

Kentucky Retirement Systems

2022 Actuarial Experience Study
for the Period Ending June 30, 2022





June 5, 2023

Board of Trustees
Kentucky Retirement Systems
Perimeter Park West
1260 Louisville Road
Frankfort, KY 40601

Dear Members of the Board:

Subject: Results of 2022 Experience Study

We are pleased to present our report of the 2022 Experience Investigation Study for the Kentucky Retirement Systems (i.e. Kentucky Employees Retirement System and the State Police Retirement System) for the period ending June 30, 2022. This report includes summaries and analysis of the experience data. Based on this analysis, we have recommendations for updates to certain actuarial assumptions and methods for use in the actuarial valuation, which will be first used in the June 30, 2023 actuarial valuation.

In addition, the report provides the estimated effect on the actuarial liabilities and the contribution requirements if these recommendations are adopted by the Board. This is the second experience study performed by GRS for the Kentucky Retirement Systems. While there were some material changes in the actuarial assumptions adopted by the Board in the prior experience study conducted in 2018, the Board will find our recommendations to be significantly subtler in this report. Further to this point, the analysis in this experience study confirms that the demographic assumptions currently used in the actuarial valuation remain applicable best estimates of the future experience of the plan.

This experience investigation study was conducted in accordance with generally accepted actuarial principles and practices, and in full compliance with the Actuarial Standards of Practice as issued by the Actuarial Standards Board. All of the undersigned are members of and meet the Qualification Standards of the American Academy of Actuaries and have experience with large public sector retirement systems.

We wish to thank the KPPA staff for their assistance in this project.

Sincerely,

A handwritten signature in black ink that reads "Jamie Shaw". The signature is fluid and cursive, with the first name being more prominent.

Jamie Shaw, ASA, EA, MAAA
Consultant

A handwritten signature in black ink that reads "Daniel J. White". The signature is fluid and cursive, with the first name being more prominent.

Daniel J. White, FSA, EA, MAAA
Senior Consultant

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Summary of Process

A periodic review and selection of the actuarial assumptions is one of many important components of understanding and managing the financial aspects of the Kentucky Employees Retirement System and the State Police Retirement System. Use of outdated or inappropriate assumptions can result in understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due. Also, a single set of assumptions is typically not expected to be suitable forever. As the actual experience of the plan changes, the assumptions should be reviewed and adjusted accordingly.

It is important to recognize that the impact from various outcomes and the ability to adjust from experience deviating from the assumption are not symmetric. Due to compounding economic forces, legal limitations, and moral obligations, outcomes from underestimating future liabilities are much more difficult to manage than outcomes of overestimates, and that un-symmetric risk should be considered when the assumption set, investment policy, and funding policy are created. As such, the assumption set used in the valuation process needs to represent the best estimate of the future experience of each fund and be at least as likely, if not more than likely, to overestimate the future liabilities versus underestimate them.

Changes in certain assumptions and methods are suggested upon this comparison to remove any bias that may exist, except to perhaps include some margin for future adverse experience where appropriate. Next, the assumption set as a whole was analyzed for consistency and to ensure that the projection of liabilities was reasonable and consistent.

The following report provides our recommended changes to the current actuarial assumptions.

SECTION I

INTRODUCTION

Introduction

In determining liabilities, contribution rates and funding periods for retirement plans, actuaries must make assumptions about the future. Among the assumptions that must be made are:

- Investment return rate
- Salary increase rates
- Inflation rate
- Cash balance interest credit rate
- Mortality rates
- Retirement rates
- Termination rates
- Disability rates

For some of these assumptions, such as the mortality rates, past experience provides important evidence about the future. For other assumptions, such as the investment return rate, the link between past and future results is much weaker. In either case, though, actuaries should review their assumptions periodically and determine whether these assumptions are consistent with actual past experience and with anticipated future experience.

In conducting experience studies, actuaries generally use data over a period of several years. This is necessary in order to gather enough data so that the results are statistically significant. In addition, if the study period is too short, the impact of the current economic conditions may lead to misleading results. It is known, for example, that the health of the general economy can impact salary increase rates and termination rates. Using results gathered during a short-term economic expansion or contraction will not be representative of the long-term trends in these assumptions. Also, the adoption of legislation, plan improvements or changes in salary schedules will sometimes cause a short-term distortion in the experience. For example, if an early retirement window was opened during the study period, we would usually see a short-term spike in the number of retirements. Using a longer period prevents giving too much weight to such short-term effects. On the other hand, using a much longer period can increase the difficulty of identifying changes in behavior that may be occurring, such as a change in the ages at which members retire. In our view, using a five-year period ending June 30, 2022 is generally reasonable for some assumptions, however we used seven and nine years of experience for developing recommended salary, termination, and mortality assumptions. More detail is provided in each applicable section.

In the review of the demographic assumptions, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number "expected" is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. For example, let's assume there is a rate of retirement of 30% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus, they are considered "exposed" to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies significantly from this figure, it is a sign that a new assumption may be needed. (However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100%, in order to



introduce some conservatism.) Of course, we not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

In some instances, we will compare the actual and expected experience based on headcount. However, there are other instances it is more appropriate to “weigh” the experience by benefit amount, liability, or salary, with the intention that our review and recommendations provide a better fit to the actual experience on a benefit basis which should result in smaller liability gains and losses prospectively.

Finally, if the data leads the actuary to conclude that new tables are needed, we will take into consideration the statistical credibility of the assumption as well as “graduate” or smooth the recommended assumption in instances where the experience has material variation age to age or from service year to service year. Please bear in mind that, while the recommended assumption set represents our best estimate, there are other reasonable assumption sets that could be supported. Some reasonable assumption sets would show higher or lower liabilities or costs.

ORGANIZATION OF REPORT

Section II of this report summarizes our recommended changes and the fiscal impact if those assumptions are adopted. Section III contains our findings and a more detailed analysis of our recommendation for each actuarial assumption. Sections IV and V show a summary of the recommended assumptions for each System (e.g. KERS and SPRS). Finally, Section VI presents detailed summaries of the data and comparisons of the A/E ratios.

SECTION VI EXHIBITS

The exhibits in Section VI should generally be self-explanatory. For example, on page 63, we show the exhibit analyzing the service-based termination rates. The second column shows the total number of members who terminated during the study period. This excludes members who became disabled or retired. Column (3) shows the total exposures. This is the number of members who could have terminated during any of the years. In this exhibit, the exposures exclude anyone eligible for retirement. A member is counted in each year they could have terminated, so the total shown is the total exposures for the study period. Column (4) shows the probability of termination based on the raw data. That is, it is the result of dividing the actual number of terminations (col. 2) by the number exposed (col. 3). Column (5) shows the current termination rate and column (6) shows the new recommended termination rate. Columns (7) and (8) show the expected numbers of terminations based on the current and proposed termination assumptions. Columns (9) and (10) show the Actual-to-Expected ratios under the current and proposed termination assumptions.

SECTION II

SUMMARY OF RECOMMENDATIONS AND FISCAL IMPACTS

Summary of Recommendations KRS and SPRS

Our recommendations for the actuarial assumptions to be used in the future actuarial valuations for the KERS and SPRS funds may be summarized as follows:

Economic Assumptions

1. **Inflation Assumption:** Given the current inflationary environment, we recommend increasing the price inflation assumption to 2.50% (i.e. a 0.20% increase from the current assumption). Changing this assumption has no impact on projected benefits, liability, and cost.
2. **Investment Return Assumption:** The forward-looking analysis supports an increase in the investment return assumption to 5.50% for the KERS non-hazardous and SPRS retirement fund. Similarly, this analysis supports an increase in the investment return assumption to 6.50% for the KERS hazardous retirement fund and all three health insurance funds. This is a 0.25% increase in the investment return assumption for all funds. This is our recommendation as it complies with the Actuarial Standards of Practice regarding selection of an investment return assumption. However, while this Standard of Practice allows an actuary to consider the nonsymmetrical investment risk (i.e. there is greater risk of downside returns compared to upside returns), it is not explicit with regard to the consideration of the current financial condition of the retirement system. Since the funded status of the KERS non-hazardous pension fund was 18.5% (i.e. \$3.1 billion in assets compared to \$16.6 billion in liability) as of the last actuarial valuation, it would be prudent for the Board to maintain the assumed rate of return for this retirement fund as it will result in more employer contributions each year. Similarly, the funded status of the KERS hazardous retirement fund and SPRS fund was 63.2% and 52.5%, respectively, as of June 30, 2022. It would also be reasonable if the Board elected to maintain the assumed rate of return for these funds.

On the other hand, each of the three insurance funds are smaller in liability and significantly better funded with the funded ratios of the KERS Hazardous and SPRS insurance funds being in excess of 100%. Therefore, we believe it is reasonable for the Board to increase the investment return assumption for each of these insurance funds by 0.25% to 6.50%.

3. **Salary Increases for Individual Members:** We recommend no changes to the rate of salary increase assumption for the KERS or SPRS funds.
4. **Tier 3 Cash Balance Interest Credit Assumption:** As a result of stochastic analysis performed on the investment returns and volatility and how it relates to the Tier 3 cash balance interest crediting rate, we recommend increasing the interest crediting assumption to 5.90% for both the KERS non-hazardous and SPRS funds, and to 6.75% for the KERS hazardous fund.
5. **Payroll growth rate (used for amortizing the UAAL):** We recommend no change to the 0% payroll growth rate assumption for the KERS Hazardous System and the State Police Retirement System.



A payroll growth assumption is currently irrelevant for the KERS Non-Hazardous System. The enactment of HB 8 during the 2021 legislative session modified how employer contributions are allocated and collected from the participating employers. This legislation strengthened the financial condition of the pension fund by de-linking the collection of contributions and employer payroll, eliminating the risk of a continual decline in active membership and payroll.

Demographic Assumptions:

6. **Mortality:** We recommend replacing the base retiree mortality tables with an updated mortality table developed using the actual mortality experience of non-disabled retirees in KERS, CERS, and SPRS through June 30, 2022. We also recommend using a more recently released generational mortality improvement assumption based on the ultimate rates of the published MP-200 improvement scales (“2020MP-Ultimate”) to explicitly project future improvement in life expectancy.

We also recommend making an adjustment to the current mortality tables for disabled retirees. We do not recommend any change to the mortality assumption for active members, which is one of the least material assumptions used in the actuarial valuation.

7. **Termination/Withdrawal:** We recommend increasing the rates of termination prior to retirement for the KERS non-hazardous and hazardous funds and SPRS.
8. **Disability Incidence:** We recommend decreasing the rates of disability incidence for the KERS non-hazardous fund. We recommend no change to the rates of disability incidence for the KERS hazardous or SPRS funds.
9. **Retirement:** Expected retirement patterns continue to follow actual experience. We are not recommending any changes to the retirement assumption for the KERS non-hazardous, KERS hazardous, or SPRS funds. The rates of retirement used in the valuation will continue to differentiate anticipated retirement behaviors for Tier 1, Tier 2, and Tier 3 members.
10. **Participation in the Retiree Health Insurance Plan:** We recommend increasing the percentage of members in the SPRS fund assumed to cover spouses at retirement. We recommend no other changes the current assumptions regarding participation in the retiree health insurance plan.

Actuarial Methods and Policies

11. **Asset Valuation Method:** We recommend continued use of the five-year asset smoothing method with each year’s investment losses based on the expected and actual investment earning determined on a market value of asset basis.
12. **Actuarial Cost Method:** We recommended the continued use of the individual Entry Age Normal cost method (EAN) used to determine the actuarial accrued liability.



Summary of Recommendations

Our recommendations to the actuarial assumptions for use in the actuarial valuation may be summarized as follows:

Assumption (1)	KERS Non-Haz (2)	KERS Haz (3)	SPRS (4)
<i>Economic Assumptions</i>			
1. Inflation	Increase	Increase	Increase
2. Investment Return (Pension / Insurance)	No Change	No Change	No Change
3. Short-Service Salary Increase	No Change	No Change	No Change
4. Long-Service Salary Increase	No Change	No Change	No Change
5. Payroll Growth Assumption	No Change	No Change	No Change
6. Cash Balance Interest Credit Assumption	Increase	Increase	Increase
<i>Demographic Assumptions</i>			
7. Retiree Mortality	Increase (KPPA Specific)	Increase (KPPA Specific)	Increase (KPPA Specific)
8. Termination	Increase	Increase	Increase
9. Retirement	No Change	No Change	No Change
10. Disability incidence	Decrease	No Change	No Change
11. Health Insurance Participation	No Change	No Change	Increase
<i>Other Assumptions and Methods</i>			
12. Asset Method	No Change	No Change	No Change
13. Entry Age Normal Cost Method	No Change	No Change	No Change

Summary of Financial Impact of Recommendations

The following pages provide the actuarial impact of the recommended assumptions for each fund based on the June 30, 2022 actuarial valuation. In actuality, these recommended assumptions will be first used when preparing the June 30, 2023 actuarial valuation, which identifies the employer contribution requirements for the bi-annual fiscal period beginning July 1, 2024 and ending June 30, 2026. For informational purposes, the tables show the changes in the contribution requirement, unfunded actuarial accrued liability, and the funded ratio due to the recommended assumption changes. The exhibits identify the financial effect due to the change in the demographic assumptions and the change in the investment return assumption. We believe the Board's decision about whether or not to adopt our recommendations should be based on the collective effect on the contribution rate or the actuarial liabilities and not changes in individual assumptions.

Fiscal Impact of Proposed Assumptions
KERS Non-Hazardous
(\$ in Thousands)

	Current Assumptions	Proposed Demographic Assumptions	Proposed Assumptions incl Discount Rate
1. Covered Payroll	\$ 1,355,267	\$ 1,355,267	\$ 1,355,267
Liability and Assets - Pension Fund			
2. Actuarial Accrued Liability	\$ 16,576,631	\$ 15,925,520	\$ 15,511,671
3. Actuarial Value of Assets	3,065,263	3,065,263	3,065,263
4. Unfunded Liability	\$ 13,511,368	\$ 12,860,257	\$ 12,446,408
5. Funded Ratio	18.5%	19.2%	19.8%
Liability and Assets - Insurance Fund			
6. Actuarial Accrued Liability	\$ 1,782,386	\$ 1,725,933	\$ 1,678,956
7. Actuarial Value of Assets	1,409,553	1,409,553	1,409,553
8. Unfunded Liability	\$ 372,833	\$ 316,380	\$ 269,403
9. Funded Ratio	79.1%	81.7%	84.0%
Actuarially Determined Employer Contribution - Pension Fund			
10. Normal Cost Rate	7.74%	7.32%	6.73%
11. Amortization Cost	N/A	N/A	N/A
12. Pension Employer Contribution Rate	7.74%	7.32%	6.73%
13. Amortization Cost	\$ 900,701	\$ 844,296	\$ 830,924
Actuarially Determined Employer Contribution - Insurance Fund			
14. Normal Cost Rate	1.86%	1.71%	1.58%
15. Amortization Cost	N/A	N/A	N/A
16. Insurance Employer Contribution Rate	1.86%	1.71%	1.58%
17. Amortization Cost	\$ 5,192	\$ (125)	\$ (3,993)
18. Total Employer Contribution Rate	9.60%	9.03%	8.31%
19. Change in Contribution Rate		-0.57%	-1.29%
20. Total Amortization Cost ¹	\$ 905,893	\$ 844,296	\$ 830,924
21. Change in Amortization Cost		(61,597)	(74,969)
22. Estimated Contributions	\$ 1,035,999	\$ 966,677	\$ 943,547
23. Change in Contributions		(69,322)	(92,452)

¹ Amortization cost for the insurance fund will not be less than \$0.



Fiscal Impact of Proposed Assumptions

KERS Hazardous

(\$ in Thousands)

	Current Assumptions	Proposed Demographic Assumptions	Proposed Assumptions incl Discount Rate
1. Covered Payroll	\$ 165,637	\$ 165,637	\$ 165,637
Liability and Assets - Pension Fund			
2. Actuarial Accrued Liability	\$ 1,316,825	\$ 1,294,856	\$ 1,260,774
3. Actuarial Value of Assets	832,436	832,436	832,436
4. Unfunded Liability	\$ 484,389	\$ 462,420	\$ 428,338
5. Funded Ratio	63.2%	64.3%	66.0%
Liability and Assets - Insurance Fund			
6. Actuarial Accrued Liability	\$ 347,044	\$ 342,769	\$ 333,681
7. Actuarial Value of Assets	597,701	597,701	597,701
8. Unfunded Liability	\$ (250,657)	\$ (254,932)	\$ (264,020)
9. Funded Ratio	172.2%	174.4%	179.1%
Actuarially Determined Employer Contribution - Pension Fund			
10. Normal Cost Rate	8.60%	8.10%	7.52%
11. Amortization Cost	21.52%	20.22%	18.73%
12. Pension Employer Contribution Rate	30.12%	28.32%	26.25%
Actuarially Determined Employer Contribution - Insurance Fund			
13. Normal Cost Rate	3.45%	2.83%	2.62%
14. Amortization Cost	-13.39%	-13.69%	-14.54%
15. Insurance Employer Contribution Rate	0.00%	0.00%	0.00%
16. Total Employer Contribution Rate	30.12%	28.32%	26.25%
17. Change in Contribution Rate		-1.80%	-3.87%
18. Estimated Contributions	\$ 49,890	\$ 46,908	\$ 43,480
19. Change in Contributions		\$ (2,982)	\$ (6,410)



Fiscal Impact of Proposed Assumptions

SPRS

(\$ in Thousands)

	Current Assumptions	Proposed Demographic Assumptions	Proposed Assumptions incl Discount Rate
1. Covered Payroll	\$ 47,885	\$ 47,885	\$ 47,885
Liability and Assets - Pension Fund			
2. Actuarial Accrued Liability	\$ 1,067,447	\$ 1,037,597	\$ 1,009,221
3. Actuarial Value of Assets	559,973	559,973	559,973
4. Unfunded Liability	\$ 507,474	\$ 477,624	\$ 449,248
5. Funded Ratio	52.5%	54.0%	55.5%
Liability and Assets - Insurance Fund			
6. Actuarial Accrued Liability	\$ 232,798	\$ 232,739	\$ 227,111
7. Actuarial Value of Assets	234,239	234,239	234,239
8. Unfunded Liability	\$ (1,441)	\$ (1,500)	\$ (7,128)
9. Funded Ratio	100.6%	100.6%	103.1%
Actuarially Determined Employer Contribution - Pension Fund			
10. Normal Cost Rate	19.49%	19.82%	18.39%
11. Amortization Cost	65.90%	60.53%	57.05%
12. Pension Employer Contribution Rate	85.39%	80.35%	75.44%
Actuarially Determined Employer Contribution - Insurance Fund			
13. Normal Cost Rate	6.66%	6.78%	6.36%
14. Amortization Cost	-2.98%	-2.98%	-4.15%
15. Insurance Employer Contribution Rate	3.68%	3.80%	2.21%
16. Total Employer Contribution Rate	89.07%	84.15%	77.65%
17. Change in Contribution Rate		-4.92%	-11.42%
18. Estimated Contributions	\$ 42,651	\$ 40,295	\$ 37,183
19. Change in Contributions		\$ (2,356)	\$ (5,468)



SECTION III

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, expenses, investment return rate, cash balance interest credit rate, the salary increase assumption, and the rate of payroll growth. Next are the demographic assumptions: mortality, disability, termination and retirement. Finally, we will discuss all of the actuarial methods used.

ECONOMIC ASSUMPTIONS

As no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The economic assumptions are much more subjective in nature than the demographic assumptions. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate historical and forward-looking information.

Also, actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB) and one of these standards is ASOP No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, which provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Nevertheless, the economic assumptions are much more subjective in nature than the demographic assumptions, which in itself can still create a difference in opinion among individuals in the actuarial profession and possibly stakeholders of the Retirement Systems.

INFLATION ASSUMPTION

By “inflation,” we mean price inflation as measured by annual increases in the Consumer Price Index (CPI). Benefits provided to members in KERS and SPRS are not explicitly impacted by the actual change in price inflation. As a result, this is a relatively insignificant assumption in the valuation, but underlies most of the other economic assumptions (e.g. the investment return assumption). The current annual inflation assumption is 2.30% and has remained unchanged since the June 30, 2017 actuarial valuation.

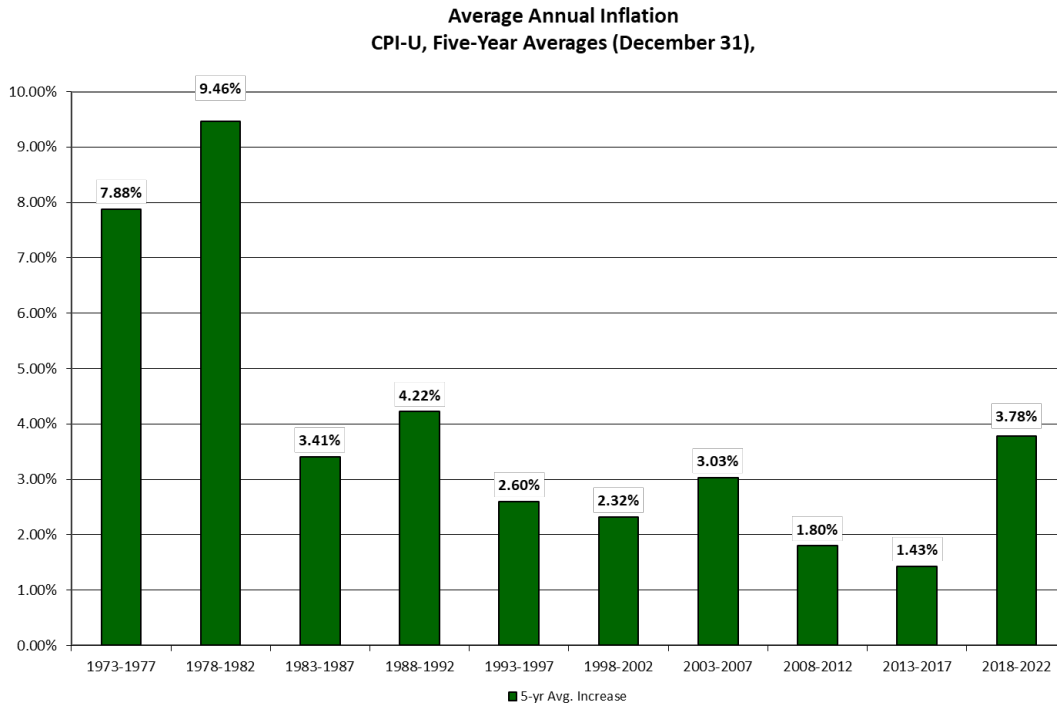
We recognize that actual inflation as measured by CPI has been much higher than the current 2.30% assumption during the last 24 months, however the Federal Reserve has broadcasted repeatedly the Committee seeks to achieve maximum employment and an inflation rate of 2% over the longer run.

Please see the following exhibits and forward-looking sources of inflation expectations.

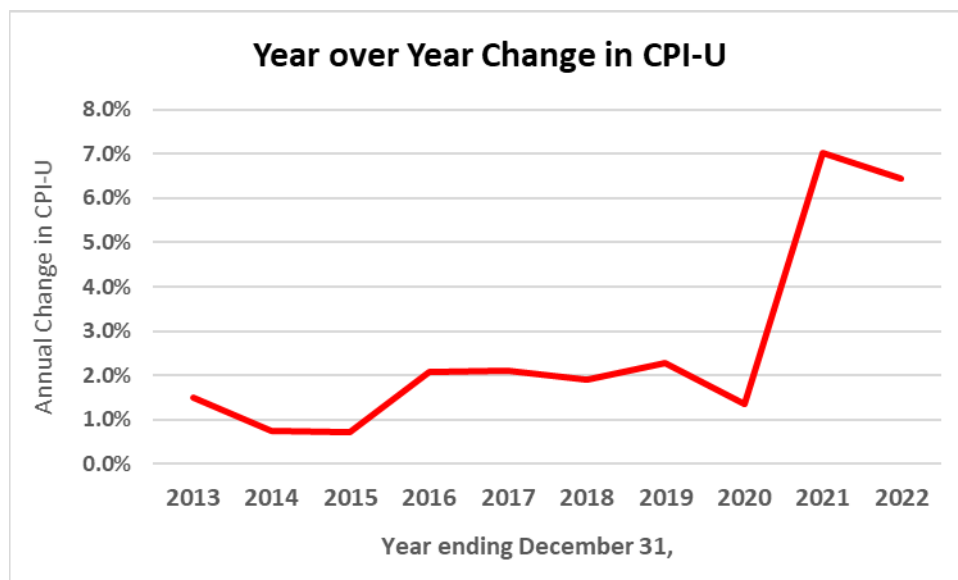


Actual Change in CPI-U

The chart below shows the average annual inflation in each of the ten consecutive five-year periods over the last fifty years:



The following chart shows the year over year change in CPI-U over the last 10 years ending December 31, 2022:



Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted.

As the charts show, with the exception of the last two years, inflation has been benign for the prior thirty years. The following is a discussion of the various sources of forward-looking inflation expectations.

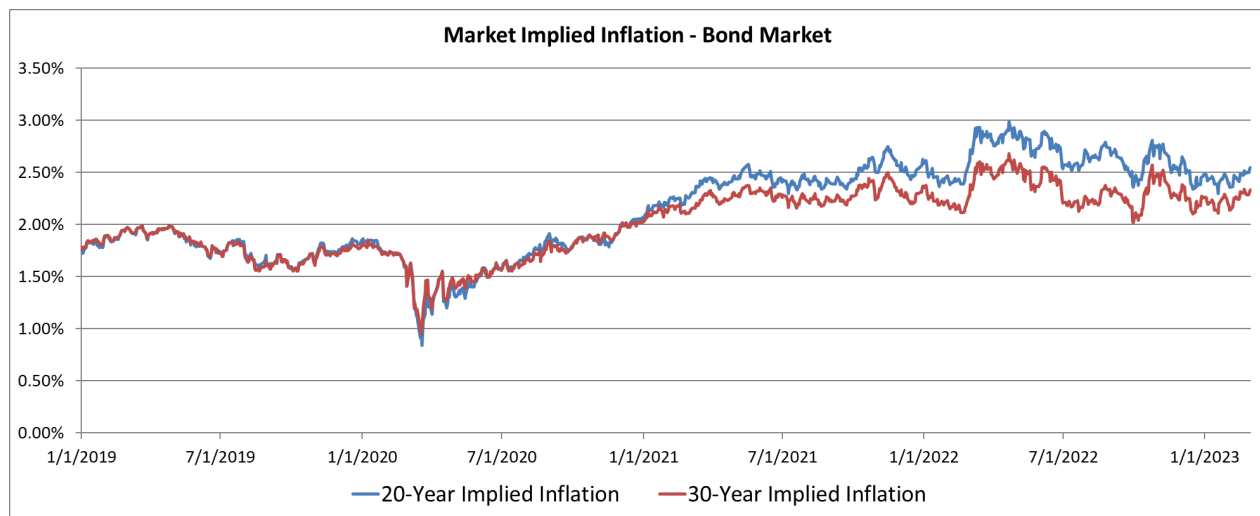


Forward-Looking Expectations Developed by Investment Consulting Firms

Most investment consulting firms, in setting their capital market assumptions, make a price inflation assumption as a building block for developing forward-looking return expectations. Based on a survey of 2023 capital market assumptions of nine investment consulting firms, the average expected price inflation for the next ten years is 2.40%. Of these nine, the minimum expectation was 2.0% (one of the nine firms) and the maximum was 2.50% (five of the nine firms).

Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. For example, the March 1, 2023 yield for 20-year inflation indexed Treasury bonds was 1.58% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 4.17%. Simplistically, this means that on that day the bond market was predicting that inflation over the next twenty years would average 2.55% $[(1 + 4.17\%) / (1 + 1.58\%) - 1]$ per year. The difference in yield for 30-year bonds implies 2.33% inflation over the next 30 years. This is consistent with most forecasts that inflation is expected to be higher for the next few years before settling down near the Federal Reserve's 2.0% target. Below is a chart with the history of the implied inflation for 20-year and 30-year Treasury securities from January 2019 through February 2023. However, this analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and TIPS.



Forecasts from Social Security Administration

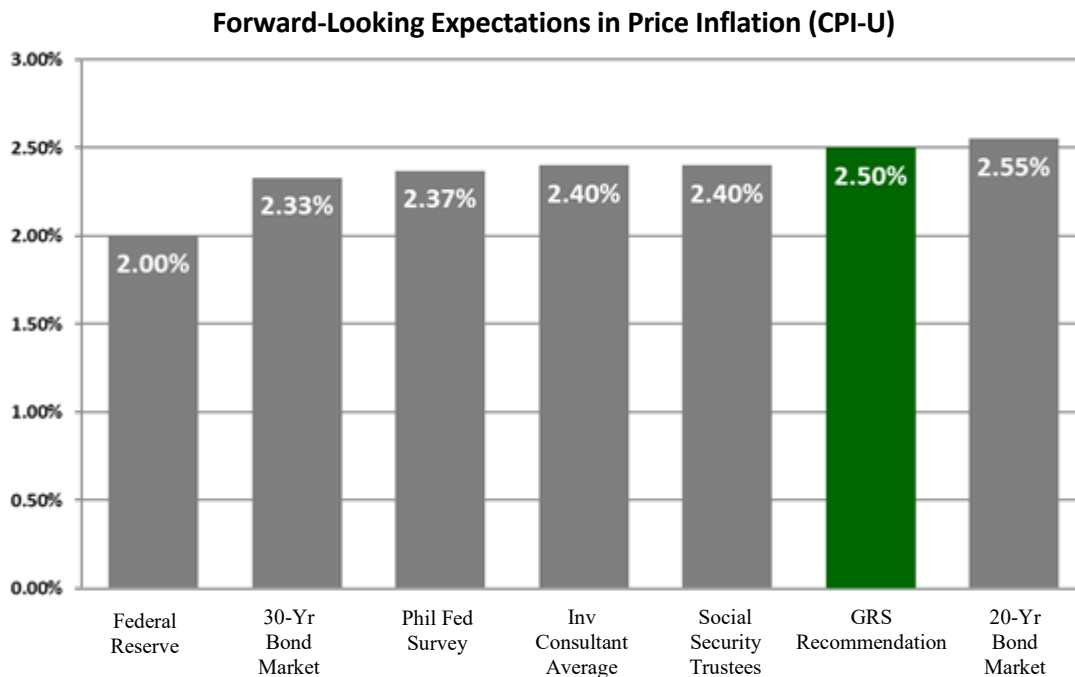
In the Social Security Administration's 2023 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.4% under the intermediate cost assumption and low cost and high cost scenarios are 1.8% and 3.0%, respectively. The Chief Actuary for the Social Security Administration has kept this assumption unchanged for the last three years.

Survey of Professional Forecasters

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their forecast for the first quarter of 2023 was for inflation over the next ten years (2023 to 2032) to average 2.37%. This survey average was a decrease from 2.80% and 2.95% in their third quarter 2022 and fourth quarter 2022 surveys, respectively.

Recommendation

The following is a chart to summarize the various forward-looking expectations.



Using these sources, we recommend the use of a 2.50% assumption, which is a 0.20% increase from the current assumption in recognition that near term inflation will remain elevated compared to historical levels.

INVESTMENT RETURN ASSUMPTION

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates.

The KRS Board oversees three retirement and three health insurance funds. Due to differences in external liquidity requirements of the systems, there are differences in how plan assets are invested. Furthermore, the differences in the investment policies have been material enough to warrant the use of different investment return assumptions. Specifically, the current investment return assumption is 6.25% for the



KERS hazardous retirement fund and the health insurance funds. On the other hand, the investment return assumption for the KERS non-hazardous and SPRS retirement fund is 5.25%.

Investment and Administrative Expenses

The trust fund pays expenses in addition to member benefits and refunds; we must make some assumption about these. Currently an explicit administrative expense assumption is included in the normal cost rate. This assumption is updated on an annual basis and is equal to the prior year’s administrative expense divided by covered payroll. We recommend no change to this process.

Additionally, the analysis below develops an investment return assumption net of any investment related expenses.

Actual Investment Performance

Below are tables with the actual annualized investment return performance on a market value of asset basis.

	Historical Average Annual Return – Retirement Funds			
Fund	FY 2022	3-Year	5-Year	10-Year
KERS Non-Hazardous	-5.2%	6.0%	6.2%	7.0%
KERS Hazardous	-6.0%	5.9%	6.4%	7.3%
SPRS	-4.6%	5.9%	6.2%	6.9%

Source: 2022 KPPA Summary Annual Report

	Historical Average Annual Return – Insurance Funds			
Fund	FY 2022	3-Year	5-Year	10-Year
KERS Non-Hazardous	-6.2%	5.9%	6.1%	6.9%
KERS Hazardous	-4.5%	6.1%	6.6%	7.3%
SPRS	-4.5%	6.4%	6.9%	7.4%

Source: 2022 KPPA Summary Annual Report

However, past performance is not a reliable indicator of future investment performance, even when returns are averaged over a long time. The actual asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not meaningful.

Forward-Looking Return Expectations

We believe the most appropriate approach to identifying an appropriate investment return assumption is to identify expected returns developed by mapping the asset allocation policy to forward-looking capital market assumptions that are developed by professional investment consulting firms.

Wilshire Associates (KRS’s Investment Consultant) provided a recommended asset allocation policy in their February 14, 2023 Board material that had the following objectives. The following table provides a summary of these two asset allocation policies which were used in our analysis of the investment return assumption.



Asset Class	Non-Hazardous and SPRS Retirement Funds	Hazardous and Insurance Funds
Public Equity	32.5%	43.5%
Private Equity	7.0%	10.0%
Core Fixed Income	20.5%	10.0%
Specialty Credit	15.0%	15.0%
Real Estate	10.0%	10.0%
Real Return	10.0%	10.0%
Cash	5.0%	1.5%
Total	100.0%	100.0%

GRS is a benefits consulting firm and does not provide investment consulting advice. We also do not develop or maintain our own forecasts of capital market expectations. Instead, we utilized 2023 forward-looking capital market return expectations developed by KRS's investment consultant, Wilshire Associates, as well as other investment consulting firms that are listed below. The primary purpose of performing this analysis using multiple investment consulting firms is to quantify possible differences in forward looking return expectations within the professional investment community.

- Aon (10-Year and 30-Year)
- Callan
- Cambridge (10-Year and 30-Year)
- NEPC (7-Year and 30-Year)
- RV Kuhns (20-Year)
- Wilshire (KRS's Investment Consultant)
- BNY Mellon
- Meketa (10-Year and 30-Year)
- JP Morgan
- Mercer (10-Year and 20-Year)
- Verus

Each of these investment consultants provided forward-looking return expectations for the next 7 to 10 years. Additionally, six of these firms (Aon, Cambridge, Meketa, Mercer, and NEPC and RV Kuhns) develop return expectations over a longer, 20- to 30-year period.

KERS and SPRS theoretically have an indefinite life span which may result in some stakeholders believing that emphasis should be placed solely on long-term expectations, even if short-term expectations are materially different. While these funds are expected to have an indefinite life span, these funds are relatively mature with material shorter-term liability attributable to current retirees. We believe it is important for decision makers to also consider return expectations over the next seven to ten years.

Throughout the 2022 calendar year, the capital markets and economic assumptions have vastly changed. The S&P 500 return during the calendar year were -18%. Actual inflation has been at a 40-year high and the year to year change continues to be over 6%. Also, the current yield on 10-year Treasuries have increased from 1.8% in January 2022 to 3.8% at the end of the calendar year. Because of these market changes, investment consultants have noticeably increased their forward-looking expectations in 2023. As a result, we believe it is prudent to view and compare the return expectations based on the 2022 and 2023 capital market assumptions for decision making purposes.



KERS Non-Hazardous and SPRS Investment Analysis Expected Annual Geometric Returns and Return Probabilities

	Investment Consultant	50th Percentile Expected Return (Geometric)		Probability of Exceeding 5.25%	
		2023	2022	2023	2022
		(1)	(2)	(3)	(4)
7 to 10 Year Expectations	1	5.9%	4.4%	55%	34%
	2	6.0%	4.8%	56%	38%
	3	6.2%	5.0%	59%	41%
	4	6.6%	5.2%	63%	43%
	5	6.7%	4.9%	65%	40%
	6	6.8%	4.9%	65%	40%
	7	7.0%	4.9%	69%	38%
	8	7.0%	5.6%	69%	47%
	9	7.2%	5.2%	69%	44%
	10	7.3%	5.7%	70%	50%
20 to 30 Year Expectations	1	5.7%	4.8%	53%	40%
	2	6.5%	5.8%	62%	51%
	3	6.6%	5.8%	64%	50%
	4	7.1%	6.0%	70%	53%
	5	7.6%	6.4%	73%	58%
	6	7.7%	6.2%	75%	55%
	7-10 Year Expectation Avg:	6.7%	5.1%	64%	42%
	20-30 Year Expectation Avg:	6.9%	5.8%	66%	51%

Source: GRS

Recommendation: KERS Non-Hazardous and SPRS Retirement Funds

Investment return expectations increased significantly compared to the prior year. Based on our broader survey, the average of the 50th percentile return expectations is 6.7% based on the 10-year assumptions and 6.9% based on the longer 30-year assumptions. The probability of exceeding the current investment return assumption of 5.25% is greater than 50% for each 2023 assumption set. However, we do not recommend the Board put undue weight in one particular investment consultant or one particular year's survey of return expectations.

Given the last two years of return expectations, we believe this analysis supports a 0.25% increase in the investment return assumption to 5.50% for the KERS non-hazardous SPRS retirement funds. This is our recommendation as it complies with the Actuarial Standards of Practice regarding the selection of an



investment return assumption. However, while this Standard of Practice allows an actuary to consider the nonsymmetrical investment risk (i.e. there is greater risk of downside returns compared to upside returns), it is not explicit with regard to the consideration of the current financial condition of the retirement system. Since the funded status of the KERS non-hazardous pension fund was 18.5% and the SPRS retirement fund was 52.5% as of the last actuarial valuation, it would be prudent for the Board to maintain the assumed rate of return for these funds as it will result in more employer contributions each year.

KERS Hazardous and Insurance Funds Expected Annual Geometric Returns and Return Probabilities

	Investment Consultant	50th Percentile Expected Return (Geometric)		Probability of Exceeding 6.25%	
		2023	2022	2023	2022
		(1)	(2)	(3)	(4)
7 to 10 Year Expectations	1	6.1%	4.9%	46%	32%
	2	6.4%	5.5%	49%	37%
	3	6.7%	5.7%	52%	40%
	4	7.1%	5.6%	56%	38%
	5	7.1%	5.8%	56%	41%
	6	7.2%	5.5%	57%	37%
	7	7.5%	6.2%	60%	44%
	8	7.6%	5.3%	62%	35%
	9	7.6%	6.3%	60%	46%
	10	7.8%	5.9%	62%	42%
20 to 30 Year Expectations	1	6.1%	5.3%	46%	40%
	2	6.9%	6.4%	54%	46%
	3	7.1%	6.4%	57%	46%
	4	7.7%	6.7%	62%	50%
	5	7.9%	6.8%	64%	50%
	6	8.5%	6.9%	68%	51%
7-10 Year Expectation Avg:		7.1%	5.7%	56%	39%
20-30 Year Expectation Avg:		7.4%	6.4%	59%	47%

Source: GRS

Recommendation: KERS Hazardous Retirement and All Insurance Funds

Similarly, the probability of exceeding the current 6.25% is greater than 50% for all but two of the 2023 assumptions with a significant increase in return expectations compared to the prior year. For the same reasons noted for the other funds, a 0.25% increase in the investment return assumption to 6.50% for the KERS hazardous retirement fund would comply with the Actuarial Standards of Practice and is our



recommendation. However, again, it would be prudent for the Board to consider the 63.2% funded status of the KERS hazardous fund and maintain the assumed rate of return at 6.25% to maintain higher contributions which will result in a slightly more accelerated funding to that retirement fund.

On the other hand, each of the three insurance funds are smaller in liability and significantly better funded with the funded ratios of the KERS Hazardous and SPRS insurance funds being in excess of 100%. Therefore, we believe it is reasonable for the Board to increase the investment return assumption for each of these insurance funds by 0.25% to 6.50%.

CASH BALANCE INTEREST CREDIT RATE ASSUMPTION

Members who become participants in the plan after January 1, 2014 earn benefits in the Tier 3 cash balance plan, where their hypothetical account balance increases with member and employer pay credits and an interest credit based on the System's actual investment performance. Specifically, each year's interest credit is equal to a minimum of 4.0% plus 75% of the five-year geometric average actual return in excess of 4.0% (if any).

With the incorporation of a 4% minimum interest credit rate, it is possible for the interest credit rate to exceed the actual five-year geometric return. The use of a five-year average period greatly reduces likelihood the 4% minimum interest credit would apply as well as the year-to-year volatility in the interest credit rate. The 4% minimum interest credit rate has never exceeded the five-year average return since the Tier 3 plan has been in place, but this plan has only been in place since 2014, which is not a sufficient time for analysis purposes.

Rather, we believe it is more relevant to model a projected average compound interest credit rate stochastically based on the mean and variance expectations for the fund. We also look at the average compound interest credit to better reflect the anticipated accumulation of a members' account balance with interest over their career. In the case of the KERS non-hazardous fund and State Police Retirement System, our stochastic model using a 50th percentile return of 5.50% and a 10% standard deviation produced an average compound interest crediting rate of 5.90%. In the case of the KERS hazardous fund, we recommend the use of a 6.75% cash balance interest credit rate, based on a 50th percentile return of 6.50% and a 13% standard deviation.

SALARY INCREASE RATES

In order to project future benefits, the actuary must project future salary increases. Salaries may increase for a variety of reasons:

- Across-the-board increases for all employees;
- Across-the-board increases for a given group of employees;
- Increases to a minimum salary schedule;
- Additional pay for additional duties;
- Step or service-related increases;
- Increases for acquisition of advanced degrees or specialized training;
- Promotions; or
- Merit increases, if available.



Our salary increase assumption is meant to reflect all of these types of increases, since all of these affect the salaries used in benefit calculations and upon which contributions are made.

An actuary should not look at the overall increase in payroll when setting this assumption, because total payroll can increase at a rate different from the average pay increase for individual members. There are two reasons for this. First, when older, longer-service employees terminate, retire or die, they are generally replaced with new employees who have a lower salary. This causes the growth in total payroll to be smaller than the average pay increase for individual employees. Second, total payroll can change due to an increase or decrease in the size of the employee group. Rather we examine the actual compensation increases on an individual basis.

We analyzed the salary increases based on the change in each member’s reported pay from one year to the next. That is, we looked at each member who appeared as an active member in two consecutive valuations—these are called continuing active members—and measured his/her salary increase.

Below is a table showing the average increase given to continuing members by year for members in various groups:

Fiscal Year Ending	Non-Hazardous	Hazardous	SPRS
2014	2.9%	3.1%	3.3%
2015	4.0%	6.5%	3.0%
2016	4.9%	18.3%*	6.4%
2017	4.4%	11.1%	9.8%
2018	4.5%	6.1%	7.0%
2019	4.1%	5.2%	5.8%
2020	4.2%	8.1%	6.7%
2021	3.6%	4.5%	3.2%
2022	6.0%	12.6%	7.0%
Average	4.3%	8.3%	5.8%

* Includes a one-time payroll adjustment.

It is typical to assume larger pay increases for younger or shorter-service employees as promotions and productivity increases tend to be greater in the first few years of a career, even if the new employee is older than the average new hire.

The current assumptions follow this pattern for all employee groups. Therefore, we divide the task of setting the salary increase into two pieces:

1. Determining the assumption for long-service employees
2. Determining the additional increases to be applied to shorter-service employees

The next two subsections will discuss these components of the salary assumption.



Salary Increase Assumptions for Long-Service Employees

Many of the sources of pay increases have diminished importance for longer-service employees. Step or service-related increases are usually smaller and promotions occur with less frequency. Additional training or acquisition of advanced degrees usually occurs early in the career. Thus, our salary increase assumption has an ultimate level when members are assumed to receive increases equal to wage inflation plus smaller increases for merit, promotion, and longevity.

The data suggests the patterns level off after around 10-11 years of service for a member to be considered a long-service employee for the purposes of this analysis.

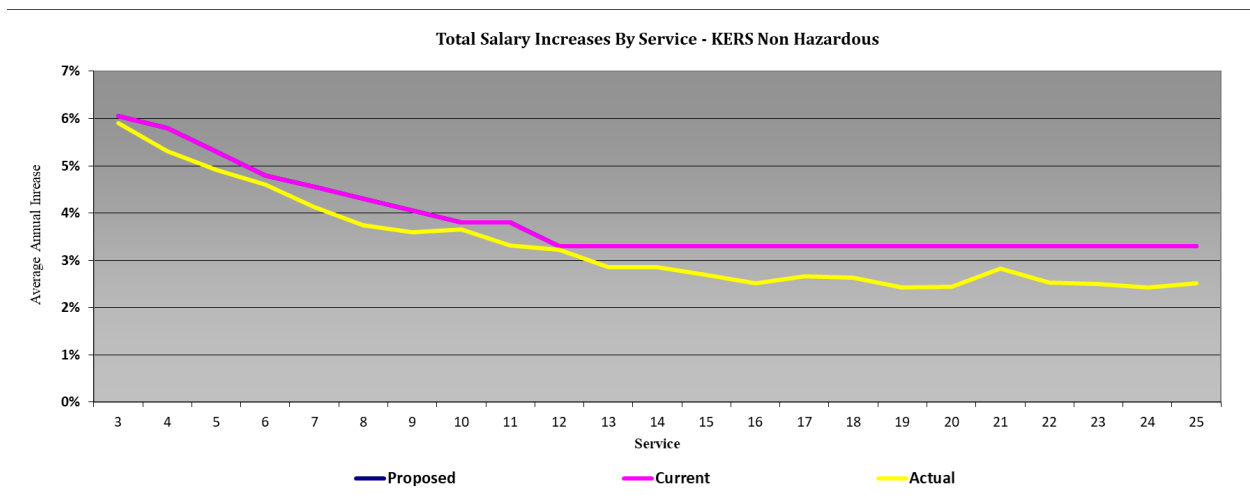
Given our analysis, we are not recommending any changes to the current salary increase assumption for long-service employees, which is 3.30% per year for members in the KERS non-hazardous fund and 3.55% per year for members in the KERS hazardous and SPRS funds.

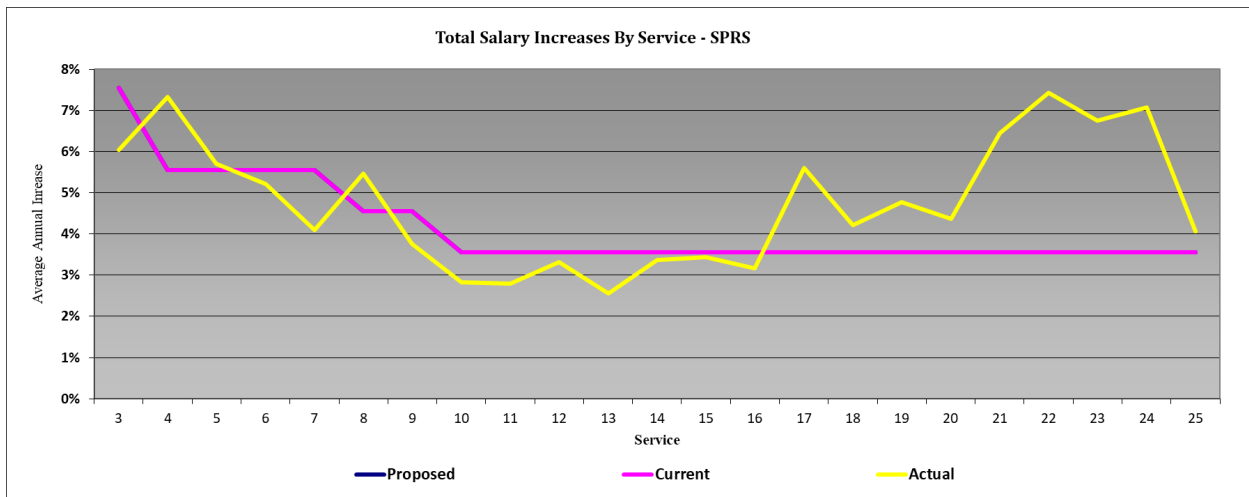
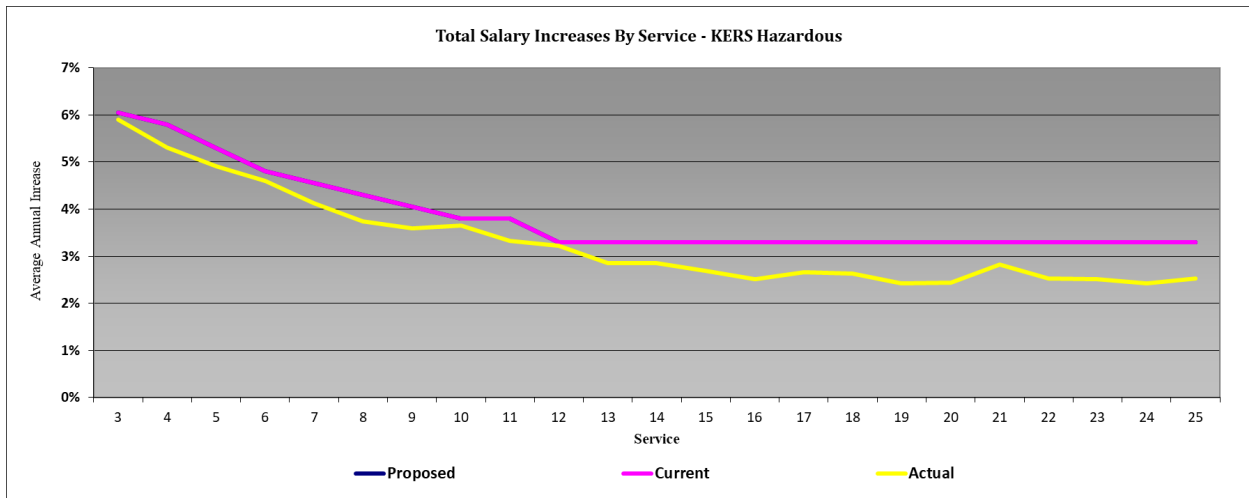
Salary Increase Assumption for Shorter-Service Employees

To analyze the service-related salary assumption, we looked at the excess in the average increases for shorter service employees over the average for longer-service employees. For example, KERS non-hazardous members with four years of service received an average increase of 4.98%, which was 2.39% more than the average increase of 2.59% for the same type of employee with eleven or more years of service. This component of the salary scale assumption behaves more like a demographic assumption than an economic assumption, and therefore, the historical experience has a high level of creditability for purposes of establishing future expectations. We are not proposing any changes to the current step-rate salary assumptions for each of the funds. Details of our analysis are shown in Section VI beginning on page 56.

Salary Increases – Combined Effect

The following charts provide a comparison of the salary increase rates applied to individuals discussed above for the service period of three years to twenty-five years.





Note, the appearance of greater volatility for SPRS in the above table is primarily due to this fund having far fewer members compared to the other two funds.

PAYROLL GROWTH RATE

The rate of salary increases discussed above are assumptions applied to individuals and are used in projecting future benefits.

HB 8, enacted in 2021, changed the method for the allocation and collection of contributions from the participating employers in the KERS non-hazardous fund so that the collection of contributions was no longer tied to an employer’s payroll. As a result, a payroll growth assumption is currently irrelevant for that fund. On the other hand, statutes still require that participating employers in the KERS hazardous fund and the State Police Retirement System make contributions to the system as a percentage of covered payroll. Therefore, it is necessary to make a reasonable assumption regarding the anticipated overall change in covered payroll to develop the amortization rate to finance the unfunded actuarial accrued liability over the specified funding period.

The change in total covered payroll is dependent on the salary increases provided to individual members as well as the change in active membership. Given the historical change in covered payroll and

membership, it is appropriate to review the change in total payroll and membership in developing this assumption.

Average Annual Change in Membership and Payroll				
	Change in Membership		Change in Payroll	
Averaging Period	5 Years	10 Years	5 Years	10 Years
KERS Hazardous	-2.2%	-1.2%	0.4%	2.3%
SPRS	-1.3%	-0.7%	-0.3%	-0.1%

Our recommendation is for the Board to maintain the current 0% payroll growth assumption for the KERS hazardous fund and SPRS for use in developing the actuarial contribution rate in the June 30, 2023 actuarial valuation.

DEMOGRAPHIC ASSUMPTIONS

Actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting noneconomic assumptions for measuring obligations under defined benefit plans. We believe the recommended assumptions in this report were developed in compliance with this standard.

POST-RETIREMENT MORTALITY RATES

KERS's and SPRS's actuarial liabilities depend in part on how long retirees live. The longer a retiree lives, the longer the retiree receives benefits from the System resulting in a larger liability to each fund.

The current mortality assumption is a custom table developed in 2018 that was based on the actual retiree experience of KERS and CERS. It is a gender distinct assumption, but there is no distinction between retirees in KERS or CERS, or the non-hazardous and hazardous funds. Separate mortality tables are used for active members and disabled retirees; these assumptions are discussed separately in a following subsection. The current mortality assumption also includes an explicit assumption for future improvement in life expectancy based on a mortality improvement assumption developed by the Society of Actuaries in 2014.

Due to the COVID-19 pandemic, mortality has come to be in the national spotlight. As our analysis will show, the retirees in KERS and SPRS were also affected by the pandemic.

Analysis of Credibility of the Retirement Systems' Mortality Experience

When selecting an appropriate mortality assumption, actuaries often use standard published mortality tables. Depending on the size, or statistical credibility, of the retiree population, actuaries often also adjust these published mortality tables with multipliers or age setbacks to better reflect characteristics of the covered group and to provide for expectations of future mortality improvement (both up to and after the measurement date). On the other hand, a retirement system with a sufficiently large number of retirees



may be able to better model mortality experience using a mortality table based on their experience. Factors that may be considered in selecting and/or adjusting a mortality table include the demographics of the retiree group and the statistical credibility of its experience.

Studies on mortality consistently show that longevity can vary significantly among industries, ethnicity, education, and geographic location. It has been documented in several sources that residents in Kentucky have a life expectancy well below the national average. A report issued in August 23, 2022 by the National Vital Statistics, states that Kentucky residents ranked 47th in life expectancy at age 65 compared to populations in the other US States. However, members in CERS and KERS predominately have formal education beyond high school or have a professional degree, which is also well documented to be an indicator they will have a longer life expectancy than someone in the same geographic location without a formal education beyond high school. Due to these possible variances, it is even more important to consider the statistical credibility of the system’s experience and provide the appropriate credibility weighting to the observed mortality experience, versus the use of a published table based on national population experience.

In our analysis of the mortality experience for KERS and SPRS, we first measured the credibility of the dataset to determine whether standard published tables should be used or if a statistical analysis of the Retirement Systems’ data was warranted. Generally, we consider 1,000 deaths per gender is the minimum necessary to be considered fully credible, however it is also preferable to develop a base mortality table with larger datasets to increase the statistical credibility that the base mortality assumption is closer to the true mortality experience of the system. The following table gives the number of deaths needed by gender to have a given level of confidence that the data is +/- X% of the actual pattern.

Statistical Confidence by Observed Deaths during the Experience Period

Std Score	Confidence	99%-101%	97%-103%	95%-105%	90%-110%	80%-120%
1.1503	75%	13,233	1,470	529	132	33
1.2816	80%	16,424	1,825	657	164	41
1.6449	90%	27,055	3,006	1,082	271	68
1.9600	95%	38,415	4,268	1,537	384	96
2.5758	99%	66,349	7,372	2,654	663	166

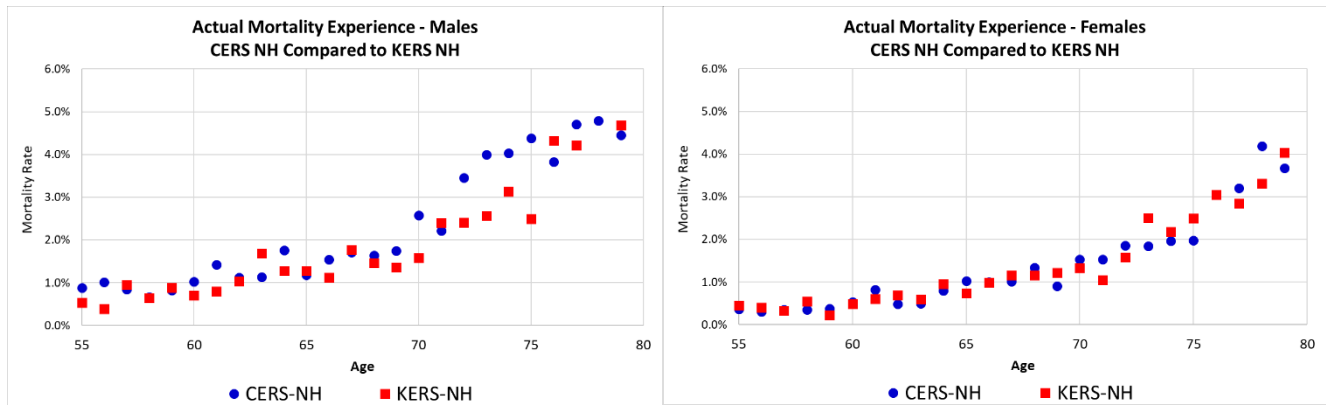
The following table provides the number of male and female deaths for each fund maintained by KPPA over the last five years.

Number of Deaths for Each Fund During the Last Five Fiscal Years

Fund	Male	Female
KERS - NH	2,718	3,142
KERS - HZ	365	94
SPRS	127	-
Sub-total	3,210	3,236
CERS - NH	3,844	4,916
CERS - HZ	675	58
Sub-total	4,519	4,974
Total	7,729	8,210



We also compared the last five years of mortality experience for the KERS non-hazardous and CERS non-hazardous funds to identify how similar the mortality experience is for the two retiree groups. Below are charts that compare the actual mortality experience for the KERS non-hazardous and CERS non-hazardous funds for males and females.



In our professional opinion, the retiree mortality experience for these two funds are very similar and appropriate to combine for developing an updated base mortality assumption to be used by all funds maintained by KPPA. While the CERS and KERS mortality experience may appear to be different for males between the ages 70 and 75, the experience is not sufficiently large enough to conclude there is a difference in the true underlying mortality experience on a forward-looking basis. We also compared the mortality experience of the hazardous funds to the non-hazardous funds and determined it also remains appropriate to use the same base mortality assumption for both non-hazardous and hazardous members. While the Society of Actuaries has developed and published mortality tables that are different for general employees and public safety members, we believe it continues to be appropriate to use the same mortality table for the valuation of all funds maintained by KPPA.

Using a system-specific mortality assumption will reduce the risk of undervaluing or overvaluing liabilities, provide better future estimates of liabilities and projected benefit payments. It will also allow for smaller, more frequent adjustments to the assumption as necessary in future experience studies instead of having to wait for a new, published table.

Recommended Base Mortality Assumption

We performed our analysis using a benefit-weighted approach, where we measure the exposures and actual deaths weighted by the retiree’s benefit amount, rather than a headcount approach that applies an equal weighting to all retirees. Developing a base table using a benefit-weighted approach is preferable because: (1) research studies have consistently shown that higher wage earners generally have a longer life expectancy than lower wage earners and (2) this approach should better model the actual liability that is released when retirees die. A benefit-weighted approach is the same method used by the Society of Actuaries’ Retirement Plans Experience Committee when they develop published mortality tables.

We also used nine years of experience in developing the table, as we believe it will result in a more appropriate table for modeling the mortality experience after the COVID-19 pandemic period. To provide a perspective of the impact of COVID-19 on the mortality experience, below is a table with the mortality experience for each fund for the last six years with the first three years being prior to the pandemic. As the table shows, the crude mortality experience for the last three years is noticeably higher than the in the first three years of the table. However, we anticipate the mortality rates will decrease to be closer, but not less than the pre-2020 mortality rates in the near-term future.

Crude Mortality Rate for Non-Disabled Retirees by Fiscal Year Ending June 30,

FY Ending	Males					Females				
	K-NH	K-HZ	SPRS	C-NH	C-HZ	K-NH	K-HZ	SPRS ¹	C-NH	C-HZ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2017	2.1%	1.8%	1.0%	2.3%	1.1%	1.5%	1.4%	--	1.8%	1.1%
2018	2.1%	1.9%	0.9%	2.5%	1.5%	1.6%	0.2%	--	1.8%	0.6%
2019	2.3%	1.5%	2.1%	2.4%	1.4%	1.5%	0.8%	--	1.8%	1.0%
2020	3.7%	2.8%	2.4%	3.7%	1.8%	2.6%	1.9%	--	2.7%	0.6%
2021	3.0%	2.3%	2.4%	3.0%	1.4%	1.9%	1.4%	--	2.2%	0.3%
2022	3.2%	2.4%	1.7%	3.2%	1.5%	2.0%	1.6%	--	2.4%	1.5%

¹ Experience for female retirees for SPRS has been excluded since there are very few female retirees in this fund.

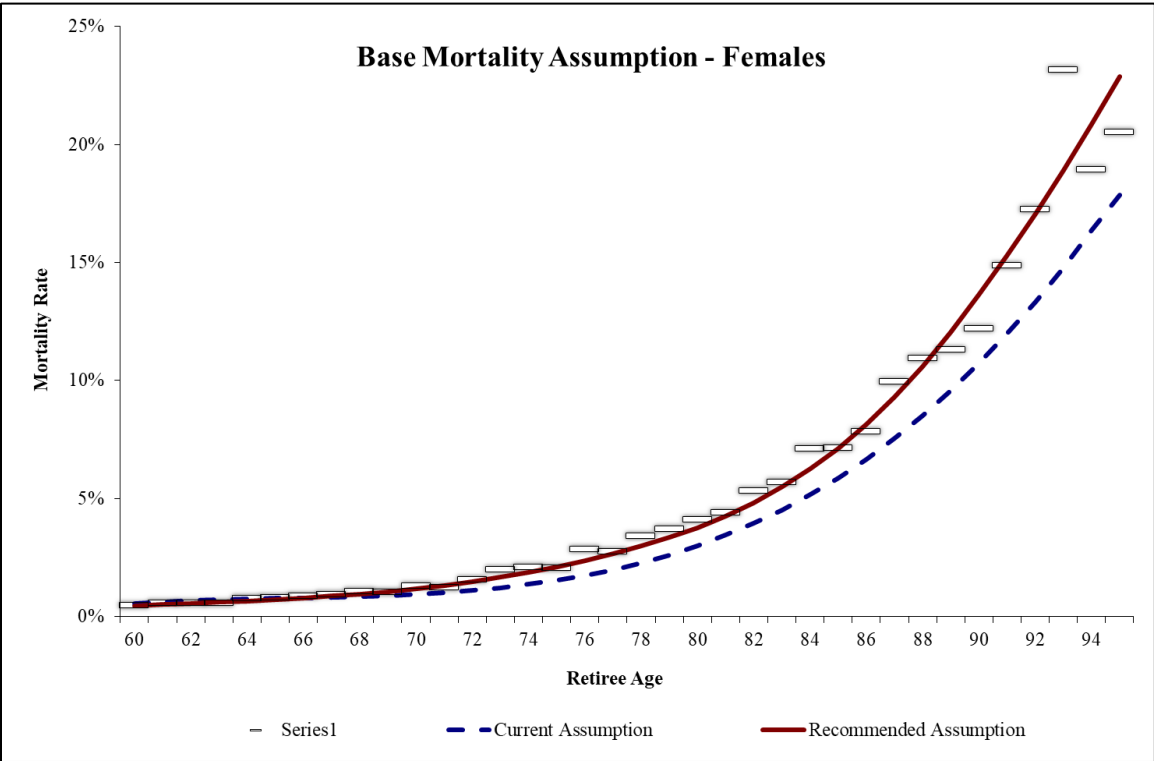
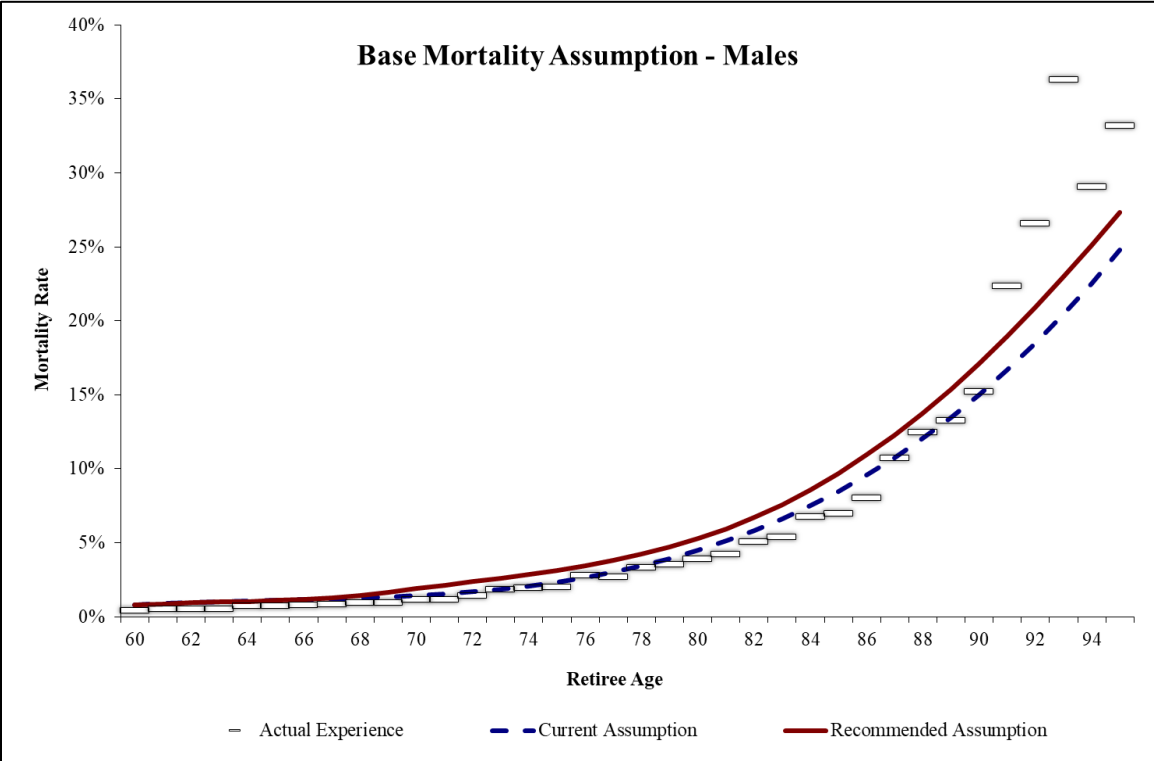
Note, comparing the crude rates from fund to fund does not provide any type of meaningful conclusion since the retiree demographics are different for each group. For instance, a higher average age for a retiree group is generally expected to result in a slightly higher crude rate.

To develop the recommended mortality assumptions, we grouped the data into five-year ages bands. Mortality rates for ages under age 55 are based on the Pub2010 mortality assumption for general employees (adjusted forward to the central point of the experience period). The mortality rates between ages 55 and 60 are equal to a credibility adjusted version of the published table and the Systems' actual experience. The mortality rates on and after age 60 and prior to age 85 are based on the plan's actual crude rate for the midpoint of the quintile and graduated using a cubic spline method to provide a smooth fit to the experience. For the oldest segment of the mortality table, the mortality rates in the table after age 84 are projected from the previous midpoint quintile using the rate of change from the current assumption. The R² for the fit of the tables to actual experience in five-year age bands was .987 and .991 for males and females, respectively. The final steps in the creation of the base mortality assumption was to project the preliminary table from the center point of the analysis period (i.e. 2017) to the year 2023 using the recommended projection scale below.

We will refer to this new table as the 2023 Public Retirees of Kentucky Mortality Table (2023 PRK).



The following charts show the actual mortality experience assumption for male and female retirees, along with the current mortality assumption, and the recommended mortality assumption. As the chart shows, the best way to provide a better fit along the entire “curve” is to use an assumption developed using actual experience, which includes ages beyond age 90 for male retirees.



As the charts show, the difference in the base mortality rate for the recommended assumption is not much different than the current base mortality assumption for male retirees. On the other hand, there is a more noticeable difference between the current and recommended base mortality assumption for females. As a result, the cost impact of changing to the updated recommended base table is minor, resulting in between a 1% and 3% decrease in the actuarial liabilities. The KERS non-hazardous fund will have a larger decrease due to its higher concentration of female members.

In the next section, we will discuss the explicit assumption for future improvement in mortality (and life expectancy).

Recommended Mortality Improvement Assumption

Society of Actuaries' Retirement Plans Experience Committee (RPEC) recognizes that there is a wide range of opinion with respect to future levels of mortality (especially since the COVID-19 pandemic) and that the assumptions underlying mortality improvement reflect some degree of subjectivity. However, there is no disagreement whether mortality will continue to improve.

The current mortality improvement assumption is based on the ultimate rates of improvement (e.g. generally 1%) in the MP-2014 improvement assumption issued by the Society of Actuaries. The Society of Actuaries have subsequently issued mortality improvement assumptions in 2015, 2016, 2017, 2018, and 2019, with reduced improvement assumptions during the selection period (approximately 15 years) but the ultimate improvement assumption has remained unchanged. However, in the Society of Actuaries 2020 report the ultimate mortality improvement rates were modified to be higher at some ages and adjusted to better reflect historical trends for different age groups. Specifically, the pattern is a rate of 1.35% for ages 62 and younger, decreasing linearly to 1.10% at age 80, further decreasing linearly to 0.40% at age 95, and then decreasing linearly to 0.00% at age 115 (and thereafter). In general, the net change in overall liabilities is minimal if a retirement system adopted the ultimate rates of the MP-2020 version because the overall pattern of the improvement over a retiree's lifetime is not much different. However, we give preference to the more recently published report all else being equal as the 2020 report provides several pages of rationale and disclosure of the process used to generate the new long-term rates, including comparing to historical trends, and we find the analysis thorough and reasonable. Thus, we are recommending use of the ultimate rates in the MP-2020 scales, applied for all years. Therefore, we recommend the use of "2020MP-Ultimate" for the mortality improvement assumption.

Below is a table with the life expectancy for an age 65 retiree, in years, under the current and recommended mortality assumption.

Life Expectancy for an Age 65 Retiree in Years					
Assumption	Year of Retirement				
	2025	2030	2035	2040	2045
Current Assumption – Male	21.4	21.8	22.2	22.6	23.0
Recommended Assumption – Male	19.8	20.2	20.6	21.0	21.3
Current Assumption – Female	24.4	24.8	25.2	25.6	25.9
Recommended Assumption – Female	22.4	22.7	23.1	23.4	23.7

As shown, life expectancies under the new assumption have decreased compared to the current assumption. This decrease reflects the actual mortality experience during FY 2020, FY2021, and FY2022. However, the mortality assumption will continue to explicitly build in the assumption that mortality will gradually improve in future years. As the table shows, a 65-year old male in 2040 is assumed to live, on average, 0.8 years longer than a 65-year old in 2030.

DISABLED RETIREE MORTALITY RATES

This is a less significant assumption than the mortality assumption for non-disabled retirees, because only one out of twenty-eight retirees in KERS is classified as disabled. Because the number of disabled retirees is much smaller, there is not sufficient experience to develop a system-specific assumption and we must continue to rely on using a published table.

The current disability mortality assumption is based on the Pub-2010 Disabled Mortality table, with various adjustments to appropriately fit to the experience.

The analysis shows that the mortality was greater than expected compared to the current assumption. As a result, we recommend adjusting the mortality assumption such that the new assumption is 150% of the base published mortality table without an age set-forward or set-back for both male and female rates. We also recommend applying the “2020MP-Ultimate” mortality improvement assumption to this assumption as well.

Mortality Experience for Disabled Retirees for the Nine-Year Period Ending June 30, 2022 (Amounts are benefit-weighted and scaled)					
Group	Actual	Current		Recommended	
		Expected	A/E	Expected	A/E
Male	174	137	127%	161	108%
Female	135	112	121%	130	103%

Details are provided in Section VI on pages 61-62.



ACTIVE MORTALITY RATES

This is the least significant of all the mortality assumptions because the mortality rates for active members are considerably lower than mortality rates for retired members (nondisabled and disabled).

The current mortality assumption for employees is the Public Retirement Plan (PUB-2010) Mortality table for employees. The assumption for the non-hazardous funds is the published table for General Employees and the assumption for the hazardous funds is the published table for Public Safety members. The census data that we receive from KPPA does not include a code that consistently identifies the members who died while employed. However, the table below provides the number of active member deaths that occurred during the last five years, which was provided by KPPA.

Fund	Actual Deaths	Expected Deaths
KERS Non-Hazardous	860	545
KERS Hazardous	83	25
SPRS	0	3

The current assumption remains the most recently published mortality table for public employees; therefore, we recommend no change in the current assumption.

Since the death benefit provided to a beneficiary is more generous if an active member's death is duty related or as a result of an act while in the line of duty, it is relevant for the valuation to include an assumption regarding the number of expected deaths that will occur in the line of duty. The valuation currently assumes that 25% of the active membership deaths are duty related or occur in the line of duty (same assumption for each fund). Over the last five years there were a total of five KERS active duty-related/in-line-of-duty deaths (five non-hazardous and zero hazardous). While the current 25% assumption appears much higher than recent experience, we remain comfortable that this remains a reasonable assumption and do not recommend a change to this assumption.

DISABILITY INCIDENCE

The disability rates are intended to reflect the probability that a member will retire with a disability retirement allowance. We analyzed the disability experience year by year separately for each fund. Our review includes an investigation to determine if there is a time-lag in the processing of disability retirements that we discuss in more detail below. The following is a table with a summary of the results of the analysis for the five-year period ending June 30, 2022.

Disability Incidence for the Five-Year Period Ending June 30, 2022							
Fund	Census Data	Processing Time-Lag	Actual for Analysis	Current Assumptions		Proposed Assumptions	
				Exp.	A/E	Exp.	A/E
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
KERS Non-Hazardous	158	164	322	372	87%	341	94%
KERS Hazardous	15	22	37	39	95%	39	95%
SPRS	7	4	11	7	157%	7	157%

Note: the actual and expected statistics are headcount based and not benefit-weighted.

Typically, when we review a System’s disability experience, our review includes an investigation into whether there is delay in a System’s classification of a retiree as a disabled retiree. Often if there is a delay, it is due to a combination of the time of year the member becomes disabled and the time necessary to approve a member’s application for a disability retirement benefit. For example, a member who becomes disabled late in the fiscal year may be reported in the census data files as follows: Year 1: “Active”, Year 2: “Inactive”, Year 3: “Disabled Retiree”. The reporting of the member as “Inactive” in year 2 is due to the processing of a member’s application for a disability retirement, where in reality the member was actually a “Disabled Retiree” in year 2.

The count in column (2) provides the number of members who are identified as having a year-to-year status change from “Active” to “Disabled Retiree”. The count in column (3) is the number of members who were identified as having a status change to “Disabled Retiree” during the five-year period from inactive status. Together, these represent the number of disability retirements that are studied for the purposes of the actuarial assumption. Note, due to the processing delay, this may be different than the number of disability applications processed by the retirement system in any given year.

Based on the analysis above, we recommend a small decrease to the disability rates for both the KERS non-hazardous and hazardous funds. We recommend no change to the disability rates for SPRS. However, we also noticed that over the last five years the number of disabilities has gradually decreased each year. We will watch the annual number of disabilities to identify if the reduced number of disabilities will continue or revert back to historical patterns and if further changes to this assumption are necessary.

Duty Related and Line of Duty Disability

Since there are minimum benefits provided to members who become disabled in the line of duty or as a result of a duty-related disability, it is important to review the System’s experience regarding disability retirements under these circumstances. KPPA provided the disability experience on a fund basis and



separately identified the number of ordinary disabilities, duty related disabilities, and in the line of duty disabilities, as well as the number of total and permanent disabilities since the passing of SB169 in 2021.

The following table provides a summary of the number of disabilities for each fund for the five-year period ending June 30, 2022.

Prevalence of Disability Incidence by Type for the Five-Year Period Ending June 30, 2022			
Fund	Percent of Disabilities Duty Related/ILD	Current Assumption for Duty Related/ILD	Recommended Assumption for Duty Related/ILD
(1)	(2)	(4)	(5)
KERS Non-Hazardous	<0%	2%	2%
KERS Hazardous	19%	10%	10%
SPRS	43%	70%	70%

The current assumption tracked reasonably well for all funds. There were only five and three disabilities classified as in the line of duty for the KERS hazardous and SPRS fund, respectively. Given the small amount of data, we recommend no change to the duty-related or in the line of duty disability incidence assumption at this time.

Total and Permanent Disability

Additional benefits are provided to members who become “totally and permanently” disabled in the line of duty or as a result of duty-related disability. The provisions for a non-hazardous duty-related disability have a requirement for “total and permanent” disability so there is no separate assumption for the non-hazardous fund. The provisions for a hazardous disability in the line of duty do not have a “total and permanent” disability requirement; therefore, we do make a separate assumption for this type of disability in the valuation for the hazardous fund.

Since the passing of SB169 in 2021, there has only been one member to qualify as “total and permanently” disabled under the KERS hazardous fund and none in the SPRS fund. Historically, approximately 10% of the in line of duty/duty-related disabilities during the period from 2010-2019 would have classified as “total and permanent”. We recommend no change to the assumption that 10% of disabilities in the line of duty will be total and permanent for the hazardous fund.

TERMINATION RATES

The termination assumption is used to model the effect of members leaving active membership in the System for any reason other than death, disability, or service retirement. This applies whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit. However, we only consider a termination to occur if the member changes status in the retirement system to an inactive member. We don’t consider a termination to occur if the member works for a new employer, but remains an active member in the same fund. The valuation uses the same termination assumption for males and females, but different assumptions for each fund. The current assumption is structured as a function of service. No terminations are assumed once a member becomes



retirement eligible (i.e. members who leave active service who are eligible to retire are assumed to commence their retirement benefit).

A higher paid member has a greater liability relative to a lower paid member, and has been shown to have lower turnover. Along those lines the termination pattern for the higher paid members will have more impact on the future liabilities of the plan. Therefore, we have weighted the experience by salary and are counting the payroll and the portion of the payroll that terminates employment (versus headcount) for the last nine years. For this assumption, it is more conservative to have an A/E ratio over 100%.

The analysis indicated that termination experience is still correlated with service. Also, we continue to develop a termination assumption that is applied to both genders for increased statistical credibility. The following table provides a summary of the results for the termination rates by fund:

Summary of Termination Analysis (Hundreds of Thousands of Payroll)					
Fund	Actual Experience	Current Assumption		Recommended Assumption	
		Expected	A/E	Expected	A/E
(1)	(2)	(3)	(4)	(5)	(6)
KERS Non-Hazardous	24,941	17,234	145%	20,183	124%
KERS Hazardous	3,963	2,092	189%	2,757	144%
SPRS	538	272	198%	319	169%

In summary, the rates of termination were higher than expected for all three funds. The higher actual turnover experience was not surprising given the extraordinary economic changes that occurred during the last few years. We are recommending a 10% increase the termination rates for the KERS non-hazardous fund and SPRS. We are also recommending a 30% increase in the termination rates for the KERS hazardous fund.

Details of the termination experience are provided in Section VI on pages 63-65.

Refund of Member Contribution Balance

If a member terminates employment with a vested benefit but prior to their retirement age, they may keep their member contributions in the System and receive a monthly annuity when they reach their eligible retirement age or withdrawal their member contributions at any time and forfeit the monthly annuity. Currently, the valuation assumes that members in each fund will refund their contributions if the value of their member contributions exceeds the value of their deferred monthly retirement benefit. We recommend no change to this assumption.

RETIREMENT RATES

The retirement rates are used to model when an employee will commence their retirement allowance. The current retirement assumption is the same for males and females, but vary by fund and benefit tier.



For this analysis we have weighted the experience by the member's benefit. Thus, the retirement pattern for the members with a greater benefit will have a larger impact on the future liabilities of the plan. For this assumption, it is more conservative to have an A/E ratio less 100%, however, it is still reasonable to have an A/E ratio greater than 100% if there is reason to believe that future retirement experience will be different than the experience period reviewed.

We recommend the continued use of an age-based and gender-distinct assumption for the KERS non-hazardous fund. For the KERS hazardous and SPRS funds, the use of a service-based retirement assumption provides a better indicator of the members retirement pattern. And, there is not enough female members in the hazardous funds to create a credible gender-distinct retirement assumption.

Summary of Retirement Analysis (Hundreds of Thousands of Payroll)						
Fund	Males			Females		
	Actual	Expected	A/E	Actual	Expected	A/E
(1)	(2)	(3)	(4)	(5)	(6)	(7)
KERS Non-Hazardous	6,159	6,449	96%	7,691	7,997	96%
KERS Hazardous	1,845	1,801	102%	Included with Males	Included with Males	Included with Males
SPRS	1,120	1,234	91%	Included with Males	Included with Males	Included with Males

We are recommending no change to the normal retirement rates for the KERS non-hazardous fund. Overall, the expected average retirement age for males is age 59 and age 57 for females. The valuation also includes an assumption for reduced, early retirement which are less material than the normal retirement assumptions. We are recommending no change to the early retirement rates as well. Similarly, we are recommending continued use of the current retirement assumption for the KERS hazardous and SPRS funds.

Details of the retirement experience are provided in Section V on pages 66-70.

Adjustment to Retirement Rates for Members Participating on or after July 1, 2003

Members with a participation date on or after July 1, 2003, receive a relatively less generous pre-age 65 health insurance benefit compared to the benefit provided to members who become participants prior to July 1, 2003. Therefore, we recommend using a different retirement assumption to reflect an expectation that these members will retire at slightly later ages. Specifically, for members with a participation date on or after July 1, 2003 we are recommending that the retirement rates at each age (or service) below age 65 are 80% of the recommended retirement rates that are developed for the members with a participation date prior to July 1, 2003. Additional adjustments were made to retirement rates for Tier 2 and Tier 3 members to reflect the different retirement eligibility and benefits applicable to these members. Note that we must rely on our professional judgement regarding these retirement rates as it will be many years into the future before there is sufficient experience to analyze their actual retirement pattern. There were no recommended changes to the adjustment for members with a participation date on or after July 1, 2003 or to the retirement rates for Tier 2 and Tier 3 members. These retirement rates are shown in Sections IV and V.



RETIREE MEDICAL PARTICIPATION

A retiree's participation in the health insurance plan is voluntary, not mandatory. Some retirees may not elect to be covered, especially if they have coverage through a spouse or a previous employer. As a result, it is relevant to include an assumption in the actuarial valuation regarding the number of future retirees that will elect to participate in the retiree health insurance plan. It may be relevant to take into consideration the design of the health insurance plan when selecting this assumption, such as eligibility, plan choices, and retiree contribution requirements, which may affect a retiree's decision to participate in the health insurance plan.

The current assumption is a service-based assumption, which is logical since the retiree's cost subsidy increases as their service at retirement increases. The table on the following page summarizes the current participation assumption.

**Health Insurance Participation Assumption at Retirement
(members with a participation date before July 1, 2003)**

Service at Retirement (Years)	System	
	KERS	SPRS
(1)	(2)	(3)
Under 10	50%	100%
10 to 14	75%	100%
15 to 19	90%	100%
20 or more	100%	100%

Additionally, 50% of KERS inactive vested members and 100% of SPRS inactive vested members with a participation date before July 1, 2003 are assumed to elect health coverage. 50% of KERS members and 75% of SPRS members with hazardous service are assumed to elect spouse coverage.

We reviewed the actual participation experience for the five-year period for each fund. The actual election rate remains relatively close to the expected election rate for those retirees. As a result, we recommend increasing the spouse election assumption for SPRS to 85% but recommend no other changes to the participation assumptions for the health insurance funds.

For members with a participation date on or after July 1, 2003 who receive the dollar subsidy benefit, 100% of members are assumed to elect health coverage. While actual participation experience for this benefit has been lower than 100%, recent experience shows that participation for this benefit is increasing as the members begin retiring with higher service. Therefore, we recommend no change to this assumption at this time.

OTHER ASSUMPTIONS

There are other assumptions made in the course of a valuation, such as the percentage of members who are married, the age difference between members and spouses, etc. Currently 100% of the members are assumed to be married with the husband three years older than the wife. We believe they are generally realistic and/or conservative and recommend no changes to these other assumptions.



There are also assumptions that are specifically used in the valuation of the retiree health insurance funds. These include: the age-related morbidity/claims utilization, health care trend, and baseline claims cost. Each of these assumptions are reviewed on an annual basis and may be periodically updated as each year of claims experience is reviewed, as well as with possible plan design changes.

ACTUARIAL COST METHOD

The individual Entry Age Normal cost method (EAN) is the current funding method being used to allocate the actuarial costs of each fund. The Entry Age Normal method will generally produce relatively level contribution amounts as a percentage of payroll from year-to-year, and allocates costs among various generations of taxpayers in a reasonable manner. It is by far the most commonly used actuarial cost method for large public retirement systems. We continue to believe this is the most appropriate funding method and recommend no change.

ACTUARIAL ASSET METHOD

The current method for developing the actuarial value of assets is based on a five-year asset smoothing method that will identify each year's investment gain or loss on a market value of asset basis, and recognize that amount at the rate of 20% per year. Under this method, an investment gain or loss that occurs in a particular year will be fully recognized in the actuarial value of assets after five years. This asset method is also the most common asset valuation method used by large public retirement systems and the actual investment volatility experienced in FY 2021 and FY 2022 shows the relevance and importance of using this method for purposes of determining the actuarial contribution rate. As a result, we recommend continued use of this asset smoothing method.

SECTION IV

SUMMARY OF RECOMMENDED ASSUMPTIONS – KERS

Kentucky Employees Retirement System

Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods proposed for use in the valuation of the Kentucky Employees Retirement System beginning with the valuation date June 30, 2023.

Investment return rate:

Assumed annual rate of 5.25% net of investment expenses for the non-hazardous retirement fund. Assumed annual rate of 6.25% net of investment expenses for the hazardous retirement fund. Assumed annual rate of 6.50% net of investment expenses for the non-hazardous and hazardous insurance funds.

Price Inflation:

Assumed annual rate of 2.50%

Payroll Growth Assumption (used for amortization of unfunded accrued liabilities):

Assumed annual rate of 0.00%

Rates of Annual Salary Increase:

Assumed rates of annual salary increases are shown below.

Service Years	Annual Rates of Salary					
	Merit & Seniority		Price Inflation & Productivity		Total Increase	
	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous
0	12.00%	16.50%	3.30%	3.55%	15.30%	20.05%
1	3.50%	4.00%	3.30%	3.55%	6.80%	7.55%
2	2.75%	3.00%	3.30%	3.55%	6.05%	6.55%
3	2.50%	3.00%	3.30%	3.55%	5.80%	6.55%
4	2.00%	2.00%	3.30%	3.55%	5.30%	5.55%
5	1.50%	1.50%	3.30%	3.55%	4.80%	5.05%
6	1.25%	1.00%	3.30%	3.55%	4.55%	4.55%
7	1.00%	0.50%	3.30%	3.55%	4.30%	4.05%
8	0.75%	0.50%	3.30%	3.55%	4.05%	4.05%
9	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
10	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
11 & Over	0.00%	0.00%	3.30%	3.55%	3.30%	3.55%



Retirement rates:

Assumed annual rates of retirement are shown below. Rates are only applicable for members who are eligible for a service retirement.

Age	Non-Hazardous				Service	Hazardous			
	Normal Retirement		Early Retirement ¹			Members participating before 9/1/2008 ²		Members participating between 9/1/2008 and 1/1/2014 ³	Members participating after 1/1/2014 ³
	Male	Female	Male	Female		Age 55-61	Age 62+		
Under 45	20.0%	33.0%			5	10.0%	35.0%		
45	21.0%	33.0%			6	10.0%	35.0%		
46	22.0%	33.0%			7	10.0%	35.0%		
47	23.0%	33.0%			8	10.0%	35.0%		
48	24.0%	33.0%			9	10.0%	35.0%		
49	25.0%	33.0%			10	10.0%	35.0%		
50	26.0%	33.0%			11	10.0%	35.0%		
51	27.0%	33.0%			12	10.0%	35.0%		
52	28.0%	33.0%			13	10.0%	35.0%		
53	29.0%	33.0%			14	10.0%	35.0%		
54	30.0%	33.0%			15	10.0%	35.0%		
55	30.0%	33.0%	5.0%	5.0%	16	10.0%	35.0%		
56	30.0%	33.0%	5.0%	5.0%	17	10.0%	35.0%		
57	30.0%	33.0%	5.0%	5.0%	18	10.0%	35.0%		
58	30.0%	33.0%	5.0%	5.0%	19	10.0%	35.0%		
59	30.0%	33.0%	5.0%	5.0%	20	50.0%	50.0%		
60	30.0%	33.0%	5.0%	8.0%	21	32.0%	32.0%		
61	30.0%	33.0%	8.0%	9.0%	22	32.0%	32.0%		
62	35.0%	35.0%	15.0%	20.0%	23	32.0%	32.0%		
63	30.0%	33.0%	15.0%	18.0%	24	32.0%	32.0%		
64	30.0%	33.0%	15.0%	16.0%	25	32.0%	32.0%	25.6%	16.0%
65	30.0%	33.0%			26	32.0%	32.0%	25.6%	16.0%
66	30.0%	33.0%			27	32.0%	32.0%	25.6%	16.0%
67	30.0%	33.0%			28	32.0%	32.0%	25.6%	16.0%
68	30.0%	33.0%			29	32.0%	32.0%	25.6%	16.0%
69	30.0%	33.0%			30+	32.0%	32.0%	25.6%	100.0%
70	30.0%	33.0%							
71	30.0%	33.0%							
72	30.0%	33.0%							
73	30.0%	33.0%							
74	30.0%	33.0%							
75	100.0%	100.0%							

¹ The annual rate of retirement is 12% for male members and 14% for female members with 25-26 years of service.

² The annual rate of retirement is 100% at age 65.

³ The annual rate of retirement is 100% at age 60.

Non-Hazardous System: For members hired after 7/1/2003, the rates shown above are multiplied by 80% if the member is under age 65 to reflect the different retiree health insurance benefit.

Hazardous System: For members hired after 7/1/2003 and prior to 9/1/2008, the rates shown above are multiplied by 80% if the member is under age 65 to reflect the different retiree health insurance benefit.



Disability rates:

An abbreviated table with assumed rates of disability is shown below.

Age	Non-Hazardous		Hazardous	
	Male	Female	Male	Female
20	0.03%	0.03%	0.05%	0.05%
30	0.05%	0.05%	0.08%	0.08%
40	0.11%	0.11%	0.18%	0.18%
50	0.31%	0.31%	0.50%	0.50%
60	0.80%	0.80%	1.32%	1.32%

Withdrawal rates (for causes other than disability and retirement):

Assumed annual rates of withdrawal are shown below and include pre-retirement mortality rates as described on the next page.

Service Years	Annual Rates of Withdrawal	
	Non-Hazardous	Hazardous
1	22.00%	32.50%
2	18.10%	25.58%
3	14.73%	19.66%
4	12.77%	16.19%
5	11.37%	13.73%
6	10.29%	11.82%
7	9.41%	10.26%
8	8.66%	8.93%
9	8.01%	7.79%
10	7.44%	6.79%
11	6.93%	5.89%
12	6.47%	5.07%
13	6.04%	4.33%
14	5.65%	3.64%
15	5.29%	3.00%
16	4.96%	2.42%
17	4.64%	1.86%
18	4.36%	1.34%
19	4.07%	0.86%
20	3.82%	0.39%
21	3.56%	0.00%
22	3.32%	0.00%
23	3.10%	0.00%
24	2.88%	0.00%
25	2.67%	0.00%
26 & Over	0.00%	0.00%

Mortality Assumption:

Pre-retirement mortality: PUB-2010 General Mortality table, for the Non-Hazardous System, and the PUB-2010 Public Safety Mortality table for the Hazardous System, projected with the ultimate rates from the MP-2020 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2022, projected with the ultimate rates from the MP-2020 mortality improvement scale using a base year of 2023.

The following table provides the life expectancy for a non-disabled retiree in future years based on the assumption with full generational projection:

Life Expectancy for an Age 65 Retiree in Years					
Gender	Year of Retirement				
	2025	2030	2035	2040	2045
Male	19.8	20.2	20.6	21.0	21.3
Female	22.4	22.7	23.1	23.4	23.7

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with rates multiplied by 150% for both male and female rates, projected with the ultimate rates from the mortality improvement scale MP-2020 using a base year of 2010.

Marital status:

100% of employees are assumed to be married, with the female spouse 3 years younger than the male spouse.

Line of Duty/Duty-Related Disability

Non-Hazardous: 2% of disabilities are assumed to be duty-related (100% of which are assumed to be “total and permanent”)

Hazardous: 10% of disabilities are assumed to occur in the line of duty (10% of which are assumed to be “total and permanent”)

Line of Duty Death

25% of deaths are assumed to occur in the line of duty

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death or disability benefit, the member is assumed to be survived by two dependent children, each age 6 with payments for 15 years.

Form of Payment:

Members are assumed to elect a life-only annuity at retirement.

Actuarial Cost Method:

Entry Age Normal, Level Percentage of Pay. The Entry Age Normal actuarial cost method allocates the System's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of pay necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

Health Care Participation Assumptions:

- Active members are assumed to elect health coverage at retirement at the following participation rates.

Service at Retirement	Members participating before 7/1/2003*	Members participating after 7/1/2003
Under 10	50%	100%
10-14	75%	100%
15-19	90%	100%
Over 20	100%	100%

* 100% of members with a duty disability or a duty death (in service) benefit are assumed to elect coverage at retirement.

- Future retirees are assumed to have a similar distribution by plan type as the current retirees.

Medicare Plan	Participation Percentage	Non-Medicare Plan	Participation Percentage
Medical Only ¹	5%	LivingWell Basic	2%
Essential Plan	8%	LivingWell CDHP	35%
Premium Plan	87%	LivingWell PPO	63%

¹Includes Medicare Advantage Mirror Plans

Health Care Participation Assumptions (continued):

- 50% of deferred vested members participating before July 1, 2003 are assumed to elect health coverage at retirement. 100% of deferred vested members participating after July 1, 2003 are assumed to elect health coverage at retirement.
- Deferred vested members receiving insurance benefits from the non-hazardous fund are assumed to begin health coverage at age 55 for members participating before September 1, 2008, at age 60 for members participating on or after September 1, 2008 but before January 1, 2014, and at age 65 for members participating on or after January 1, 2014.
- Deferred vested members receiving insurance benefits from the hazardous fund are assumed to begin health coverage at age 50 for members participating before January 1, 2014 and at age 60 for members participating on or after January 1, 2014.
- 50% of future retirees, with hazardous service, are assumed to elect spouse health care coverage. No dependent coverage is assumed for members who only have non-hazardous service. 100% of spouses with health care coverage are assumed to continue coverage after the member's death.

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.
2. Individual salaries used to project benefits: For salary amounts prior to the valuation date, the salary from the last fiscal year is projected backward with the valuation salary scale assumption. For future salaries, the salary from the last fiscal year is projected forward with one year's salary scale.
3. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported salaries represent amounts paid to members during the year ending on the valuation date.
4. Current active members that terminated employment (for reasons other than retirement, disability, or death) are assumed to commence their retirement benefits at first unreduced retirement eligibility. Members are assumed to elect a refund of member contributions if the value of their account balance exceeds the present value of the deferred benefit. Members participating in the Cash Balance plan are assumed to elect to receive a lump sum of their cash balance account if their account balance exceeds the present value of the deferred benefit and the member is not eligible for insurance benefits at termination.
5. The beneficiaries of current active members that die while active are assumed to commence their survivor benefits at the member's first unreduced retirement eligibility. Beneficiaries are assumed to elect a refund of member contributions if the value of the member's account balance exceeds the present value of the survivor benefit. Beneficiaries of active members that die while in the line of duty are assumed to commence their survivor benefits immediately at the death of the member.

6. There will be no recoveries once disabled.
7. Cash Balance Provisions: The cash balance interest crediting rate while a member is an active employee is assumed to equal 5.9% (based upon the 5.50% assumed investment return) for the Non-Hazardous Fund and 6.75% (based upon the 6.50% assumed investment return) for the Hazardous Fund. The interest crediting rate after a member terminates employment is 4% for all plans.
8. Decrement timing: Decrements of all types are assumed to occur mid-year. Decrement rates are used as described in this report, without adjustment for multiple decrement table effects.
9. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.
10. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
11. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.
12. Current Inactive Population (Retirement Funds): All non-vested members are assumed to take an immediate refund of member contributions. Vested members are assumed to elect an immediate refund of member contributions at the valuation date if the value of their account balance exceeds the present value of their deferred benefit. Non-hazardous members are assumed to retire at age 65. Hazardous members hired prior to September 1, 2008 are assumed to retire at age 55 and hazardous members hired on or after September 1, 2008 are assumed to retire at age 60.
13. The additional \$5 per year of service insurance dollar subsidy effective January 1, 2023 is assumed to be paid in all applicable years.

SECTION V

SUMMARY OF RECOMMENDED ASSUMPTIONS – SPRS

State Police Retirement System

Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods proposed for use in the valuation of the State Police Retirement System beginning with the valuation date June 30, 2023.

Investment return rate:

Assumed annual rate of 5.25% net of investment expenses for the retirement fund.

Assumed annual rate of 6.25% net of investment expenses for the insurance fund.

Price Inflation:

Assumed annual rate of 2.50%

Payroll Growth Assumption (used for amortization of unfunded accrued liabilities):

Assumed annual rate of 0.00%

Rates of Annual Salary Increase:

Assumed rates of annual salary increases are shown below.

Service Years	Annual Rates of Salary Increases		
	Merit & Seniority	Price Inflation & Productivity	Total Increase
0	12.50%	3.55%	16.05%
1	5.00%	3.55%	8.55%
2	4.00%	3.55%	7.55%
3	2.00%	3.55%	5.55%
4	2.00%	3.55%	5.55%
5	2.00%	3.55%	5.55%
6	2.00%	3.55%	5.55%
7	1.00%	3.55%	4.55%
8	1.00%	3.55%	4.55%
9	0.00%	3.55%	3.55%
10 & Over	0.00%	3.55%	3.55%

Retirement rates:

Assumed annual rates of retirement are shown below. Rates are only applicable for members who are eligible for a service retirement.

Service	Members participating Before 9/1/2008 ¹	Members participating on or after 9/1/2008 ²	Members participating after 1/1/2014 ²
20	22.0%		
21	22.0%		
22	22.0%		
23	28.0%		
24	28.0%		
25	28.0%	17.6%	16.0%
26	28.0%	17.6%	16.0%
27	28.0%	17.6%	16.0%
28	44.0%	22.4%	16.0%
29	44.0%	22.4%	16.0%
30	44.0%	22.4%	100.0%
31	58.0%	22.4%	
32	58.0%	22.4%	
33	58.0%	35.2%	
34	58.0%	35.2%	
35	58.0%	35.2%	
36	58.0%	46.4%	
37	58.0%	46.4%	
38	58.0%	46.4%	
39	58.0%	46.4%	
40+	58.0%	46.4%	

¹ The annual rate of service retirement is 100% at age 55.

² The annual rate of service retirement is 100% at age 60.

For members hired after 7/1/2003 and prior to 9/1/2008, the rates shown above are multiplied by 80% if the member is under the age of 55 to reflect the different retiree health insurance benefit.

Disability rates:

An abbreviated table with assumed rates of disability is show below.

Age	Annual Rates of Disability	
	Male	Female
20	0.05%	0.05%
30	0.09%	0.09%
40	0.20%	0.20%
50	0.56%	0.56%
60	1.46%	1.46%

Withdrawal rates (for causes other than disability and retirement):

Assumed annual rates of withdrawal are shown below and include pre-retirement mortality rates as described on the next page.

Service	Annual Rates of Withdrawal
1	15.00%
2	5.30%
3	4.14%
4	3.47%
5	2.98%
6	2.61%
7	2.30%
8	2.05%
9	1.83%
10	1.63%
11	1.45%
12	1.29%
13	1.14%
14	1.01%
15	0.88%
16	0.77%
17	0.66%
18	0.56%
19	0.46%
20	0.37%
21 & Over	0.00%

Mortality Assumption:

Pre-retirement mortality: PUB-2010 Public Safety Mortality, projected with the ultimate rates from the MP-2020 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2022, projected with the ultimate rates from the MP-2020 mortality improvement scale using a base year of 2023.

The following table provides the life expectancy for a non-disabled retiree in future years based on the assumption with full generational projection:

Life Expectancy for an Age 65 Retiree in Years					
Gender	Year of Retirement				
	2025	2030	2035	2040	2045
Male	19.8	20.2	20.6	21.0	21.3
Female	22.4	22.7	23.1	23.4	23.7

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with rates multiplied by 150% for both male and female rates, projected with the ultimate rates from the mortality improvement scale MP-2020 using a base year of 2010.

Marital status:

100% of employees are assumed to be married, with the female spouse 3 years younger than the male spouse.

Line of Duty Disability

70% of disabilities are assumed to occur in the line of duty (10% of which are assumed to be “total and permanent”)

Line of Duty Death

25% of deaths are assumed to occur in the line of duty

Dependent Children:

For members who receive a duty-related death or disability benefit, the member is assumed to be survived by two dependent children, each age 6 with payments for 15 years.

Form of Payment:

Members are assumed to elect a life-only annuity at retirement.

Actuarial Cost Method:

Entry Age Normal, Level Percentage of Pay. The Entry Age Normal actuarial cost method allocates the System's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of pay necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

Health Care Participation Assumptions:

- Active members are assumed to elect health coverage at retirement at the following participation rates.

Service at Retirement	Members participating before 7/1/2003*	Members participating after 7/1/2003
Under 10	100%	100%
10-14	100%	100%
15-19	100%	100%
Over 20	100%	100%

* 100% of members with a duty disability or a duty death (in service) benefit are assumed to elect coverage at retirement.

- Future retirees are assumed to have a similar distribution by plan type as the current retirees.

Medicare Plan	Participation Percentage	Non-Medicare Plan	Participation Percentage
Medical Only ¹	5%	LivingWell Basic	2%
Essential Plan	8%	LivingWell CDHP	35%
Premium Plan	87%	LivingWell PPO	63%

¹ Includes Medicare Advantage Mirror Plans

Health Care Participation Assumptions (continued):

- 100% of deferred vested members participating are assumed to elect health coverage at retirement.
- Deferred vested members are assumed to begin health coverage at age 50 for members participating before January 1, 2014 and at age 60 for members participating on or after January 1, 2014.
- 85% of future retirees, with hazardous service, are assumed to elect spouse health care coverage. 100% of spouses with health care coverage are assumed to continue coverage after the member's death.

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.
2. Individual salaries used to project benefits: For salary amounts prior to the valuation date, the salary from the last fiscal year is projected backward with the valuation salary scale assumption. For future salaries, the salary from the last fiscal year is projected forward with one year's salary scale.
3. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported salaries represent amounts paid to members during the year ending on the valuation date.
4. Current active members that terminated employment (for reasons other than retirement, disability, or death) are assumed to commence their retirement benefits at first unreduced retirement eligibility. Members are assumed to elect a refund of member contributions if the value of their account balance exceeds the present value of the deferred benefit. Members participating in the Cash Balance plan are assumed to elect to receive a lump sum of their cash balance account if their account balance exceeds the present value of the deferred benefit and the member is not eligible for insurance benefits at termination.
5. The beneficiaries of current active members that die while active are assumed to commence their survivor benefits at the member's first unreduced retirement eligibility. Beneficiaries are assumed to elect a refund of member contributions if the value of the member's account balance exceeds the present value of the survivor benefit. Beneficiaries of active members that die while in the line of duty are assumed to commence their survivor benefits immediately at the death of the member.
6. There will be no recoveries once disabled.
7. Cash Balance Provisions: The cash balance interest crediting rate while a member is an active employee is assumed to equal 5.9% (based upon the 5.50% assumed investment return). The interest crediting rate after a member terminates employment is 4%.
8. Cash Balance Credit for Unused Sick Leave (annual and at retirement): It is assumed Tier 3 members will receive an additional 7.5% of pay employer pay credit each year due to the

conversion of unused sick leave after the member attains five years of service. It is also assumed the Tier 3 members will have fund 480 hours of unused sick leave to convert to pay credit at the time of their retirement. It is assumed that the General Assembly will fund this benefit in all future years.

9. Decrement timing: Decrements of all types are assumed to occur mid-year. Decrement rates are used as described in this report, without adjustment for multiple decrement table effects.
10. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.
11. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur
12. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.
13. Current Inactive Population (Retirement Fund): All non-vested members are assumed to take an immediate refund of member contributions. Vested members are assumed to elect an immediate refund of member contributions at the valuation date if the value of their account balance exceeds the present value of their deferred benefit. Members hired prior to September 1, 2008 are assumed to retire at age 55 and members hired on or after September 1, 2008 are assumed to retire at age 60.
14. The additional \$5 per year of service insurance dollar subsidy effective January 1, 2023 is assumed to be paid in all applicable years.

SECTION VI

SUMMARY OF DATA AND EXPERIENCE

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Salary Experiences

Kentucky Public Pensions Authority Kentucky Employees Retirement System (KERS) Non-Hazardous Salary Increase Experience

Years of Service (1)	Current Salary Scale		2014-2022 Actual Experience			Proposed Salary Scale	
	Total (2)	Step Rate/ Promotional (3)	Total (4)	Above Inflation (5)	Step Rate/ Promotional (6)	Total (7)	Step Rate/ Promotional (8)
1	15.30%	12.00%	13.89%	11.21%	11.30%	15.30%	12.00%
2	6.80%	3.50%	5.87%	3.19%	3.27%	6.80%	3.50%
3	6.05%	2.75%	5.35%	2.67%	2.76%	6.05%	2.75%
4	5.80%	2.50%	4.98%	2.30%	2.39%	5.80%	2.50%
5	5.30%	2.00%	4.67%	1.99%	2.08%	5.30%	2.00%
6	4.80%	1.50%	4.18%	1.50%	1.59%	4.80%	1.50%
7	4.55%	1.25%	3.86%	1.17%	1.26%	4.55%	1.25%
8	4.30%	1.00%	3.67%	0.99%	1.08%	4.30%	1.00%
9	4.05%	0.75%	3.68%	1.00%	1.09%	4.05%	0.75%
10	3.80%	0.50%	3.38%	0.70%	0.79%	3.80%	0.50%
11 & Over	3.80%	0.50%	2.59%	-0.09%	0.00%	3.80%	0.50%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.50%
Current Productivity Component	1.00%	Proposed Productivity Component	0.80%
Actual CPI-U Inflation for June 2013 - June 2018	2.68%	Proposed Wage Inflation	3.30%
Apparent Productivity Component	-0.09%		



Salary Experiences

Kentucky Public Pensions Authority Kentucky Employees Retirement System (KERS) Hazardous Salary Increase Experience

Years of Service (1)	Current Salary Scale		2014-2022 Actual Experience			Proposed Salary Scale	
	Total (2)	Step Rate/ Promotional (3)	Total (4)	Above Inflation (5)	Step Rate/ Promotional (6)	Total (7)	Step Rate/ Promotional (8)
1	20.05%	16.50%	21.41%	18.73%	16.54%	20.05%	16.50%
2	7.55%	4.00%	8.31%	5.63%	3.44%	7.55%	4.00%
3	6.55%	3.00%	7.31%	4.63%	2.45%	6.55%	3.00%
4	6.55%	3.00%	7.11%	4.42%	2.24%	6.55%	3.00%
5	5.55%	2.00%	6.48%	3.80%	1.62%	5.55%	2.00%
6	5.05%	1.50%	6.92%	4.24%	2.05%	5.05%	1.50%
7	4.55%	1.00%	5.94%	3.26%	1.08%	4.55%	1.00%
8	4.05%	0.50%	4.96%	2.28%	0.10%	4.05%	0.50%
9	4.05%	0.50%	5.45%	2.77%	0.58%	4.05%	0.50%
10	3.55%	0.00%	5.49%	2.81%	0.63%	3.55%	0.00%
11 & Over	3.55%	0.00%	4.86%	2.18%	0.00%	3.55%	0.00%
Current Inflation Assumption			2.30%	Proposed Inflation Assumption			2.50%
Current Productivity Component			1.25%	Proposed Productivity Component			1.05%
Actual CPI-U Inflation for June 2013 - June 2018			2.68%	Proposed Wage Inflation			3.55%
Apparent Productivity Component			2.18%				



Salary Experiences

Kentucky Public Pensions Authority State Police Retirement System (SPRS) Salary Increase Experience

Years of Service	Current Salary Scale		2014-2022 Actual Experience			Proposed Salary Scale	
	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	16.05%	12.50%	34.10%	31.42%	29.66%	16.05%	12.50%
2	8.55%	5.00%	6.28%	3.60%	1.84%	8.55%	5.00%
3	7.55%	4.00%	7.68%	5.00%	3.24%	7.55%	4.00%
4	5.55%	2.00%	6.43%	3.75%	1.99%	5.55%	2.00%
5	5.55%	2.00%	5.62%	2.94%	1.18%	5.55%	2.00%
6	5.55%	2.00%	4.12%	1.44%	-0.32%	5.55%	2.00%
7	5.55%	2.00%	5.33%	2.65%	0.89%	5.55%	2.00%
8	4.55%	1.00%	4.25%	1.57%	-0.19%	4.55%	1.00%
9	4.55%	1.00%	2.99%	0.31%	-1.45%	4.55%	1.00%
10	3.55%	0.00%	2.88%	0.20%	-1.56%	3.55%	0.00%
11 & Over	3.55%	0.00%	4.44%	1.76%	0.00%	3.55%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.50%
Current Productivity Component	1.25%	Proposed Productivity Component	1.05%
Actual CPI-U Inflation for June 2013 - June 2018	2.68%	Proposed Wage Inflation	3.55%
Apparent Productivity Component	1.76%		



Mortality Experiences

Kentucky Public Pensions Authority Post-Retirement Mortality Experience - Male

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	27	7,034	0.0038	0.32%	0.34%	23	25	116.08%	106.17%
55-59	70	11,349	0.0062	0.48%	0.62%	64	73	109.94%	96.83%
60-64	159	15,704	0.0101	1.06%	1.01%	165	159	96.66%	100.35%
65-69	259	18,509	0.0140	1.30%	1.40%	242	267	106.81%	97.01%
70-74	349	13,647	0.0256	1.83%	2.56%	250	342	139.86%	102.17%
75-79	303	7,450	0.0407	3.27%	4.07%	241	301	125.70%	100.74%
80-84	284	3,980	0.0713	6.25%	7.13%	244	279	116.47%	101.75%
85-89	236	1,762	0.1340	11.40%	12.86%	194	219	121.73%	107.83%
90-94	107	508	0.2111	19.35%	21.62%	93	104	115.01%	102.94%
95-99	26	82	0.3180	27.33%	32.86%	22	25	119.80%	103.44%
100-104	3	8	0.4015	35.06%	45.52%	2	3	121.62%	92.93%
105-109	0	0	0.3333	44.56%	50.00%	0	0	77.97%	67.24%
Total	1,825	80,033				1,541	1,797	118.42%	101.51%

Actual, expected and exposures are in thousands of benefit



Mortality Experiences

Kentucky Public Pensions Authority Post-Retirement Mortality Experience - Female

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
50-54	9	3,646	0.0025	0.23%	0.24%	8	9	109.03%	98.86%
55-59	30	8,524	0.0035	0.29%	0.41%	30	36	100.81%	83.24%
60-64	85	14,145	0.0060	0.73%	0.65%	102	94	82.90%	89.97%
65-69	157	16,655	0.0094	0.90%	1.03%	150	172	104.48%	90.97%
70-74	199	12,512	0.0159	1.20%	1.73%	151	216	131.65%	92.06%
75-79	207	7,227	0.0287	2.15%	3.12%	154	222	134.74%	93.21%
80-84	194	3,778	0.0513	4.24%	5.59%	157	208	123.40%	93.24%
85-89	169	1,864	0.0909	8.00%	10.61%	145	193	116.54%	87.71%
90-94	118	729	0.1619	13.94%	19.23%	97	134	121.35%	88.32%
95-99	38	150	0.2534	21.60%	30.47%	31	43	124.01%	88.44%
100-104	6	15	0.4084	30.98%	44.60%	4	6	142.45%	98.32%
105-109	0	1	0.5820	41.38%	54.50%	0	0	151.72%	110.98%
Total	1,212	69,246				1,030	1,334	117.69%	90.87%

Actual, expected, and exposures are in thousands of benefit.

Mortality Experiences

Kentucky Public Pensions Authority Post-Retirement Mortality Experience - Disabled Male

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
40-44	2	106	0.0198	1.03%	1.04%	1	1	182.91%	181.82%
45-49	5	245	0.0204	1.60%	1.67%	4	4	125.54%	117.90%
50-54	9	423	0.0212	2.05%	2.48%	9	11	102.97%	84.76%
55-59	16	611	0.0254	2.41%	3.11%	15	19	104.51%	81.46%
60-64	31	760	0.0408	2.98%	3.65%	23	28	136.37%	110.93%
65-69	34	682	0.0496	3.83%	4.60%	26	31	129.72%	108.30%
70-74	29	435	0.0662	5.16%	5.98%	22	26	129.12%	111.33%
75-79	23	235	0.0992	7.39%	8.20%	17	19	135.62%	122.06%
80-84	18	116	0.1517	10.88%	11.97%	12	14	142.79%	129.82%
85-89	6	36	0.1727	16.51%	17.91%	6	6	109.81%	100.44%
90-94	2	7	0.2672	23.68%	27.62%	2	2	117.18%	101.51%
95-99	0	1	0.2527	32.81%	39.38%	0	0	81.32%	67.82%
Total	174	3,656				137	161	127.46%	108.27%

Actual, expected, and exposures are in thousands of benefit.

Mortality Experiences

Kentucky Public Pensions Authority Post-Retirement Mortality Experience - Disabled Female

Age	Actual Deaths	Total Exposures	Actual Rate	Assumed Rate		Expected Deaths		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
40-44	0	47	0.0085	1.00%	1.03%	0	1	79.86%	77.22%
45-49	4	151	0.0283	1.43%	1.59%	2	2	196.35%	171.93%
50-54	10	316	0.0301	1.67%	2.16%	5	7	179.87%	138.05%
55-59	14	580	0.0243	1.86%	2.50%	11	15	129.27%	96.85%
60-64	21	775	0.0273	2.19%	2.80%	17	22	124.24%	97.27%
65-69	24	698	0.0342	2.83%	3.36%	20	23	120.84%	101.83%
70-74	23	484	0.0477	4.03%	4.46%	19	22	119.00%	107.33%
75-79	18	300	0.0608	6.11%	6.48%	18	19	100.45%	94.58%
80-84	12	137	0.0905	9.47%	9.99%	13	13	98.97%	93.54%
85-89	6	35	0.1632	13.65%	15.65%	5	5	124.08%	109.42%
90-94	2	5	0.2774	19.51%	22.58%	1	1	150.83%	130.00%
95-99	0	1	0.2777	28.67%	32.83%	0	0	105.26%	92.02%
Total	135	3,529				112	130	120.56%	103.20%

Actual, expected, and exposures are in thousands of benefit.

Termination Experiences

**Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Termination Experience - Service Based**

Service	Actual Terminations	Total Exposures	Actual Rate	Assumed Rate		Expected Terminations		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	563	2,073	0.2714	20.00%	22.00%	416	456	135.27%	123.40%
2	1,492	6,435	0.2319	16.45%	18.10%	1,063	1,164	140.36%	128.18%
3	1,567	7,460	0.2100	13.39%	14.73%	1,005	1,149	155.88%	136.34%
4	1,405	7,868	0.1785	11.61%	12.77%	920	1,051	152.68%	133.65%
5	1,286	8,490	0.1515	10.34%	11.37%	876	1,010	146.82%	127.34%
6	1,255	9,089	0.1380	9.35%	10.29%	838	978	149.73%	128.30%
7	1,309	10,197	0.1283	8.55%	9.41%	859	1,002	152.35%	130.61%
8	1,294	11,003	0.1176	7.87%	8.66%	852	996	151.87%	129.92%
9	1,278	12,055	0.1060	7.28%	8.01%	862	1,009	148.22%	126.62%
10	1,323	12,377	0.1069	6.76%	7.44%	821	962	161.12%	137.51%
11	1,279	12,718	0.1006	6.30%	6.93%	786	921	162.78%	138.92%
12	1,209	13,706	0.0882	5.88%	6.47%	789	927	153.20%	130.40%
13	1,218	14,753	0.0826	5.49%	6.04%	791	931	153.99%	130.83%
14	1,186	15,672	0.0757	5.14%	5.65%	785	926	151.07%	128.07%
15	1,128	16,630	0.0678	4.81%	5.29%	778	920	144.93%	122.56%
16	990	16,436	0.0603	4.51%	4.96%	719	853	137.75%	116.11%
17	928	16,266	0.0571	4.22%	4.64%	663	789	140.01%	117.65%
18	762	15,852	0.0480	3.96%	4.36%	604	722	126.08%	105.48%
19	749	15,963	0.0469	3.70%	4.07%	566	680	132.37%	110.18%
20	605	16,153	0.0375	3.47%	3.82%	535	644	113.18%	94.02%
21	626	15,395	0.0406	3.24%	3.56%	474	573	131.98%	109.18%
22	512	14,596	0.0350	3.02%	3.32%	416	507	122.97%	100.90%
23	349	13,728	0.0254	2.82%	3.10%	363	445	96.13%	78.42%
24	341	13,080	0.0260	2.62%	2.88%	319	394	106.75%	86.43%
25	289	6,229	0.0465	2.43%	2.67%	134	174	216.02%	166.36%
Total	24,941	304,222				17,234	20,183	144.72%	123.57%

Actual, expected, and exposures are in thousands of salary.



Termination Experiences

**Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Hazardous
Termination Experience - Service Based**

Service	Actual Terminations	Total Exposures	Actual Rate	Assumed Rate		Expected Terminations		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	246	535	0.4591	25.00%	32.50%	134	174	183.44%	141.27%
2	546	1,630	0.3353	19.68%	25.58%	322	417	169.69%	131.03%
3	460	1,691	0.2720	15.12%	19.66%	257	332	179.03%	138.58%
4	358	1,616	0.2213	12.45%	16.19%	203	262	176.16%	136.49%
5	291	1,611	0.1804	10.56%	13.73%	170	221	170.98%	131.52%
6	276	1,655	0.1666	9.09%	11.82%	149	196	185.03%	140.66%
7	274	1,701	0.1613	7.89%	10.26%	132	174	207.83%	157.66%
8	190	1,747	0.1087	6.87%	8.93%	118	156	160.96%	121.75%
9	207	1,883	0.1099	5.99%	7.79%	111	147	186.41%	140.76%
10	181	1,883	0.0962	5.22%	6.79%	96	128	188.70%	141.52%
11	143	1,879	0.0763	4.53%	5.89%	83	111	172.74%	129.16%
12	115	1,939	0.0595	3.90%	5.07%	73	98	158.02%	117.71%
13	121	2,022	0.0600	3.33%	4.33%	65	88	186.68%	137.89%
14	156	2,186	0.0713	2.80%	3.64%	58	80	268.70%	194.81%
15	88	2,033	0.0431	2.31%	3.00%	44	61	198.94%	143.49%
16	91	1,770	0.0514	1.86%	2.42%	31	43	293.41%	211.53%
17	84	1,732	0.0487	1.43%	1.86%	23	32	366.85%	263.67%
18	68	1,578	0.0434	1.03%	1.34%	14	21	488.94%	325.96%
19	50	1,497	0.0337	0.66%	0.86%	8	13	629.58%	387.43%
20	17	754	0.0221	0.30%	0.39%	1	3	1668.87%	556.29%
Total	3,963	33,343				2,092	2,757	189.43%	143.74%

Actual, expected, and exposures are in thousands of salary.



Termination Experiences

Kentucky Public Pensions Authority State Police Retirement System (SPRS) Termination Experience - Service Based

Service	Actual Terminations	Total Exposures	Actual Rate	Assumed Rate		Expected Terminations		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	21	114	0.1853	15.00%	15.00%	17	17	124.07%	124.07%
2	37	465	0.0787	4.82%	5.30%	22	25	166.22%	146.27%
3	25	590	0.0415	3.76%	4.14%	22	24	111.45%	102.16%
4	40	704	0.0567	3.15%	3.47%	22	24	181.41%	166.29%
5	39	740	0.0525	2.71%	2.98%	20	22	194.47%	176.79%
6	23	827	0.0283	2.37%	2.61%	19	22	123.12%	106.33%
7	51	948	0.0543	2.09%	2.30%	19	22	270.81%	233.88%
8	36	929	0.0388	1.86%	2.05%	16	19	225.15%	189.60%
9	28	996	0.0284	1.66%	1.83%	16	18	176.61%	156.98%
10	34	1,026	0.0333	1.48%	1.63%	14	17	244.31%	201.20%
11	38	1,164	0.0322	1.32%	1.45%	14	17	268.16%	220.84%
12	57	1,208	0.0469	1.17%	1.29%	13	16	435.70%	354.01%
13	19	1,150	0.0166	1.04%	1.14%	11	13	173.75%	147.02%
14	27	1,330	0.0201	0.92%	1.01%	11	13	243.41%	205.96%
15	11	1,377	0.0082	0.80%	0.88%	9	12	125.89%	94.42%
16	17	1,491	0.0112	0.70%	0.77%	9	11	185.75%	151.98%
17	7	1,504	0.0047	0.60%	0.66%	7	10	102.00%	71.40%
18	10	1,471	0.0068	0.51%	0.56%	6	8	165.97%	124.48%
19	13	1,497	0.0086	0.42%	0.46%	4	7	322.65%	184.37%
20	5	575	0.0093	0.34%	0.37%	1	2	533.25%	266.62%
Total	538	20,106				272	319	197.71%	168.58%

Actual, expected, and exposures are in thousands of salary.



Retirement Experiences

**Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Male**

Age (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ¹ (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
Under 45	101	153	0.66	20%	20%	31	31	326.31%	326.31%
45	42	106	0.40	21%	21%	22	22	191.14%	191.14%
46	83	247	0.33	22%	22%	54	54	152.98%	152.98%
47	144	335	0.43	23%	23%	77	77	186.80%	186.80%
48	140	567	0.25	24%	24%	136	136	102.75%	102.75%
49	178	741	0.24	25%	25%	185	185	96.05%	96.05%
50	271	876	0.31	26%	26%	228	228	119.07%	119.07%
51	324	1,029	0.31	27%	27%	278	278	116.58%	116.58%
52	312	1,133	0.28	28%	28%	317	317	98.46%	98.46%
53	280	1,102	0.25	29%	29%	320	320	87.50%	87.50%
54	305	1,264	0.24	30%	30%	379	379	80.34%	80.34%
55	322	1,358	0.24	30%	30%	407	407	79.23%	79.23%
56	315	1,221	0.26	30%	30%	366	366	86.18%	86.18%
57	229	980	0.23	30%	30%	294	294	77.96%	77.96%
58	262	953	0.27	30%	30%	286	286	91.49%	91.49%
59	295	824	0.36	30%	30%	247	247	119.39%	119.39%
60	166	718	0.23	30%	30%	215	215	77.10%	77.10%
61	202	741	0.27	30%	30%	222	222	90.88%	90.88%
62	235	657	0.36	35%	35%	230	230	102.35%	102.35%
63	178	586	0.30	30%	30%	176	176	100.94%	100.94%
64	120	453	0.27	30%	30%	136	136	88.54%	88.54%
65	382	1,443	0.27	30%	30%	433	433	88.30%	88.30%
66	323	1,173	0.28	30%	30%	352	352	91.68%	91.68%
67	311	904	0.34	30%	30%	271	271	114.71%	114.71%
68	113	594	0.19	30%	30%	178	178	63.33%	63.33%
69	159	594	0.27	30%	30%	178	178	89.53%	89.53%
70	120	452	0.27	30%	30%	136	136	88.35%	88.35%
71	66	344	0.19	30%	30%	103	103	63.60%	63.60%
72	89	295	0.30	30%	30%	88	88	100.75%	100.75%
73	59	208	0.28	30%	30%	62	62	95.30%	95.30%
74	34	140	0.24	30%	30%	42	42	80.15%	80.15%
Total	6,159	22,188				6,449	6,449	95.50%	95.50%
75 & Over	119	445	0.27	100%	100%	445	445	26.71%	26.71%
Total	6,278	22,633				6,894	6,894	91.06%	91.06%

¹ For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.



Retirement Experiences

**Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Female**

Age (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ¹ (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
Under 45	98	108	0.90	33%	33%	36	36	271.12%	271.12%
45	86	174	0.49	33%	33%	57	57	150.15%	150.15%
46	108	302	0.36	33%	33%	100	100	108.10%	108.10%
47	180	486	0.37	33%	33%	160	160	112.23%	112.23%
48	275	680	0.40	33%	33%	225	225	122.06%	122.06%
49	244	824	0.30	33%	33%	272	272	89.67%	89.67%
50	421	1,236	0.34	33%	33%	408	408	103.29%	103.29%
51	377	1,286	0.29	33%	33%	424	424	88.81%	88.81%
52	375	1,349	0.28	33%	33%	445	445	84.23%	84.23%
53	470	1,327	0.35	33%	33%	438	438	107.42%	107.42%
54	386	1,185	0.33	33%	33%	391	391	98.84%	98.84%
55	349	1,117	0.31	33%	33%	368	368	94.91%	94.91%
56	304	1,092	0.28	33%	33%	360	360	84.43%	84.43%
57	309	1,001	0.31	33%	33%	330	330	93.50%	93.50%
58	281	996	0.28	33%	33%	329	329	85.50%	85.50%
59	277	938	0.29	33%	33%	310	310	89.22%	89.22%
60	296	918	0.32	33%	33%	303	303	97.62%	97.62%
61	275	887	0.31	33%	33%	293	293	93.87%	93.87%
62	301	799	0.38	35%	35%	280	280	107.44%	107.44%
63	192	580	0.33	33%	33%	192	192	100.16%	100.16%
64	170	538	0.32	33%	33%	177	177	95.89%	95.89%
65	622	1,904	0.33	33%	33%	628	628	99.03%	99.03%
66	449	1,304	0.34	33%	33%	430	430	104.35%	104.35%
67	300	886	0.34	33%	33%	292	292	102.75%	102.75%
68	129	582	0.22	33%	33%	192	192	67.10%	67.10%
69	107	468	0.23	33%	33%	154	154	69.22%	69.22%
70	112	387	0.29	33%	33%	128	128	87.14%	87.14%
71	64	292	0.22	33%	33%	96	96	66.28%	66.28%
72	56	203	0.28	33%	33%	67	67	83.40%	83.40%
73	45	156	0.29	33%	33%	51	51	88.57%	88.57%
74	36	123	0.29	33%	33%	41	41	87.92%	87.92%
Total	7,691	24,130				7,977	7,977	96.41%	96.41%
75 & Over	68	288	0.24	100%	100%	288	288	23.72%	23.72%
Total	7,759	24,418				8,265	8,265	93.88%	93.88%

1 For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

Actual, expected, and exposures are in thousands of benefit.



Retirement Experiences

**Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Hazardous
Unreduced Retirement Experience - Age Based - Male & Female**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ¹ (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
20	603	1,366	0.44	50%	50%	682	682	88.38%	88.38%
21	344	847	0.41	32%	32%	271	271	126.97%	126.97%
22	147	562	0.26	32%	32%	179	179	82.03%	82.03%
23	163	531	0.31	32%	32%	170	170	96.14%	96.14%
24	104	373	0.28	32%	32%	119	119	86.99%	86.99%
25	109	306	0.36	32%	32%	98	98	111.03%	111.03%
26	91	208	0.44	32%	32%	66	66	138.50%	138.50%
27	66	153	0.43	32%	32%	49	49	134.74%	134.74%
28	69	151	0.46	32%	32%	48	48	144.73%	144.73%
29	66	130	0.51	32%	32%	41	41	159.98%	159.98%
30	37	76	0.49	32%	32%	24	24	154.44%	154.44%
31	13	46	0.27	32%	32%	15	15	84.91%	84.91%
32	0	29	0.00	32%	32%	9	9	0.00%	0.00%
33	13	29	0.44	32%	32%	9	9	140.79%	140.79%
34	0	22	0.00	32%	32%	7	7	0.00%	0.00%
35	3	15	0.22	32%	32%	5	5	68.12%	68.12%
36	3	16	0.22	32%	32%	5	5	69.57%	69.57%
37	13	13	1.00	32%	32%	4	4	332.51%	332.51%
38	0	0	N/A	32%	32%	0	0	N/A	N/A
39	0	0	N/A	32%	32%	0	0	N/A	N/A
40	0	0	N/A	32%	32%	0	0	N/A	N/A
Total	1,845	4,874				1,801	1,801	102.42%	102.42%

¹ For members hired before 09/01/2008, the annual rate of service retirement is 100% at age 65.

¹ For members hired on or after 09/01/2008, the annual rate of service retirement is 100% at age 60.

¹ For member with years of service greater than 5, but less than 20, the rate is 10% for age from 55 to 61 and 35% for age 62 and over.

¹ For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

¹ For members hired after 01/01/2014, the rate is 20% until 30 years of service

Actual, expected, and exposures are in thousands of benefit.



Retirement Experiences

**Kentucky Public Pensions Authority
State Police Retirement System (SPRS)
Unreduced Retirement Experience - Age Based - Male & Female**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ¹ (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
20	120	722	0.17	22%	22%	158	158	75.82%	75.82%
21	135	612	0.22	22%	22%	134	134	100.56%	100.56%
22	124	580	0.21	22%	22%	128	128	96.76%	96.76%
23	143	609	0.24	28%	28%	170	170	84.33%	84.33%
24	184	561	0.33	28%	28%	157	157	117.18%	117.18%
25	104	411	0.25	28%	28%	115	115	90.64%	90.64%
26	132	345	0.38	28%	28%	97	97	136.25%	136.25%
27	62	201	0.31	28%	28%	56	56	111.40%	111.40%
28	32	167	0.19	44%	44%	73	73	44.10%	44.10%
29	51	142	0.36	44%	44%	62	62	82.54%	82.54%
30	22	85	0.26	44%	44%	37	37	59.89%	59.89%
31	0	47	0.00	58%	58%	27	27	0.00%	0.00%
32	0	26	0.00	58%	58%	15	15	0.00%	0.00%
33	9	9	1.00	58%	58%	5	5	189.60%	189.60%
Total	1,120	4,516				1,234	1,234	90.72%	90.72%

¹ For members hired before 09/01/2008, the annual rate of service retirement is 100% at age 55.

¹ For members hired on or after 09/01/2008, the annual rate of service retirement is 100% at age 60.

¹ For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

¹ For members hired after 01/01/2014, the rate is 20% until 30 years of service

Actual, expected, and exposures are in thousands of benefit.



Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Male

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹	Proposed ¹	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55 ²	768	5,527	0.14	12%	12%	663	663	115.88%	115.88%
55	121	2,285	0.05	5%	5%	109	109	110.71%	110.71%
56	148	2,125	0.07	5%	5%	101	101	146.45%	146.45%
57	100	2,005	0.05	5%	5%	95	95	105.52%	105.52%
58	105	1,862	0.06	5%	5%	88	88	118.93%	118.93%
59	92	1,689	0.05	5%	5%	80	80	115.36%	115.36%
60	107	1,692	0.06	5%	5%	80	80	133.33%	133.33%
61	118	1,612	0.07	8%	8%	121	121	97.58%	97.58%
62	255	1,509	0.17	15%	15%	212	212	120.44%	120.44%
63	185	1,317	0.14	15%	15%	185	185	99.76%	99.76%
64	191	1,135	0.17	15%	15%	160	160	119.36%	119.36%
Total	2,190	22,758				1,894	1,894	115.61%	115.61%

1 For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

2 Reflects members eligible for early retirement with 25-26 years of service but prior to reaching age 55

Kentucky Public Pensions Authority
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Female

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹	Proposed ¹	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 55 ²	967	7,505	0.13	14%	14%	1,050	1,050	92.12%	92.12%
55	191	3,513	0.05	5%	5%	169	169	113.20%	113.20%
56	225	3,326	0.07	5%	5%	160	160	140.66%	140.66%
57	179	3,157	0.06	5%	5%	151	151	118.63%	118.63%
58	227	3,115	0.07	5%	5%	149	149	152.06%	152.06%
59	165	3,004	0.05	5%	5%	144	144	114.66%	114.66%
60	238	2,904	0.08	8%	8%	221	221	107.70%	107.70%
61	220	2,697	0.08	9%	9%	230	230	95.45%	95.45%
62	477	2,468	0.19	20%	20%	468	468	101.95%	101.95%
63	295	1,972	0.15	18%	18%	335	335	87.94%	87.94%
64	264	1,666	0.16	16%	16%	251	251	105.28%	105.28%
Total	3,448	35,326				3,328	3,328	103.61%	103.61%

1 For members hired after 09/01/2008 and younger than 65, the rates other than 100% are reduced by 20% to account for a different health insurance benefit.

2 Reflects members eligible for early retirement with 25-26 years of service but prior to reaching age 55

Actual, expected, and exposures are in thousands of benefit.

