree	70.81	6.699	6.849	7.229	74.76	5.940	6.347	75.92	5.889	7.397
Female Term Vested	46.23	18.412	18.698	19.552	51.08	14.004	14.456	51.11	13.986	15.729
Male Term Vested	47.40	17.724	18.267	18.925	50.99	13.195	14.079	51.00	13.191	15.166
Total Term Vested	46.81	18.065	18.477	19.233	51.04	13.613	14.268	51.05	13.602	15.451
Female PVB Actives	43.98	21.064	21.370	22.275	44.46	18.639	19.169	44.47	18.619	20.567
Male PVB Actives	43.75	19.863	20.485	21.209	44.47	17.795	18.834	44.49	17.788	20.041
Total PVB Actives	43.86	20.456	20.914	21.730	44.47	18.236	19.003	44.48	18.222	20.309
Female PBO Actives	43.98	19.029	19.309	20.150	44.46	15.017	15.489	44.47	14.999	16.791
Male PBO Actives	43.75	17.794	18.354	19.022	44.47	14.174	15.098	44.48	14.169	16.213
Total PBO Actives	43.86	18.397	18.812	19.567	44.47	14.612	15.294	44.47	14.600	16.507
Female ABO Actives	43.98	17.627	17.893	18.699	44.46	13.613	14.062	44.47	13.596	15.326
Male ABO Actives	43.75	16.396	16.923	17.557	44.47	12.785	13.662	44.47	12.781	14.741
Total ABO Actives	43.86	16.990	17.384	18.103	44.47	13.213	13.862	44.47	13.203	15.038
Total PVB	43.98	13.892	14.303	15.000	44.46	12.178	12.820	44.47	12.037	13.772
Total PBO	43.75	11.531	11.861	12.459	44.47	9.387	9.920	44.47	9.278	10.868
Total ABO	43.86	9.951	10.227	10.757	44.47	8.522	9.023	44.47	8.425	9.980

Appendix D – Census Data Tables

Summary of Active Participant Data for 1/1/2000 Population

TABLE A - Annual Earnings by Age Groups

Age Group	MALE		FEMALE		ALL	
	Number of People	Average Annual Earnings	Number of People	Average Annual Earnings	Number of People	Average Annual Earnings
0-19	0	0	1	19796	1	19796
20-24	50	39651	55	33961	105	36671
25-29	108	58681	118	52993	226	55711
30-34	296	69422	299	63580	595	66486
35-39	420	76562	431	70193	851	73336
40-44	504	76604	484	72926	988	74802
45-49	379	76574	400	69868	779	73131
50-54	424	78028	399	70569	823	74412
55-59	236	78968	233	68865	469	73949
60-64	79	74708	67	62671	146	69184
65-69	4	78406	9	59509	13	65323
70-74	0	0	4	65778	4	65778
75-79	0	0	0	0	0	0
80-84	0	0	0	0	0	0
85+	0	0	0	0	0	0
TOTAL	2500	74636	2500	67939	5000	71288

TABLE B - Annual Earnings by Service Groups

Service Group	MALE		FEMALE		ALL	
	Number of People	Average Annual Earnings	Number of People	Average Annual Earnings	Number of People	Average Annual Earnings
0	100	55972	95	53673	195	54852
1	101	63800	114	52363	215	57736
2	105	71911	156	54824	261	61698
3	57	78152	50	65957	107	72453
4	41	85263	39	91078	80	88098
0-4	404	68174	454	58306	858	62952
5-9	273	72751	276	72552	549	72651
10-11	486	74931	433	70234	919	72718
15-19	468	76998	508	68430	976	72539
20-24	248	77558	260	69996	508	73688
25-29	274	73925	273	69939	547	71936
30-34	241	75008	212	69291	453	72333
35-39	84	87634	64	74898	148	82126
40+	22	82175	20	70179	42	76463
TOTAL	2500	74636	2500	67939	5000	71288

Appendix D – Census Data Tables (Continued)

**Summary of Active Participant Data for 1/1/2000 Population
(Continued)**

**TABLE C
SERVICE GROUPS BY AGE GROUPS**

MALE AGE GROUP	Service Group									TOTAL
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+	
0-19	0	0	0	0	0	0	0	0	0	0
20-24	50	0	0	0	0	0	0	0	0	50
25-29	68	30	10	0	0	0	0	0	0	108
30-34	84	88	121	3	0	0	0	0	0	296
35-39	67	68	165	110	10	0	0	0	0	420
40-44	59	40	106	190	103	6	0	0	0	504
45-49	43	28	37	89	77	88	17	0	0	379
50-54	26	12	27	48	35	128	141	7	0	424
55-59	6	5	15	19	19	42	76	51	3	236
60-64	1	2	5	8	4	8	7	26	18	79
65-69	0	0	0	1	0	2	0	0	1	4
70-74	0	0	0	0	0	0	0	0	0	0
75-79	0	0	0	0	0	0	0	0	0	0
80-84	0	0	0	0	0	0	0	0	0	0
85+	0	0	0	0	0	0	0	0	0	0
TOTAL	404	273	486	468	248	274	241	84	22	2500

FEMALE AGE GROUP	Service Group									TOTAL
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+	
0-19	1	0	0	0	0	0	0	0	0	1
20-24	55	0	0	0	0	0	0	0	0	55
25-29	78	30	10	0	0	0	0	0	0	118
30-34	100	83	108	8	0	0	0	0	0	299
35-39	69	74	152	123	13	0	0	0	0	431
40-44	58	41	88	181	104	12	0	0	0	484
45-49	46	26	41	86	73	107	21	0	0	400
50-54	30	14	16	58	41	111	123	6	0	399
55-59	17	5	11	37	23	34	57	47	2	233
60-64	0	2	6	11	5	9	9	11	14	67
65-69	0	1	1	3	1	0	1	0	2	9
70-74	0	0	0	1	0	0	1	0	2	4
75-79	0	0	0	0	0	0	0	0	0	0
80-84	0	0	0	0	0	0	0	0	0	0
85+	0	0	0	0	0	0	0	0	0	0
TOTAL	454	276	433	508	260	273	212	64	20	2500

Appendix D – Census Data Tables (Continued)

Schedule of Non-Active Participant Data for 1/1/2000 Population

Age	Deferred Vested						Retired					
	Number of Participants			Total Average Benefit			Number of Participants			Total Average Benefit		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Under 45	106	124	230	7071	6990	7027	12	24	36	9715	5453	6874
45 to 49	43	42	85	8386	8451	8418	9	30	39	11206	9435	9844
50 to 54	62	50	112	8987	6012	7659	32	68	100	17372	13856	14981
55 to 59	30	25	55	5661	5597	5632	151	187	338	27879	21243	24208
60 to 64	14	22	36	5552	5752	5674	326	313	639	27897	23636	25810
65 to 69	2	1	3	2312	5811	3478	433	491	924	22528	18166	20210
70 to 74	0	0	0	0	0	0	467	497	964	18807	14208	16436
75 to 79	0	0	0	0	0	0	318	405	723	11989	9627	10666
80 to 84	0	0	0	0	0	0	163	267	430	10136	7419	8449
85 to 89	0	0	0	0	0	0	62	121	183	9754	6733	7757
90 and up	0	0	0	0	0	0	29	74	103	10609	6319	7527
Total	257	264	521	7469	6798	7129	2002	2477	4479	19477	14481	16714
Average Age	46.9	45.7	46.3				69.9	70.7	70.3			

Appendix E – Demographic Assumptions

Turnover Table

x

16	0
17	0
18	0
19	0
20	0.186
21	0.176
22	0.166
23	0.156
24	0.146
25	0.136
26	0.126
27	0.116
28	0.111
29	0.106
30	0.101
31	0.096
32	0.091
33	0.087
34	0.083
35	0.079
36	0.075
37	0.071
38	0.069
39	0.067
40	0.065
41	0.063
42	0.061
43	0.059
44	0.057
45	0.055
46	0.053
47	0.051
48	0.049
49	0.047
50	0.045
51	0.043
52	0.041
53	0.039
54	0.037
55	0