

Wisconsin Retirement System

36th Annual Actuarial Valuation of Retired Lives

December 31, 2018



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February 28, 2019

Employee Trust Funds Board
Madison, Wisconsin

Ladies and Gentlemen:

The results of the **36th annual actuarial valuation of core and variable annuities** being paid from the Wisconsin Retirement System are presented in this report. The purpose of this report is to establish the ratio of assets to liabilities in the Core and Variable Funds and to make recommendations for related benefit adjustments in accordance with statutory provisions and administrative code. This report should not be relied on for any other purpose.

The date of this valuation was December 31, 2018. Actuarial assumptions used in the valuation are summarized in the Appendix.

The results of the valuation may be briefly summarized as follows (\$ millions):

| | Core | Variable |
|---------------------------------|--------------|-----------------|
| Number of Annuitants | 211,126 | 41,187 |
| Annual Amount of Annuities Paid | \$ 5,040.9 | \$ 425.8 |
| Fund Balance | 56,493.8 | 3,749.1 |
| Actuarial Reserve | 56,629.3 | 4,207.6 |
| Ratio | 0.998 | 0.891 |

Based upon these results, there is no change in core annuities and variable annuities will be decreased by 10.0%.

This report was prepared at the request of the Wisconsin Retirement System and those designated or approved by the Wisconsin Retirement System. This report may be provided to parties other than the Wisconsin Retirement System only in its entirety and only with the permission of the Wisconsin Retirement System. GRS is not responsible for unauthorized use of this report. The valuation was based upon data furnished by the WRS staff, concerning Fund assets and individual annuitants and beneficiaries. Data was checked for internal consistency, but was not audited. We are not responsible for the accuracy or completeness of the information provided by the Wisconsin Retirement System.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

This report includes some risk graphics on page 13, but does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment. A discussion of various risk factors will be included in the active lives valuation report.

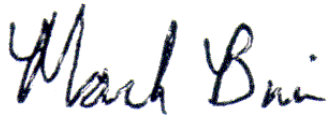
To the best of our knowledge this report is complete and accurate. All calculations have been made in conformity with generally accepted actuarial principles and practices and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. Brian B. Murphy, Mark Buis and James D. Anderson are all Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor.

The cooperation of the Secretary and his staff in gathering materials for this valuation is acknowledged with appreciation.

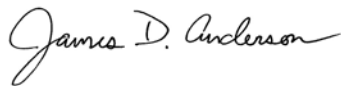
Respectfully submitted,



Brian B. Murphy, FSA, EA, FCA, MAAA



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BBM/MB/JDA:ah



SECTION A

EXECUTIVE SUMMARY

Executive Summary

1. Retiree Dividend in Core Annuities

The Net of fee investment return of -3.66% in the Core annuity fund was lower than the assumed investment return of 7.0% on a market value basis. However, under the asset valuation method, investment gains and losses are spread over a 5-year period. Partial recognition of this year's loss was combined with the continued phase-in of investment gains and losses from prior years resulting in a published effective earnings rate of 5.0%. The 5.0% published effective earnings rate does not exceed the 5.0% assumed investment return threshold that triggers an annuity adjustment. This valuation determined the amount of available surplus/deficit. The deficit in the core fund is \$135.5 million as of December 31, 2018. After adjusting for expected improvements in longevity and various other items (described in detail on page 6), **the result is no change in the core annuity benefit.**

2. Change in Variable Annuities

The variable fund effective earnings rate was -7.0% resulting in a deficit of \$458.5 million. The deficit of \$458.5 million will **result in a 10.0% decrease in all variable annuities in force.**

3. General Comments

Due to the asset smoothing method used in the core annuity fund, there are approximately \$4.9 billion in unrecognized asset losses as of December 31, 2018 which will be recognized over the next four years. Although approximately half of this applies to the annuitant reserve, this will put downward pressure on dividends being granted over the next few years.

The value of previously granted dividends is approximately \$6.9 billion. It is important that the value of dividend payments continue to build up in order to avoid the possibility of leveraged negative adjustments in the future. This buildup will happen naturally as long as investments in the core fund attain the long term investment assumption of 7.0% adopted with the most recent experience study.

Long Term Disability Insurance (LTDI) assets and liabilities were folded into the Core valuation at the beginning of the year. This was a one-time change affecting both assets and liabilities that does not affect the dividend process in a material way.

4. Conclusion

In accordance with the Administrative Code, ETF 20.25, Section 40.27(2) and Section 40.28(2) of the Wisconsin Statutes:

Core annuities will not be changed, and
Variable annuities will be decreased by 10.0%.

SECTION B

OPERATION OF THE SYSTEM

Operation of the Retirement System

Each year, as of December 31, an actuarial valuation of the liability for retired persons receiving benefits from the Wisconsin Retirement System is conducted. The purpose of the valuation is to determine the actuarial present value of future benefit payments on behalf of current retired lives. This present value is the “actuarial reserve.” Theoretically, if an amount of money equal to the actuarial present value were invested at a yield equal to the valuation interest rate, the initial amount plus the continuing investment income would provide exactly the right amount of money to pay the annuities of all current retired persons and their beneficiaries for the rest of their lives. The fund would decrease each year, and would become zero many decades in the future when the last annuitant dies.

The above is a “closed group” description of the operation of the annuity reserve fund. But the fund is really an “open group.” The size of the fund does not actually decrease because each year more benefits are added to the rolls than are removed and fresh money is transferred into the annuity reserve fund to finance the benefits of the new annuitants. (The actuary calculates the reserve transfers for new annuitants each year as a by-product of the actuarial valuation.)

According to theory, the fund will eventually reach a state when the number of people entering (retiring) each year is approximately equal to the number of people exiting (dying) each year. When this mature state is reached, the amount of money in the fund will remain approximately level in constant dollars from year to year. Each year, the reserve transfers for the new annuitants plus real investment earnings on the whole fund (total money in) will be approximately equal to the benefit payments (total money out). The only source of growth in assets would be the result of the effects of inflation. The dollars in the fund would increase, but the “real” value of the fund would not change.

There are at least two factors that cause the actual operation to be different from the theoretical operation described above. The first is that annuitants may have longer or shorter lifetimes than expected. In recognition of this, the actuary monitors mortality experience of the retirement system and recommends a new mortality table when appropriate. The second factor is that actual investment earnings are rarely equal to the assumed rate. When either mortality or investment earnings differ from expectations, the difference, positive or negative, is recorded in a supplemental reserve. The operation of the supplemental reserve is described on the next page.

Operation of the Retirement System

The Wisconsin Retirement System (WRS) maintains separate reserves for core and variable annuities. Each year, the actuary determines the actuarial reserve for core and variable annuities separately. WRS' practice with respect to the use of supplemental reserves is described below.

Core Annuity Division: If the supplemental reserve is positive and is at least 0.5% of core annuity liabilities, core annuity increases (dividends) may be granted. If the supplemental reserve is negative and is equal to or greater than 0.5% of core annuity liabilities in absolute value, prior core annuity dividends are reduced by an aggregate amount equal to the shortfall. Increases or decreases become effective in April following the December 31 valuation.

Variable Annuity Division: If the supplemental reserve is at least 2% of variable annuity liabilities, substantially all of the reserve (dropping fractions of a percent) is used to increase or decrease variable annuities for the ensuing year. Increases or decreases become effective in April following the December 31 valuation.

In calculating both the dividend for the Core annuities and the adjustment for Variable annuities, a 5.0% assumed investment return is used to fund the original benefit. Returns in excess of 5.0% can produce an increase in a member's annuity. Returns below 5% result in a decrease. Please see page 29 for a full description of the statutory provisions.

SECTION C

CORE ANNUITIES

Core Annuity Division Development of Assets and Liabilities

| | \$ Millions | | Ratio |
|--|-------------------|-------------------|--------------|
| | Assets | Liabilities | |
| Ending Balance December 31, 2017 | \$54,899.9 | \$53,590.0 | 1.024 |
| Closing Adjustments ¹ | 308.9 | 311.2 | |
| Variable Terminations | 84.3 | 84.3 | |
| 2018 Core Annuity Average Adjustment: 2.4% | 0.0 | 1,224.7 | |
| Beginning Balance January 1, 2018 | 55,293.1 | 55,210.2 | 1.002 |
| Increases | | | |
| Reserve Transfers | 3,583.8 | 3,583.8 | |
| Regular Interest | 2,710.1 | 2,710.1 | |
| Additional Earnings | (102.4) | 0.0 | |
| Addition for Experience Study/Mortality Reserve | 0.0 | 115.0 | |
| Other | 0.0 | 1.0 | |
| Total Increases | 6,191.5 | 6,409.9 | |
| Decreases | | | |
| Annuities & Lump Sums | 4,990.8 | 4,990.8 | |
| Credit Re-establishments | 0.0 | 0.0 | |
| Subtraction for Experience Study/Mortality Reserve | 0.0 | 0.0 | |
| Other | 0.0 | 0.0 | |
| Total Decreases | 4,990.8 | 4,990.8 | |
| Ending Balance December 31, 2018 | \$56,493.8 | \$56,629.3 | 0.998 |

The ending liability balance includes a data reserve of \$56.6 million and a liability for previously granted dividends of \$6,903 million (prior to any 2019 adjustments).

¹ Includes one-time adjustment for LTDI members.

Reserve Transfer Recommendation

Amounts to be transferred from the Employer Reserve and the Employee Reserve to the Annuity Reserve to cover liabilities for new annuities are computed as the first step in the annual actuarial valuation. The actuarial present value at time of retirement of core annuities reported as new since the last actuarial valuation is \$3,561,202,042. Adjustments to prior transfers, related to estimated annuities for which final computations have now been made, totaled \$22,592,516. Reserve transfers are distributed as follows:

| Group | Regular Transfer | Adjustment to Prior Transfer | Total Transfer |
|------------------------------------|------------------------|------------------------------|------------------------|
| General | \$3,065,074,428 | \$19,072,995 | \$3,084,147,423 |
| Protective with Social Security | 375,641,117 | 2,805,345 | 378,446,462 |
| Protective without Social Security | 87,840,204 | 193,676 | 88,033,880 |
| Executive & Elected | 32,646,293 | 520,500 | 33,166,793 |
| Totals | \$3,561,202,042 | \$22,592,516 | \$3,583,794,558 |

Accordingly, we recommend that \$3,583,794,558 be transferred to the Core Annuity Reserve. The results in this report assume that this transfer has been made.

Discussion of Dividend

The Core Annuity Fund balance, \$56,493.8 million, was lower than the actuarial present value of core annuities and reserves, \$56,629.3 million, by \$135.5 million, which resulted in an annuity adjustment of 0.0%. The primary sources of the 0.0% adjustment are:

| | % of APV |
|---|-----------------|
| 1. SWIB net of fee investment return | (3.66)% |
| 2. MRA adjustment | 8.66% |
| 3. Published effective earnings rate | 5.00% |
| 4. Adjustment to relate earnings to average core annuity fund balance | (0.22)% |
| 5. Earnings rate based on average balance | 4.78% |
| 6. Expected dividend before adjustments: 1.0478/1.05-1 | (0.21)% |
| 7. Adjustment to relate average asset to ending liability | 0.03% |
| 8. Carryover from last year due to timing of dividend accounting adjustments and rounding | 0.15% |
| 9. Experience study/mortality reserve adjustment | (0.20)% |
| 10. Experience and other effects | (0.01)% |
| 11. Statutory adjustment to round to nearest one-tenth percent | 0.04% |
| 12. Computed average dividend rate: (6)+(7)+(8)+(9)+(10)+(11) | (0.2)% |
| 13. Adjustment for members at or near the statutory floor | 0.0% |
| 14. Final computed dividend rate: (12)+(13), if greater than 0.5% (or less than -0.5%) of core annuities, otherwise 0% | 0.0% |

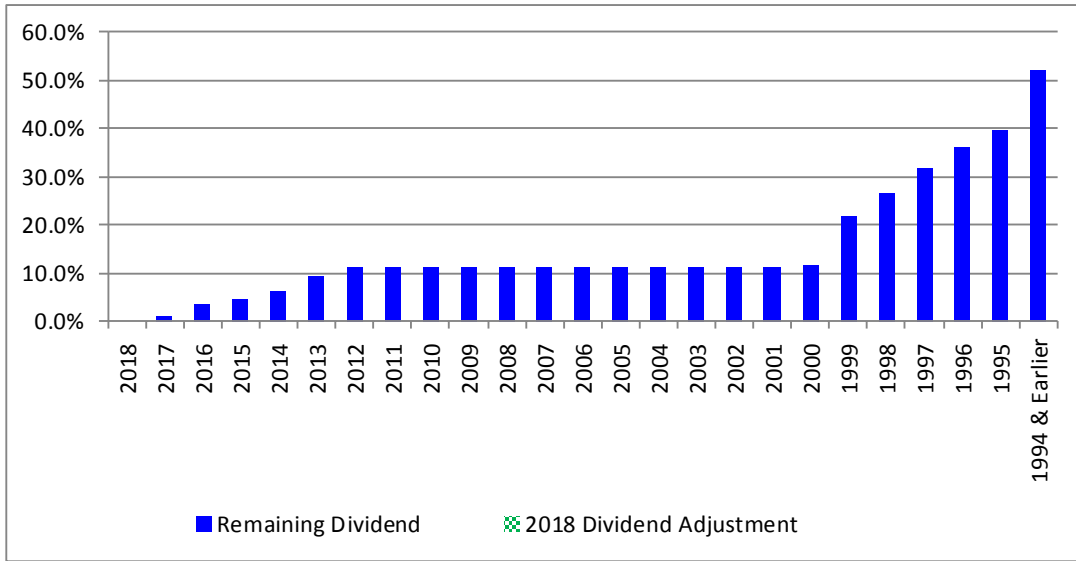
See pages 30 and 31 for a description of items on this page.

In accordance with the Administrative Code, ETF 20.25 and Section 40.27(2) Wisconsin Statutes (shown on page 29 of this report), the dividend adjustment is 0.0% effective April 1, 2019.

Discussion of Dividend

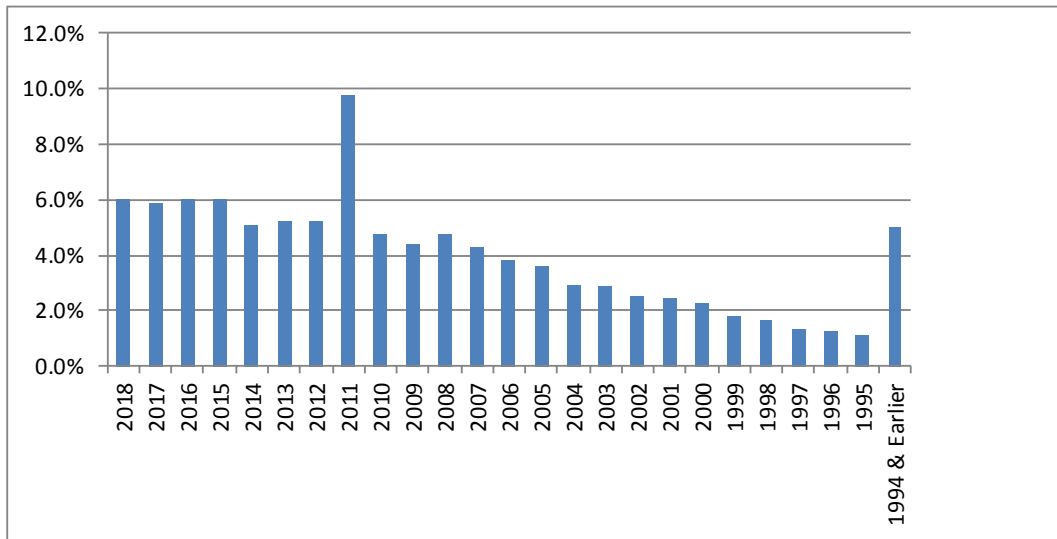
As shown on the prior page, the adjustment for all core fund members is 0.0%.

Dividend Remaining (as a Percentage of Total Benefit) by Year of Retirement



After the 2019 dividend adjustment, members retired prior to 2000 continue to have the highest dividend remaining as a percentage of total benefit and also represent a shrinking portion of the liabilities. The chart below shows liabilities by year of retirement.

Liabilities (as a Percentage of Total) by Year of Retirement



Looking ahead, a few years of spreading positive dividends over all annuitants is needed to decrease the probability of leveraged negative dividends that occurred between 2008 and 2012. Over this period, the liability for dividends decreased from about \$9.2 billion to \$3.0 billion. The value of previously granted dividends is approximately \$6.9 billion as of December 31, 2018. However, there are currently about \$4.9 billion in unrecognized asset losses that will be recognized over the next four years, about half of which will be applied to the annuitant reserve.

Transfers to Annuity Reserve to Finance Core Annuities Approved in 2018 Tabulated by Type of Annuity and Option

| Alpha Code | Type of Benefit | Number | Annual Amount | Present Value |
|----------------------------------|---|---------------|-----------------------|-------------------------|
| REGULAR RETIREMENT | | | | |
| SL | Straight Life | 1,595 | \$ 31,969,172 | \$ 418,214,333 |
| SL | Straight Life (accelerated) | 0 | 3,876,501 | 14,721,287 |
| A60 | Life Annuity with 60 payments guaranteed | 846 | 17,991,982 | 249,737,907 |
| A60 | Life Annuity with 60 payments guaranteed (accelerated) | 0 | 2,962,275 | 10,796,555 |
| A180 | Life Annuity with 180 payments guaranteed | 1,923 | 38,576,632 | 558,955,066 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 6,987,983 | 26,331,763 |
| A180F | Life Annuity with 180 payments guaranteed (forced) | 61 | 490,196 | 6,046,802 |
| JOINT | Joint and 75% Survivor | 853 | 22,451,617 | 343,425,133 |
| JOINT | Joint and 75% Survivor (accelerated) | 0 | 3,096,109 | 11,961,081 |
| R25 | Reduced 25% on First Death | 421 | 12,465,067 | 181,781,743 |
| R25 | Reduced 25% on First Death (accelerated) | 0 | 1,455,053 | 5,690,090 |
| C100 | 100% Continued to Named Survivor | 1,014 | 22,959,720 | 352,529,448 |
| C100 | 100% Continued to Named Survivor (accelerated) | 0 | 3,203,108 | 12,954,648 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 3,015 | 75,163,097 | 1,195,065,750 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed (accelerated) | 0 | 13,336,928 | 54,259,175 |
| LOL | Life with Optional Length Guaranteed | 2 | 156,477 | 1,665,507 |
| AC24 | Annuity Certain with 24 Payments | 0 | 35,064 | 92,118 |
| AC60 | Annuity Certain with 60 Payments | 2 | 110,589 | 533,633 |
| AC120 | Annuity Certain with 120 Payments | 1 | 202,267 | 1,618,563 |
| AC180 | Annuity Certain between 24 and 180 Payments | 0 | 151,094 | 906,168 |
| SLNSD | Straight Life - Named Survivor Deceased | 2 | 29,496 | 340,181 |
| | Total Regular | 9,735 | \$ 257,670,427 | \$ 3,447,626,951 |
| | Average Age at Retirement | 61.3 Years | | |
| DISABILITY RETIREMENT | | | | |
| SL | Straight Life | 40 | \$ 1,171,524 | \$ 17,374,115 |
| A60 | Life Annuity with 60 payments guaranteed | 15 | 313,939 | 4,513,103 |
| A180 | Life Annuity with 180 payments guaranteed | 41 | 1,194,069 | 17,565,886 |
| JOINT | Joint and 75% Survivor | 16 | 422,447 | 6,296,816 |
| R25 | Reduced 25% on First Death | 4 | 135,614 | 2,190,158 |
| C100 | 100% Continued to Named Survivor | 26 | 606,384 | 10,337,533 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 88 | 2,066,339 | 34,040,062 |
| AC180 | Annuity Certain between 24 and 180 Payments | 0 | 2,458 | 8,705 |
| | Total Disability | 230 | \$ 5,912,774 | \$ 92,326,378 |
| | Average Age at Retirement | 53.7 Years | | |
| DEATH-IN-SERVICE BENEFITS | | | | |
| SL | Straight Life | 5 | \$ 84,617 | \$ 1,149,271 |
| SL | Straight Life (accelerated) | 0 | 23,796 | 96,590 |
| A60 | Life Annuity with 60 payments guaranteed | 3 | 41,878 | 644,756 |
| A180 | Life Annuity with 180 payments guaranteed | 62 | 1,342,664 | 18,995,832 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 109,083 | 362,264 |
| | Total Death-in-Service | 70 | \$ 1,602,038 | \$ 21,248,713 |
| | Average Age at Retirement | 58.4 Years | | |
| GRAND TOTAL | | 10,035 | \$ 265,185,239 | \$ 3,561,202,042 |

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Core Annuities Being Paid

Tabulated by Type of Annuity and Option

| Alpha Code | Type of Benefit | Number | Annual Amount | Present Value |
|---------------------------|--|---------|-----------------|------------------|
| REGULAR RETIREMENT | | | | |
| SL | Straight Life | 27,833 | \$ 580,139,157 | \$ 6,247,336,587 |
| SL | Straight Life (accelerated) | 0 | 17,394,935 | 42,343,604 |
| A60 | Life Annuity with 60 payments guaranteed | 20,780 | 436,707,580 | 4,477,601,633 |
| A60 | Life Annuity with 60 payments guaranteed (accelerated) | 0 | 13,014,331 | 29,767,069 |
| A120 | Life Annuity with 120 payments guaranteed | 39 | 406,979 | 1,128,968 |
| A180 | Life Annuity with 180 payments guaranteed | 40,637 | 815,197,086 | 8,826,018,427 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 34,642,431 | 88,602,400 |
| A180F | Life Annuity with 180 payments guaranteed (forced) | 372 | 3,088,925 | 27,611,592 |
| JOINT | Joint and 75% Survivor | 23,069 | 610,386,958 | 7,086,315,550 |
| JOINT | Joint and 75% Survivor (accelerated) | 0 | 16,128,925 | 39,015,029 |
| R25 | Reduced 25% on First Death | 14,028 | 403,839,452 | 4,070,759,086 |
| R25 | Reduced 25% on First Death (accelerated) | 0 | 6,659,980 | 16,222,209 |
| C100 | 100% Continued to Named Survivor | 19,510 | 437,925,012 | 5,359,233,481 |
| C100 | 100% Continued to Named Survivor (accelerated) | 0 | 15,078,539 | 37,476,450 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 54,206 | 1,355,531,004 | 17,834,081,408 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed (accelerated) | 0 | 67,207,275 | 176,969,032 |
| LOL | Life with Optional Length Guaranteed | 36 | 850,477 | 5,718,293 |
| LOLF | Life with Optional Length Guaranteed (Forced) | 2 | 38,205 | 118,956 |
| AC24 | Annuity Certain with 24 Payments | 2 | 187,192 | 190,557 |
| AC60 | Annuity Certain with 60 Payments | 6 | 477,190 | 1,198,942 |
| AC120 | Annuity Certain with 120 Payments | 14 | 1,232,953 | 5,309,003 |
| AC180 | Annuity Certain between 24 and 180 Payments | 8 | 1,713,147 | 7,769,733 |
| C50 | 50% Continued to One Beneficiary | 29 | 319,012 | 1,093,465 |
| C50W180 | 50% Continued to One Beneficiary with 180 Months guaranteed | 2 | 17,172 | 45,444 |
| C75WSS | 75% Continued to One Beneficiary and Social Security Integrated | 41 | 952,521 | 3,859,327 |
| R25W120 | Reduced 25% on Death of Annuitant or Named Survivor with 120 Months guaranteed | 1 | 4,300 | 12,094 |
| A60WSS | Life with 60 Months Guaranteed and Social Security Integrated | 32 | 160,566 | 495,971 |
| A180WSS | Life with 180 Months Guaranteed and Social Security Integrated | 37 | 850,096 | 2,472,812 |
| PF6213 | Police and Firemen s.62.13 * | 32 | 1,122,356 | 3,830,427 |
| SLNSD | Straight Life - Named Survivor Deceased | 750 | 20,638,014 | 201,834,869 |
| Total Regular | | 201,466 | \$4,841,911,770 | \$54,594,432,418 |

(concluded on next page)

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Core Annuities Being Paid Tabulated by Type of Annuity and Option

| Alpha Code | Type of Benefit | Number | Annual Amount | Present Value |
|----------------------------------|---|----------------|-------------------------|--------------------------|
| DISABILITY RETIREMENT | | | | |
| SL | Straight Life ⁽¹⁾ | 2,888 | \$ 59,638,709 | \$ 459,842,752 |
| A60 | Life Annuity with 60 payments guaranteed | 386 | 10,097,791 | 94,122,457 |
| A180 | Life Annuity with 180 payments guaranteed | 1,045 | 26,021,364 | 268,633,745 |
| JOINT | Joint and 75% Survivor | 502 | 11,559,441 | 125,694,765 |
| R25 | Reduced 25% on First Death | 206 | 4,638,799 | 48,719,478 |
| C100 | 100% Continued to Named Survivor | 1,165 | 21,169,666 | 231,097,761 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 2,067 | 44,405,496 | 566,939,400 |
| AC180 | Annuity Certain between 24 and 180 Payments | 0 | 2,458 | 6,462 |
| DWSMC | Disability with Spouse or Minor/Dependent Child | 7 | 160,691 | 1,294,974 |
| DWOSMC | Disability without Spouse or Minor/Dependent Child | 1 | 12,375 | 62,414 |
| PF6213 | Police and Firemen s.62.13 * | 8 | 125,431 | 575,992 |
| SLNSD | Straight Life - Named Survivor Deceased | 6 | 188,462 | 1,970,289 |
| Total Disability | | 8,281 | \$ 178,020,683 | \$ 1,798,960,489 |
| DEATH-IN-SERVICE BENEFITS | | | | |
| SL | Straight Life | 241 | \$ 3,394,045 | \$ 36,347,033 |
| SL | Straight Life (accelerated) | 0 | 89,390 | 368,136 |
| A60 | Life Annuity with 60 payments guaranteed | 130 | 2,311,775 | 25,335,544 |
| A60 | Life Annuity with 60 payments guaranteed (accelerated) | 0 | 46,887 | 221,837 |
| A180 | Life Annuity with 180 payments guaranteed | 980 | 14,227,982 | 170,028,934 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 617,260 | 2,049,780 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 2 | 11,046 | 159,390 |
| LOL | Life with Optional Length Guaranteed | 6 | 178,215 | 1,098,311 |
| A60WSS | Life with 60 Months Guaranteed and Social Security Integrated | 18 | 19,751 | 78,539 |
| PF6213 | Police and Firemen s.62.13 * | 2 | 62,071 | 219,644 |
| Total Death-in-Service | | 1,379 | \$ 20,958,422 | \$ 235,907,148 |
| GRAND TOTAL | | 211,126 | \$ 5,040,890,875 | \$ 56,629,300,055 |

⁽¹⁾Includes 2,152 LTDI members.

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

*Additional Information for Police and Firemen 62.13 Annuities

| | <u>Regular Retirement</u> | | | <u>Disability Retirement</u> | | | <u>Death-in-Service Retirement</u> | | |
|-----------------------|---------------------------|------------------|--------------|------------------------------|------------------|--------------|------------------------------------|------------------|--------------|
| | <u>Original</u> | <u>Dividends</u> | <u>Total</u> | <u>Original</u> | <u>Dividends</u> | <u>Total</u> | <u>Original</u> | <u>Dividends</u> | <u>Total</u> |
| Benefit Amount | \$ 295,534 | \$826,822 | \$1,122,356 | \$ 27,713 | \$97,718 | \$125,431 | \$ 14,477 | \$ 47,594 | \$ 62,071 |
| Present Value | 1,010,293 | 2,820,134 | 3,830,427 | 127,261 | 448,731 | 575,992 | 51,217 | 168,427 | 219,644 |

Core Annuities Being Paid Tabulated by Attained Ages

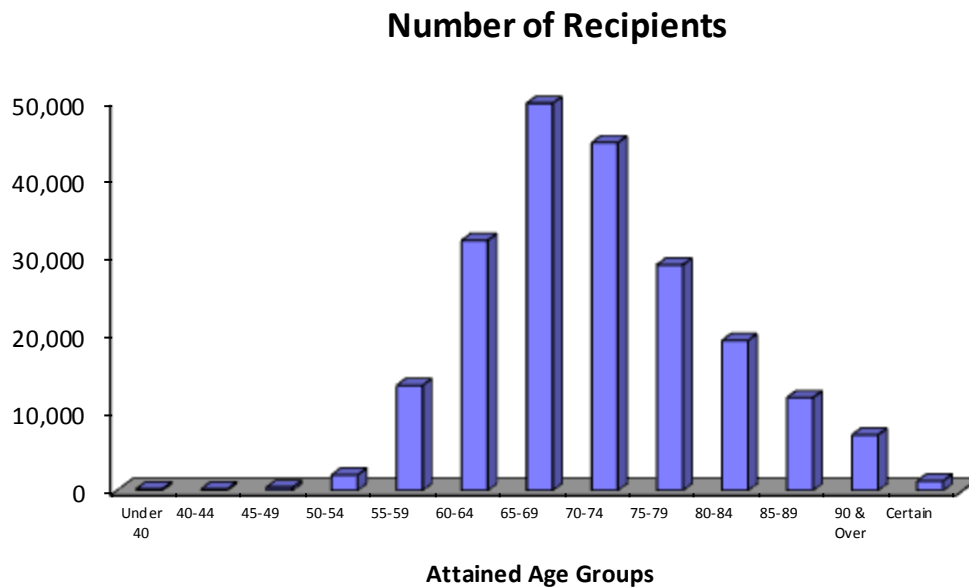
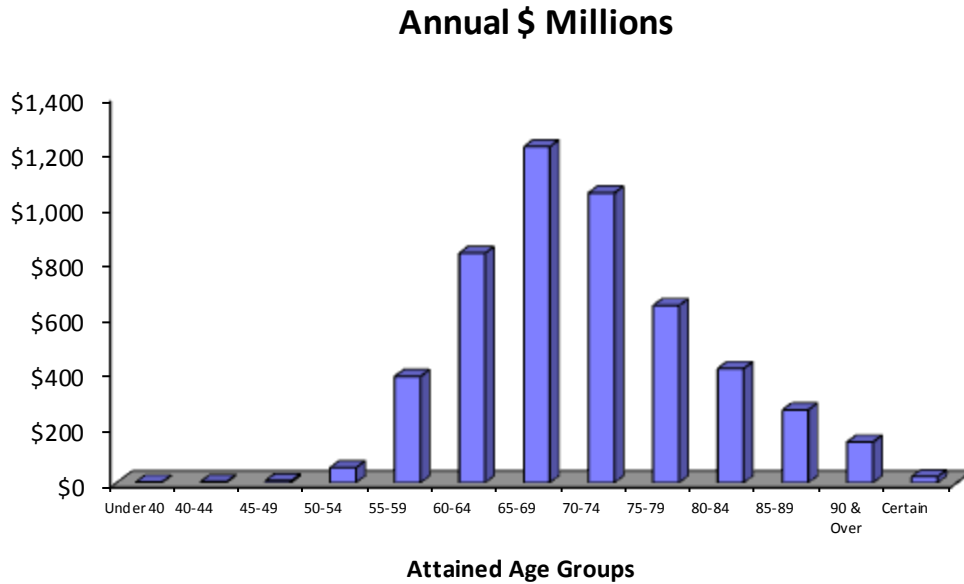
| Attained Ages | Regular | | Disability | | Death-in-Service | | Totals | |
|---------------|----------------|------------------------|--------------|----------------------|------------------|---------------------|----------------|------------------------|
| | No. | Annual Amount | No. | Annual Amount | No. | Annual Amount | No. | Annual Amount |
| Under 20 | 0 | \$ 0 | 0 | \$ 0 | 2 | \$ 28,514 | 2 | \$ 28,514 |
| 20-24 | 0 | 0 | 5 | 42,731 | 10 | 74,679 | 15 | 117,410 |
| 25-29 | 0 | 0 | 11 | 196,790 | 19 | 115,357 | 30 | 312,147 |
| 30-34 | 1 | 4,527 | 30 | 408,385 | 20 | 125,815 | 51 | 538,727 |
| 35-39 | 0 | 0 | 72 | 1,248,044 | 36 | 275,665 | 108 | 1,523,709 |
| 40-44 | 10 | 124,028 | 169 | 3,243,639 | 28 | 216,642 | 207 | 3,584,309 |
| 45-49 | 55 | 550,918 | 310 | 6,151,487 | 48 | 457,037 | 413 | 7,159,442 |
| 50-54 | 1,296 | 38,572,158 | 649 | 14,991,502 | 66 | 773,016 | 2,011 | 54,336,676 |
| 55-59 | 12,093 | 354,322,224 | 1,255 | 28,841,188 | 136 | 1,969,032 | 13,484 | 385,132,444 |
| 60-64 | 30,185 | 790,329,264 | 1,687 | 38,140,654 | 204 | 3,397,300 | 32,076 | 831,867,218 |
| 65-69 | 48,152 | 1,183,641,781 | 1,289 | 29,371,690 | 228 | 4,658,822 | 49,669 | 1,217,672,293 |
| 70-74 | 43,417 | 1,025,014,965 | 1,014 | 21,900,913 | 186 | 3,400,769 | 44,617 | 1,050,316,647 |
| 75-79 | 28,024 | 624,266,234 | 778 | 15,629,875 | 133 | 2,106,957 | 28,935 | 642,003,066 |
| 80-84 | 18,609 | 402,377,671 | 539 | 10,154,548 | 90 | 1,278,949 | 19,238 | 413,811,168 |
| 85-89 | 11,519 | 257,743,844 | 315 | 5,216,939 | 74 | 733,294 | 11,908 | 263,694,077 |
| 90-94 | 5,328 | 113,024,390 | 122 | 2,056,819 | 39 | 759,204 | 5,489 | 115,840,413 |
| 95& Up | 1,591 | 30,779,554 | 36 | 425,479 | 23 | 128,118 | 1,650 | 31,333,151 |
| Certain Only* | 1,186 | 21,160,212 | 0 | 0 | 37 | 459,252 | 1,223 | 21,619,464 |
| Totals | 201,466 | \$4,841,911,770 | 8,281 | \$178,020,683 | 1,379 | \$20,958,422 | 211,126 | \$5,040,890,875 |

Averages in Years

| | | | | |
|-------------------|------|------|------|------|
| Age at retirement | 59.8 | 51.0 | 52.0 | 59.5 |
| Attained age | 70.9 | 64.0 | 67.4 | 70.6 |

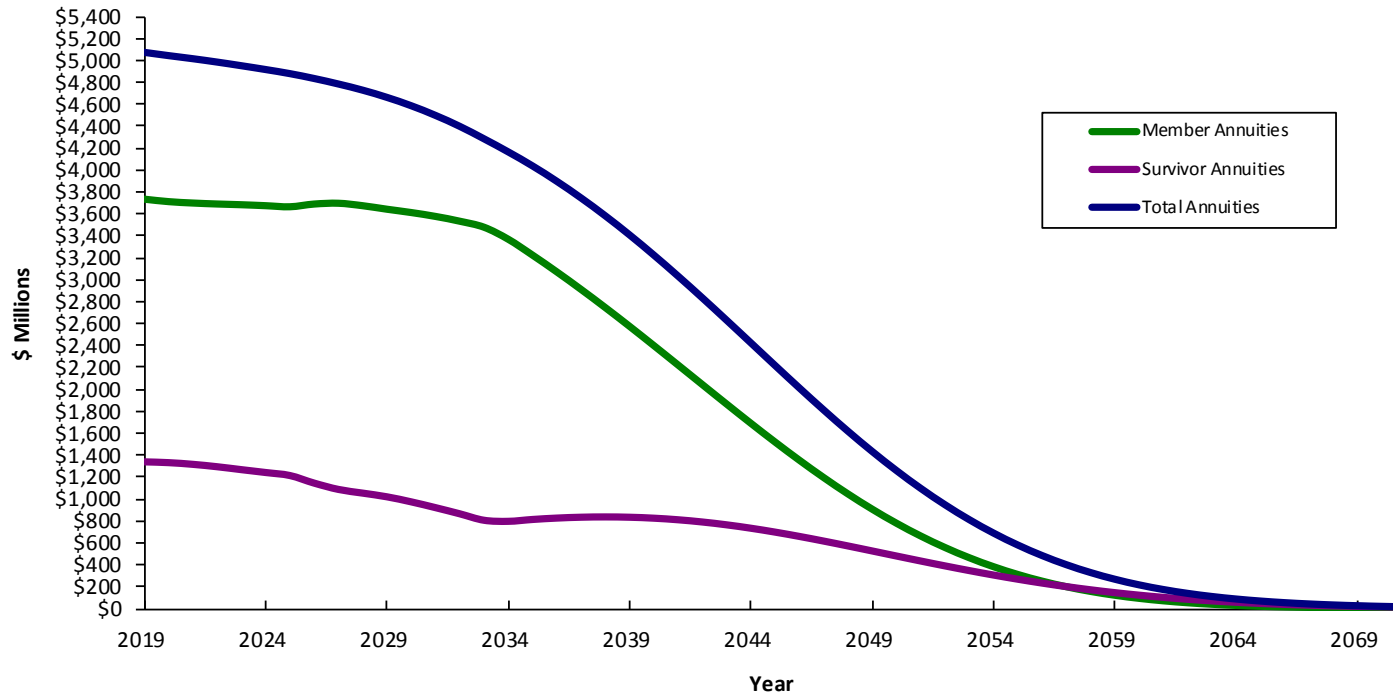
* Certain Only category consists of continuations of 5, 10 and 15-year certain and life annuities to beneficiaries of deceased annuitants.

Core Annuities Being Paid by Attained Age*



* Includes regular and disability retirees and survivor beneficiaries. The “certain” category includes annuities paid for a fixed period which is not dependent upon the age of the recipient.

Projected Future Core Annuity Payments on Behalf of Present Retired Lives Including Present and Future Expected Dividends



| | \$ Billions | |
|---------------------------------|--------------------------------|-----------------------------------|
| | <u>With Expected Dividends</u> | <u>Without Expected Dividends</u> |
| Total Future Benefit Payments | \$125.6 | \$96.5 |
| Present Assets | 56.5 | 56.5 |
| Future Investment Return Needed | 69.1 | 40.0 |

Based upon the assumptions used in the valuation, future dividends are expected to be a approximately 1.9% per year. Of course actual dividends will be based upon actual future investment return and the operation of the Market Recognition Account.

SECTION D

VARIABLE ANNUITIES

Variable Annuity Division Development of Assets and Liabilities

| | \$ Millions | | Ratio |
|--|------------------|------------------|--------------|
| | Assets | Liabilities | |
| Ending Balance December 31, 2017 | \$4,324.9 | \$3,682.1 | 1.175 |
| Closing Adjustments | (1.3) | 0.0 | |
| Variable Terminations | (84.3) | (84.3) | |
| 2018 Adjustment: 17% | 0.0 | 611.4 | |
| Beginning Balance January 1, 2018 | 4,239.3 | 4,209.2 | 1.007 |
| Increases | | | |
| Reserve Transfers | 203.2 | 203.2 | |
| Regular Interest | 205.3 | 205.3 | |
| Additional Earnings | (487.5) | 0.0 | |
| Addition for Experience Study/Mortality Reserve | 0.0 | 8.4 | |
| Other | 0.0 | 0.0 | |
| Total Increases | (79.0) | 416.9 | |
| Decreases | | | |
| Annuities & Lump Sums | 411.2 | 411.2 | |
| Credit Re-establishments | 0.0 | 0.0 | |
| Subtraction for Experience Study/Mortality Reserve | 0.0 | 0.0 | |
| Other | 0.0 | 7.3 | |
| Total Decreases | 411.2 | 418.5 | |
| Ending Balance December 31, 2018 | \$3,749.1 | \$4,207.6 | 0.891 |

Reserve Transfer Recommendation

Amounts to be transferred from the Employer Reserve and the Employee Reserve to the Annuity Reserve to cover liabilities for new annuities are computed as the first step in the annual actuarial valuation. The actuarial present value at time of retirement of variable annuities reported as new since the last actuarial valuation is \$194,174,811. Adjustments to prior transfers, relating to estimated annuities for which final computations have now been made, totaled \$9,016,471. Reserve transfers were distributed as follows:

| Group | Regular Transfer | Adjustment to Prior Transfer | Total Transfer |
|------------------------------------|----------------------|------------------------------|----------------------|
| General | \$175,555,435 | \$6,873,457 | \$182,428,892 |
| Protective with Social Security | 13,844,462 | 1,469,441 | 15,313,903 |
| Protective without Social Security | 2,261,456 | 28,633 | 2,290,089 |
| Executive & Elected | 2,513,458 | 644,940 | 3,158,398 |
| Totals | \$194,174,811 | \$9,016,471 | \$203,191,282 |

Accordingly, we recommend that \$203,191,282 be transferred to the Variable Annuity Reserve. The results in this report assume that this transfer has been made.

Discussion of Variable Annuity Change

Variable Annuity Reserves, \$3,749.1 million, were less than the actuarial present value of variable annuities, \$4,207.6 million, by \$458.5 million as of December 31, 2018 or 10.9% of the Actuarial Present Value (APV) of variable annuity payments. In accordance with Section 40.28(2) of the Wisconsin statutes (see page 29 of this report), variable annuities will be decreased by 10.0% effective April 1, 2019. The primary sources of the 10.0% are as follows:

| | % of APV |
|--|-----------------|
| 1. SWIB net of fee investment return | (8.0)% |
| 2. Adjustment to published effective rate | 1.0% |
| 3. Published effective earnings rate | (7.0)% |
| 4. Adjustment to relate earnings to average variable annuity fund balance | 0.2% |
| 5. Earnings rate based on average balance | (6.8)% |
| 6. Expected change before adjustments: $(1-0.068)/1.05-1$ | (11.2)% |
| 7. Adjustment to relate average asset to ending liability | (0.4)% |
| 8. Carryover from last year due to timing of distribution, accounting adjustments and truncation | 0.7% |
| 9. Experience study/mortality reserve adjustment | (0.2)% |
| 10. Experience and other effects | 0.2% |
| 11. Statutory adjustment: (truncate to whole percent) | 0.9% |
| 12. Variable annuity change: (6)+(7)+(8)+(9)+(10)+(11) | (10.0)% |

Please see pages 30 and 31 for a description of the items on this page.

In accordance with the Administrative Code, ETF 20.25 and Section 40.28(2) Wisconsin Statutes (shown on page 29 of this report), variable annuities will be decreased by 10.0% effective April 1, 2019.

Transfers to Annuity Reserve to Finance Variable Annuities Approved in 2018 Tabulated by Type of Annuity and Option

| Alpha Code | Type of Benefit | Number | Annual Amount | Present Value |
|----------------------------------|---|--------------|----------------------|-----------------------|
| REGULAR RETIREMENT | | | | |
| SL | Straight Life | 242 | \$ 1,999,289 | \$ 25,975,513 |
| SL | Straight Life (accelerated) | 0 | 202,504 | 798,255 |
| A60 | Life Annuity with 60 payments guaranteed | 120 | 858,363 | 11,779,566 |
| A60 | Life Annuity with 60 payments guaranteed (accelerated) | 0 | 141,871 | 549,461 |
| A180 | Life Annuity with 180 payments guaranteed | 403 | 2,488,566 | 35,514,893 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 495,807 | 1,976,648 |
| A180F | Life Annuity with 180 payments guaranteed (forced) | 1 | 641 | 7,852 |
| JOINT | Joint and 75% Survivor | 160 | 1,221,615 | 18,789,658 |
| JOINT | Joint and 75% Survivor (accelerated) | 0 | 219,866 | 913,972 |
| R25 | Reduced 25% on First Death | 82 | 873,369 | 11,399,013 |
| R25 | Reduced 25% on First Death (accelerated) | 0 | 103,263 | 372,177 |
| C100 | 100% Continued to Named Survivor | 164 | 1,430,565 | 19,561,126 |
| C100 | 100% Continued to Named Survivor (accelerated) | 0 | 163,831 | 737,618 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 527 | 3,513,154 | 55,747,467 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed (accelerated) | 0 | 855,442 | 3,598,176 |
| AC24 | Annuity Certain with 24 Payments | 0 | 30,039 | 75,655 |
| AC60 | Annuity Certain with 60 Payments | 0 | 7,412 | 37,989 |
| AC120 | Annuity Certain with 120 Payments | 0 | 15,207 | 119,210 |
| AC180 | Annuity Certain between 24 and 180 Payments | 0 | 8,614 | 90,993 |
| | Total Regular | 1,699 | \$ 14,629,418 | \$ 188,045,242 |
| | Average Age at Retirement | 60.4 Years | | |
| DISABILITY RETIREMENT | | | | |
| SL | Straight Life | 11 | \$ 71,802 | \$ 995,468 |
| A60 | Life Annuity with 60 payments guaranteed | 6 | 24,912 | 356,322 |
| A180 | Life Annuity with 180 payments guaranteed | 7 | 41,340 | 606,490 |
| JOINT | Joint and 75% Survivor | 4 | 29,340 | 429,549 |
| R25 | Reduced 25% on First Death | 2 | 12,978 | 204,619 |
| C100 | 100% Continued to Named Survivor | 7 | 31,344 | 515,962 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 17 | 89,062 | 1,453,696 |
| | Total Disability | 54 | \$ 300,778 | \$ 4,562,106 |
| | Average Age at Retirement | 53.5 Years | | |
| DEATH-IN-SERVICE BENEFITS | | | | |
| SL | Straight Life | 1 | \$ 7,759 | \$ 103,644 |
| A180 | Life Annuity with 180 payments guaranteed | 18 | 93,496 | 1,397,533 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 13,405 | 66,286 |
| | Total Death-in-Service | 19 | \$ 114,660 | \$ 1,567,463 |
| | Average Age at Retirement | 58.8 Years | | |
| GRAND TOTAL | | 1,772 | \$ 15,044,856 | \$ 194,174,811 |

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Variable Annuities Being Paid Tabulated by Type of Annuity and Option

| Alpha Code | Type of Benefit | Number | Annual Amount | Present Value |
|---------------------------|--|--------|---------------|-----------------|
| REGULAR RETIREMENT | | | | |
| SL | Straight Life | 5,010 | \$ 46,757,098 | \$ 436,498,555 |
| SL | Straight Life (accelerated) | 0 | 750,972 | 1,826,028 |
| A60 | Life Annuity with 60 payments guaranteed | 3,623 | 34,272,862 | 308,511,514 |
| A60 | Life Annuity with 60 payments guaranteed (accelerated) | 0 | 546,884 | 1,305,871 |
| A120 | Life Annuity with 120 payments guaranteed | 11 | 78,809 | 228,425 |
| A180 | Life Annuity with 180 payments guaranteed | 7,886 | 69,178,078 | 663,715,651 |
| A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 1,761,337 | 4,779,353 |
| A180F | Life Annuity with 180 payments guaranteed (forced) | 35 | 255,647 | 1,920,781 |
| JOINT | Joint and 75% Survivor | 4,901 | 58,029,110 | 593,691,877 |
| JOINT | Joint and 75% Survivor (accelerated) | 0 | 785,500 | 2,084,936 |
| R25 | Reduced 25% on First Death | 3,423 | 53,779,530 | 453,796,580 |
| R25 | Reduced 25% on First Death (accelerated) | 0 | 366,414 | 840,667 |
| C100 | 100% Continued to Named Survivor | 3,786 | 39,988,048 | 413,040,529 |
| C100 | 100% Continued to Named Survivor (accelerated) | 0 | 613,462 | 1,557,222 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 10,698 | 103,355,270 | 1,202,186,584 |
| C180 | 100% Continued to Named Survivor with 180 payments guaranteed (accelerated) | 0 | 2,714,282 | 7,434,651 |
| LOL | Life with Optional Length Guaranteed | 3 | 58,432 | 190,863 |
| AC24 | Annuity Certain with 24 Payments | 0 | 30,039 | 61,828 |
| AC60 | Annuity Certain with 60 Payments | 0 | 67,986 | 107,887 |
| AC120 | Annuity Certain with 120 Payments | 1 | 120,071 | 455,540 |
| AC180 | Annuity Certain between 24 and 180 Payments | 0 | 437,739 | 1,960,878 |
| C50 | 50% Continued to One Beneficiary | 17 | 195,610 | 599,300 |
| C50W180 | 50% Continued to One Beneficiary with 180 Months guaranteed | 2 | 22,673 | 62,983 |
| C75WSS | 75% Continued to One Beneficiary and Social Security Integrated | 17 | 154,564 | 665,157 |
| R25W120 | Reduced 25% on Death of Annuitant or Named Survivor with 120 Months guaranteed | 1 | 7,063 | 19,842 |
| A60WSS | Life with 60 Months Guaranteed and Social Security Integrated | 12 | 54,795 | 171,311 |
| A180WSS | Life with 180 Months Guaranteed and Social Security Integrated | 5 | 41,799 | 127,797 |
| SLNSD | Straight Life - Named Survivor Deceased | 143 | 1,711,742 | 15,422,146 |
| Total Regular | | 39,574 | \$416,135,816 | \$4,113,264,756 |

(concluded on next page)

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Variable Annuities Being Paid Tabulated by Type of Annuity and Option

| Numeric Code | Alpha Code | Type of Benefit | Number | Annual Amount | Present Value |
|----------------------------------|------------|---|---------------|-----------------------|-------------------------|
| DISABILITY RETIREMENT | | | | | |
| 1 | SL | Straight Life | 126 | \$ 664,635 | \$ 6,040,805 |
| 3 | A60 | Life Annuity with 60 payments guaranteed | 76 | 573,452 | 4,697,684 |
| 7 | A180 | Life Annuity with 180 payments guaranteed | 245 | 1,197,961 | 11,511,882 |
| 10 | JOINT | Joint and 75% Survivor | 106 | 881,001 | 8,305,308 |
| 12 | R25 | Reduced 25% on First Death | 43 | 287,035 | 2,545,576 |
| 14 | C100 | 100% Continued to Named Survivor | 231 | 1,382,482 | 12,799,006 |
| 16 | C180 | 100% Continued to Named Survivor with 180 payments guaranteed | 428 | 2,427,155 | 26,834,382 |
| 30 | DWSMC | Disability with Spouse or Minor/Dependent Child | 1 | 615 | 6,824 |
| Total Disability | | | 1,256 | \$ 7,414,336 | \$ 72,741,467 |
| DEATH-IN-SERVICE BENEFITS | | | | | |
| 1 | SL | Straight Life | 67 | \$ 509,510 | \$ 4,872,924 |
| 2 | SL | Straight Life (accelerated) | 0 | 6,560 | 4,517 |
| 3 | A60 | Life Annuity with 60 payments guaranteed | 28 | 248,475 | 1,902,327 |
| 4 | A60 | Life Annuity with 60 payments guaranteed (accelerated) | 0 | 3,579 | 10,678 |
| 7 | A180 | Life Annuity with 180 payments guaranteed | 254 | 1,420,587 | 14,442,541 |
| 8 | A180 | Life Annuity with 180 payments guaranteed (accelerated) | 0 | 69,645 | 337,228 |
| 28 | A60WSS | Life with 60 Months Guaranteed and Social Security Integrated | 8 | 8,112 | 30,719 |
| Total Death-in-Service | | | 357 | \$ 2,266,468 | \$ 21,600,934 |
| GRAND TOTAL | | | 41,187 | \$ 425,816,620 | \$ 4,207,607,157 |

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Variable Annuities Being Paid Tabulated by Attained Ages

| Attained Ages | Regular | | Disability | | Death-in-Service | | Totals | |
|------------------|---------------|----------------------|--------------|--------------------|------------------|--------------------|---------------|----------------------|
| | No. | Annual Amount | No. | Annual Amount | No. | Annual Amount | No. | Annual Amount |
| 20-24 | 0 | \$ 0 | 2 | \$ 2,028 | 3 | \$ 6,047 | 5 | \$ 8,075 |
| 25-29 | 0 | 0 | 3 | 5,433 | 3 | 2,734 | 6 | 8,167 |
| 30-34 | 0 | 0 | 7 | 6,319 | 5 | 1,341 | 12 | 7,660 |
| 35-39 | 0 | 300 | 13 | 39,344 | 8 | 12,661 | 21 | 52,305 |
| 40-44 | 5 | 60,666 | 10 | 19,526 | 5 | 15,993 | 20 | 96,185 |
| 45-49 | 15 | 135,334 | 22 | 112,532 | 20 | 75,549 | 57 | 323,415 |
| 50-54 | 299 | 3,167,098 | 81 | 354,097 | 15 | 49,260 | 395 | 3,570,455 |
| 55-59 | 2,499 | 19,388,968 | 150 | 544,725 | 41 | 193,315 | 2,690 | 20,127,008 |
| 60-64 | 5,841 | 36,183,163 | 207 | 833,495 | 46 | 266,378 | 6,094 | 37,283,036 |
| 65-69 | 8,942 | 68,313,490 | 240 | 1,091,879 | 55 | 247,644 | 9,237 | 69,653,013 |
| 70-74 | 8,842 | 95,013,141 | 183 | 1,576,941 | 44 | 403,761 | 9,069 | 96,993,843 |
| 75-79 | 5,100 | 73,983,503 | 134 | 1,420,169 | 37 | 349,145 | 5,271 | 75,752,817 |
| 80-84 | 3,507 | 57,890,237 | 106 | 854,206 | 23 | 159,547 | 3,636 | 58,903,990 |
| 85-89 | 2,511 | 38,994,231 | 63 | 387,057 | 20 | 199,439 | 2,594 | 39,580,727 |
| 90-94 | 1,322 | 17,089,720 | 25 | 134,511 | 22 | 178,291 | 1,369 | 17,402,522 |
| 95 & Up | 437 | 4,186,718 | 10 | 32,074 | 8 | 72,088 | 455 | 4,290,880 |
| Certain Only* | 254 | 1,729,247 | 0 | 0 | 2 | 33,275 | 256 | 1,762,522 |
| Totals | 39,574 | \$416,135,816 | 1,256 | \$7,414,336 | 357 | \$2,266,468 | 41,187 | \$425,816,620 |

Averages in Years

| | | | | |
|-------------------|------|------|------|------|
| Age at retirement | 59.2 | 52.5 | 52.0 | 59.0 |
| Attained age | 70.8 | 66.6 | 68.1 | 70.7 |

* Certain only category consists of continuations of 5, 10 and 15-year certain and life annuities to beneficiaries of deceased annuitants.

SECTION E

COMPARATIVE STATEMENTS

Core Annuities Comparative Statement 1984 Through 2018

| Valuation Date | Number | \$ Millions | | | | Change in | | |
|------------------------|---------|---------------------|-----------------|----------------------|-------|--------------|---------|--------------|
| | | Annual Annuities | Fund Balance | Actuarial Reserve | Ratio | Annuities | | CPI* |
| | | | | | | Average | Maximum | |
| 1984 | 60,302 | \$ 214.3 | \$ 2,255.5 | \$ 2,121.3 | 1.064 | 6.0 % | | 4.0 % |
| 1985 | 62,953 | 257.6 | 2,758.2 | 2,561.0 | 1.077 | 7.2 % | | 3.8 % |
| 1986 | 65,425 | 303.5 | 3,256.9 | 3,021.2 | 1.078 | 7.6 % | | 1.1 % |
| 1987 | 67,688 | 366.9 | 3,833.7 | 3,594.6 | 1.067 | 6.7 % | | 4.4 % |
| 1988 | 70,017 | 420.6 | 4,319.6 | 4,150.9 | 1.041 | 4.1 % | | 4.4 % |
| 1989 | 73,232 | 488.7 | 5,487.4 | 4,928.1 | 1.113 | 11.3 % | | 4.6 % |
| 1990 | 77,666 | 611.3 | 6,443.8 | 6,219.1 | 1.036 | 3.6 % | | 6.2 % |
| 1991 | 79,465 | 660.4 | 7,137.8 | 6,711.3 | 1.063 | 6.3 % | | 3.0 % |
| 1992 | 81,508 | 732.3 | 7,782.4 | 7,456.6 | 1.044 | 4.4 % | | 3.0 % |
| 1993 | 83,836 | 801.7 | 8,608.2 | 8,205.3 | 1.049 | 4.9 % | | 2.7 % |
| 1994 | 86,214 | 882.2 | 9,286.2 | 9,029.6 | 1.028 | 2.8 % | | 2.7 % |
| 1995 | 88,998 | 955.8 | 10,351.7 | 9,804.1 | 1.056 | 5.6 % | | 2.6 % |
| 1996 | 92,198 | 1,065.8 | 11,699.8 | 10,977.1 | 1.066 | 6.6 % | | 3.3 % |
| 1997 | 95,128 | 1,188.4 | 13,185.1 | 12,240.4 | 1.077 | 7.7 % | | 1.7 % |
| 1998 | 99,112 | 1,349.5 | 14,951.8 | 13,943.0 | 1.072 | 7.2 % | | 1.6 % |
| 1999 | 102,817 | 1,513.8 | 16,857.8 | 15,687.2 | 1.075 | 17.1 % | ** | 2.7 % |
| 2000 | 107,425 | 1,867.0 | 20,517.8 | 19,405.3 | 1.057 | 5.7 % | | 3.4 % |
| 2001 | 112,142 | 2,048.6 | 21,979.7 | 21,283.6 | 1.033 | 3.3 % | | 1.6 % |
| 2002 | 116,289 | 2,226.6 | 23,142.4 | 23,202.9 | 0.997 | 0.0 % | | 2.4 % |
| 2003 | 121,582 | 2,364.7 | 25,071.9 | 24,724.0 | 1.014 | 1.4 % | | 1.9 % |
| 2004 | 126,211 | 2,500.3 | 26,920.0 | 26,232.2 | 1.026 | 2.6 % | | 3.3 % |
| 2005 | 131,674 | 2,691.4 | 28,575.3 | 28,359.7 | 1.008 | 0.8 % | | 3.4 % |
| 2006 | 137,117 | 2,843.6 | 31,180.5 | 30,273.9 | 1.030 | 3.0 % | | 2.6 % |
| 2007 | 142,906 | 3,075.3 | 35,050.1 | 32,877.5 | 1.066 | 6.6 % | | 4.1 % |
| 2008 | 144,033 | 3,399.3 | 35,798.1 | 36,551.5 | 0.979 | (2.1)% | (2.1)% | 0.1 % |
| 2009 | 150,671 | 3,449.3 | 36,655.8 | 37,072.7 | 0.989 | (1.1)% | (1.3)% | 2.7 % |
| 2010 | 155,775 | 3,532.4 | 37,798.4 | 38,148.5 | 0.991 | (0.9)% | (1.2)% | 1.5 % |
| 2011 | 167,453 | 3,842.0 | 40,411.5 | 42,078.3 | 0.960 | (4.0)% | (7.0)% | 3.0 % |
| 2012 | 173,655 | 3,806.3 | 40,591.6 | 41,852.4 | 0.970 | (3.0)% | (9.6)% | 1.7 % |
| 2013 | 180,056 | 3,800.7 | 44,273.2 | 42,300.5 | 1.047 | 4.7 % | 4.7 % | 1.5 % |
| 2014 | 185,605 | 4,102.3 | 47,135.7 | 45,790.7 | 1.029 | 2.9 % | 2.9 % | 0.8 % |
| 2015 | 191,795 | 4,364.9 | 49,147.0 | 48,897.5 | 1.005 | 0.5 % | 0.5 % | 0.7 % |
| 2016 | 197,647 | 4,523.1 | 51,972.0 | 50,941.4 | 1.020 | 2.0 % | 2.0 % | 2.1 % |
| 2017 | 203,202 | 4,747.0 | 54,900.0 | 53,590.0 | 1.024 | 2.4 % | 2.4 % | 2.1 % |
| 2018 | 211,126 | 5,040.9 | 56,493.8 | 56,629.3 | 0.998 | 0.0 % | 0.0 % | 1.9 % |
| 35-Year Average | | | | | | 3.7 % | | 2.6 % |
| 20-Year Average | | | | | | 2.0 % | | 2.2 % |
| 10-Year Average | | | | | | 0.3 % | | 1.8 % |
| 5-Year Average | | | | | | 1.6 % | | 1.5 % |

* CPI percentage increase determined by ratio of current year CPI-U67 December index over prior year December index.

** Including 10.6% Act 11 transfer.

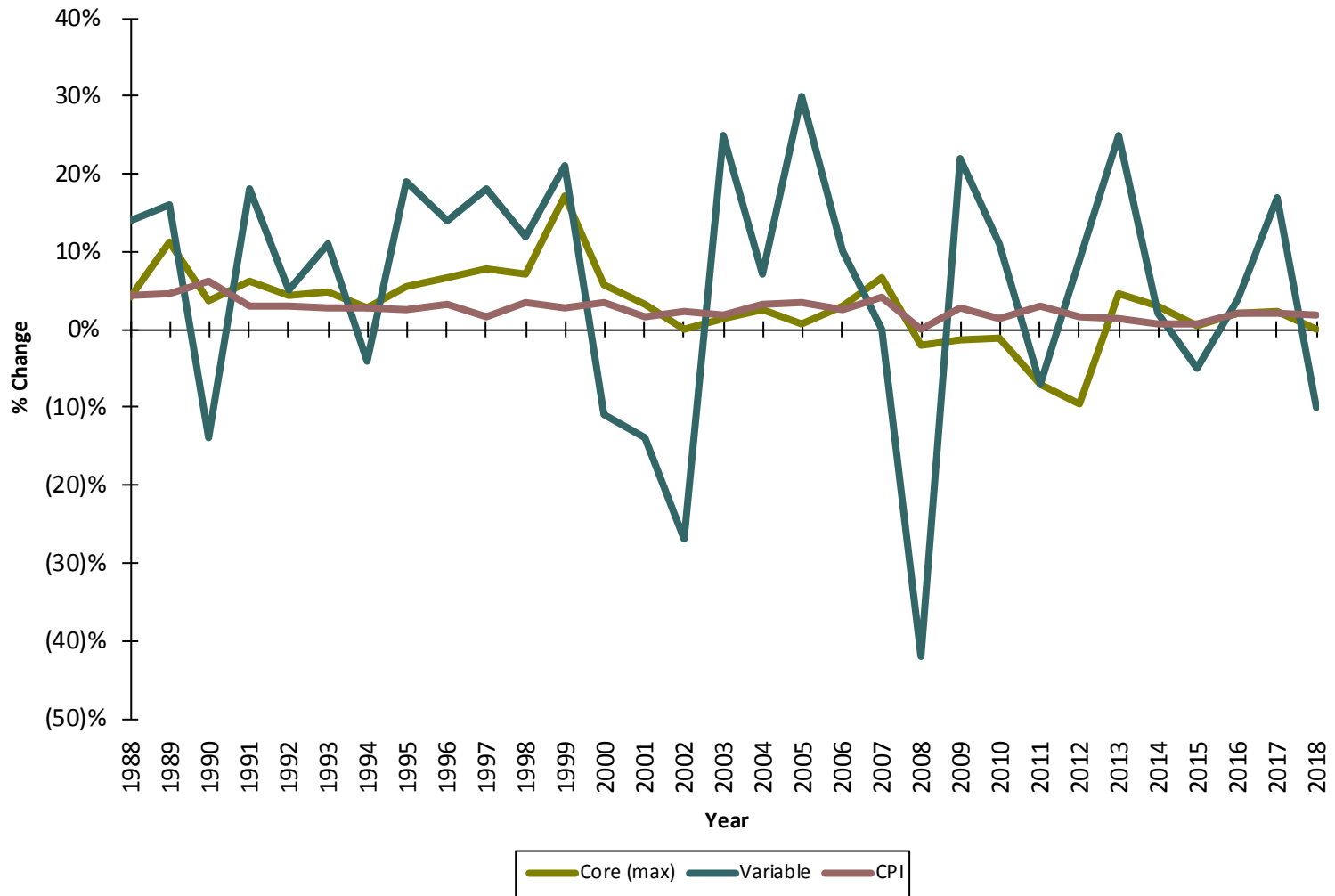
In cases where there is a negative dividend, a maximum decrease is calculated to account for annuitants that are already at the floor and whose dividend cannot be reduced.

Variable Annuities Comparative Statement 1984 Through 2018

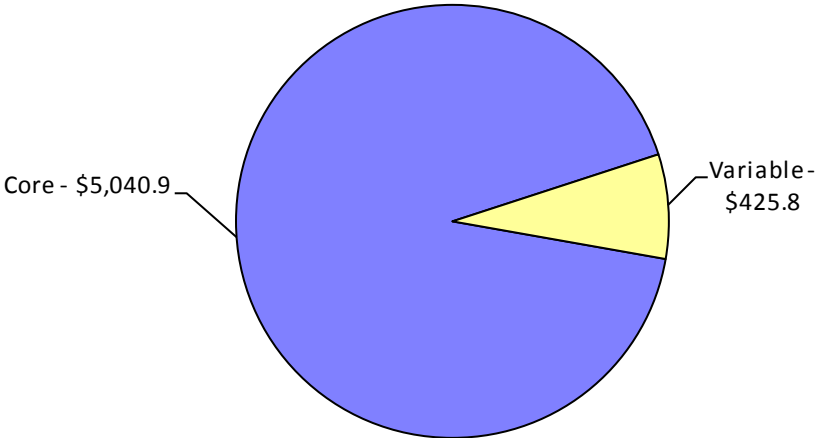
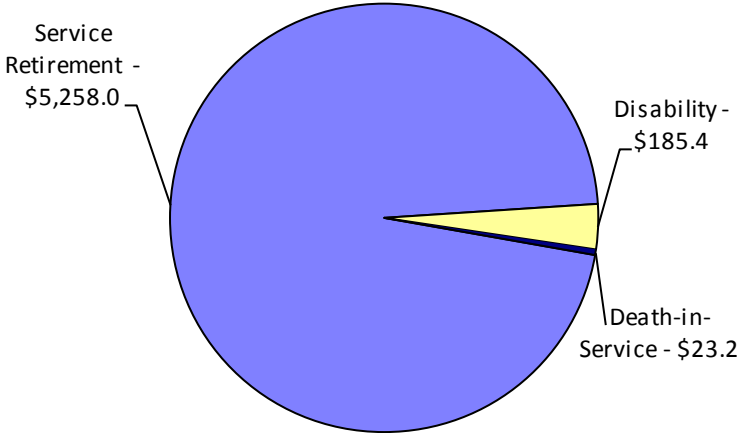
| Valuation Date | Number | \$ Millions | | | | Change in | |
|------------------------|--------|---------------------|-----------------|----------------------|-------|--------------|--------------|
| | | Annual Annuities | Fund Balance | Actuarial Reserve | Ratio | Annuities | CPI* |
| 1984 | 14,520 | \$ 34.2 | \$ 329.2 | \$ 327.5 | 1.005 | 0.0 % | 4.0 % |
| 1985 | 15,529 | 38.0 | 463.1 | 366.6 | 1.263 | 26.0 % | 3.8 % |
| 1986 | 16,276 | 51.8 | 538.7 | 498.6 | 1.080 | 8.0 % | 1.1 % |
| 1987 | 17,084 | 60.4 | 548.8 | 584.2 | 0.939 | (6.0)% | 4.4 % |
| 1988 | 17,779 | 61.4 | 682.6 | 594.0 | 1.149 | 14.0 % | 4.4 % |
| 1989 | 18,502 | 75.9 | 878.1 | 756.5 | 1.161 | 16.0 % | 4.6 % |
| 1990 | 19,922 | 101.0 | 868.6 | 1,013.4 | 0.857 | (14.0)% | 6.2 % |
| 1991 | 20,538 | 91.5 | 1,101.3 | 929.7 | 1.184 | 18.0 % | 3.0 % |
| 1992 | 20,968 | 112.6 | 1,208.6 | 1,147.4 | 1.053 | 5.0 % | 3.0 % |
| 1993 | 21,623 | 123.7 | 1,407.9 | 1,268.6 | 1.110 | 11.0 % | 2.7 % |
| 1994 | 22,248 | 144.6 | 1,418.0 | 1,487.0 | 0.954 | (4.0)% | 2.7 % |
| 1995 | 22,978 | 150.2 | 1,854.2 | 1,556.0 | 1.192 | 19.0 % | 2.6 % |
| 1996 | 23,725 | 189.8 | 2,264.9 | 1,976.7 | 1.146 | 14.0 % | 3.3 % |
| 1997 | 24,462 | 228.2 | 2,800.0 | 2,371.5 | 1.181 | 18.0 % | 1.7 % |
| 1998 | 25,424 | 289.5 | 3,400.5 | 3,035.5 | 1.120 | 12.0 % | 1.6 % |
| 1999 | 26,257 | 345.8 | 4,432.9 | 3,659.1 | 1.212 | 21.0 % | 2.7 % |
| 2000 | 27,321 | 445.3 | 4,211.4 | 4,749.3 | 0.887 | (11.0)% | 3.4 % |
| 2001 | 28,314 | 424.4 | 3,901.8 | 4,547.4 | 0.858 | (14.0)% | 1.6 % |
| 2002 | 28,662 | 374.0 | 2,899.3 | 3,999.1 | 0.726 | (27.0)% | 2.4 % |
| 2003 | 29,496 | 273.3 | 3,635.9 | 2,892.2 | 1.257 | 25.0 % | 1.9 % |
| 2004 | 30,270 | 346.0 | 3,909.9 | 3,654.5 | 1.070 | 7.0 % | 3.3 % |
| 2005 | 31,499 | 376.5 | 4,092.7 | 3,970.7 | 1.031 | 3.0 % | 3.4 % |
| 2006 | 32,683 | 391.8 | 4,594.2 | 4,145.2 | 1.108 | 10.0 % | 2.6 % |
| 2007 | 33,880 | 432.6 | 4,625.0 | 4,563.7 | 1.013 | 0.0 % | 4.1 % |
| 2008 | 34,927 | 427.0 | 2,574.5 | 4,491.0 | 0.573 | (42.0)% | 0.1 % |
| 2009 | 34,836 | 240.3 | 3,078.4 | 2,512.7 | 1.225 | 22.0 % | 2.7 % |
| 2010 | 35,866 | 288.4 | 3,340.6 | 3,005.4 | 1.111 | 11.0 % | 1.5 % |
| 2011 | 38,949 | 330.3 | 3,197.9 | 3,462.9 | 0.924 | (7.0)% | 3.0 % |
| 2012 | 39,873 | 304.6 | 3,463.9 | 3,169.6 | 1.093 | 9.0 % | 1.7 % |
| 2013 | 40,317 | 324.5 | 4,187.3 | 3,347.0 | 1.251 | 25.0 % | 1.5 % |
| 2014 | 39,420 | 386.5 | 3,995.4 | 3,917.1 | 1.020 | 2.0 % | 0.8 % |
| 2015 | 40,152 | 387.8 | 3,704.8 | 3,910.1 | 0.947 | (5.0)% | 0.7 % |
| 2016 | 40,647 | 363.6 | 3,792.0 | 3,645.1 | 1.040 | 4.0 % | 2.1 % |
| 2017 | 40,877 | 369.9 | 4,324.9 | 3,682.1 | 1.175 | 17.0 % | 2.1 % |
| 2018 | 41,187 | 425.8 | 3,749.1 | 4,207.6 | 0.891 | (10.0)% | 1.9 % |
| 35-Year Average | | | | | | 3.8 % | 2.6 % |
| 20-Year Average | | | | | | 0.4 % | 2.2 % |
| 10-Year Average | | | | | | 6.2 % | 1.8 % |
| 5-Year Average | | | | | | 1.2 % | 1.5 % |

* CPI percentage increase determined by ratio of current year CPI-U67 December index over prior year December index.

History of % Changes in Annuities and CPI



Annual Annuities Being Paid by Type \$ Millions



Annuities Being Paid Tabulated by Year of Retirement⁽¹⁾ (\$1,000s annually)

| Year Ret'd | Core Annuities | | | | Variable Annuities | | | | Avg. Total Annuity |
|--------------|----------------|--------------------|------------------|--------------------|--------------------|------------------|------------------|------------------|--------------------|
| | No. | Initial | Increases | Total | No. | Initial | Increases | Total | |
| 2018 | 9,620 | \$ 254,697 | \$ 0 | \$ 254,697 | 1,712 | \$ 14,297 | \$ 0 | \$ 14,297 | \$31,205 |
| 2017 | 9,895 | 250,476 | 3,311 | 253,787 | 1,547 | 9,431 | 1,603 | 11,034 | 29,779 |
| 2016 | 10,182 | 254,660 | 8,808 | 263,468 | 1,572 | 9,301 | 2,015 | 11,316 | 29,477 |
| 2015 | 10,314 | 253,233 | 11,822 | 265,055 | 1,683 | 9,837 | 1,534 | 11,371 | 29,704 |
| 2014 | 9,339 | 212,602 | 13,776 | 226,378 | 1,695 | 9,425 | 1,690 | 11,115 | 28,246 |
| 2013 | 9,655 | 210,744 | 21,979 | 232,723 | 1,678 | 7,341 | 3,479 | 10,820 | 28,178 |
| 2012 | 9,590 | 207,925 | 26,561 | 234,486 | 1,724 | 6,320 | 3,832 | 10,152 | 28,613 |
| 2011 | 15,251 | 380,494 | 48,994 | 429,488 | 3,131 | 14,528 | 7,177 | 21,705 | 33,671 |
| 2010 | 8,364 | 189,898 | 24,340 | 214,238 | 1,602 | 5,673 | 3,734 | 9,407 | 29,493 |
| 2009 | 7,870 | 179,299 | 23,116 | 202,415 | 1,424 | 4,143 | 4,240 | 8,383 | 29,474 |
| 2008 | 8,493 | 197,076 | 25,330 | 222,406 | 1,669 | 10,211 | 1,780 | 11,991 | 28,203 |
| 2007 | 8,324 | 180,338 | 23,205 | 203,543 | 1,840 | 11,638 | 2,025 | 13,663 | 26,252 |
| 2006 | 8,034 | 163,830 | 21,131 | 184,961 | 1,701 | 11,388 | 3,312 | 14,700 | 24,926 |
| 2005 | 7,995 | 159,960 | 20,682 | 180,642 | 1,724 | 12,068 | 3,979 | 16,047 | 24,766 |
| 2004 | 7,118 | 134,236 | 17,393 | 151,629 | 1,601 | 11,335 | 4,791 | 16,126 | 23,748 |
| 2003 | 6,977 | 133,640 | 17,315 | 150,955 | 1,434 | 9,305 | 7,242 | 16,547 | 24,084 |
| 2002 | 6,509 | 120,946 | 15,652 | 136,598 | 1,273 | 12,507 | 3,738 | 16,245 | 23,558 |
| 2001 | 6,557 | 121,089 | 15,684 | 136,773 | 1,349 | 19,740 | 2,298 | 22,038 | 24,324 |
| 2000 | 6,452 | 117,575 | 15,328 | 132,903 | 1,133 | 22,501 | (143) | 22,358 | 24,210 |
| 1999 | 5,387 | 85,011 | 23,851 | 108,862 | 956 | 15,079 | 3,049 | 18,128 | 23,608 |
| 1998 | 5,162 | 76,943 | 28,060 | 105,003 | 961 | 13,432 | 4,654 | 18,086 | 23,943 |
| 1997 | 4,273 | 61,760 | 28,626 | 90,386 | 809 | 9,585 | 5,640 | 15,225 | 24,867 |
| 1996 | 4,081 | 58,022 | 32,858 | 90,880 | 828 | 8,609 | 6,965 | 15,574 | 26,239 |
| 1995 | 3,604 | 49,296 | 32,236 | 81,532 | 717 | 6,084 | 7,029 | 13,113 | 26,459 |
| 1994 | 3,181 | 41,498 | 29,739 | 71,237 | 713 | 5,823 | 6,229 | 12,052 | 26,483 |
| 1993 | 2,790 | 34,259 | 26,734 | 60,993 | 620 | 4,318 | 5,589 | 9,907 | 25,614 |
| 1992 | 2,289 | 26,411 | 22,931 | 49,342 | 517 | 3,348 | 4,726 | 8,074 | 25,305 |
| 1991 | 1,959 | 22,051 | 21,390 | 43,441 | 466 | 2,650 | 4,897 | 7,547 | 26,474 |
| 1990 | 3,133 | 36,941 | 38,812 | 75,753 | 788 | 4,757 | 6,888 | 11,645 | 28,358 |
| 1989 | 2,192 | 25,420 | 30,612 | 56,032 | 506 | 2,694 | 4,952 | 7,646 | 29,399 |
| 1988 | 1,432 | 12,923 | 17,851 | 30,774 | 350 | 1,415 | 3,165 | 4,580 | 25,003 |
| 1987 | 1,162 | 9,553 | 14,493 | 24,046 | 317 | 1,191 | 2,437 | 3,628 | 24,382 |
| 1986 | 971 | 7,945 | 13,730 | 21,675 | 283 | 986 | 2,254 | 3,240 | 26,143 |
| 1985 | 855 | 6,783 | 13,342 | 20,125 | 224 | 585 | 1,832 | 2,417 | 27,094 |
| 1984 | 569 | 4,001 | 8,628 | 12,629 | 174 | 462 | 1,451 | 1,913 | 26,154 |
| 1983 | 432 | 2,386 | 5,473 | 7,859 | 147 | 329 | 1,267 | 1,596 | 22,249 |
| 1982 | 274 | 1,130 | 2,868 | 3,998 | 78 | 121 | 570 | 691 | 17,176 |
| 1981 | 244 | 825 | 2,304 | 3,129 | 72 | 85 | 385 | 470 | 14,935 |
| 1980 | 146 | 524 | 1,495 | 2,019 | 41 | 48 | 278 | 326 | 16,066 |
| 1979 | 89 | 231 | 735 | 966 | 27 | 24 | 155 | 179 | 12,870 |
| Prior | 362 | 704 | 2,361 | 3,065 | 101 | 57 | 408 | 465 | 6,185 |
| Total | 211,126 | \$4,287,335 | \$753,556 | \$5,040,891 | 41,187 | \$292,671 | \$133,146 | \$425,817 | \$25,893 |

⁽¹⁾ Includes 2,152 LTDI members based on year of termination.

Liabilities as of December 31, 2018 Tabulated by Year of Retirement⁽¹⁾ (\$1,000s annually)

| Year Ret'd | Core Liabilities | | | | Variable Liabilities | | | | Total Liabilities |
|--------------|------------------|---------------------|--------------------|---------------------|----------------------|--------------------|--------------------|--------------------|---------------------|
| | No. | Initial | Increases | Total | No. | Initial | Increases | Total | |
| 2018 | 9,620 | \$ 3,395,765 | \$ 0 | \$ 3,395,765 | 1,712 | \$ 184,599 | \$ 0 | \$ 184,599 | \$3,580,364 |
| 2017 | 9,895 | 3,284,653 | 43,623 | 3,328,276 | 1,547 | 122,418 | 20,812 | 143,230 | 3,471,506 |
| 2016 | 10,182 | 3,291,647 | 114,622 | 3,406,269 | 1,572 | 116,575 | 25,251 | 141,826 | 3,548,095 |
| 2015 | 10,314 | 3,244,597 | 152,588 | 3,397,185 | 1,683 | 124,412 | 19,405 | 143,818 | 3,541,003 |
| 2014 | 9,339 | 2,688,001 | 175,821 | 2,863,822 | 1,695 | 118,183 | 21,186 | 139,369 | 3,003,190 |
| 2013 | 9,655 | 2,658,006 | 280,051 | 2,938,057 | 1,678 | 92,371 | 43,777 | 136,147 | 3,074,204 |
| 2012 | 9,590 | 2,620,602 | 338,153 | 2,958,755 | 1,724 | 79,479 | 48,192 | 127,671 | 3,086,427 |
| 2011 | 15,251 | 4,901,318 | 633,789 | 5,535,107 | 3,131 | 181,989 | 89,901 | 271,891 | 5,806,998 |
| 2010 | 8,364 | 2,370,305 | 305,816 | 2,676,121 | 1,602 | 69,629 | 45,833 | 115,462 | 2,791,583 |
| 2009 | 7,870 | 2,214,092 | 287,064 | 2,501,156 | 1,424 | 49,184 | 50,334 | 99,518 | 2,600,674 |
| 2008 | 8,493 | 2,375,591 | 306,810 | 2,682,401 | 1,669 | 119,938 | 20,863 | 140,801 | 2,823,202 |
| 2007 | 8,324 | 2,150,454 | 277,689 | 2,428,142 | 1,840 | 135,279 | 23,533 | 158,812 | 2,586,955 |
| 2006 | 8,034 | 1,913,391 | 247,583 | 2,160,974 | 1,701 | 129,830 | 37,758 | 167,588 | 2,328,562 |
| 2005 | 7,995 | 1,811,904 | 234,870 | 2,046,774 | 1,724 | 133,597 | 44,051 | 177,648 | 2,224,422 |
| 2004 | 7,118 | 1,480,271 | 192,075 | 1,672,346 | 1,601 | 124,555 | 52,643 | 177,198 | 1,849,544 |
| 2003 | 6,977 | 1,449,978 | 188,030 | 1,638,008 | 1,434 | 100,301 | 78,061 | 178,362 | 1,816,371 |
| 2002 | 6,509 | 1,272,006 | 164,863 | 1,436,869 | 1,273 | 133,168 | 39,805 | 172,973 | 1,609,842 |
| 2001 | 6,557 | 1,222,721 | 158,497 | 1,381,218 | 1,349 | 197,591 | 23,000 | 220,591 | 1,601,809 |
| 2000 | 6,452 | 1,143,964 | 149,150 | 1,293,114 | 1,133 | 217,910 | (1,382) | 216,528 | 1,509,643 |
| 1999 | 5,387 | 791,878 | 221,157 | 1,013,035 | 956 | 137,196 | 27,736 | 164,932 | 1,177,967 |
| 1998 | 5,162 | 683,835 | 249,249 | 933,084 | 961 | 116,464 | 40,357 | 156,821 | 1,089,905 |
| 1997 | 4,273 | 519,968 | 240,556 | 760,524 | 809 | 78,932 | 46,438 | 125,370 | 885,894 |
| 1996 | 4,081 | 466,209 | 263,233 | 729,442 | 828 | 66,144 | 53,509 | 119,652 | 849,094 |
| 1995 | 3,604 | 374,294 | 244,118 | 618,413 | 717 | 44,118 | 50,982 | 95,100 | 713,512 |
| 1994 | 3,181 | 297,498 | 213,063 | 510,561 | 713 | 40,768 | 43,613 | 84,382 | 594,943 |
| 1993 | 2,790 | 234,241 | 182,726 | 416,967 | 620 | 28,084 | 36,331 | 64,415 | 481,382 |
| 1992 | 2,289 | 168,628 | 146,694 | 315,321 | 517 | 20,491 | 28,923 | 49,414 | 364,735 |
| 1991 | 1,959 | 133,022 | 129,287 | 262,309 | 466 | 15,074 | 27,840 | 42,914 | 305,222 |
| 1990 | 3,133 | 220,015 | 231,116 | 451,132 | 788 | 27,501 | 39,826 | 67,327 | 518,459 |
| 1989 | 2,192 | 137,949 | 166,228 | 304,177 | 506 | 14,142 | 25,993 | 40,135 | 344,312 |
| 1988 | 1,432 | 65,196 | 90,285 | 155,481 | 350 | 7,006 | 15,663 | 22,669 | 178,150 |
| 1987 | 1,162 | 44,304 | 67,058 | 111,363 | 317 | 5,238 | 10,711 | 15,948 | 127,311 |
| 1986 | 971 | 34,498 | 60,135 | 94,634 | 283 | 4,295 | 9,813 | 14,108 | 108,742 |
| 1985 | 855 | 28,549 | 56,156 | 84,705 | 224 | 2,434 | 7,617 | 10,051 | 94,757 |
| 1984 | 569 | 15,565 | 33,800 | 49,365 | 174 | 1,779 | 5,588 | 7,367 | 56,733 |
| 1983 | 432 | 8,712 | 20,018 | 28,730 | 147 | 1,174 | 4,502 | 5,675 | 34,405 |
| 1982 | 274 | 4,423 | 11,193 | 15,616 | 78 | 417 | 1,962 | 2,379 | 17,995 |
| 1981 | 244 | 3,159 | 8,887 | 12,047 | 72 | 315 | 1,427 | 1,742 | 13,789 |
| 1980 | 146 | 1,893 | 5,380 | 7,273 | 41 | 155 | 902 | 1,056 | 8,329 |
| 1979 | 89 | 827 | 2,603 | 3,430 | 27 | 72 | 469 | 541 | 3,971 |
| Prior | 362 | 2,592 | 8,740 | 11,332 | 101 | 196 | 1,380 | 1,576 | 12,908 |
| Total | 211,126 | \$49,726,522 | \$6,902,778 | \$56,629,300 | 41,187 | \$3,043,001 | \$1,164,606 | \$4,207,607 | \$60,836,908 |

⁽¹⁾ Includes 2,152 LTDI members based on year of termination.

Comparison of Actual to Expected Deaths Among Retired Lives (Normal Retirement Only) During 2018

| Age | Male Deaths | | | Female Deaths | | | Total Deaths | | |
|-----------------|--------------|--------------|---------------|---------------|--------------|----------------|--------------|--------------|----------------|
| | Actual | Expected | Exposure | Actual | Expected | Exposure | Actual | Expected | Exposure |
| 30-34 | | | | | | 1 | | | 1 |
| 35-39 | | | | | | | | | |
| 40-44 | | | 1 | | | 10 | | | 11 |
| 45-49 | | | 12 | | | 59 | | | 71 |
| 50-54 | 3 | 2 | 893 | | | 526 | 3 | 2 | 1,419 |
| 55-59 | 18 | 24 | 5,264 | 25 | 21 | 6,889 | 43 | 45 | 12,153 |
| 60-64 | 73 | 75 | 11,731 | 65 | 77 | 18,352 | 138 | 152 | 30,083 |
| 65-69 | 173 | 196 | 18,948 | 156 | 191 | 29,664 | 329 | 387 | 48,612 |
| 70-74 | 304 | 292 | 17,827 | 260 | 267 | 24,261 | 564 | 559 | 42,088 |
| 75-79 | 333 | 339 | 11,932 | 299 | 318 | 15,625 | 632 | 657 | 27,557 |
| 80-84 | 411 | 416 | 7,742 | 424 | 421 | 10,806 | 835 | 837 | 18,548 |
| 85-89 | 500 | 463 | 4,738 | 599 | 567 | 7,283 | 1,099 | 1,030 | 12,021 |
| 90-94 | 330 | 306 | 1,885 | 557 | 500 | 3,801 | 887 | 806 | 5,686 |
| 95-99 | 112 | 110 | 411 | 299 | 283 | 1,233 | 411 | 393 | 1,644 |
| 100 & Up | 15 | 12 | 35 | 76 | 57 | 194 | 91 | 69 | 229 |
| Totals | 2,272 | 2,235 | 81,419 | 2,760 | 2,702 | 118,704 | 5,032 | 4,937 | 200,123 |
| Average Ages | 81.3 | 80.9 | 71.3 | 84.2 | 83.4 | 71.6 | 82.9 | 82.3 | 71.5 |

SECTION F

APPENDIX

Actuarial Assumptions Used in the Retired Life Actuarial Valuation

The interest rate used in the valuation was 5.0% a year, compounded yearly, as provided in Section 40.02 of the Wisconsin Statutes. To the extent that unfavorable investment performance reduces current dividends, liabilities would be lower than reported in this valuation. The mortality table used in the valuation was the Wisconsin 2018 Mortality Table, as adopted by the Board in connection with the 2015-2017 Experience Study. This table includes margin for future improvements in mortality by incorporating 60% of the MP-2018 fully generational scale. The impact of the new mortality tables is recognized equally over a three year period.

Single Life Retirement Values Wisconsin Projected Experience Table - 2018 with 5% Interest

| Sample Attained Ages in 2018 | Present Value of \$1 Monthly for Life | | Future Life Expectancy (years) | | Probability of Death Next Year | |
|---------------------------------|--|----------|-----------------------------------|---------|-----------------------------------|---------|
| | Males | Females | Males | Females | Males | Females |
| 40 | \$212.90 | \$217.54 | 45.2 | 48.2 | 0.098% | 0.061% |
| 45 | 204.56 | 210.17 | 40.2 | 43.1 | 0.123% | 0.092% |
| 50 | 194.06 | 201.03 | 35.2 | 38.1 | 0.162% | 0.134% |
| 55 | 181.39 | 189.92 | 30.3 | 33.1 | 0.378% | 0.242% |
| 60 | 167.14 | 176.70 | 25.7 | 28.3 | 0.544% | 0.351% |
| 65 | 150.16 | 160.71 | 21.3 | 23.7 | 0.832% | 0.526% |
| 70 | 130.92 | 141.69 | 17.1 | 19.2 | 1.352% | 0.878% |
| 75 | 109.41 | 120.10 | 13.2 | 14.9 | 2.276% | 1.590% |
| 80 | 86.66 | 96.87 | 9.7 | 11.1 | 4.182% | 2.990% |
| 85 | 65.27 | 73.75 | 6.8 | 7.8 | 7.818% | 6.005% |

The values shown above are for non-disabled participants. Sample values for disabled participants are as follows:

| Sample Attained Ages in 2018 | Present Value of \$1 Monthly for Life | | Future Life Expectancy (years) | | Probability of Death Next Year | |
|---------------------------------|--|----------|-----------------------------------|---------|-----------------------------------|---------|
| | Males | Females | Males | Females | Males | Females |
| 40 | \$199.47 | \$207.80 | 37.7 | 41.7 | 0.141% | 0.101% |
| 45 | 187.81 | 198.07 | 32.7 | 36.7 | 0.234% | 0.153% |
| 50 | 174.32 | 186.31 | 28.0 | 31.8 | 0.467% | 0.272% |
| 55 | 158.54 | 172.30 | 23.4 | 27.0 | 0.632% | 0.398% |
| 60 | 140.06 | 155.51 | 19.0 | 22.4 | 1.096% | 0.612% |
| 65 | 119.73 | 135.79 | 15.0 | 17.9 | 1.777% | 1.051% |
| 70 | 97.72 | 113.71 | 11.3 | 13.8 | 3.073% | 1.908% |
| 75 | 75.52 | 90.25 | 8.1 | 10.1 | 5.841% | 3.608% |
| 80 | 55.90 | 67.76 | 5.7 | 7.1 | 10.766% | 7.371% |
| 85 | 39.92 | 49.64 | 3.8 | 4.9 | 17.368% | 12.711% |

Statutory Provisions - Post-Retirement Adjustments

Core Annuities - 40.27(2)

“CORE ANNUITY RESERVE SURPLUS DISTRIBUTIONS. Surpluses in the core annuity reserve established under s. 40.04 (6) and (7) shall be distributed by the board if the distribution will result in at least a 0.5% increase in the amount of annuities in force, except as otherwise provided by the department by rule, on recommendation of the actuary, as follows:

(a) The distributions shall be expressed as percentage increases in the amount of the monthly annuity in force, including prior distributions of surpluses but not including any amount paid from funds other than the core annuity reserve fund, preceding the effective date of the distribution. For purposes of this subsection, annuities in force include any disability annuity suspended because the earnings limitation had been exceeded by that annuitant in that year.

(b) Prorated percentages based on the annuity effective date may be applied to annuities with effective dates during the calendar year preceding the effective date of the distribution, as provided by rule, but no other distinction may be made among the various types of annuities payable from the core annuity reserve.

(c) The distributions shall not be offset against any other benefit being received but shall be paid in full, nor shall any other benefit being received be reduced by the distributions. The annuity reserve surplus distributions authorized under this subsection may be revoked by the board in part or in total as to future payments upon recommendation of the actuary if a deficit occurs in the core annuity reserves and such deficit would result in a 0.5 percent or greater decrease in the amount of annuities in force, except as otherwise provided by the department by rule.

(d) Notwithstanding s 40.03 (2) (i), (7) (d), and (8) (d), the department may promulgate rules under this subsection without the approval of the teachers retirement board and the Wisconsin retirement board.”

Variable Annuities - 40.28(2)

“Whenever the balance in the variable annuity reserve, as of December 31 of any year, exceeds or is less than the then present value of all variable annuities in force, determined in accordance with the rate of interest and approved actuarial tables then in effect, by at least 2% of the present value of all variable annuities in force, the amount of each variable annuity payment shall be proportionately increased or decreased, disregarding fractional percentages, and effective on a date determined by rule, so as to reduce the variance between the balance of the variable annuity reserve and the present value of variable annuities to less than one percent.”

Narrative Regarding the Development of Dividend and Variable Annuity Changes Shown on Pages 6 and 16

- 1. SWIB Net of Fee Investment Return**
State of Wisconsin Investment Board net earnings rate on the Core/Variable Fund.
- 2. MRA Adjustment (Core)/Adjustment to Published Effective Rate (Variable)**
Item 3 below minus Item 1 above. For core annuities, this is the MRA adjustment which takes into account five-year smoothing of gains and losses.
- 3. Published Effective Earnings Rate**
The earnings rate published by DETF is funds' earnings credits expressed as a percentage of the beginning year balance adjusted for benefit payments and reserve transfers.
- 4. Adjustment to Relate Earnings to Average Core/Variable Annuity Balance**
Item 5 below minus Item 3 above.
- 5. Earnings Rate Based on Average Balance**
This is similar to the published earnings rate except that the rate is determined as a percentage of the average balance during the year instead of the adjusted beginning of year balance.
- 6. Expected Dividend (Variable Change) before Adjustments**
The relative difference in fund growth based on actual versus the 5% assumed earnings rates.
- 7. Adjustment to Relate Average Asset to Ending Liability**
The final dividend/variable change is calculated based on the end of year assets divided by the end of year liabilities. Since the calculations in Items 5 and 6 are based on average (approximately mid-year) balances, this adjustment is needed so that the final rate will be based on the end of year liabilities.
- 8. Carryover from Last Year Due to Timing of Distribution and Accounting Adjustments (and Truncation for Variable Annuity)**
The dividend or variable rate changes are made effective April 1 of each year. This adjustment takes into account the fact that the prior year dividend/variable increase was in effect for less than a full year as well as any accounting adjustments made to the asset value at the beginning of the year. This adjustment also carries over any truncated or rounded amounts from the prior year.

Narrative Regarding the Development of Dividend and Variable Annuity Changes Shown on Pages 6 and 16

9. Experience Study/Mortality Reserve Adjustment

A study is conducted for WRS every three years to analyze the assumptions that are made in the valuation versus the experience that actually occurred. If the results of the study show material changes in experience, WRS generally adopts a new set of assumptions. When assumptions are changed, this item displays the effect of the change on the dividend/variable rate. Although the mortality table now includes a projection for expected future improvements in mortality, each valuation phases into the full table incrementally over the three year experience study cycle. By increasing reserves gradually each year, instead of all at once every three years, the effect on dividends and variable increases will also be more gradual.

10. Experience and Other Effects

After making all other known adjustments, this is the remainder of all other experience. Changes here are primarily attributable to mortality experience and, generally to a lesser extent, on any data adjustments.

11. Statutory Adjustment to Round/Truncate

By statute, the dividend rate is calculated to the nearest one-tenth of a percent. For the variable annuity change, the rate is truncated to a whole percent. This is the adjustment made from the calculated dividend/variable annuity rate change without rounding/truncation to the statutory rate.

12. Computed Average Dividend Rate/Variable Annuity Change

This is the end of year asset value divided by the end of year liability. It is reconciled to the published earnings rate (Item 3) by making the adjustments in Items 6 through 11.

13. Adjustment for Members Not Eligible for Negative Dividend

This is an adjustment that is sometimes made for Core Fund recipients to reflect that some members may not have any remaining dividends and hence are not subject to a further negative dividend.

14. Final Maximum Computed Dividend Rate

When there is a negative dividend for the Core Fund, this will affect people differently based upon year of retirement. In years when there is a negative dividend, this will be the largest negative dividend that will occur in the Core Fund. If greater in absolute value than 0.5% of core annuities, Item 12 plus Item 13, otherwise 0%.