

**Kentucky Retirement Systems
CERS Board of Trustees Educational Session
May 14, 2021, 2 p.m. EDT (1 p.m. CDT)
Live Video Conference/Facebook Live**

AGENDA

1. **Call to Order**
2. **Roll Call** Alane Foley
3. **Public Comment**
4. **Actuarial Training** Danny White, GRS
5. **Development of Actuarial Assumptions** Danny White, GRS
6. **Adjourn**



MEMORANDUM

Date: April 20, 2021
To: CERS Board of Trustees
From: Betty A Pendergrass, Chair
Subject: 2020 Actuarial Audit

The following materials in this tab provide the results of a Segal Group, Inc. actuarial audit conducted in 2020 on the June 30, 2019 Actuarial Valuation and the 2014-2018 Actuarial Experience Study. I have also included the 2018 Actuarial Experience Study that was audited by Segal in the next tab. The audit report, the response from GRS, and the experience study are provided for your information and require no action from the CERS Board of Trustees.

We have generally requested this type of audit every five (5) years. In addition, the Actuarial Experience Study is also conducted every five (5) years. Therefore, we will be using these reports until 2023 and 2025 unless we identify a need to update this type of actuarial information earlier than the five-year interval.

If you have any questions about the information in any of these reports, we can discuss during the educational session or when we discuss the actuarial assumptions for the 2021 Annual Actuarial Valuation at our May 19, 2021 Board of Trustees meeting. In addition, the Actuarial Committee can also schedule a special meeting to discuss the background for actuarial projects, if desired.

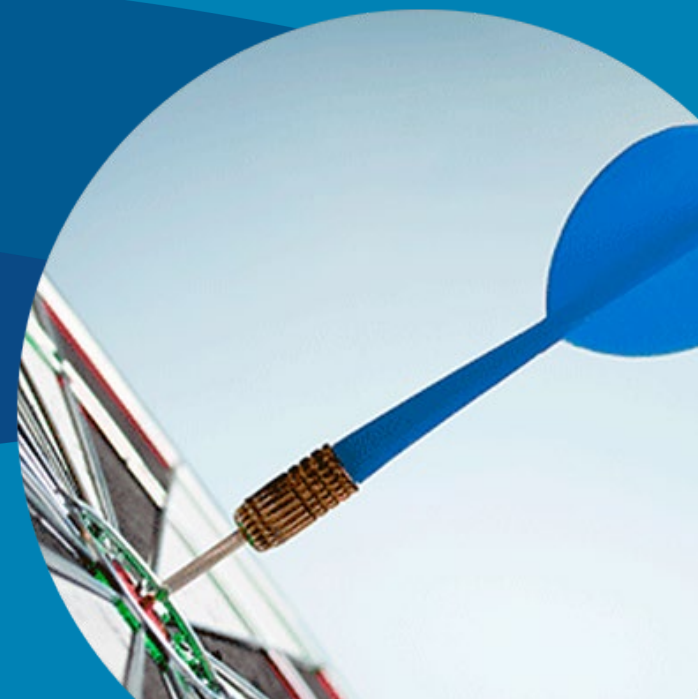


Overview of Actuarial Process

April 27, 2021

Janie Shaw, ASA, EA, MAAA

Danny White, FSA, EA, MAAA



Agenda

- Introductory overview of
 - Retirement Plan Types
 - System Demographics
 - Actuarial Model
 - Actuarial Assumptions
 - Summary of Valuation Process and Results
 - Assets, Liability, and Contribution Rates
- Other Information Provided by the Actuary
 - Legislative Actuarial Analysis Example



Retirement Plan Types

	Defined Benefit (DB)	Hybrid Plan	Defined Contribution (DC)
Retirement Plan Characteristics	Benefit is determined by a specific formula (i.e. CERS Tier 1/2)	Elements of DB and DC plans but generally regulated as a DB plan (i.e. CERS Tier 3)	Set percentage of salary is contributed into an account (i.e. a 401(k) plan)
Investment Risk/Reward	Employers	Employers/Employees	Employees
Longevity Risk/Reward	Employers	Employers/Employees	Employees
Member Benefit Payment Form	Monthly Annuity	Monthly Annuity/ Lump Sum	Lump Sum
Employer Cost Volatility	Can vary from year to year	Generally more stable from year to year	Stable from year to year
Member Benefit Predictability	Very Predictable	Somewhat Predictable	Unpredictable

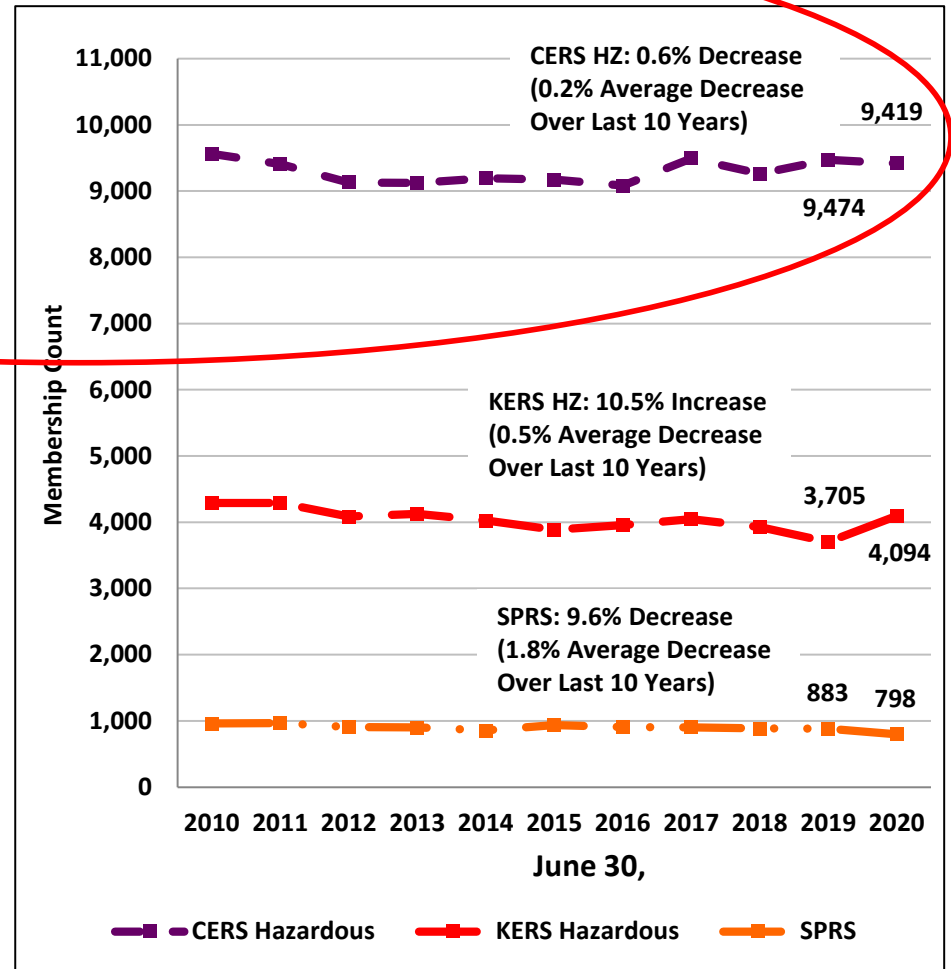
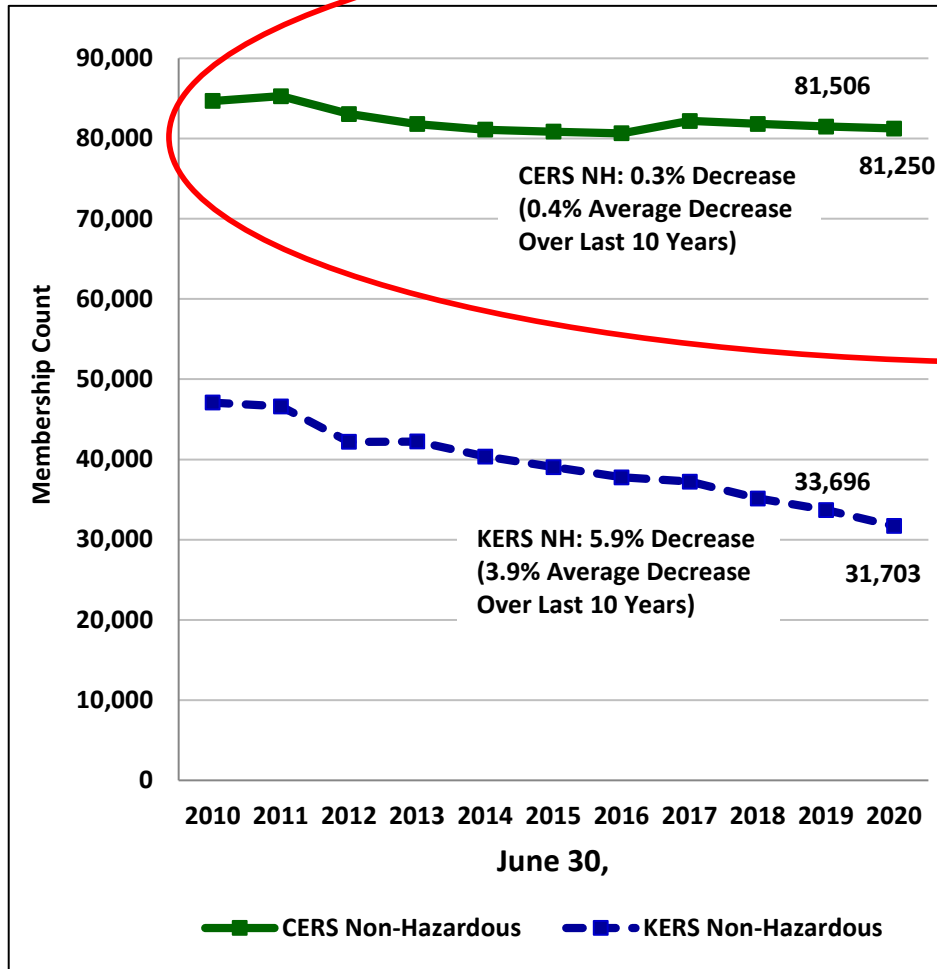


Membership Data at June 30, 2020

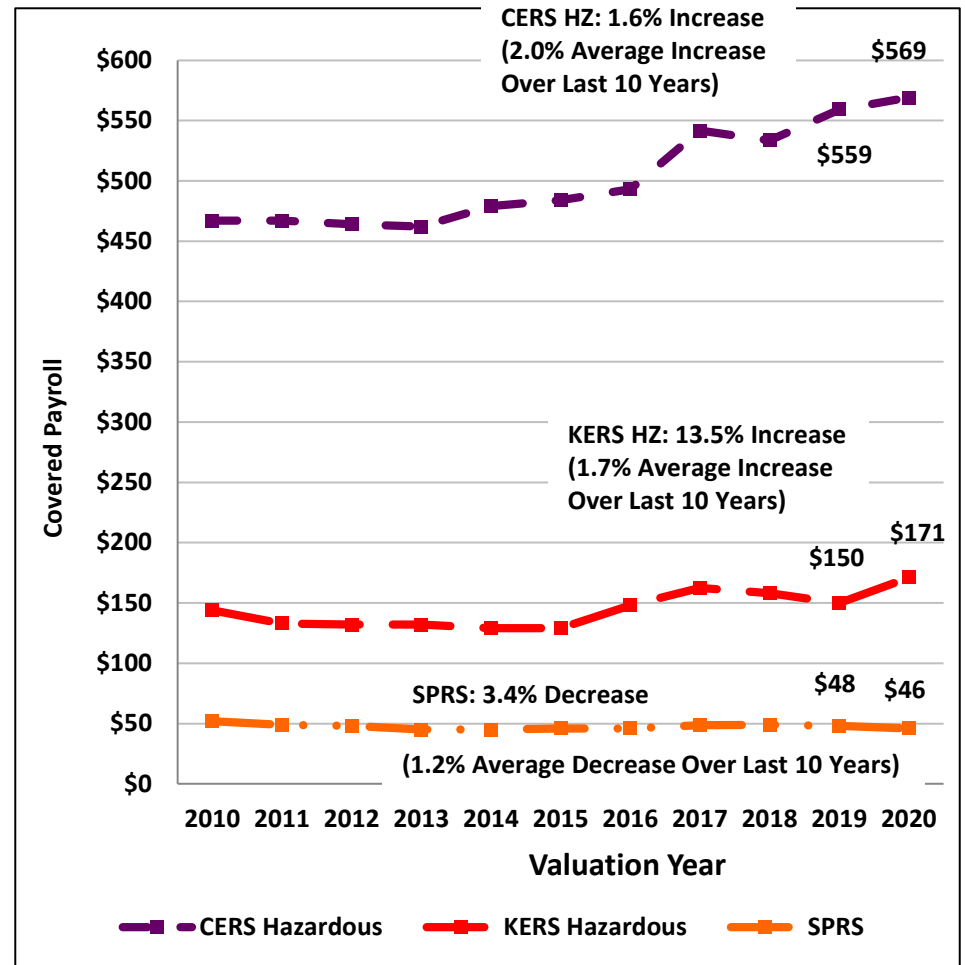
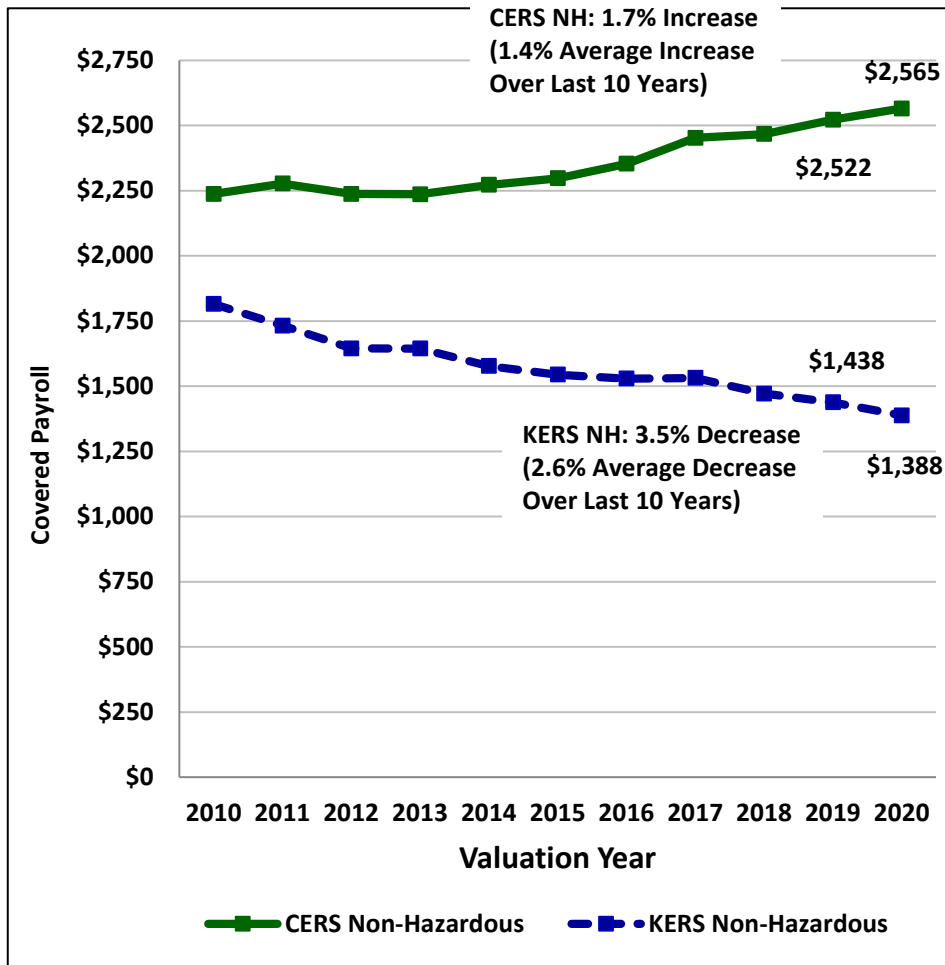
	Non-Hazardous System	Hazardous System
Active – Tier 1	32,531	4,090
Active – Tier 2	13,804	1,911
Active – Tier 3	<u>34,915</u>	<u>3,418</u>
Total Active Headcount	81,250	9,419
Average Annual Salary	\$31,574	\$60,363
Average Age (years)	47.8	38.4
Average Service (years)	9.1	10.0
Vested Inactive Members	50,599	1,767
Average Annual Deferred Benefits	\$1,580	\$4,325
Nonvested Inactive Members	45,093	1,823
Retirees and Beneficiaries	65,414	10,452
Average Annual Benefits	\$11,671	\$26,291



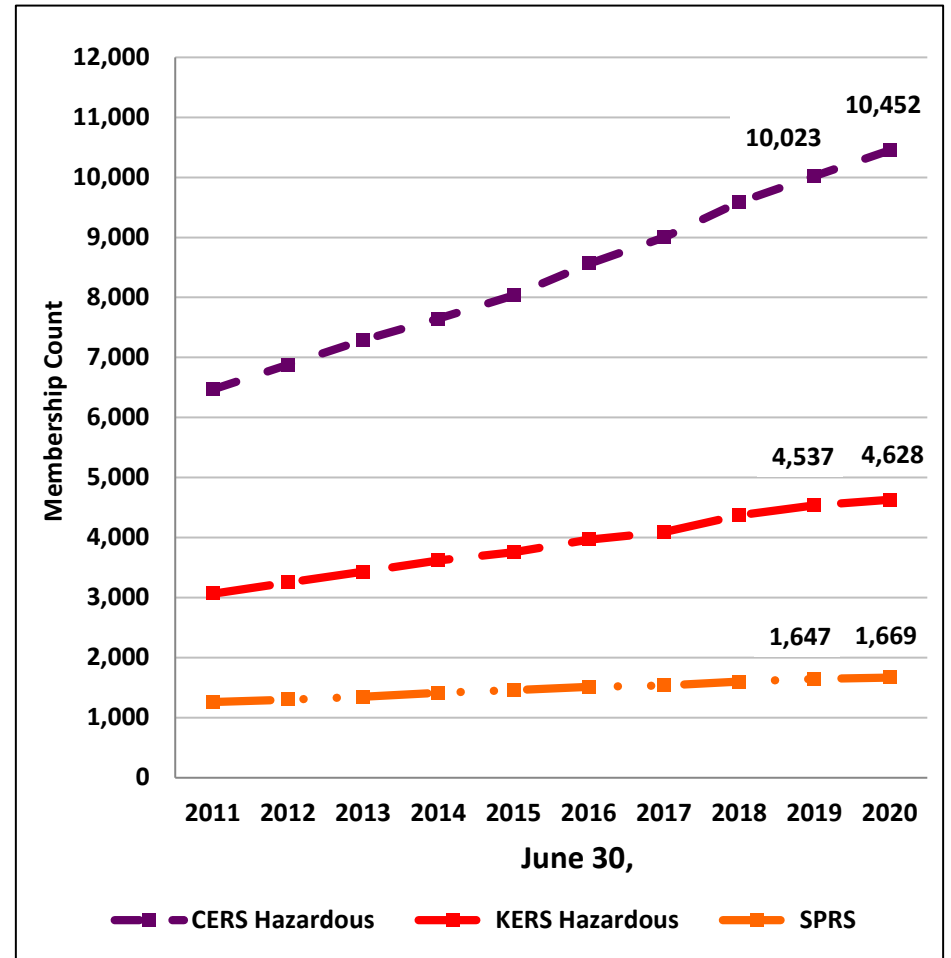
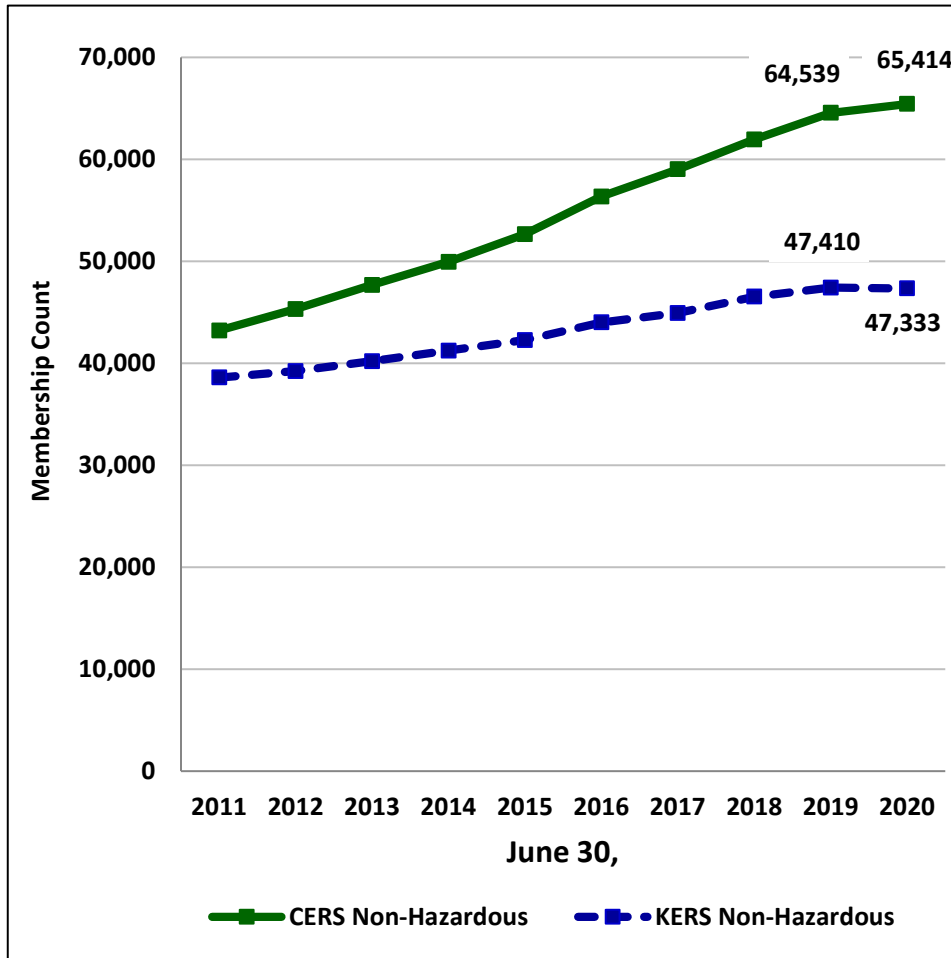
Active Membership Count



Covered Payroll (\$ in Millions)



Retired Membership Count





Actuarial Model - Illustration

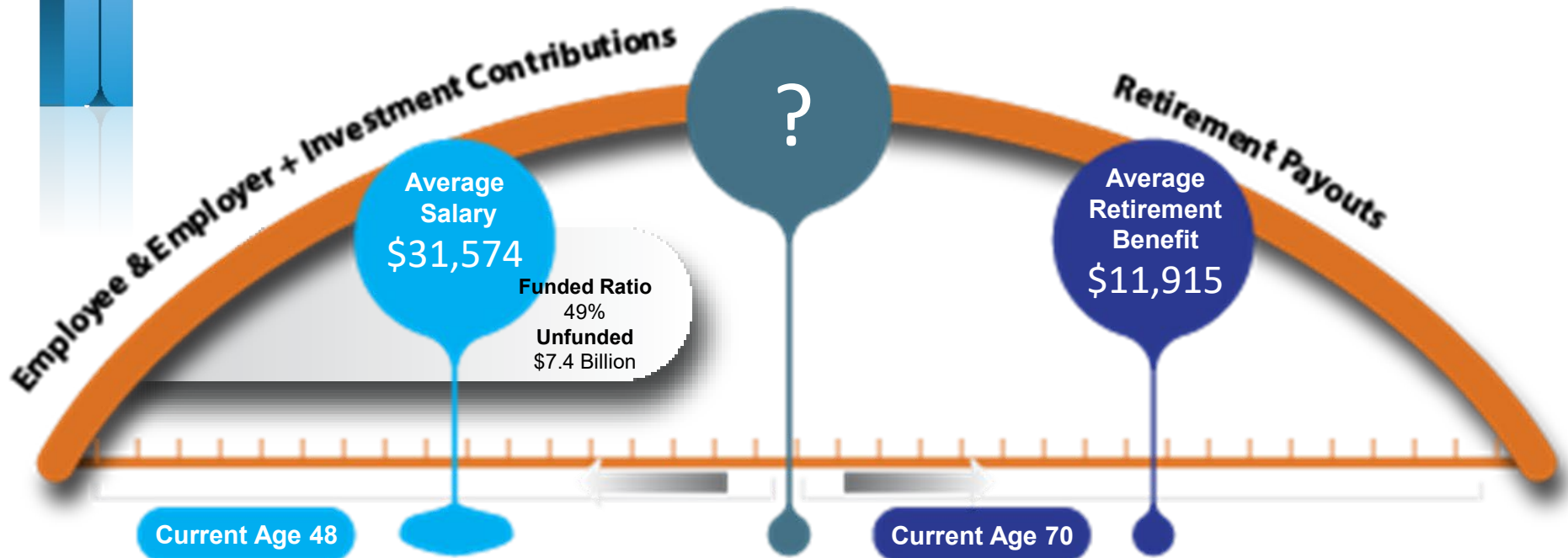


KNOWN at valuation date

1. Age
2. Salary
3. Gender
4. Service to date
5. Occupation

ASSUMED at valuation date

1. Future salary increases
2. Retirement date(s)
3. Death rates before and after retirement
4. Disability rates; other termination rates
5. Investment return (discount rate) = 6.25%



Average Age at Date of Hire
(Age 39)

Total Active
81,250

Average Age at Retirement
(Age 61)

Total Retired
55,440

Average Age of Death
(Age 80)

Actuarial Assumptions

Economic Assumptions

- Investment return assumption
 - 6.25% for both Systems
- Payroll growth rate
 - 2.00% for both Systems
- Salary increases for individuals
 - Service based assumption that includes increases due to promotions and job changes
 - Assumed annual increases after the first year are as follows:
 - Non-Hazardous: 7.30% to 3.30%
 - Hazardous: 7.55% to 3.55%

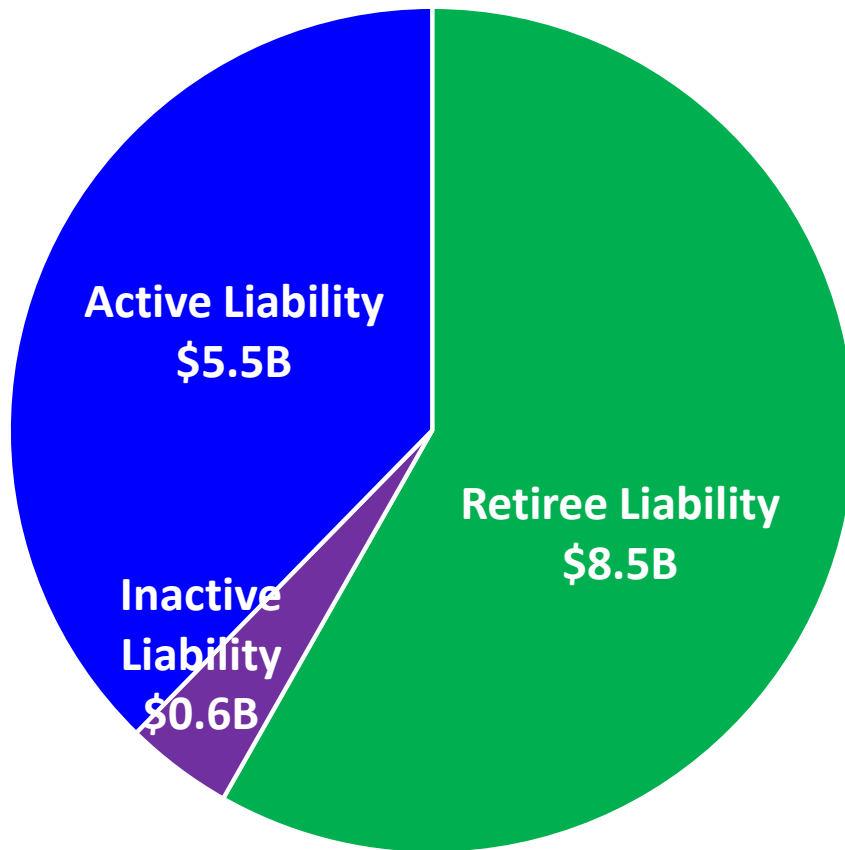
Demographic Assumptions

- Mortality Rates
- Retirement Rates
- Withdrawal Rates
- Disability Rates
- Various other assumptions for both pension and insurance plans

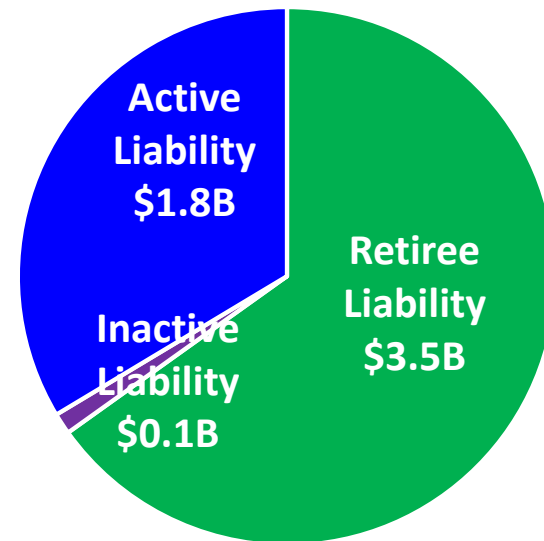


Actuarial Accrued Liability at June 30, 2020

Non-Hazardous Pension Fund
Total Accrued Liability = \$14.6B



Hazardous Pension Fund
Total Accrued Liability = \$5.4B



Insurance Funds Accrued Liability
CERS Non-Hazardous = \$3.4B
CERS Hazardous = \$1.7B

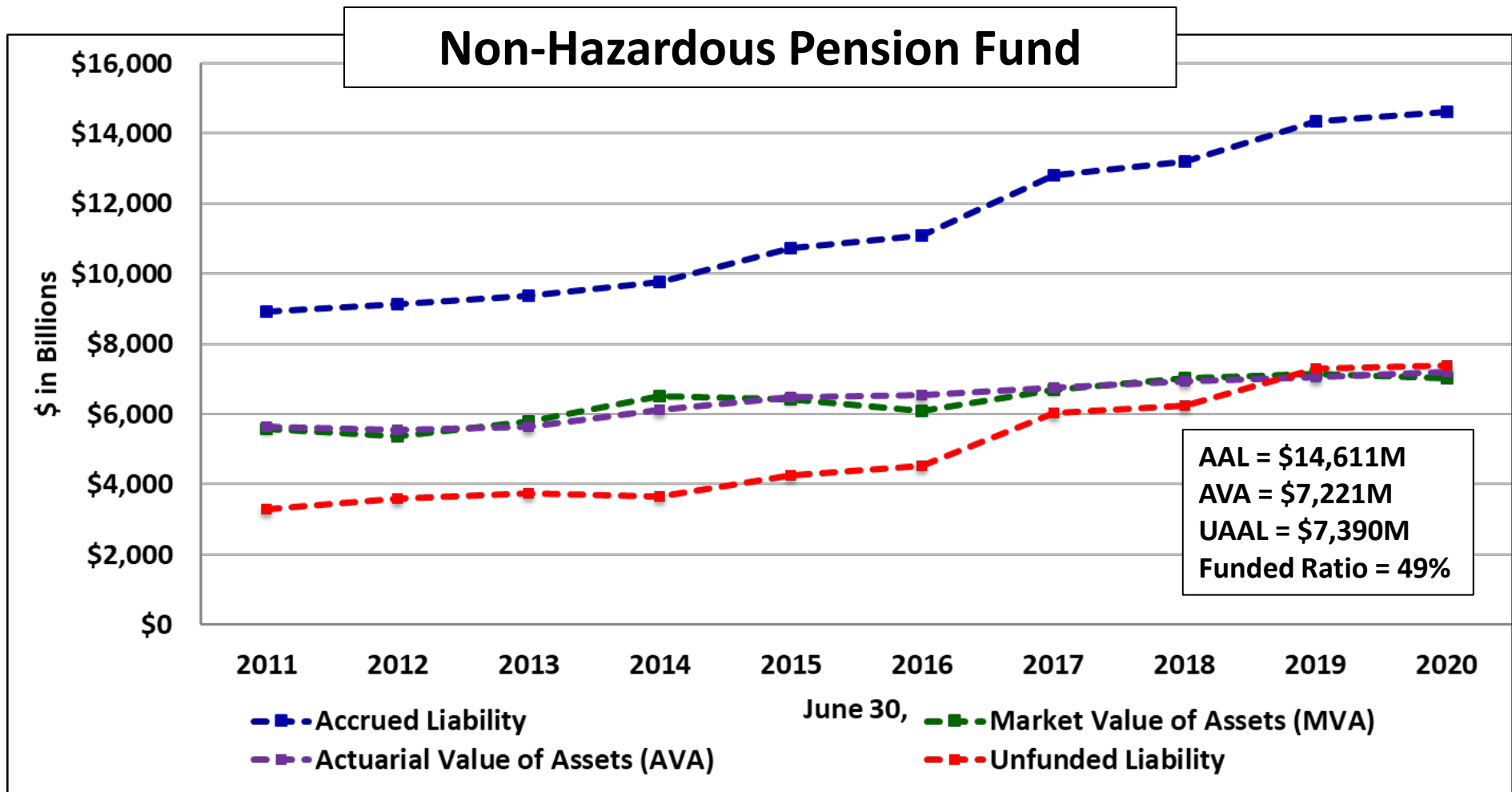


Actuarial Value of Assets

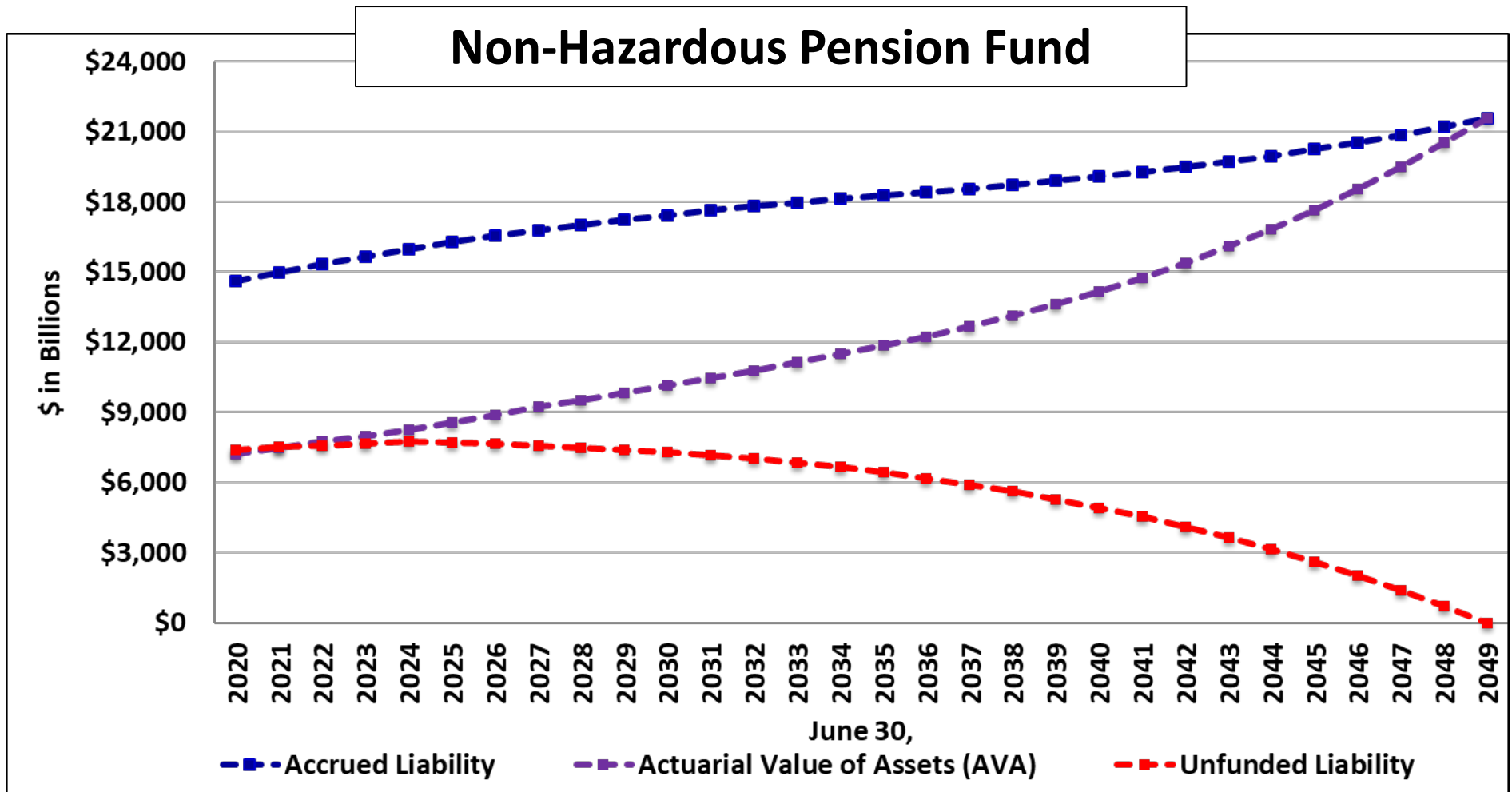
- Market value of assets are used in determining the accounting information (GASB Statements)
- Market value of assets can be volatile, which could cause volatility in the contribution rate
- For purposes of determining the contribution rate, investment gains/losses are recognized or “smoothed” over a five-year period
 - Referred to as the “Actuarial Value of Assets”



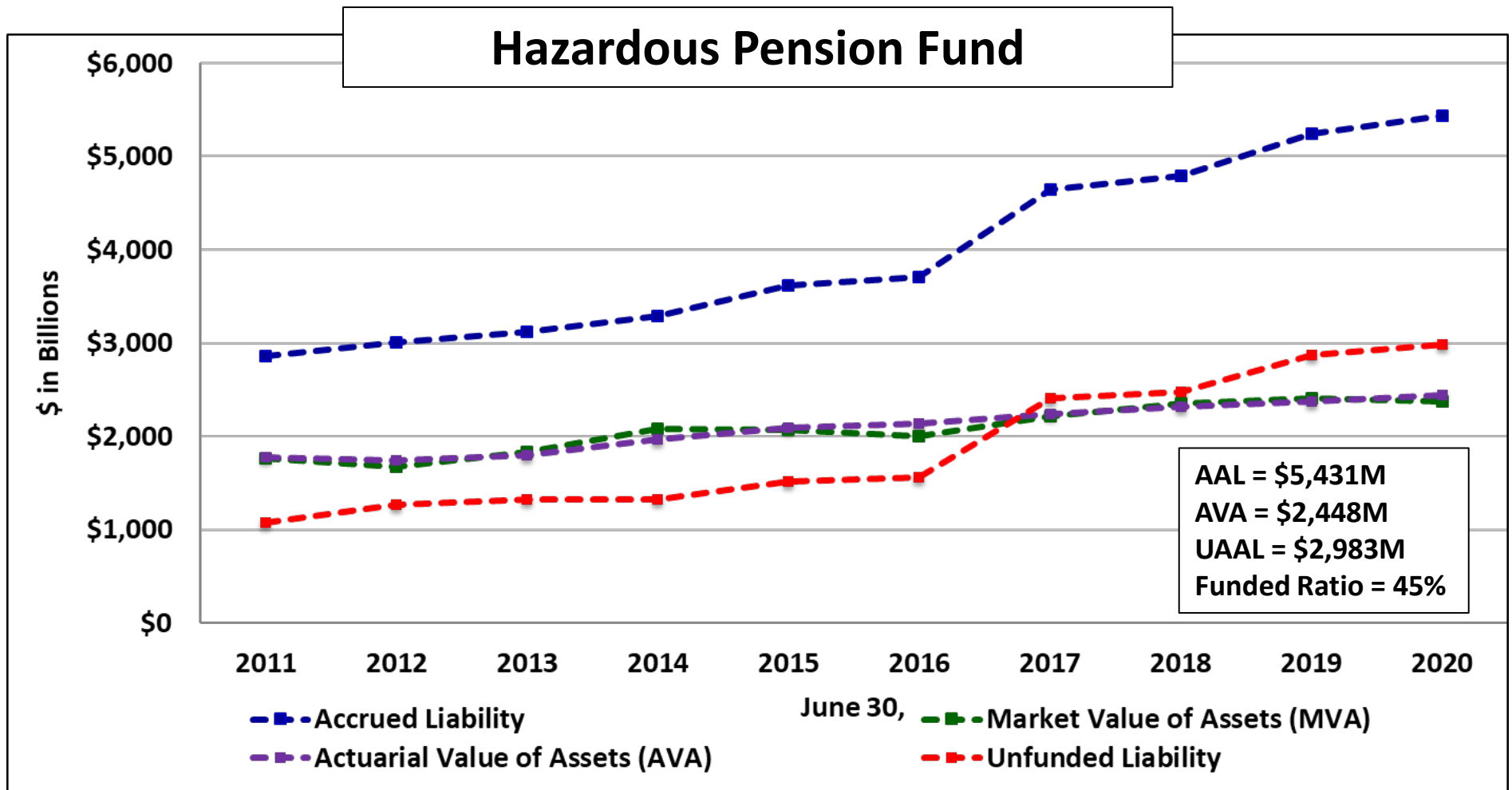
Accrued Liability and Assets



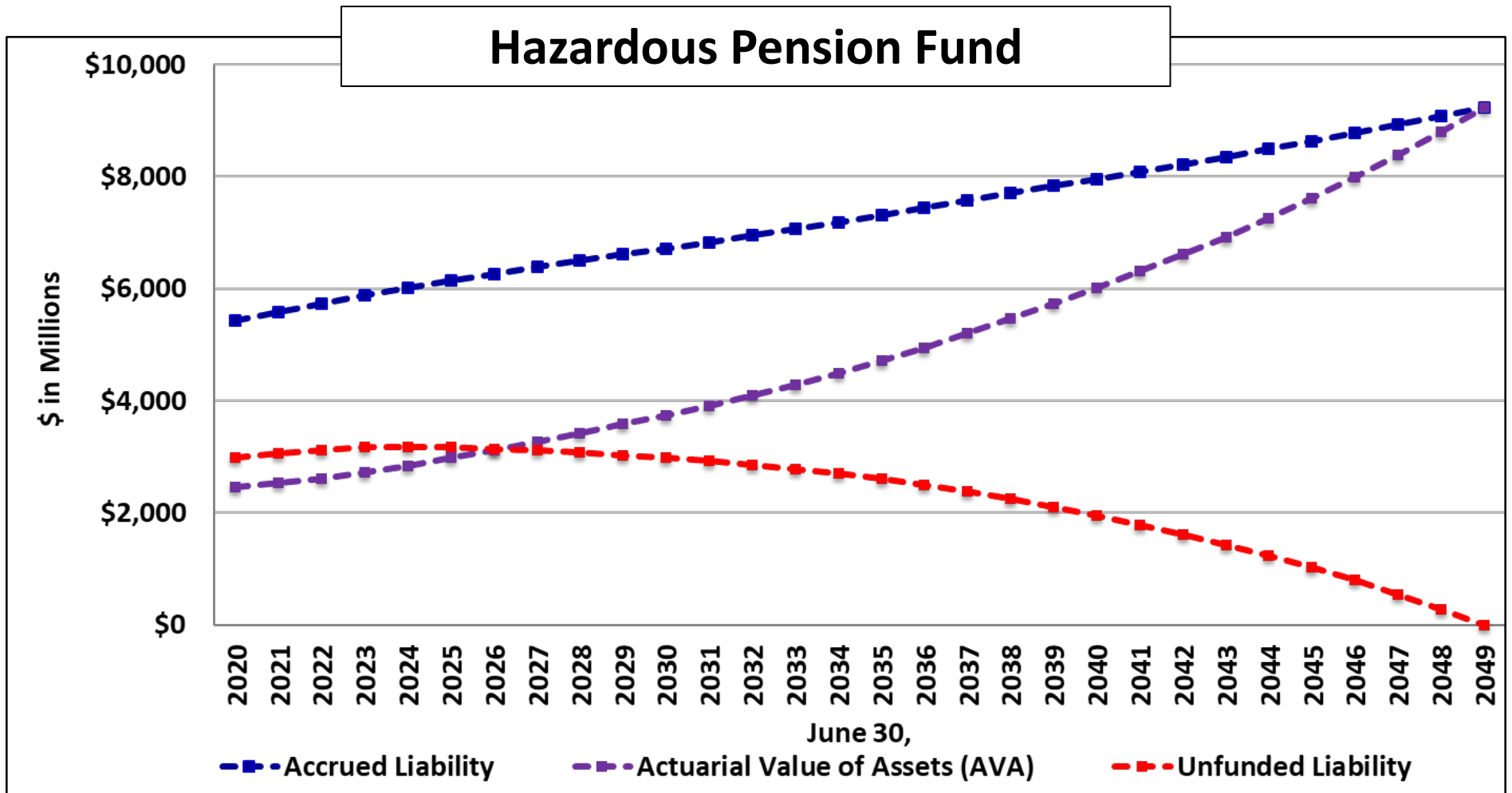
Accrued Liability and Assets – Projection



Accrued Liability and Assets



Accrued Liability and Assets – Projection



Actuarially Determined Contribution Rate

- Two components to a contribution rate:
 - Normal cost
 - Finance the benefits earned in the current year
 - Offset by employee contributions
 - 5% of pay for non-hazardous funds
 - 8% of pay for hazardous funds
 - Amortization cost
 - Finance the unfunded actuarial accrued liability



Amortization Cost

- Amortization method is based on a funding policy
- Most parameters are established in statute
- Length of amortization period
 - Unfunded liability as of June 30, 2019 amortized over a closed 30-year period
 - Unfunded gains/losses incurring each subsequent year are amortized over a closed 20-year period
- Amortization payments assumed to increase to remain level as a percentage of covered payroll
 - Board establishes the payroll growth assumption
 - Current assumption is 2.00% annual payroll growth



Development of the Actuarially Determined Contribution Rate (ADEC)

Non-Hazardous Pension Fund		
(\$millions)	2019	2020
Actuarial Accrued Liability (AAL)	\$14,356	\$14,611
Actuarial Value of Assets (AVA)	<u>7,050</u>	<u>7,221</u>
Unfunded AAL	\$7,307	\$7,390
Funded Ratio	49.1%	49.4%
Amortization Payments		
June 30, 2019 Base	\$442	\$451
June 30, 2020 Base	<u>N/A</u>	<u>5</u>
Total Amortization Cost	\$442	\$456
Projected Salary for FYE 2022	\$2,572	\$2,617
Amortization as a % of Salary	17.18%	17.42%

Unfunded AAL for CERS funds expected to increase for a few more years due to contribution phase-in and contribution backloading (currently just paying interest on UAAL)



Development of the Actuarially Determined Contribution Rate (ADEC)

Non-Hazardous Pension Fund		
(\$millions)	2019	2020
Actuarial Accrued Liability (AAL)	\$14,356	\$14,611
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Unfunded AAL	\$7,307	\$7,390
Funded Ratio	49.1%	49.4%
Amortization Payments		
June 30, 2019 Valuation	\$442	\$451
June 30, 2020 Valuation	<u>N/A</u>	<u>5</u>
Total	\$442	\$456
Projected Salary for FYE 2022	\$2,572	\$2,617
Amortization as a % of Salary	17.18%	17.42%

2019 UAAL was amortized over a closed 30-year period. Payments increase 2% annually and will end in FYE 2049

After 2019, new gains/losses are amortized over new closed 20-year periods



Development of the Actuarially Determined Contribution Rate (ADEC)

Non-Hazardous Pension Fund		
(\$millions)	2019	2020
Amortization Payments		
June 30, 2019 Valuation	\$442	\$451
June 30, 2020 Valuation	<u>N/A</u>	<u>5</u>
Total	\$442	\$456
Projected Salary for FYE 2022	\$2,572	\$2,617
Amortization as a % of Salary	17.18%	17.42%
Total Normal Cost Rate	10.77%	10.59%
Member Rate	<u>(5.00%)</u>	<u>(5.00%)</u>
Employer Normal Cost Rate	5.77%	5.59%
Administrative Expenses	0.86%	0.87%
Amortization Cost	<u>17.18%</u>	<u>17.42%</u>
Total Actuarially Determined Rate	23.81%	23.88%

Normal cost rate expected to decrease each year as Tier 1 and Tier 2 members are replaced with Tier 3 members

ADEC calculated in the June 30, 2020 valuation effective July 1, 2021 through June 30, 2022

Funding Results (\$ in millions)

Item	Non-Hazardous System				Hazardous System			
	Pension		Insurance		Pension		Insurance	
	2019*	2020	2019*	2020	2019*	2020	2019*	2020
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Actuarial Accrued Liability (AAL)	\$14,356	\$14,611	\$3,568	\$3,392	\$5,245	\$5,431	\$1,733	\$1,741
Actuarial Value of Assets	<u>7,050</u>	<u>7,221</u>	<u>2,523</u>	<u>2,661</u>	<u>2,375</u>	<u>2,448</u>	<u>1,314</u>	<u>1,362</u>
Unfunded AAL	\$7,307	\$7,390	\$1,045	\$731	\$2,870	\$2,983	\$419	\$379
Funded Ratio	49.1%	49.4%	70.7%	78.5%	45.3%	45.1%	75.8%	78.2%
Total Normal Cost Rate	10.77%	10.59%	3.40%	3.17%	19.05%	18.65%	5.84%	5.33%
Member Rate	<u>(5.00%)</u>	<u>(5.00%)</u>	<u>(0.49%)</u>	<u>(0.52%)</u>	<u>(8.00%)</u>	<u>(8.00%)</u>	<u>(0.46%)</u>	<u>(0.51%)</u>
Employer Normal Cost Rate	5.77%	5.59%	2.91%	2.65%	11.05%	10.65%	5.38%	4.82%
Administrative Expenses	0.86%	0.87%	0.04%	0.04%	0.31%	0.35%	0.08%	0.08%
Amortization Cost	<u>17.18%</u>	<u>17.42%</u>	<u>2.48%</u>	<u>1.48%</u>	<u>30.66%</u>	<u>32.23%</u>	<u>4.40%</u>	<u>3.83%</u>
Total Actuarially Determined Rate	23.81%	23.88%	5.43%	4.17%	42.02%	43.23%	9.86%	8.73%



* after reflection of SB 249

Phase-In Provisions

Valuation Year	Fiscal Year Ending	Non-Hazardous System		Hazardous System	
		ADEC	Contribution Budgeted	ADEC	Contribution Budgeted
(1)	(2)	(3)	(4)	(5)	(6)
2016	2018	19.18%	19.18%	31.55%	31.55%
2017	2019	28.05% ¹	21.48% ³	47.86% ¹	35.34% ³
2018	2020	27.28%	24.06% ³	46.50%	39.58% ³
2019	2021	29.24% ²	24.06% ⁴	51.88% ²	39.58% ⁴
2020	2022	28.05%	26.95% ³	51.96%	44.33% ³

¹ Investment return assumption reduced from 7.50% to 6.25%

² New assumptions adopted after Experience Study. Impact was partially offset by amortization period reset to 30 years.

³ HB 362 passed in 2018, which capped increases in the CERS contribution rate at 12% a year.

⁴ SB 249 passed in 2020, which froze the CERS contribution rate for one year.

Employer Contribution Rates

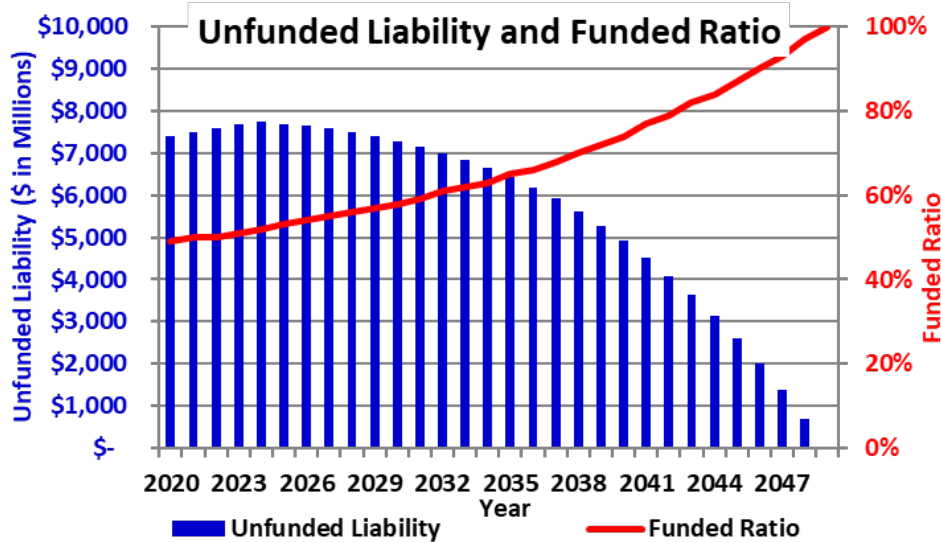
Fund (1)	Actuarially Determined Rates 2020 Valuation			FYE 2021 Certified Rates ¹ (8)	FYE 2022 Certified Rates ¹ (9)
	Pension (5)	Insurance (6)	Combined (7)		
CERS Non-Hazardous	23.88%	4.17%	28.05%	24.06%	26.95%
CERS Hazardous	43.23%	8.73%	51.96%	39.58%	44.33%

¹ Contribution rates that employers actually contribute (after phase-in provisions are applied).

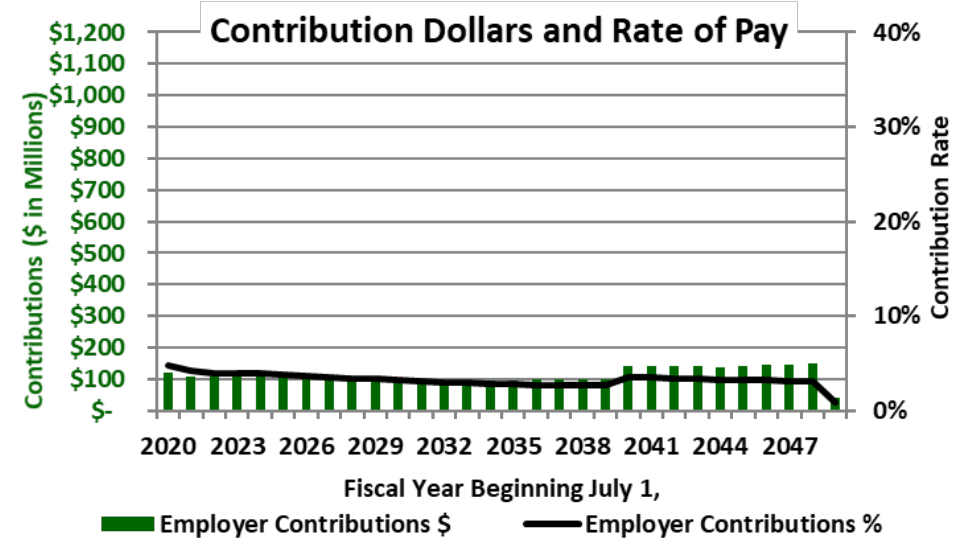
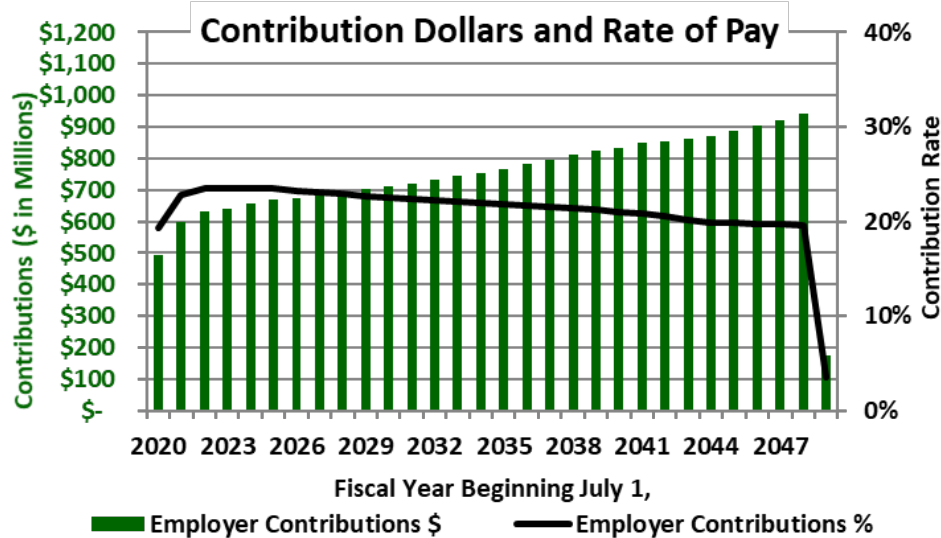
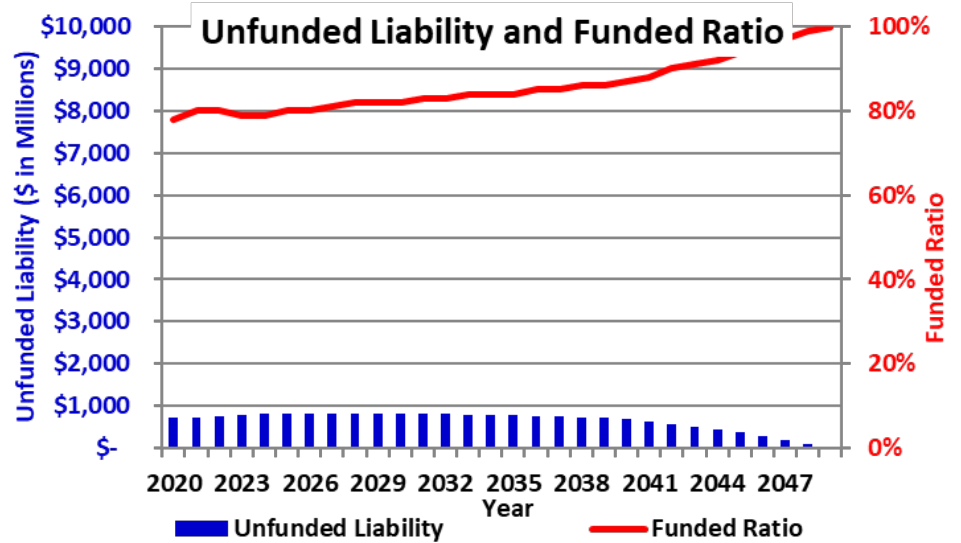


Non-Hazardous Plan Projection

Pension

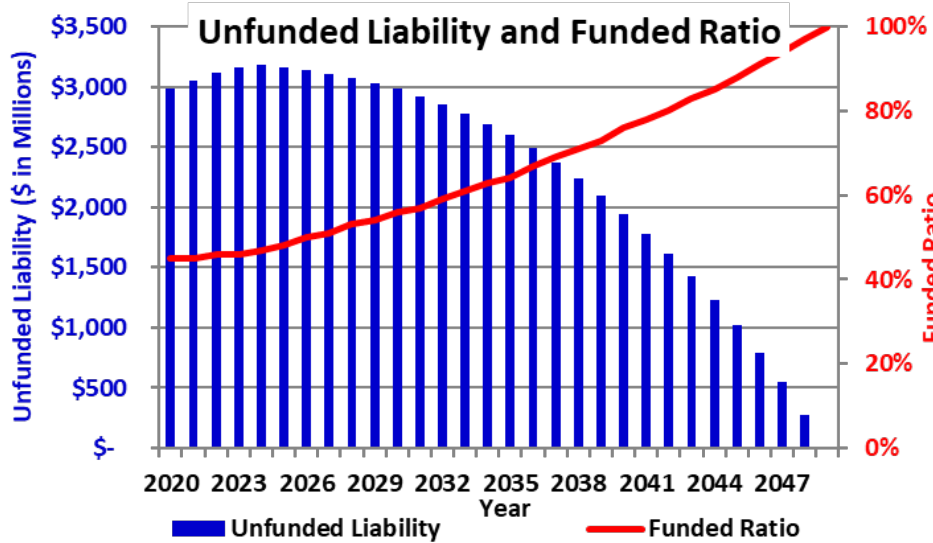


Insurance

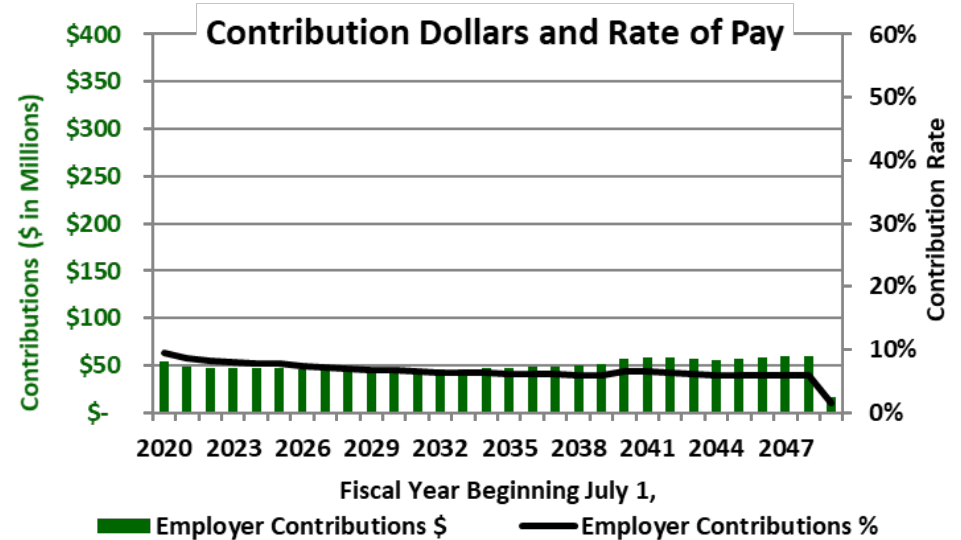
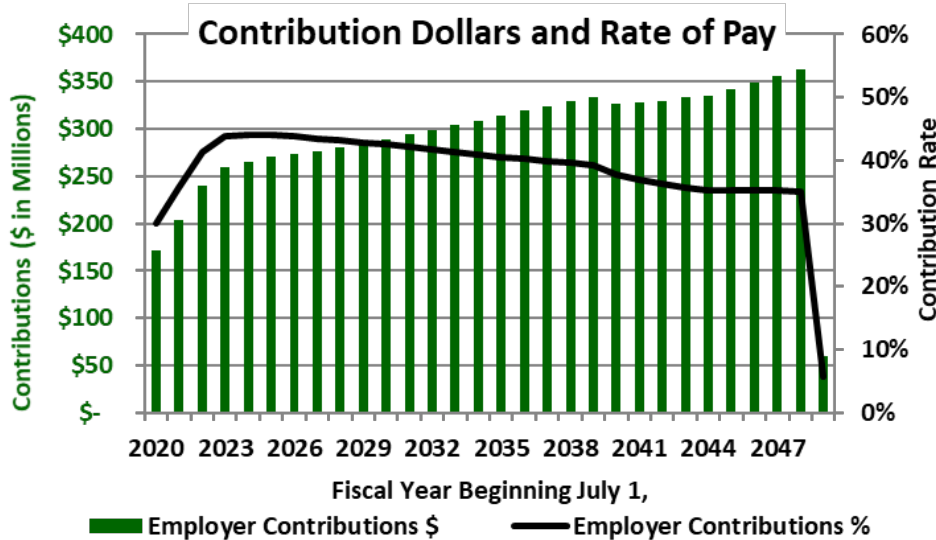
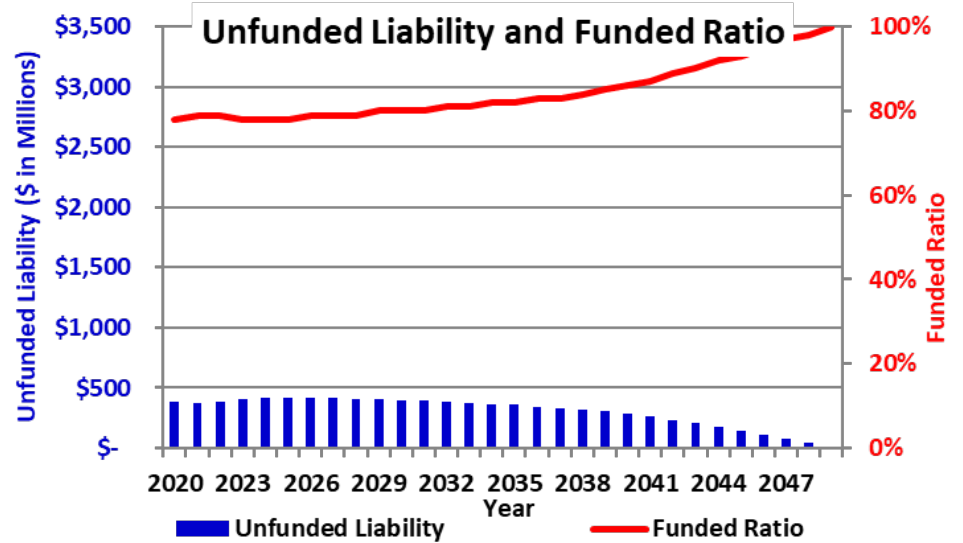


Hazardous Plan Projection

Pension



Insurance



Other Information Provided by the Actuary

- Accounting Reports (GASB Reports)
- Funding Projections and Risk Analysis
- Actuarial Analysis of Proposed Legislation
- Actuarial Assumption Review
 - Demographic assumptions reviewed in detail every five years (next experience study presented in 2024)
 - Economic assumptions reviewed on a more periodic basis
- Ad hoc assistance to the System
 - Uncommon benefit administration items
 - Assistance in responding to certain employer questions



Disclaimers

- This presentation is intended to be used in conjunction with the actuarial valuation as of June 30, 2020. This presentation should not be relied on for any purpose other than the purpose described in the valuation report.
- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- Readers are cautioned to examine original source materials and to consult with subject matter experts before making decisions related to the subject matter of this presentation.





March 1, 2018

Mr. David Eager
Interim Executive Director
Kentucky Retirement Systems
1260 Louisville Road
Frankfort, KY 40601

Re: Actuarial Analysis of Proposed Pension Reform Legislation HB 406 (BR 1687) and its Financial Impact on CERS Non-Hazardous and Hazardous Systems

Dear Mr. Eager:

We have reviewed and analyzed the summary of changes in the proposed legislation HB 406 (BR 1687). The purpose of this letter is to communicate to the fiscal analysis of this proposed legislation on the retirement and insurance funds maintained by the Kentucky Retirement System (KRS) as it applies to the County Employees Retirement System (CERS).

Principal Provisions of Proposed Legislation

In summary, the proposed legislation defines the employer contribution rates for fiscal years 2018/2019 through 2022/2023 for the CERS Non-Hazardous and Hazardous funds such that the total employer contributions (the sum of pension and insurance contributions) as a dollar amount are not to increase by more than 10% from the prior fiscal year. Given the magnitude of the currently scheduled increase in the contribution rates for the participating employers in CERS from FY 2017/2018 to FY 2018/2019, legislation like this provides those participating employers increased ability to budget for the increased contribution requirements to KRS.

Summary of Cost Impact

Section 1 includes exhibits that show a comparison of the fiscal impact of the proposed legislation to the current plan over the next 35 years. Specifically, these exhibits show the projected impact on the: (1) unfunded actuarial accrued liability, (2) funded ratio, (3) total employer contribution dollars, and (4) projected composite employer contribution rates, for each of the funds (retirement and health insurance). Section 2 provides additional detail regarding each projection under the current plan and Section 3 provides similar information under the proposed legislation.

Mr. David Eager
March 1, 2018
Page 2

The actuarial valuation (and these calculations) for CERS includes a 2.00% payroll growth assumption, meaning that over a long time period the covered payroll is expected to increase at the rate of 2.00% per year. Since the System collects employers contributions as a percentage of covered payroll, the dollar amount of the employer contributions is expected to increase by 2.00% per year even if the contribution rate, as a percentage of payroll remains unchanged from the prior year.

Therefore, the maximum increase in contribution rates during the phase-in period will be 8.00% each year (which is equal to the 10% increase in dollar contributions divided by the 2.00% payroll growth assumption).

Note, actuarial assumptions are long-term assumptions, and may not year-to-year variations. As a result, if the actual compensation increases by more (or less) than the 2.00% assumption from the prior year, then the actual employer contributions as a dollar amount will increase by more (or less) than the 10% maximum dollar amount change prescribed under the proposed legislation. However, there is no practical mechanism for KRS to prevent the dollar amount of the contributions exceeding the 10% limit.

Additionally, the phase-in of employer contributions was applied determining the contribution rate applicable to all the participating employers in the system. Annual changes in compensation (and, therefore, changes in contributions as dollar amounts) for individual employers may vary significantly from year to year and this limit does not apply on an individual employer basis.

Basis of Calculations

GRS based the calculations and analysis in this letter on the member and financial data provided by KRS and used to perform the actuarial valuation as of June 30, 2017. Except where noted otherwise, the projections assume no actuarial gains or losses will occur in the future, and that members will terminate, retire, become disabled, or die as predicted by the actuarial assumptions documented in the June 30, 2017 actuarial valuation report. Except where noted in this letter, our calculations are further based on the plan provisions effective for the June 30, 2017 actuarial valuation. In the event that any other legislation with a fiscal impact on the applicable plans is passed in conjunction with this proposed legislation, results could vary significantly.

These projections also do not reflect the actual investment experience of the retirement system after the measurement date of June 30, 2017. The projections assume that the participating employers in each Retirement System will maintain the current workforce in each future year and that as current active members terminate or retire from a covered position in the Retirement System, the employer would replace them with a new employee.

Our calculations are based upon assumptions regarding future events, which may or may not materialize. Depending on actual plan experience, actual results could deviate significantly from our projections.



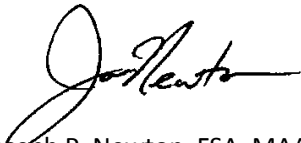
Mr. David Eager
March 1, 2018
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General Comments

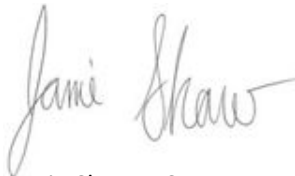
We are not attorneys, and we cannot provide a legal opinion regarding the changes in this proposed legislation. Nothing in this letter should be construed as providing legal, investment or tax advice. It may be prudent to consult with the Retirement System's counsel before enacting any such changes. Finally, no statement in this letter is intended to be interpreted as a recommendation in favor of or in opposition to the changes studied herein.

Mr. White and Mr. Newton are Enrolled Actuaries. All the of the undersigned are also members of the American Academy of Actuaries and we meet all of the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. In addition, all of the undersigned are experienced in performing valuations for large public retirement systems. If you have any questions, or require any additional or clarifying information, please do not hesitate to contact us.

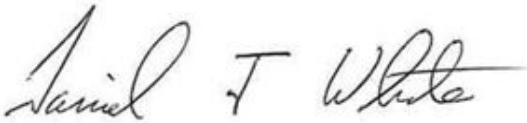
Sincerely,



Joseph P. Newton, FSA, MAAA, EA
Senior Consultant



Janie Shaw, ASA, MAAA
Consultant



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

K:\3505\2018\Leg\2018-02-21.2 HB 406 (CERS Phase-In)\Analysis_KRS_HB406.docx

Enclosures

Section 1. Comparison of Fiscal Impact

Section 2. Projected Cost of the Retirement and Insurance – Current Plan

Section 3. Projected Cost of the Retirement and Insurance – Proposed Legislation



Section 1.
Comparison of Fiscal Impact
Current Plan vs. Proposed Changes

Kentucky Retirement Systems
Exhibit 1-1
CERS Non-Hazardous Retirement Fund
Comparison of Fiscal Impact
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contribution			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2017	\$ 6,039	\$ 6,039	\$ -	53%	53%	0%	\$ 355	\$ 355	\$ 0	14.5%	14.5%	0.0%
2018	6,219	6,219	-	53%	53%	0%	546	391	(155)	21.8%	15.6%	-6.2%
2019	6,299	6,459	160	53%	52%	-1%	548	429	(119)	21.5%	16.9%	-4.7%
2020	6,292	6,585	293	54%	52%	-2%	558	471	(87)	21.5%	18.2%	-3.4%
2021	6,165	6,566	401	56%	53%	-3%	563	528	(35)	21.3%	20.0%	-1.4%
2022	6,099	6,562	463	57%	54%	-3%	561	595	34	20.9%	22.1%	1.2%
2023	6,026	6,483	457	58%	55%	-3%	565	599	34	20.6%	21.9%	1.2%
2024	5,941	6,392	451	59%	56%	-3%	570	604	34	20.4%	21.7%	1.2%
2025	5,840	6,284	444	61%	58%	-3%	575	610	35	20.2%	21.5%	1.2%
2026	5,725	6,161	436	62%	59%	-3%	580	615	35	20.0%	21.3%	1.2%
2027	5,595	6,021	426	63%	60%	-3%	585	622	37	19.8%	21.1%	1.3%
2028	5,446	5,861	415	64%	62%	-2%	591	628	37	19.7%	20.9%	1.2%
2029	5,280	5,682	402	66%	63%	-3%	597	635	38	19.5%	20.8%	1.3%
2030	5,094	5,481	387	67%	64%	-3%	604	643	39	19.3%	20.6%	1.2%
2031	4,885	5,257	372	68%	66%	-2%	611	651	40	19.2%	20.4%	1.2%
2032	4,654	5,008	354	70%	68%	-2%	619	660	41	19.0%	20.3%	1.2%
2033	4,397	4,732	335	72%	70%	-2%	627	669	42	18.9%	20.1%	1.3%
2034	4,115	4,428	313	74%	72%	-2%	636	678	42	18.7%	20.0%	1.2%
2035	3,803	4,092	289	76%	74%	-2%	645	688	43	18.6%	19.9%	1.2%
2036	3,462	3,724	262	78%	76%	-2%	655	699	44	18.5%	19.7%	1.2%
2037	3,087	3,321	234	80%	79%	-1%	666	711	45	18.4%	19.6%	1.2%
2038	2,677	2,880	203	83%	81%	-2%	678	723	45	18.3%	19.5%	1.2%
2039	2,230	2,399	169	86%	84%	-2%	690	737	47	18.1%	19.4%	1.2%
2040	1,742	1,873	131	89%	88%	-1%	703	750	47	18.0%	19.3%	1.2%
2041	1,211	1,302	91	92%	92%	0%	715	763	48	17.9%	19.1%	1.2%
2042	634	681	47	96%	96%	0%	730	779	49	17.9%	19.1%	1.2%
2043	-	-	-	100%	100%	0%	78	78	-	1.9%	1.9%	0.0%
2044	-	-	-	100%	100%	0%	79	79	-	1.9%	1.9%	0.0%
2045	-	-	-	100%	100%	0%	80	80	-	1.8%	1.8%	0.0%
2046	-	-	-	100%	100%	0%	82	82	-	1.8%	1.8%	0.0%
2047	-	-	-	100%	100%	0%	83	83	-	1.8%	1.8%	0.0%
2048	-	-	-	100%	100%	0%	84	84	-	1.8%	1.8%	0.0%
2049	-	-	-	100%	100%	0%	86	86	-	1.8%	1.8%	0.0%
2050	-	-	-	100%	100%	0%	88	88	-	1.8%	1.8%	0.0%
2051	-	-	-	100%	100%	0%	89	89	-	1.8%	1.8%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-2
CERS Non-Hazardous Insurance Fund
Summary of Fiscal Impact
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contribution			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2017	\$ 1,128	\$ 1,128	\$ -	66%	66%	0%	\$ 114	\$ 114	\$ 0	4.7%	4.7%	0.0%
2018	1,171	1,171	-	67%	67%	0%	154	126	(28)	6.2%	5.1%	-1.1%
2019	1,192	1,221	29	67%	67%	0%	153	138	(15)	6.1%	5.5%	-0.6%
2020	1,190	1,236	46	69%	68%	-1%	154	152	(2)	6.0%	5.9%	-0.1%
2021	1,153	1,205	52	71%	70%	-1%	153	157	4	5.8%	6.0%	0.1%
2022	1,140	1,190	50	72%	71%	-1%	150	153	3	5.6%	5.8%	0.1%
2023	1,125	1,175	50	73%	72%	-1%	149	153	4	5.5%	5.6%	0.1%
2024	1,109	1,158	49	74%	73%	-1%	148	152	4	5.4%	5.5%	0.1%
2025	1,089	1,138	49	75%	74%	-1%	147	151	4	5.2%	5.4%	0.1%
2026	1,067	1,115	48	76%	75%	-1%	146	150	4	5.1%	5.2%	0.1%
2027	1,042	1,089	47	77%	76%	-1%	145	149	4	5.0%	5.1%	0.1%
2028	1,013	1,058	45	78%	77%	-1%	144	148	4	4.8%	5.0%	0.1%
2029	982	1,026	44	79%	78%	-1%	144	148	4	4.7%	4.9%	0.1%
2030	947	989	42	80%	79%	-1%	143	147	4	4.6%	4.7%	0.1%
2031	908	949	41	81%	80%	-1%	143	147	4	4.5%	4.6%	0.1%
2032	865	904	39	82%	82%	0%	143	147	4	4.4%	4.6%	0.1%
2033	818	854	36	84%	83%	-1%	144	148	4	4.4%	4.5%	0.1%
2034	766	800	34	85%	84%	-1%	144	149	5	4.3%	4.4%	0.1%
2035	709	740	31	86%	85%	-1%	146	150	4	4.2%	4.4%	0.1%
2036	646	675	29	87%	87%	0%	147	152	5	4.2%	4.3%	0.1%
2037	578	604	26	89%	88%	-1%	150	155	5	4.2%	4.3%	0.1%
2038	503	525	22	90%	90%	0%	151	157	6	4.1%	4.2%	0.1%
2039	421	439	18	92%	92%	0%	155	160	5	4.1%	4.2%	0.1%
2040	330	344	14	94%	93%	-1%	157	162	5	4.1%	4.2%	0.1%
2041	231	241	10	96%	95%	-1%	160	166	6	4.0%	4.2%	0.1%
2042	123	128	5	98%	98%	0%	166	170	4	4.1%	4.2%	0.1%
2043	-	-	-	100%	100%	0%	41	41	-	1.0%	1.0%	0.0%
2044	-	-	-	100%	100%	0%	41	41	-	1.0%	1.0%	0.0%
2045	-	-	-	100%	100%	0%	42	42	-	1.0%	1.0%	0.0%
2046	-	-	-	100%	100%	0%	42	42	-	1.0%	1.0%	0.0%
2047	-	-	-	100%	100%	0%	43	43	-	0.9%	0.9%	0.0%
2048	-	-	-	100%	100%	0%	43	43	-	0.9%	0.9%	0.0%
2049	-	-	-	100%	100%	0%	43	43	-	0.9%	0.9%	0.0%
2050	-	-	-	100%	100%	0%	43	43	-	0.9%	0.9%	0.0%
2051	-	-	-	100%	100%	0%	44	44	-	0.9%	0.9%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-3
CERS Hazardous Retirement Fund
Summary of Fiscal Impact
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contribution			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2017	\$ 2,411	\$ 2,411	\$ -	48%	48%	0%	\$ 120	\$ 120	\$ 0	22.2%	22.2%	0.0%
2018	2,478	2,478	-	48%	48%	0%	192	128	(64)	35.7%	23.9%	-11.8%
2019	2,504	2,569	65	49%	47%	-2%	193	139	(54)	36.0%	25.8%	-10.1%
2020	2,500	2,625	125	50%	47%	-3%	197	151	(46)	36.4%	27.9%	-8.6%
2021	2,456	2,637	181	52%	48%	-4%	199	169	(30)	36.5%	30.9%	-5.6%
2022	2,433	2,656	223	53%	48%	-5%	199	192	(7)	36.1%	34.8%	-1.3%
2023	2,405	2,650	245	54%	49%	-5%	201	219	18	36.0%	39.2%	3.2%
2024	2,372	2,614	242	55%	50%	-5%	202	221	19	35.8%	39.1%	3.2%
2025	2,333	2,571	238	56%	52%	-4%	204	223	19	35.7%	38.9%	3.3%
2026	2,288	2,521	233	57%	53%	-4%	207	226	19	35.5%	38.8%	3.3%
2027	2,236	2,465	229	59%	54%	-5%	209	229	20	35.3%	38.6%	3.3%
2028	2,178	2,400	222	60%	56%	-4%	212	232	20	35.1%	38.5%	3.3%
2029	2,111	2,327	216	61%	57%	-4%	215	235	20	35.0%	38.3%	3.3%
2030	2,037	2,246	209	63%	59%	-4%	218	239	21	34.8%	38.1%	3.3%
2031	1,954	2,154	200	64%	61%	-3%	222	243	21	34.5%	37.9%	3.3%
2032	1,861	2,052	191	66%	63%	-3%	225	247	22	34.3%	37.7%	3.3%
2033	1,759	1,939	180	68%	65%	-3%	229	252	23	34.1%	37.4%	3.3%
2034	1,646	1,814	168	70%	67%	-3%	233	256	23	33.9%	37.2%	3.3%
2035	1,522	1,677	155	72%	69%	-3%	238	261	23	33.7%	37.0%	3.3%
2036	1,385	1,526	141	75%	72%	-3%	242	266	24	33.6%	36.8%	3.3%
2037	1,235	1,360	125	78%	75%	-3%	247	270	23	33.4%	36.6%	3.2%
2038	1,071	1,180	109	81%	79%	-2%	251	276	25	33.3%	36.5%	3.2%
2039	892	983	91	84%	82%	-2%	256	281	25	33.1%	36.4%	3.2%
2040	697	767	70	87%	86%	-1%	261	286	25	33.0%	36.2%	3.2%
2041	484	533	49	91%	90%	-1%	267	292	25	32.9%	36.1%	3.2%
2042	254	279	25	95%	95%	0%	272	299	27	32.9%	36.1%	3.2%
2043	-	-	-	100%	100%	0%	12	12	-	1.4%	1.4%	0.0%
2044	-	-	-	100%	100%	0%	12	12	-	1.4%	1.4%	0.0%
2045	-	-	-	100%	100%	0%	12	12	-	1.4%	1.4%	0.0%
2046	-	-	-	100%	100%	0%	13	13	-	1.4%	1.4%	0.0%
2047	-	-	-	100%	100%	0%	13	13	-	1.4%	1.4%	0.0%
2048	-	-	-	100%	100%	0%	13	13	-	1.4%	1.4%	0.0%
2049	-	-	-	100%	100%	0%	14	14	-	1.4%	1.4%	0.0%
2050	-	-	-	100%	100%	0%	14	14	-	1.4%	1.4%	0.0%
2051	-	-	-	100%	100%	0%	14	14	-	1.4%	1.4%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-4
CERS Hazardous Insurance Fund
Summary of Fiscal Impact
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contribution			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2017	\$ 591	\$ 591	\$ -	67%	67%	0%	\$ 51	\$ 51	\$ 0	9.4%	9.4%	0.0%
2018	610	610	-	67%	67%	0%	65	54	(11)	12.2%	10.1%	-2.1%
2019	622	633	11	67%	67%	0%	64	58	(6)	12.0%	10.9%	-1.1%
2020	619	637	18	68%	68%	0%	64	63	(1)	11.8%	11.7%	-0.1%
2021	600	620	20	70%	69%	-1%	63	64	1	11.5%	11.8%	0.3%
2022	592	612	20	71%	70%	-1%	61	62	1	11.0%	11.3%	0.3%
2023	583	603	20	72%	71%	-1%	59	61	2	10.7%	10.9%	0.3%
2024	574	594	20	72%	71%	-1%	59	60	1	10.4%	10.6%	0.3%
2025	564	584	20	73%	72%	-1%	58	59	1	10.1%	10.4%	0.3%
2026	552	571	19	73%	73%	0%	58	59	1	9.9%	10.2%	0.3%
2027	540	558	18	74%	73%	-1%	57	59	2	9.7%	10.0%	0.3%
2028	525	543	18	74%	74%	0%	58	59	1	9.6%	9.8%	0.3%
2029	509	526	17	75%	74%	-1%	58	60	2	9.4%	9.7%	0.3%
2030	491	508	17	76%	75%	-1%	59	60	1	9.3%	9.6%	0.3%
2031	471	487	16	76%	75%	-1%	59	61	2	9.2%	9.5%	0.3%
2032	448	464	16	77%	76%	-1%	60	62	2	9.2%	9.4%	0.3%
2033	424	439	15	78%	77%	-1%	61	63	2	9.1%	9.4%	0.3%
2034	397	410	13	79%	78%	-1%	62	64	2	9.0%	9.3%	0.3%
2035	367	380	13	80%	80%	0%	63	65	2	9.0%	9.2%	0.3%
2036	334	346	12	82%	81%	-1%	64	66	2	8.9%	9.2%	0.3%
2037	298	308	10	84%	83%	-1%	66	67	1	8.9%	9.2%	0.3%
2038	259	268	9	86%	85%	-1%	67	69	2	8.9%	9.1%	0.3%
2039	216	223	7	88%	88%	0%	68	70	2	8.8%	9.1%	0.3%
2040	168	174	6	91%	90%	-1%	69	72	3	8.8%	9.1%	0.3%
2041	118	122	4	93%	93%	0%	71	73	2	8.8%	9.0%	0.3%
2042	62	64	2	97%	96%	-1%	72	75	3	8.8%	9.0%	0.3%
2043	-	-	-	100%	100%	0%	10	10	-	1.1%	1.1%	0.0%
2044	-	-	-	100%	100%	0%	10	10	-	1.1%	1.1%	0.0%
2045	-	-	-	100%	100%	0%	10	10	-	1.1%	1.1%	0.0%
2046	-	-	-	100%	100%	0%	10	10	-	1.1%	1.1%	0.0%
2047	-	-	-	100%	100%	0%	10	10	-	1.1%	1.1%	0.0%
2048	-	-	-	100%	100%	0%	10	10	-	1.1%	1.1%	0.0%
2049	-	-	-	100%	100%	0%	10	10	-	1.0%	1.0%	0.0%
2050	-	-	-	100%	100%	0%	10	10	-	1.0%	1.0%	0.0%
2051	-	-	-	100%	100%	0%	10	10	-	1.0%	1.0%	0.0%

Gabriel Roeder Smith & Company

Section 2.
Projected Cost of the Retirement and Insurance
Current Plan

Kentucky Retirement Systems
Exhibit 2-1
CERS Non-Hazardous Retirement Fund
Current Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 12,804	\$ 6,765	\$ 6,039	53%	\$ 355	\$ 123	\$ 2,452	14.48%	14.48%
2018	13,121	6,902	6,219	53%	546	125	2,500	21.84%	21.84%
2019	13,421	7,122	6,299	53%	548	127	2,547	21.50%	21.50%
2020	13,704	7,412	6,292	54%	558	130	2,594	21.53%	21.53%
2021	13,970	7,805	6,165	56%	563	132	2,642	21.33%	21.33%
2022	14,218	8,119	6,099	57%	561	135	2,690	20.86%	20.86%
2023	14,445	8,419	6,026	58%	565	137	2,740	20.64%	20.64%
2024	14,652	8,711	5,941	59%	570	140	2,790	20.43%	20.43%
2025	14,836	8,996	5,840	61%	575	142	2,842	20.22%	20.22%
2026	14,998	9,273	5,725	62%	580	145	2,894	20.03%	20.03%
2027	15,136	9,541	5,595	63%	585	147	2,948	19.84%	19.84%
2028	15,259	9,813	5,446	64%	591	150	3,003	19.67%	19.67%
2029	15,359	10,079	5,280	66%	597	153	3,062	19.50%	19.50%
2030	15,438	10,344	5,094	67%	604	156	3,124	19.34%	19.34%
2031	15,496	10,611	4,885	68%	611	159	3,187	19.18%	19.18%
2032	15,536	10,882	4,654	70%	619	163	3,254	19.03%	19.03%
2033	15,558	11,161	4,397	72%	627	166	3,323	18.88%	18.88%
2034	15,565	11,450	4,115	74%	636	170	3,394	18.74%	18.74%
2035	15,556	11,753	3,803	76%	645	173	3,467	18.61%	18.61%
2036	15,535	12,073	3,462	78%	655	177	3,545	18.49%	18.49%
2037	15,507	12,420	3,087	80%	666	181	3,628	18.37%	18.37%
2038	15,478	12,801	2,677	83%	678	186	3,714	18.25%	18.25%
2039	15,451	13,221	2,230	86%	690	190	3,803	18.14%	18.14%
2040	15,428	13,686	1,742	89%	703	195	3,895	18.04%	18.04%
2041	15,413	14,202	1,211	92%	715	199	3,988	17.94%	17.94%
2042	15,406	14,772	634	96%	730	204	4,083	17.87%	17.87%
2043	15,409	15,409	0	100%	78	209	4,179	1.87%	1.87%
2044	15,423	15,423	0	100%	79	214	4,277	1.85%	1.85%
2045	15,449	15,449	0	100%	80	219	4,377	1.83%	1.83%
2046	15,488	15,488	0	100%	82	224	4,478	1.82%	1.82%
2047	15,540	15,540	0	100%	83	229	4,581	1.81%	1.81%
2048	15,606	15,606	0	100%	84	234	4,686	1.80%	1.80%
2049	15,687	15,687	0	100%	86	240	4,792	1.79%	1.79%
2050	15,783	15,783	0	100%	88	245	4,901	1.79%	1.79%
2051	15,895	15,895	0	100%	89	251	5,012	1.78%	1.78%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.

The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 2-2
CERS Non-Hazardous Insurance Fund
Current Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 3,355	\$ 2,227	\$ 1,128	66%	\$ 114	\$ 10	\$ 2,429	4.70%	4.70%
2018	3,514	2,343	1,171	67%	154	11	2,477	6.21%	6.21%
2019	3,667	2,475	1,192	67%	153	13	2,524	6.06%	6.06%
2020	3,813	2,623	1,190	69%	154	14	2,572	5.98%	5.98%
2021	3,951	2,798	1,153	71%	153	15	2,619	5.84%	5.84%
2022	4,081	2,941	1,140	72%	150	17	2,668	5.62%	5.62%
2023	4,202	3,077	1,125	73%	149	18	2,718	5.48%	5.48%
2024	4,315	3,206	1,109	74%	148	19	2,768	5.35%	5.35%
2025	4,419	3,330	1,089	75%	147	20	2,820	5.21%	5.21%
2026	4,514	3,447	1,067	76%	146	22	2,873	5.08%	5.08%
2027	4,600	3,558	1,042	77%	145	23	2,926	4.96%	4.96%
2028	4,676	3,663	1,013	78%	144	24	2,982	4.83%	4.83%
2029	4,745	3,763	982	79%	144	26	3,040	4.72%	4.72%
2030	4,807	3,860	947	80%	143	27	3,102	4.60%	4.60%
2031	4,862	3,954	908	81%	143	28	3,166	4.51%	4.51%
2032	4,912	4,047	865	82%	143	29	3,232	4.42%	4.42%
2033	4,958	4,140	818	84%	144	31	3,301	4.35%	4.35%
2034	5,002	4,236	766	85%	144	32	3,372	4.28%	4.28%
2035	5,045	4,336	709	86%	146	33	3,445	4.23%	4.23%
2036	5,089	4,443	646	87%	147	34	3,522	4.18%	4.18%
2037	5,135	4,557	578	89%	150	35	3,605	4.15%	4.15%
2038	5,184	4,681	503	90%	151	36	3,691	4.10%	4.10%
2039	5,235	4,814	421	92%	155	37	3,780	4.09%	4.09%
2040	5,289	4,959	330	94%	157	38	3,872	4.06%	4.06%
2041	5,347	5,116	231	96%	160	39	3,965	4.04%	4.04%
2042	5,409	5,286	123	98%	166	40	4,059	4.08%	4.08%
2043	5,475	5,475	0	100%	41	41	4,156	0.98%	0.98%
2044	5,545	5,545	0	100%	41	42	4,253	0.97%	0.97%
2045	5,619	5,619	0	100%	42	43	4,352	0.97%	0.97%
2046	5,696	5,696	0	100%	42	44	4,453	0.95%	0.95%
2047	5,775	5,775	0	100%	43	46	4,555	0.94%	0.94%
2048	5,855	5,855	0	100%	43	47	4,660	0.92%	0.92%
2049	5,937	5,937	0	100%	43	48	4,766	0.91%	0.91%
2050	6,019	6,019	0	100%	43	49	4,874	0.89%	0.89%
2051	6,102	6,102	0	100%	44	50	4,985	0.88%	0.88%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.

The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 2-3
CERS Hazardous Retirement Fund
Current Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 4,649	\$ 2,238	\$ 2,411	48%	\$ 120	\$ 43	\$ 542	22.20%	22.20%
2018	4,771	2,293	2,478	48%	192	43	537	35.69%	35.69%
2019	4,880	2,376	2,504	49%	193	43	538	35.95%	35.95%
2020	4,978	2,478	2,500	50%	197	43	542	36.42%	36.42%
2021	5,066	2,610	2,456	52%	199	44	546	36.48%	36.48%
2022	5,145	2,712	2,433	53%	199	44	551	36.06%	36.06%
2023	5,214	2,809	2,405	54%	201	45	558	35.95%	35.95%
2024	5,274	2,902	2,372	55%	202	45	565	35.81%	35.81%
2025	5,325	2,992	2,333	56%	204	46	573	35.66%	35.66%
2026	5,367	3,079	2,288	57%	207	47	582	35.49%	35.49%
2027	5,400	3,164	2,236	59%	209	47	592	35.32%	35.32%
2028	5,426	3,248	2,178	60%	212	48	602	35.14%	35.14%
2029	5,444	3,333	2,111	61%	215	49	614	34.96%	34.96%
2030	5,457	3,420	2,037	63%	218	50	628	34.75%	34.75%
2031	5,466	3,512	1,954	64%	222	51	642	34.54%	34.54%
2032	5,472	3,611	1,861	66%	225	53	657	34.33%	34.33%
2033	5,478	3,719	1,759	68%	229	54	672	34.12%	34.12%
2034	5,483	3,837	1,646	70%	233	55	688	33.92%	33.92%
2035	5,489	3,967	1,522	72%	238	56	705	33.73%	33.73%
2036	5,495	4,110	1,385	75%	242	58	721	33.56%	33.56%
2037	5,502	4,267	1,235	78%	247	59	738	33.40%	33.40%
2038	5,510	4,439	1,071	81%	251	60	755	33.26%	33.26%
2039	5,519	4,627	892	84%	256	62	773	33.13%	33.13%
2040	5,528	4,831	697	87%	261	63	791	33.02%	33.02%
2041	5,540	5,056	484	91%	267	65	809	32.94%	32.94%
2042	5,555	5,301	254	95%	272	66	828	32.89%	32.89%
2043	5,573	5,573	0	100%	12	68	848	1.41%	1.41%
2044	5,595	5,595	0	100%	12	69	867	1.40%	1.40%
2045	5,619	5,619	0	100%	12	71	887	1.40%	1.40%
2046	5,646	5,646	0	100%	13	73	907	1.40%	1.40%
2047	5,674	5,674	0	100%	13	74	927	1.40%	1.40%
2048	5,704	5,704	0	100%	13	76	948	1.40%	1.40%
2049	5,736	5,736	0	100%	14	78	970	1.40%	1.40%
2050	5,769	5,769	0	100%	14	79	992	1.40%	1.40%
2051	5,803	5,803	0	100%	14	81	1,014	1.40%	1.40%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.
The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 2-4
CERS Hazardous Insurance Fund
Current Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 1,788	\$ 1,197	\$ 591	67%	\$ 51	\$ 2	\$ 541	9.35%	9.35%
2018	1,853	1,243	610	67%	65	2	536	12.17%	12.17%
2019	1,912	1,290	622	67%	64	3	538	11.97%	11.97%
2020	1,962	1,343	619	68%	64	3	541	11.83%	11.83%
2021	2,005	1,405	600	70%	63	3	546	11.52%	11.52%
2022	2,038	1,446	592	71%	61	4	551	11.00%	11.00%
2023	2,061	1,478	583	72%	59	4	558	10.66%	10.66%
2024	2,075	1,501	574	72%	59	4	565	10.37%	10.37%
2025	2,081	1,517	564	73%	58	5	573	10.12%	10.12%
2026	2,078	1,526	552	73%	58	5	582	9.89%	9.89%
2027	2,068	1,528	540	74%	57	5	591	9.71%	9.71%
2028	2,052	1,527	525	74%	58	5	602	9.57%	9.57%
2029	2,031	1,522	509	75%	58	6	614	9.43%	9.43%
2030	2,008	1,517	491	76%	59	6	627	9.33%	9.33%
2031	1,982	1,511	471	76%	59	6	641	9.24%	9.24%
2032	1,954	1,506	448	77%	60	6	656	9.16%	9.16%
2033	1,927	1,503	424	78%	61	7	672	9.09%	9.09%
2034	1,899	1,502	397	79%	62	7	688	9.03%	9.03%
2035	1,873	1,506	367	80%	63	7	704	8.98%	8.98%
2036	1,849	1,515	334	82%	64	7	721	8.93%	8.93%
2037	1,828	1,530	298	84%	66	7	738	8.89%	8.89%
2038	1,811	1,552	259	86%	67	8	755	8.85%	8.85%
2039	1,796	1,580	216	88%	68	8	772	8.82%	8.82%
2040	1,785	1,617	168	91%	69	8	790	8.79%	8.79%
2041	1,779	1,661	118	93%	71	8	809	8.77%	8.77%
2042	1,776	1,714	62	97%	72	8	828	8.75%	8.75%
2043	1,777	1,777	0	100%	10	8	847	1.13%	1.13%
2044	1,782	1,782	0	100%	10	9	866	1.11%	1.11%
2045	1,789	1,789	0	100%	10	9	886	1.10%	1.10%
2046	1,799	1,799	0	100%	10	9	906	1.08%	1.08%
2047	1,811	1,811	0	100%	10	9	926	1.07%	1.07%
2048	1,823	1,823	0	100%	10	9	947	1.06%	1.06%
2049	1,836	1,836	0	100%	10	10	969	1.04%	1.04%
2050	1,847	1,847	0	100%	10	10	991	1.03%	1.03%
2051	1,859	1,859	0	100%	10	10	1,013	1.01%	1.01%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.

The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company

Section 3.
Projected Cost of the Retirement and Insurance
Proposed Legislation

Kentucky Retirement Systems
Exhibit 3-1
CERS Non-Hazardous Retirement Fund
Proposed Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 12,804	\$ 6,765	\$ 6,039	53%	\$ 355	\$ 123	\$ 2,452	14.48%	14.48%
2018	13,121	6,902	6,219	53%	391	125	2,500	15.62%	21.84%
2019	13,421	6,962	6,459	52%	429	127	2,547	16.85%	21.93%
2020	13,704	7,119	6,585	52%	471	130	2,594	18.17%	22.30%
2021	13,970	7,404	6,566	53%	528	132	2,642	19.97%	22.39%
2022	14,218	7,656	6,562	54%	595	135	2,690	22.10%	22.10%
2023	14,445	7,962	6,483	55%	599	137	2,740	21.87%	21.87%
2024	14,652	8,260	6,392	56%	604	140	2,790	21.66%	21.66%
2025	14,836	8,552	6,284	58%	610	142	2,842	21.46%	21.46%
2026	14,998	8,837	6,161	59%	615	145	2,894	21.26%	21.26%
2027	15,136	9,115	6,021	60%	622	147	2,948	21.09%	21.09%
2028	15,259	9,398	5,861	62%	628	150	3,003	20.91%	20.91%
2029	15,359	9,677	5,682	63%	635	153	3,062	20.75%	20.75%
2030	15,438	9,957	5,481	64%	643	156	3,124	20.58%	20.58%
2031	15,496	10,239	5,257	66%	651	159	3,187	20.42%	20.42%
2032	15,536	10,528	5,008	68%	660	163	3,254	20.27%	20.27%
2033	15,558	10,826	4,732	70%	669	166	3,323	20.13%	20.13%
2034	15,565	11,137	4,428	72%	678	170	3,394	19.98%	19.98%
2035	15,556	11,464	4,092	74%	688	173	3,467	19.85%	19.85%
2036	15,535	11,811	3,724	76%	699	177	3,545	19.72%	19.72%
2037	15,507	12,186	3,321	79%	711	181	3,628	19.60%	19.60%
2038	15,478	12,598	2,880	81%	723	186	3,714	19.47%	19.47%
2039	15,451	13,052	2,399	84%	737	190	3,803	19.37%	19.37%
2040	15,428	13,555	1,873	88%	750	195	3,895	19.25%	19.25%
2041	15,413	14,111	1,302	92%	763	199	3,988	19.14%	19.14%
2042	15,406	14,725	681	96%	779	204	4,083	19.07%	19.07%
2043	15,409	15,409	0	100%	78	209	4,179	1.87%	1.87%
2044	15,423	15,423	0	100%	79	214	4,277	1.85%	1.85%
2045	15,449	15,449	0	100%	80	219	4,377	1.83%	1.83%
2046	15,488	15,488	0	100%	82	224	4,478	1.82%	1.82%
2047	15,540	15,540	0	100%	83	229	4,581	1.81%	1.81%
2048	15,606	15,606	0	100%	84	234	4,686	1.80%	1.80%
2049	15,687	15,687	0	100%	86	240	4,792	1.79%	1.79%
2050	15,783	15,783	0	100%	88	245	4,901	1.79%	1.79%
2051	15,895	15,895	0	100%	89	251	5,012	1.78%	1.78%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.
 The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Kentucky Retirement Systems
Exhibit 3-2
CERS Non-Hazardous Insurance Fund
Proposed Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 3,355	\$ 2,227	\$ 1,128	66%	\$ 114	\$ 10	\$ 2,429	4.70%	4.70%
2018	3,514	2,343	1,171	67%	126	11	2,477	5.07%	6.21%
2019	3,667	2,446	1,221	67%	138	13	2,524	5.47%	6.14%
2020	3,813	2,577	1,236	68%	152	14	2,572	5.90%	6.11%
2021	3,951	2,746	1,205	70%	157	15	2,619	5.98%	5.98%
2022	4,081	2,891	1,190	71%	153	17	2,668	5.75%	5.75%
2023	4,202	3,027	1,175	72%	153	18	2,718	5.62%	5.62%
2024	4,315	3,157	1,158	73%	152	19	2,768	5.49%	5.49%
2025	4,419	3,281	1,138	74%	151	20	2,820	5.35%	5.35%
2026	4,514	3,399	1,115	75%	150	22	2,873	5.22%	5.22%
2027	4,600	3,511	1,089	76%	149	23	2,926	5.10%	5.10%
2028	4,676	3,618	1,058	77%	148	24	2,982	4.97%	4.97%
2029	4,745	3,719	1,026	78%	148	26	3,040	4.86%	4.86%
2030	4,807	3,818	989	79%	147	27	3,102	4.73%	4.73%
2031	4,862	3,913	949	80%	147	28	3,166	4.64%	4.64%
2032	4,912	4,008	904	82%	147	29	3,232	4.56%	4.56%
2033	4,958	4,104	854	83%	148	31	3,301	4.49%	4.49%
2034	5,002	4,202	800	84%	149	32	3,372	4.42%	4.42%
2035	5,045	4,305	740	85%	150	33	3,445	4.36%	4.36%
2036	5,089	4,414	675	87%	152	34	3,522	4.31%	4.31%
2037	5,135	4,531	604	88%	155	35	3,605	4.29%	4.29%
2038	5,184	4,659	525	90%	157	36	3,691	4.24%	4.24%
2039	5,235	4,796	439	92%	160	37	3,780	4.22%	4.22%
2040	5,289	4,945	344	93%	162	38	3,872	4.19%	4.19%
2041	5,347	5,106	241	95%	166	39	3,965	4.18%	4.18%
2042	5,409	5,281	128	98%	170	40	4,059	4.20%	4.20%
2043	5,475	5,475	0	100%	41	41	4,156	0.98%	0.98%
2044	5,545	5,545	0	100%	41	42	4,253	0.97%	0.97%
2045	5,619	5,619	0	100%	42	43	4,352	0.97%	0.97%
2046	5,696	5,696	0	100%	42	44	4,453	0.95%	0.95%
2047	5,775	5,775	0	100%	43	46	4,555	0.94%	0.94%
2048	5,855	5,855	0	100%	43	47	4,660	0.92%	0.92%
2049	5,937	5,937	0	100%	43	48	4,766	0.91%	0.91%
2050	6,019	6,019	0	100%	43	49	4,874	0.89%	0.89%
2051	6,102	6,102	0	100%	44	50	4,985	0.88%	0.88%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.
 The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 3-3
CERS Hazardous Retirement Fund
Proposed Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 4,649	\$ 2,238	\$ 2,411	48%	\$ 120	\$ 43	\$ 542	22.20%	22.20%
2018	4,771	2,293	2,478	48%	128	43	537	23.94%	35.69%
2019	4,880	2,311	2,569	47%	139	43	538	25.82%	36.76%
2020	4,978	2,353	2,625	47%	151	43	542	27.85%	38.00%
2021	5,066	2,429	2,637	48%	169	44	546	30.90%	38.78%
2022	5,145	2,489	2,656	48%	192	44	551	34.77%	38.96%
2023	5,214	2,564	2,650	49%	219	45	558	39.18%	39.18%
2024	5,274	2,660	2,614	50%	221	45	565	39.05%	39.05%
2025	5,325	2,754	2,571	52%	223	46	573	38.93%	38.93%
2026	5,367	2,846	2,521	53%	226	47	582	38.78%	38.78%
2027	5,400	2,935	2,465	54%	229	47	592	38.62%	38.62%
2028	5,426	3,026	2,400	56%	232	48	602	38.46%	38.46%
2029	5,444	3,117	2,327	57%	235	49	614	38.28%	38.28%
2030	5,457	3,211	2,246	59%	239	50	628	38.08%	38.08%
2031	5,466	3,312	2,154	61%	243	51	642	37.86%	37.86%
2032	5,472	3,420	2,052	63%	247	53	657	37.65%	37.65%
2033	5,478	3,539	1,939	65%	252	54	672	37.43%	37.43%
2034	5,483	3,669	1,814	67%	256	55	688	37.21%	37.21%
2035	5,489	3,812	1,677	69%	261	56	705	37.00%	37.00%
2036	5,495	3,969	1,526	72%	266	58	721	36.82%	36.82%
2037	5,502	4,142	1,360	75%	270	59	738	36.64%	36.64%
2038	5,510	4,330	1,180	79%	276	60	755	36.49%	36.49%
2039	5,519	4,536	983	82%	281	62	773	36.35%	36.35%
2040	5,528	4,761	767	86%	286	63	791	36.22%	36.22%
2041	5,540	5,007	533	90%	292	65	809	36.12%	36.12%
2042	5,555	5,276	279	95%	299	66	828	36.05%	36.05%
2043	5,573	5,573	0	100%	12	68	848	1.41%	1.41%
2044	5,595	5,595	0	100%	12	69	867	1.40%	1.40%
2045	5,619	5,619	0	100%	12	71	887	1.40%	1.40%
2046	5,646	5,646	0	100%	13	73	907	1.40%	1.40%
2047	5,674	5,674	0	100%	13	74	927	1.40%	1.40%
2048	5,704	5,704	0	100%	13	76	948	1.40%	1.40%
2049	5,736	5,736	0	100%	14	78	970	1.40%	1.40%
2050	5,769	5,769	0	100%	14	79	992	1.40%	1.40%
2051	5,803	5,803	0	100%	14	81	1,014	1.40%	1.40%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.
The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 3-4
CERS Hazardous Insurance Fund
Proposed Plan
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Employer Contribution	Member Contribution	Covered Payroll	Employer Contribution as % of Covered Payroll	Employer Actuarially Determined Contribution Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2017	\$ 1,788	\$ 1,197	\$ 591	67%	\$ 51	\$ 2	\$ 541	9.35%	9.35%
2018	1,853	1,243	610	67%	54	2	536	10.08%	12.17%
2019	1,912	1,279	633	67%	58	3	538	10.87%	12.11%
2020	1,962	1,325	637	68%	63	3	541	11.72%	12.06%
2021	2,005	1,385	620	69%	64	3	546	11.77%	11.77%
2022	2,038	1,426	612	70%	62	4	551	11.25%	11.25%
2023	2,061	1,458	603	71%	61	4	558	10.92%	10.92%
2024	2,075	1,481	594	71%	60	4	565	10.63%	10.63%
2025	2,081	1,497	584	72%	59	5	573	10.38%	10.38%
2026	2,078	1,507	571	73%	59	5	582	10.16%	10.16%
2027	2,068	1,510	558	73%	59	5	591	9.98%	9.98%
2028	2,052	1,509	543	74%	59	5	602	9.84%	9.84%
2029	2,031	1,505	526	74%	60	6	614	9.70%	9.70%
2030	2,008	1,500	508	75%	60	6	627	9.60%	9.60%
2031	1,982	1,495	487	75%	61	6	641	9.51%	9.51%
2032	1,954	1,490	464	76%	62	6	656	9.43%	9.43%
2033	1,927	1,488	439	77%	63	7	672	9.36%	9.36%
2034	1,899	1,489	410	78%	64	7	688	9.30%	9.30%
2035	1,873	1,493	380	80%	65	7	704	9.24%	9.24%
2036	1,849	1,503	346	81%	66	7	721	9.19%	9.19%
2037	1,828	1,520	308	83%	67	7	738	9.15%	9.15%
2038	1,811	1,543	268	85%	69	8	755	9.11%	9.11%
2039	1,796	1,573	223	88%	70	8	772	9.08%	9.08%
2040	1,785	1,611	174	90%	72	8	790	9.05%	9.05%
2041	1,779	1,657	122	93%	73	8	809	9.03%	9.03%
2042	1,776	1,712	64	96%	75	8	828	9.01%	9.01%
2043	1,777	1,777	0	100%	10	8	847	1.13%	1.13%
2044	1,782	1,782	0	100%	10	9	866	1.11%	1.11%
2045	1,789	1,789	0	100%	10	9	886	1.10%	1.10%
2046	1,799	1,799	0	100%	10	9	906	1.08%	1.08%
2047	1,811	1,811	0	100%	10	9	926	1.07%	1.07%
2048	1,823	1,823	0	100%	10	9	947	1.06%	1.06%
2049	1,836	1,836	0	100%	10	10	969	1.04%	1.04%
2050	1,847	1,847	0	100%	10	10	991	1.03%	1.03%
2051	1,859	1,859	0	100%	10	10	1,013	1.01%	1.01%

Notes and assumptions:

The projection is based on the results of the June 30, 2017 actuarial valuation and assumes constant active membership count in all future years.

The employer actuarially determined contribution rate for a particular year is determined by the prior year's actuarial valuation.

Gabriel Roeder Smith & Company



March 12, 2020

Mr. David Eager
Executive Director
Kentucky Retirement Systems
1260 Louisville Road
Frankfort, KY 40601

Re: Actuarial Analysis of Proposed Legislation SB 249 and its Financial Impact on the Kentucky Retirement Systems

Dear Mr. Eager:

We have reviewed the proposed changes in the proposed legislation SB 249 and the purpose of this letter is to communicate the actuarial analysis of this legislation on the systems maintained by the Kentucky Retirement Systems (KRS).

Summary of Fiscal Impact

The proposed legislation increases the unfunded liability amortization period from 24 years to 30 years as of June 30, 2019 and freezes the CERS employer contribution rates for one year. Increasing the amortization period does not change the liability of or the projected benefit payments to be paid from the retirement and insurance funds. Rather it increases the number of years employers are expected to pay for the current unfunded liability, which results in a decrease in the annual contribution requirement.

Impact on Employer Contribution Requirements for FY 2020/2021

Plan	Actuarially Determined Contribution		Budgeted Employer Contribution		Decrease in FY 20/21 Contribution
	Current	Proposed	Current	Proposed	
KERS Non-Hazardous	93.01%	84.43%	93.01%	84.43%	\$123 million
KERS Hazardous	38.71%	36.00%	38.71%	36.00%	\$4 million
CERS Non-Hazardous	31.99%	29.24%	26.95%	24.06%	\$74 million
CERS Hazardous	56.78%	51.88%	44.33%	39.58%	\$27 million
SPRS	156.97%	143.48%	156.97%	143.48%	\$7 million
Total Decrease in FY 20/21 Contributions (All Systems):					\$235 million

Mr. David Eager
March 12, 2020
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Reducing the employer contribution effort (specifically for the System's lowest funded Plan – the KERS Non-Hazardous Retirement Fund) without making additional changes to the mechanism for collecting employer contributions decreases the financial stability of the System and increases the risk of plan assets being exhausted. Please see additional discussion later in this letter.

Section 1 of the enclosed exhibits provides a 35-year projection of the fiscal impact of the proposed legislation on the unfunded actuarial accrued liability, the funded ratio, and the employer contributions of all the retirement and insurance funds maintained by KRS. Section 2 of the enclosed exhibits provides a 35-year projection of the funds under the current plan provisions and section 3 of the enclosed exhibits provides a 35-year projection of the funds under the proposed funding methods.

Comments on Proposed Legislation

The amortization period of the unfunded liability was set to 30 years in the year 2007. With 24 years remaining in the funding period, the amortization period was re-set to 30 years again in the year 2013. This is the current amortization period in statute, with 24 years remaining as of the last actuarial valuation date of June 30, 2019. The proposed legislation would again re-set the amortization period of the unfunded liability as of June 30, 2019 to be 30 years. Any subsequent increases or decreases in the unfunded liability after the June 30, 2019 actuarial valuation would be amortized over 20 years as of the date of the actuarial valuation they are recognized.

If the proposed legislation is passed, we believe this establishes a pattern of the General Assembly re-setting the amortization period every five to seven years. When an amortization period is continually re-set in this pattern, the unfunded liability and the financial condition of the System will not ever materially improve.

KERS Non-Hazardous Retirement Fund – As we have noted in the 2019 actuarial valuation report, the KERS Non-Hazardous Retirement Fund has \$16.5 billion in liability and only \$2.2 billion in plan assets. Also benefit payments and expenses during fiscal year 2018/2019 totaled \$1.012 billion and the Fund is expected to receive \$0.996 billion in employer and member contributions for fiscal year 2019/2020. The proposed legislation is expected to reduce employer contributions for fiscal year 2020/2021 by \$0.123 billion. We believe there is additional risk that actual contributions will be less than this amount as contributions would continue to be collected on covered payroll as well as the possibility of enactment of other legislation to provide additional contribution relief to the quasi-governmental agencies without contributions or appropriations for other sources to offset these lower contributions.

This legislation will result in a slight reduction in the employers' pension cost by reducing the FY 20/21 contribution rate (from 93.01% of pay to 84.43% of pay in the case of the KERS Non-Hazardous System). However, there is a known behavior of many employers in this System of continually reducing their reported covered payroll in an effort to reduce their pension cost and this proposed legislation does not address this behavior and risk to the System. As a result, we



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recommend any KRS related pension legislation that is considered by the General Assembly include provisions that addresses the current risk of the System receiving insufficient contributions because contributions continue to be collected on reported covered payroll. For example, if enacted, HB 171 (as amended to change the amortization period to 27 years) will amend the employer contribution allocation methodology and we believe that those changes will significantly reduce the System's contribution risk and will offset the System's financial risk associated with an increase in the funding period.

CERS Retirement and Insurance Funds – While the CERS Non-Hazardous and Hazardous Retirement Systems are relatively better funded with funded ratios of 49% and 45%, respectively, the funded ratios of both these Systems are in the bottom 20th percentile of funded ratios for large retirement systems in the country. Because the calculation of the contribution rates for these Systems includes an assumption that the covered payroll will increase at the rate of 2.00% per year, the contributions these Systems will receive for the next several years will be insufficient to finance the interest on the unfunded actuarial accrued liability (i.e. negative amortization). As the projections show for the CERS Non-Hazardous Retirement System, the unfunded actuarial accrued liability is projected to increase from the current \$7.3 billion to \$7.5 billion in the year 2023 and is not projected to decrease below the current unfunded liability amount until the year 2029. Again, given the historical pattern of the General Assembly resetting the amortization period, we believe this change imposes significant long-term financial risk to both CERS Systems. Given their current financial condition and these potential financial risks, we recommend the proposed legislation keep the current funding period for the CERS Systems.

Basis of Calculations

GRS based the calculations and analysis in this letter on the member and financial data provided by KRS for use in performing the actuarial valuation as of June 30, 2019. The projections assume no actuarial gains or losses will occur in the future, and that members will terminate, retire, become disabled, or die as anticipated by the actuarial assumptions used to perform the June 30, 2019 actuarial valuation. The analysis and projections were performed without regard to HB 1 that was enacted during the 2019 special session as individual employer elections regarding their future cessation from participating in KERS is unknown at this time.

Our calculations are based upon assumptions regarding future events, which may or may not materialize. Depending on actual plan experience, actual results could deviate significantly from our projections.



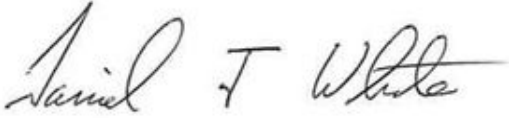
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Closing

We are not attorneys, and we cannot provide a legal opinion regarding the changes in this proposed legislation. Nothing in this letter should be construed as providing legal, investment or tax advice.

Mr. White is an Enrolled Actuary. Both of the undersigned are members of the American Academy of Actuaries and we meet all of the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. In addition, all of the undersigned are experienced in performing valuations for large public retirement systems.

Sincerely,



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



Janie Shaw, ASA, MAAA
Consultant



SB 249
Section 1.
Comparison of Fiscal Impact
Current Plan vs. Proposed Changes

Kentucky Retirement Systems
Exhibit 1-1
KERS Non-Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 14,260	\$ 14,260	\$ -	13%	13%	0%	\$ 924	\$ 924	\$ -	64.3%	64.3%	0.0%
2020	14,192	14,192	-	14%	14%	0%	1,156	1,046	(110)	81.0%	73.3%	-7.7%
2021	13,840	13,952	112	16%	15%	-1%	1,151	1,042	(109)	81.0%	73.3%	-7.7%
2022	13,490	13,721	231	18%	17%	-1%	1,150	1,040	(110)	81.2%	73.4%	-7.8%
2023	13,127	13,483	356	20%	18%	-2%	1,147	1,037	(110)	81.2%	73.4%	-7.8%
2024	12,746	13,234	488	22%	19%	-3%	1,144	1,034	(110)	81.2%	73.4%	-7.8%
2025	12,345	12,972	627	24%	21%	-3%	1,142	1,032	(110)	81.2%	73.4%	-7.8%
2026	11,922	12,694	772	27%	22%	-5%	1,139	1,028	(111)	81.2%	73.3%	-7.9%
2027	11,476	12,403	927	29%	23%	-6%	1,136	1,026	(110)	81.2%	73.3%	-7.9%
2028	11,007	12,095	1,088	31%	25%	-6%	1,134	1,023	(111)	81.2%	73.3%	-7.9%
2029	10,512	11,771	1,259	34%	26%	-8%	1,132	1,021	(111)	81.2%	73.3%	-7.9%
2030	9,991	11,430	1,439	36%	27%	-9%	1,130	1,019	(111)	81.2%	73.2%	-8.0%
2031	9,442	11,071	1,629	39%	29%	-10%	1,130	1,019	(111)	81.2%	73.2%	-8.0%
2032	8,861	10,690	1,829	42%	30%	-12%	1,128	1,016	(112)	81.0%	73.0%	-8.0%
2033	8,250	10,290	2,040	46%	32%	-14%	1,129	1,017	(112)	81.0%	73.0%	-8.0%
2034	7,605	9,866	2,261	49%	34%	-15%	1,126	1,014	(112)	80.7%	72.7%	-8.0%
2035	6,926	9,422	2,496	53%	36%	-17%	1,128	1,015	(113)	80.7%	72.7%	-8.0%
2036	6,210	8,952	2,742	57%	38%	-19%	1,126	1,013	(113)	80.4%	72.3%	-8.1%
2037	5,457	8,458	3,001	62%	41%	-21%	1,130	1,017	(113)	80.4%	72.3%	-8.1%
2038	4,657	7,932	3,275	67%	44%	-23%	1,126	1,013	(113)	79.7%	71.7%	-8.0%
2039	3,821	7,383	3,562	72%	47%	-25%	1,131	1,018	(113)	79.7%	71.7%	-8.0%
2040	2,934	6,800	3,866	78%	50%	-28%	1,123	1,012	(111)	78.7%	70.9%	-7.8%
2041	2,009	6,192	4,183	85%	54%	-31%	1,128	1,016	(112)	78.7%	70.9%	-7.8%
2042	1,031	5,547	4,516	92%	58%	-34%	1,118	1,010	(108)	77.8%	70.2%	-7.6%
2043	-	4,874	4,874	100%	62%	-38%	64	1,014	950	4.4%	70.2%	65.8%
2044	-	4,162	4,162	100%	67%	-33%	64	1,009	945	4.4%	69.6%	65.2%
2045	-	3,418	3,418	100%	73%	-27%	63	1,012	949	4.4%	69.6%	65.2%
2046	-	2,631	2,631	100%	79%	-21%	63	1,009	946	4.3%	69.3%	65.0%
2047	-	1,805	1,805	100%	85%	-15%	63	1,012	949	4.3%	69.3%	65.0%
2048	-	933	933	100%	92%	-8%	63	1,015	952	4.3%	69.3%	65.0%
2049	-	-	-	100%	100%	0%	62	62	-	4.3%	4.3%	0.0%
2050	-	-	-	100%	100%	0%	63	63	-	4.2%	4.2%	0.0%
2051	-	-	-	100%	100%	0%	64	64	-	4.2%	4.2%	0.0%
2052	-	-	-	100%	100%	0%	65	65	-	4.2%	4.2%	0.0%
2053	-	-	-	100%	100%	0%	66	66	-	4.2%	4.2%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-2
KERS Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 554	\$ 554	\$ -	55%	55%	0%	\$ 52	\$ 52	\$ -	34.4%	34.4%	0.0%
2020	552	552	-	56%	56%	0%	58	54	(4)	38.7%	36.0%	-2.7%
2021	532	536	4	58%	58%	0%	59	55	(4)	38.7%	36.0%	-2.7%
2022	517	526	9	60%	60%	0%	57	53	(4)	37.3%	34.7%	-2.6%
2023	506	519	13	62%	61%	-1%	57	53	(4)	37.3%	34.7%	-2.6%
2024	493	511	18	64%	62%	-2%	56	52	(4)	36.4%	33.9%	-2.5%
2025	479	503	24	65%	63%	-2%	56	52	(4)	36.4%	33.9%	-2.5%
2026	464	494	30	67%	65%	-2%	56	52	(4)	35.8%	33.2%	-2.6%
2027	450	485	35	68%	66%	-2%	56	52	(4)	35.8%	33.2%	-2.6%
2028	433	474	41	70%	67%	-3%	55	51	(4)	35.2%	32.6%	-2.6%
2029	415	463	48	71%	68%	-3%	56	52	(4)	35.2%	32.6%	-2.6%
2030	397	452	55	73%	69%	-4%	55	51	(4)	34.6%	32.1%	-2.5%
2031	376	439	63	75%	71%	-4%	56	52	(4)	34.6%	32.1%	-2.5%
2032	355	426	71	76%	72%	-4%	55	51	(4)	33.9%	31.5%	-2.4%
2033	333	412	79	78%	73%	-5%	56	52	(4)	33.9%	31.5%	-2.4%
2034	308	397	89	80%	74%	-6%	56	51	(5)	33.3%	30.9%	-2.4%
2035	282	381	99	82%	76%	-6%	56	52	(4)	33.3%	30.9%	-2.4%
2036	254	364	110	84%	77%	-7%	56	51	(5)	32.7%	30.3%	-2.4%
2037	225	345	120	86%	79%	-7%	56	52	(4)	32.7%	30.3%	-2.4%
2038	194	326	132	88%	80%	-8%	56	51	(5)	32.4%	29.9%	-2.5%
2039	161	305	144	90%	82%	-8%	56	52	(4)	32.4%	29.9%	-2.5%
2040	125	283	158	93%	83%	-10%	56	51	(5)	32.2%	29.6%	-2.6%
2041	87	259	172	95%	85%	-10%	56	51	(5)	32.2%	29.6%	-2.6%
2042	46	234	188	97%	86%	-11%	57	51	(6)	32.9%	29.4%	-3.5%
2043	-	209	209	100%	88%	-12%	10	51	41	5.9%	29.4%	23.5%
2044	-	180	180	100%	90%	-10%	10	52	42	5.8%	29.6%	23.8%
2045	-	150	150	100%	92%	-8%	10	52	42	5.8%	29.6%	23.8%
2046	-	119	119	100%	93%	-7%	10	53	43	5.8%	30.3%	24.5%
2047	-	83	83	100%	96%	-4%	10	52	42	5.8%	30.3%	24.5%
2048	-	47	47	100%	97%	-3%	10	56	46	5.8%	32.6%	26.8%
2049	-	-	-	100%	100%	0%	10	10	-	5.8%	5.8%	0.0%
2050	-	-	-	100%	100%	0%	10	10	-	5.8%	5.8%	0.0%
2051	-	-	-	100%	100%	0%	10	10	-	5.8%	5.8%	0.0%
2052	-	-	-	100%	100%	0%	11	11	-	5.8%	5.8%	0.0%
2053	-	-	-	100%	100%	0%	11	11	-	5.8%	5.8%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-3
CERS Non-Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 7,306	\$ 7,306	\$ -	49%	49%	0%	\$ 487	\$ 487	\$ -	19.3%	19.3%	0.0%
2020	7,445	7,445	-	49%	49%	0%	558	498	(60)	21.6%	19.3%	-2.3%
2021	7,410	7,472	62	51%	50%	-1%	648	572	(76)	24.6%	21.7%	-2.9%
2022	7,357	7,502	145	52%	51%	-1%	692	628	(64)	25.7%	23.3%	-2.4%
2023	7,288	7,508	220	54%	52%	-2%	697	632	(65)	25.4%	23.0%	-2.4%
2024	7,198	7,498	300	55%	53%	-2%	707	640	(67)	25.2%	22.8%	-2.4%
2025	7,091	7,479	388	57%	54%	-3%	716	648	(68)	25.0%	22.6%	-2.4%
2026	6,965	7,447	482	58%	55%	-3%	725	656	(69)	24.8%	22.4%	-2.4%
2027	6,820	7,404	584	60%	56%	-4%	735	664	(71)	24.6%	22.3%	-2.3%
2028	6,654	7,348	694	61%	57%	-4%	746	673	(73)	24.5%	22.1%	-2.4%
2029	6,466	7,278	812	63%	58%	-5%	758	683	(75)	24.4%	22.0%	-2.4%
2030	6,253	7,192	939	64%	59%	-5%	770	694	(76)	24.3%	21.9%	-2.4%
2031	6,014	7,090	1,076	66%	60%	-6%	784	706	(78)	24.2%	21.8%	-2.4%
2032	5,744	6,969	1,225	68%	61%	-7%	798	718	(80)	24.1%	21.7%	-2.4%
2033	5,444	6,828	1,384	70%	62%	-8%	813	730	(83)	24.0%	21.6%	-2.4%
2034	5,111	6,666	1,555	72%	63%	-9%	829	744	(85)	23.9%	21.5%	-2.4%
2035	4,742	6,482	1,740	74%	65%	-9%	845	759	(86)	23.8%	21.4%	-2.4%
2036	4,334	6,272	1,938	77%	66%	-11%	864	774	(90)	23.8%	21.3%	-2.5%
2037	3,884	6,036	2,152	79%	68%	-11%	884	790	(94)	23.8%	21.3%	-2.5%
2038	3,387	5,769	2,382	82%	69%	-13%	904	808	(96)	23.7%	21.2%	-2.5%
2039	2,841	5,472	2,631	85%	71%	-14%	927	825	(102)	23.7%	21.1%	-2.6%
2040	2,241	5,142	2,901	88%	73%	-15%	951	844	(107)	23.7%	21.1%	-2.6%
2041	1,582	4,774	3,192	92%	75%	-17%	980	863	(117)	23.9%	21.0%	-2.9%
2042	856	4,369	3,513	96%	78%	-18%	1,020	883	(137)	24.2%	21.0%	-3.2%
2043	-	3,920	3,920	100%	80%	-20%	162	905	743	3.8%	21.0%	17.2%
2044	-	3,425	3,425	100%	83%	-17%	165	928	763	3.7%	21.0%	17.3%
2045	-	2,881	2,881	100%	86%	-14%	169	953	784	3.7%	21.1%	17.4%
2046	-	2,280	2,280	100%	89%	-11%	172	981	809	3.7%	21.2%	17.5%
2047	-	1,619	1,619	100%	92%	-8%	176	1,015	839	3.7%	21.4%	17.7%
2048	-	886	886	100%	96%	-4%	179	1,065	886	3.7%	21.9%	18.2%
2049	-	-	-	100%	100%	0%	183	183	-	3.7%	3.7%	0.0%
2050	-	-	-	100%	100%	0%	187	187	-	3.7%	3.7%	0.0%
2051	-	-	-	100%	100%	0%	190	190	-	3.7%	3.7%	0.0%
2052	-	-	-	100%	100%	0%	195	195	-	3.7%	3.7%	0.0%
2053	-	-	-	100%	100%	0%	199	199	-	3.7%	3.7%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-4
CERS Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 2,870	\$ 2,870	\$ -	45%	45%	0%	\$ 168	\$ 168	\$ -	30.1%	30.1%	0.0%
2020	2,945	2,945	-	46%	46%	0%	190	169	(21)	33.9%	30.1%	-3.8%
2021	2,965	2,987	22	47%	46%	-1%	226	199	(27)	39.7%	35.0%	-4.7%
2022	2,974	3,026	52	48%	47%	-1%	268	237	(31)	46.4%	41.0%	-5.4%
2023	2,952	3,038	86	49%	48%	-1%	275	249	(26)	46.8%	42.3%	-4.5%
2024	2,916	3,036	120	51%	49%	-2%	279	252	(27)	46.6%	42.1%	-4.5%
2025	2,873	3,027	154	53%	50%	-3%	283	255	(28)	46.4%	41.8%	-4.6%
2026	2,823	3,016	193	55%	51%	-4%	287	259	(28)	46.1%	41.6%	-4.5%
2027	2,764	2,998	234	56%	53%	-3%	291	262	(29)	45.9%	41.3%	-4.6%
2028	2,696	2,975	279	58%	54%	-4%	296	266	(30)	45.6%	41.1%	-4.5%
2029	2,620	2,946	326	60%	55%	-5%	301	270	(31)	45.4%	40.8%	-4.6%
2030	2,532	2,910	378	62%	56%	-6%	307	275	(32)	45.1%	40.5%	-4.6%
2031	2,433	2,867	434	64%	58%	-6%	312	280	(32)	44.7%	40.2%	-4.5%
2032	2,323	2,817	494	66%	59%	-7%	319	286	(33)	44.4%	39.9%	-4.5%
2033	2,199	2,757	558	69%	61%	-8%	325	292	(33)	44.1%	39.6%	-4.5%
2034	2,062	2,690	628	71%	62%	-9%	331	297	(34)	43.8%	39.2%	-4.6%
2035	1,911	2,613	702	74%	64%	-10%	338	302	(36)	43.5%	38.9%	-4.6%
2036	1,743	2,526	783	76%	66%	-10%	344	308	(36)	43.2%	38.7%	-4.5%
2037	1,559	2,428	869	79%	68%	-11%	350	313	(37)	43.0%	38.4%	-4.6%
2038	1,359	2,320	961	82%	70%	-12%	357	319	(38)	42.8%	38.3%	-4.5%
2039	1,138	2,198	1,060	85%	72%	-13%	365	325	(40)	42.8%	38.1%	-4.7%
2040	896	2,064	1,168	89%	74%	-15%	373	331	(42)	42.8%	38.0%	-4.8%
2041	630	1,914	1,284	92%	76%	-16%	384	338	(46)	43.0%	37.9%	-5.1%
2042	339	1,750	1,411	96%	79%	-17%	398	346	(52)	43.5%	37.8%	-5.7%
2043	-	1,569	1,569	100%	81%	-19%	56	354	298	6.0%	37.8%	31.8%
2044	-	1,369	1,369	100%	84%	-16%	57	362	305	6.0%	37.8%	31.8%
2045	-	1,150	1,150	100%	87%	-13%	58	370	312	6.0%	38.0%	32.0%
2046	-	911	911	100%	90%	-10%	59	382	323	6.0%	38.3%	32.3%
2047	-	646	646	100%	93%	-7%	60	395	335	5.9%	38.8%	32.9%
2048	-	353	353	100%	96%	-4%	62	414	352	5.9%	39.9%	34.0%
2049	-	-	-	100%	100%	0%	63	63	-	5.9%	5.9%	0.0%
2050	-	-	-	100%	100%	0%	64	64	-	5.9%	5.9%	0.0%
2051	-	-	-	100%	100%	0%	66	66	-	5.9%	5.9%	0.0%
2052	-	-	-	100%	100%	0%	67	67	-	5.9%	5.9%	0.0%
2053	-	-	-	100%	100%	0%	68	68	-	5.9%	5.9%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-5
State Police Retirement System Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 763	\$ 763	\$ -	27%	27%	0%	\$ 57	\$ 57	\$ -	119.1%	119.1%	0.0%
2020	755	755	-	28%	28%	0%	64	58	(6)	136.1%	123.8%	-12.3%
2021	734	740	6	30%	30%	0%	64	58	(6)	136.1%	123.8%	-12.3%
2022	715	727	12	32%	31%	-1%	64	58	(6)	137.1%	124.5%	-12.6%
2023	696	714	18	34%	32%	-2%	63	58	(5)	137.1%	124.5%	-12.6%
2024	676	701	25	36%	33%	-3%	63	57	(6)	136.6%	124.0%	-12.6%
2025	654	687	33	38%	35%	-3%	63	57	(6)	136.6%	124.0%	-12.6%
2026	631	672	41	40%	36%	-4%	63	57	(6)	136.7%	123.9%	-12.8%
2027	609	658	49	41%	37%	-4%	63	57	(6)	136.7%	123.9%	-12.8%
2028	583	641	58	44%	38%	-6%	62	56	(6)	135.5%	122.6%	-12.9%
2029	556	623	67	46%	39%	-7%	62	56	(6)	135.5%	122.6%	-12.9%
2030	528	605	77	48%	41%	-7%	62	56	(6)	133.8%	121.1%	-12.7%
2031	499	585	86	51%	42%	-9%	63	57	(6)	133.8%	121.1%	-12.7%
2032	467	564	97	54%	44%	-10%	62	56	(6)	130.8%	118.3%	-12.5%
2033	434	542	108	56%	46%	-10%	63	57	(6)	130.8%	118.3%	-12.5%
2034	398	518	120	60%	48%	-12%	61	56	(5)	127.2%	115.2%	-12.0%
2035	363	495	132	63%	49%	-14%	62	56	(6)	127.2%	115.2%	-12.0%
2036	323	468	145	67%	52%	-15%	61	55	(6)	123.9%	112.4%	-11.5%
2037	284	442	158	70%	54%	-16%	61	55	(6)	123.9%	112.4%	-11.5%
2038	242	414	172	75%	57%	-18%	60	54	(6)	121.9%	110.6%	-11.3%
2039	199	387	188	79%	59%	-20%	60	54	(6)	121.9%	110.6%	-11.3%
2040	152	355	203	84%	62%	-22%	59	54	(5)	120.7%	109.5%	-11.2%
2041	105	324	219	89%	65%	-24%	59	54	(5)	120.7%	109.5%	-11.2%
2042	55	291	236	94%	68%	-26%	60	54	(6)	122.1%	109.6%	-12.5%
2043	-	255	255	100%	72%	-28%	4	54	50	8.5%	109.6%	101.1%
2044	-	219	219	100%	75%	-25%	4	54	50	8.3%	109.3%	101.0%
2045	-	180	180	100%	79%	-21%	4	52	48	8.1%	109.3%	101.2%
2046	-	140	140	100%	84%	-16%	4	54	50	8.0%	112.4%	104.4%
2047	-	97	97	100%	89%	-11%	4	54	50	7.9%	112.4%	104.5%
2048	-	50	50	100%	94%	-6%	4	54	50	7.8%	113.0%	105.2%
2049	-	-	-	100%	100%	0%	4	4	-	7.7%	7.7%	0.0%
2050	-	-	-	100%	100%	0%	4	4	-	7.7%	7.7%	0.0%
2051	-	-	-	100%	100%	0%	4	4	-	7.7%	7.7%	0.0%
2052	-	-	-	100%	100%	0%	4	4	-	7.7%	7.7%	0.0%
2053	-	-	-	100%	100%	0%	4	4	-	7.7%	7.7%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-6
KERS Non-Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 1,742	\$ 1,742	\$ -	36%	36%	0%	\$ 165	\$ 165	\$ -	11.5%	11.5%	0.0%
2020	1,718	1,718	-	39%	39%	0%	171	158	(13)	12.0%	11.2%	-0.8%
2021	1,673	1,686	13	42%	41%	-1%	170	158	(12)	12.0%	11.2%	-0.8%
2022	1,633	1,660	27	45%	44%	-1%	167	154	(13)	11.8%	10.9%	-0.9%
2023	1,595	1,636	41	47%	46%	-1%	166	154	(12)	11.8%	10.9%	-0.9%
2024	1,550	1,607	57	50%	48%	-2%	163	151	(12)	11.6%	10.7%	-0.9%
2025	1,505	1,578	73	52%	49%	-3%	163	150	(13)	11.6%	10.7%	-0.9%
2026	1,454	1,544	90	54%	51%	-3%	159	147	(12)	11.4%	10.5%	-0.9%
2027	1,403	1,512	109	56%	53%	-3%	159	146	(13)	11.4%	10.5%	-0.9%
2028	1,346	1,474	128	58%	54%	-4%	155	143	(12)	11.2%	10.3%	-0.9%
2029	1,288	1,437	149	60%	56%	-4%	155	142	(13)	11.2%	10.3%	-0.9%
2030	1,225	1,396	171	62%	57%	-5%	151	139	(12)	10.9%	10.0%	-0.9%
2031	1,161	1,356	195	64%	58%	-6%	151	139	(12)	10.9%	10.0%	-0.9%
2032	1,090	1,310	220	66%	60%	-6%	148	136	(12)	10.7%	9.8%	-0.9%
2033	1,018	1,264	246	68%	61%	-7%	148	136	(12)	10.7%	9.8%	-0.9%
2034	940	1,215	275	71%	62%	-9%	146	133	(13)	10.5%	9.6%	-0.9%
2035	858	1,162	304	73%	63%	-10%	146	134	(12)	10.5%	9.6%	-0.9%
2036	770	1,106	336	76%	65%	-11%	144	132	(12)	10.3%	9.5%	-0.8%
2037	679	1,049	370	78%	67%	-11%	145	132	(13)	10.3%	9.5%	-0.8%
2038	581	986	405	81%	68%	-13%	143	131	(12)	10.1%	9.3%	-0.8%
2039	478	921	443	85%	70%	-15%	143	131	(12)	10.1%	9.3%	-0.8%
2040	368	850	482	88%	72%	-16%	141	130	(11)	9.9%	9.1%	-0.8%
2041	252	777	525	92%	74%	-18%	142	130	(12)	9.9%	9.1%	-0.8%
2042	128	697	569	96%	77%	-19%	139	129	(10)	9.7%	9.0%	-0.7%
2043	-	615	615	100%	80%	-20%	6	129	123	0.4%	9.0%	8.6%
2044	-	527	527	100%	82%	-18%	6	128	122	0.4%	8.9%	8.5%
2045	-	434	434	100%	85%	-15%	6	129	123	0.4%	8.9%	8.5%
2046	-	334	334	100%	89%	-11%	6	128	122	0.4%	8.8%	8.4%
2047	-	230	230	100%	92%	-8%	6	128	122	0.4%	8.8%	8.4%
2048	-	118	118	100%	96%	-4%	5	127	122	0.4%	8.7%	8.3%
2049	-	-	-	100%	100%	0%	5	5	-	0.4%	0.4%	0.0%
2050	-	-	-	100%	100%	0%	5	5	-	0.4%	0.4%	0.0%
2051	-	-	-	100%	100%	0%	5	5	-	0.3%	0.3%	0.0%
2052	-	-	-	100%	100%	0%	5	5	-	0.3%	0.3%	0.0%
2053	-	-	-	100%	100%	0%	5	5	-	0.3%	0.3%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-7
KERS Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ (98)	\$ (98)	\$ -	123%	123%	0%	\$ 4	\$ 4	\$ -	2.5%	2.5%	0.0%
2020	(103)	(103)	-	123%	123%	0%	-	-	-	0.0%	0.0%	0.0%
2021	(110)	(110)	-	124%	124%	0%	-	-	-	0.0%	0.0%	0.0%
2022	(113)	(113)	-	124%	124%	0%	-	-	-	0.0%	0.0%	0.0%
2023	(114)	(114)	-	124%	124%	0%	-	-	-	0.0%	0.0%	0.0%
2024	(116)	(116)	-	124%	124%	0%	-	-	-	0.0%	0.0%	0.0%
2025	(119)	(119)	-	124%	124%	0%	-	-	-	0.0%	0.0%	0.0%
2026	(122)	(122)	-	125%	125%	0%	-	-	-	0.0%	0.0%	0.0%
2027	(125)	(125)	-	125%	125%	0%	-	-	-	0.0%	0.0%	0.0%
2028	(129)	(129)	-	126%	126%	0%	-	-	-	0.0%	0.0%	0.0%
2029	(133)	(133)	-	127%	127%	0%	-	-	-	0.0%	0.0%	0.0%
2030	(138)	(138)	-	128%	128%	0%	-	-	-	0.0%	0.0%	0.0%
2031	(143)	(143)	-	128%	128%	0%	-	-	-	0.0%	0.0%	0.0%
2032	(148)	(148)	-	129%	129%	0%	-	-	-	0.0%	0.0%	0.0%
2033	(154)	(154)	-	130%	130%	0%	-	-	-	0.0%	0.0%	0.0%
2034	(160)	(160)	-	132%	132%	0%	-	-	-	0.0%	0.0%	0.0%
2035	(167)	(167)	-	133%	133%	0%	-	-	-	0.0%	0.0%	0.0%
2036	(173)	(173)	-	134%	134%	0%	-	-	-	0.0%	0.0%	0.0%
2037	(181)	(181)	-	135%	135%	0%	-	-	-	0.0%	0.0%	0.0%
2038	(188)	(188)	-	136%	136%	0%	-	-	-	0.0%	0.0%	0.0%
2039	(197)	(197)	-	138%	138%	0%	-	-	-	0.0%	0.0%	0.0%
2040	(205)	(205)	-	139%	139%	0%	-	-	-	0.0%	0.0%	0.0%
2041	(215)	(215)	-	141%	141%	0%	-	-	-	0.0%	0.0%	0.0%
2042	(225)	(225)	-	142%	142%	0%	-	-	-	0.0%	0.0%	0.0%
2043	(236)	(236)	-	144%	144%	0%	-	-	-	0.0%	0.0%	0.0%
2044	(247)	(247)	-	145%	145%	0%	-	-	-	0.0%	0.0%	0.0%
2045	(259)	(259)	-	147%	147%	0%	-	-	-	0.0%	0.0%	0.0%
2046	(272)	(272)	-	149%	149%	0%	-	-	-	0.0%	0.0%	0.0%
2047	(286)	(286)	-	151%	151%	0%	-	-	-	0.0%	0.0%	0.0%
2048	(301)	(301)	-	153%	153%	0%	-	-	-	0.0%	0.0%	0.0%
2049	(317)	(317)	-	156%	156%	0%	-	-	-	0.0%	0.0%	0.0%
2050	(333)	(333)	-	158%	158%	0%	-	-	-	0.0%	0.0%	0.0%
2051	(351)	(351)	-	161%	161%	0%	-	-	-	0.0%	0.0%	0.0%
2052	(369)	(369)	-	164%	164%	0%	-	-	-	0.0%	0.0%	0.0%
2053	(390)	(390)	-	167%	167%	0%	-	-	-	0.0%	0.0%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-8
CERS Non-Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 1,045	\$ 1,045	\$ -	71%	71%	0%	\$ 119	\$ 119	\$ -	4.8%	4.8%	0.0%
2020	1,058	1,058	-	72%	72%	0%	136	122	(14)	5.3%	4.8%	-0.5%
2021	1,022	1,037	15	74%	73%	-1%	146	138	(8)	5.6%	5.3%	-0.3%
2022	997	1,022	25	75%	75%	0%	143	134	(9)	5.3%	5.0%	-0.3%
2023	987	1,022	35	76%	76%	0%	141	132	(9)	5.2%	4.9%	-0.3%
2024	972	1,018	46	78%	77%	-1%	140	131	(9)	5.0%	4.7%	-0.3%
2025	955	1,013	58	79%	77%	-2%	139	130	(9)	4.9%	4.6%	-0.3%
2026	935	1,005	70	80%	78%	-2%	138	129	(9)	4.8%	4.5%	-0.3%
2027	913	997	84	81%	79%	-2%	136	128	(8)	4.6%	4.3%	-0.3%
2028	888	986	98	82%	80%	-2%	136	126	(10)	4.5%	4.2%	-0.3%
2029	860	974	114	83%	80%	-3%	135	125	(10)	4.4%	4.1%	-0.3%
2030	829	961	132	83%	81%	-2%	134	124	(10)	4.3%	4.0%	-0.3%
2031	796	945	149	84%	81%	-3%	134	124	(10)	4.2%	3.9%	-0.3%
2032	758	927	169	85%	82%	-3%	134	123	(11)	4.1%	3.8%	-0.3%
2033	717	907	190	86%	83%	-3%	134	124	(10)	4.0%	3.7%	-0.3%
2034	672	884	212	87%	83%	-4%	135	125	(10)	3.9%	3.6%	-0.3%
2035	622	858	236	88%	84%	-4%	137	126	(11)	3.9%	3.6%	-0.3%
2036	567	829	262	90%	85%	-5%	138	127	(11)	3.9%	3.5%	-0.4%
2037	508	797	289	91%	86%	-5%	140	129	(11)	3.8%	3.5%	-0.3%
2038	442	761	319	92%	86%	-6%	142	130	(12)	3.8%	3.5%	-0.3%
2039	370	721	351	94%	87%	-7%	145	133	(12)	3.8%	3.4%	-0.4%
2040	291	676	385	95%	88%	-7%	148	135	(13)	3.7%	3.4%	-0.3%
2041	205	628	423	97%	89%	-8%	151	137	(14)	3.7%	3.4%	-0.3%
2042	109	573	464	98%	90%	-8%	155	140	(15)	3.8%	3.4%	-0.4%
2043	-	513	513	100%	92%	-8%	45	142	97	1.1%	3.4%	2.3%
2044	-	447	447	100%	93%	-7%	45	145	100	1.0%	3.3%	2.3%
2045	-	375	375	100%	94%	-6%	45	148	103	1.0%	3.3%	2.3%
2046	-	296	296	100%	95%	-5%	46	151	105	1.0%	3.3%	2.3%
2047	-	208	208	100%	97%	-3%	46	154	108	1.0%	3.3%	2.3%
2048	-	112	112	100%	98%	-2%	46	159	113	1.0%	3.3%	2.3%
2049	-	-	-	100%	100%	0%	47	47	-	1.0%	1.0%	0.0%
2050	-	-	-	100%	100%	0%	47	47	-	0.9%	0.9%	0.0%
2051	-	-	-	100%	100%	0%	47	47	-	0.9%	0.9%	0.0%
2052	-	-	-	100%	100%	0%	47	47	-	0.9%	0.9%	0.0%
2053	-	-	-	100%	100%	0%	47	47	-	0.9%	0.9%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-9
CERS Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 419	\$ 419	\$ -	76%	76%	0%	\$ 53	\$ 53	\$ -	9.5%	9.5%	0.0%
2020	418	418	-	77%	77%	0%	59	53	(6)	10.5%	9.5%	-1.0%
2021	393	398	5	79%	79%	0%	56	53	(3)	9.9%	9.3%	-0.6%
2022	380	390	10	80%	79%	-1%	53	50	(3)	9.2%	8.6%	-0.6%
2023	375	388	13	81%	80%	-1%	51	47	(4)	8.6%	8.1%	-0.5%
2024	369	386	17	81%	80%	-1%	49	46	(3)	8.2%	7.7%	-0.5%
2025	362	384	22	82%	81%	-1%	48	45	(3)	7.9%	7.4%	-0.5%
2026	354	381	27	82%	81%	-1%	47	44	(3)	7.6%	7.1%	-0.5%
2027	347	379	32	83%	81%	-2%	47	43	(4)	7.4%	6.8%	-0.6%
2028	338	375	37	83%	82%	-1%	46	43	(3)	7.2%	6.6%	-0.6%
2029	328	371	43	84%	82%	-2%	46	43	(3)	7.0%	6.5%	-0.5%
2030	317	367	50	85%	82%	-3%	47	43	(4)	6.9%	6.3%	-0.6%
2031	305	361	56	85%	82%	-3%	47	43	(4)	6.7%	6.2%	-0.5%
2032	291	355	64	86%	83%	-3%	48	44	(4)	6.7%	6.1%	-0.6%
2033	276	348	72	87%	83%	-4%	48	44	(4)	6.6%	6.0%	-0.6%
2034	259	340	81	87%	83%	-4%	49	45	(4)	6.5%	6.0%	-0.5%
2035	240	330	90	88%	84%	-4%	50	46	(4)	6.5%	5.9%	-0.6%
2036	219	319	100	89%	84%	-5%	51	47	(4)	6.4%	5.9%	-0.5%
2037	197	307	110	90%	85%	-5%	52	48	(4)	6.4%	5.8%	-0.6%
2038	172	294	122	92%	86%	-6%	53	49	(4)	6.4%	5.8%	-0.6%
2039	144	278	134	93%	87%	-6%	55	50	(5)	6.4%	5.8%	-0.6%
2040	114	262	148	95%	88%	-7%	56	51	(5)	6.4%	5.8%	-0.6%
2041	80	243	163	96%	89%	-7%	57	52	(5)	6.4%	5.8%	-0.6%
2042	44	223	179	98%	90%	-8%	60	53	(7)	6.5%	5.8%	-0.7%
2043	-	199	199	100%	91%	-9%	16	54	38	1.7%	5.7%	4.0%
2044	-	174	174	100%	92%	-8%	16	55	39	1.7%	5.7%	4.0%
2045	-	146	146	100%	94%	-6%	16	56	40	1.7%	5.8%	4.1%
2046	-	116	116	100%	95%	-5%	16	57	41	1.7%	5.8%	4.1%
2047	-	83	83	100%	96%	-4%	16	59	43	1.6%	5.8%	4.2%
2048	-	44	44	100%	98%	-2%	17	61	44	1.6%	5.9%	4.3%
2049	-	-	-	100%	100%	0%	17	17	-	1.6%	1.6%	0.0%
2050	-	-	-	100%	100%	0%	17	17	-	1.6%	1.6%	0.0%
2051	-	-	-	100%	100%	0%	17	17	-	1.5%	1.5%	0.0%
2052	-	-	-	100%	100%	0%	17	17	-	1.5%	1.5%	0.0%
2053	-	-	-	100%	100%	0%	17	17	-	1.5%	1.5%	0.0%

Gabriel Roeder Smith & Company

Kentucky Retirement Systems
Exhibit 1-10
State Police Retirement System Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Comparison of Current Plan and Proposed Legislation
(\$ in Millions)

Fiscal Year Beginning July 1,	Unfunded Actuarial Accrued Liability			Funded Ratio			Employer Contributions			Employer Contribution Rate		
	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference	Current	Proposed	Difference
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2019	\$ 80	\$ 80	\$ -	71%	71%	0%	\$ 13	\$ 13	\$ -	27.2%	27.2%	0.0%
2020	74	74	-	74%	74%	0%	10	9	(1)	20.9%	19.7%	-1.2%
2021	70	70	-	76%	76%	0%	10	9	(1)	20.9%	19.7%	-1.2%
2022	67	68	1	77%	77%	0%	9	8	(1)	19.0%	17.9%	-1.1%
2023	65	67	2	78%	78%	0%	9	8	(1)	19.0%	17.9%	-1.1%
2024	63	65	2	79%	79%	0%	8	8	-	17.5%	16.4%	-1.1%
2025	61	64	3	80%	79%	-1%	8	8	-	17.5%	16.4%	-1.1%
2026	59	63	4	81%	79%	-2%	8	7	(1)	16.5%	15.4%	-1.1%
2027	57	61	4	81%	80%	-1%	8	7	(1)	16.5%	15.4%	-1.1%
2028	54	60	6	82%	80%	-2%	7	7	-	15.7%	14.6%	-1.1%
2029	52	58	6	83%	81%	-2%	7	7	-	15.7%	14.6%	-1.1%
2030	50	57	7	83%	81%	-2%	7	7	-	15.1%	14.1%	-1.0%
2031	47	55	8	84%	82%	-2%	7	7	-	15.1%	14.1%	-1.0%
2032	44	53	9	85%	82%	-3%	7	6	(1)	14.7%	13.6%	-1.1%
2033	41	51	10	86%	83%	-3%	7	7	-	14.7%	13.6%	-1.1%
2034	38	49	11	87%	83%	-4%	7	6	(1)	14.2%	13.2%	-1.0%
2035	35	47	12	88%	84%	-4%	7	6	(1)	14.2%	13.2%	-1.0%
2036	31	45	14	89%	84%	-5%	7	6	(1)	13.9%	13.0%	-0.9%
2037	27	42	15	90%	85%	-5%	7	6	(1)	13.9%	13.0%	-0.9%
2038	24	40	16	91%	86%	-5%	7	6	(1)	13.8%	12.8%	-1.0%
2039	19	37	18	93%	86%	-7%	7	6	(1)	13.8%	12.8%	-1.0%
2040	15	35	20	94%	87%	-7%	7	6	(1)	13.8%	12.8%	-1.0%
2041	11	32	21	96%	88%	-8%	7	6	(1)	13.8%	12.8%	-1.0%
2042	5	28	23	98%	90%	-8%	7	6	(1)	14.3%	12.9%	-1.4%
2043	-	26	26	100%	90%	-10%	1	6	5	2.7%	12.9%	10.2%
2044	-	22	22	100%	92%	-8%	1	6	5	2.7%	12.9%	10.2%
2045	-	18	18	100%	93%	-7%	1	6	5	2.6%	12.9%	10.3%
2046	-	14	14	100%	95%	-5%	1	6	5	2.6%	13.2%	10.6%
2047	-	10	10	100%	96%	-4%	1	6	5	2.5%	13.2%	10.7%
2048	-	5	5	100%	98%	-2%	1	6	5	2.5%	13.3%	10.8%
2049	-	-	-	100%	100%	0%	1	1	-	2.4%	2.4%	0.0%
2050	-	-	-	100%	100%	0%	1	1	-	2.3%	2.3%	0.0%
2051	-	-	-	100%	100%	0%	1	1	-	2.3%	2.3%	0.0%
2052	-	-	-	100%	100%	0%	1	1	-	2.3%	2.3%	0.0%
2053	-	-	-	100%	100%	0%	1	1	-	2.2%	2.2%	0.0%

Gabriel Roeder Smith & Company

SB 249
Section 2.
Projected Cost of the Retirement and Insurance
Current Plan

Kentucky Retirement Systems
Exhibit 2-1
KERS Non-Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 16,466	\$ 2,206	\$ 14,260	13%	\$ 924	\$ 72	\$ 1,438	64.26%	74.54%	\$ 996	\$ (1,008)	\$ (12)	\$ 117
2020	16,493	2,301	14,192	14%	1,156	71	1,428	80.98%	80.98%	1,227	(1,024)	203	128
2021	16,500	2,660	13,840	16%	1,151	71	1,422	80.98%	81.27%	1,222	(1,038)	184	145
2022	16,489	2,999	13,490	18%	1,150	71	1,417	81.21%	81.21%	1,221	(1,051)	170	162
2023	16,459	3,332	13,127	20%	1,147	71	1,412	81.21%	81.20%	1,218	(1,065)	153	179
2024	16,410	3,664	12,746	22%	1,144	70	1,409	81.23%	81.23%	1,214	(1,077)	137	196
2025	16,342	3,997	12,345	24%	1,142	70	1,406	81.23%	81.22%	1,212	(1,089)	123	213
2026	16,255	4,333	11,922	27%	1,139	70	1,402	81.20%	81.20%	1,209	(1,100)	109	230
2027	16,149	4,673	11,476	29%	1,136	70	1,399	81.20%	81.19%	1,206	(1,110)	96	248
2028	16,024	5,017	11,007	31%	1,134	70	1,396	81.20%	81.20%	1,204	(1,118)	86	266
2029	15,880	5,368	10,512	34%	1,132	70	1,394	81.20%	81.19%	1,202	(1,121)	81	284
2030	15,724	5,733	9,991	36%	1,130	70	1,393	81.16%	81.16%	1,200	(1,126)	74	303
2031	15,552	6,110	9,442	39%	1,130	70	1,393	81.16%	81.12%	1,200	(1,128)	72	323
2032	15,366	6,505	8,861	42%	1,128	70	1,393	81.00%	81.00%	1,198	(1,128)	70	343
2033	15,168	6,918	8,250	46%	1,129	70	1,394	81.00%	80.88%	1,199	(1,127)	72	365
2034	14,959	7,354	7,605	49%	1,126	70	1,395	80.72%	80.72%	1,196	(1,124)	72	388
2035	14,740	7,814	6,926	53%	1,128	70	1,397	80.72%	80.57%	1,198	(1,119)	79	412
2036	14,515	8,305	6,210	57%	1,126	70	1,401	80.36%	80.36%	1,196	(1,109)	87	438
2037	14,286	8,829	5,457	62%	1,130	70	1,406	80.36%	80.07%	1,200	(1,097)	103	466
2038	14,056	9,399	4,657	67%	1,126	71	1,413	79.66%	79.66%	1,197	(1,082)	115	496
2039	13,830	10,009	3,821	72%	1,131	71	1,420	79.66%	79.26%	1,202	(1,067)	135	529
2040	13,608	10,674	2,934	78%	1,123	71	1,426	78.73%	78.73%	1,194	(1,049)	145	564
2041	13,392	11,383	2,009	85%	1,128	72	1,433	78.73%	78.39%	1,200	(1,032)	168	602
2042	13,183	12,152	1,031	92%	1,118	72	1,438	77.75%	77.75%	1,190	(1,014)	176	643
2043	12,980	12,980	-	100%	64	72	1,444	4.44%	4.44%	136	(996)	(860)	658
2044	12,785	12,785	-	100%	64	72	1,448	4.40%	4.40%	136	(979)	(843)	648
2045	12,599	12,599	-	100%	63	73	1,453	4.36%	4.36%	136	(961)	(825)	639
2046	12,421	12,421	-	100%	63	73	1,457	4.32%	4.32%	136	(943)	(807)	629
2047	12,252	12,252	-	100%	63	73	1,461	4.29%	4.29%	136	(925)	(789)	620
2048	12,093	12,093	-	100%	63	73	1,465	4.27%	4.27%	136	(907)	(771)	612
2049	11,944	11,944	-	100%	62	73	1,468	4.25%	4.25%	135	(888)	(753)	604
2050	11,809	11,809	-	100%	63	75	1,494	4.23%	4.23%	138	(870)	(732)	597
2051	11,687	11,687	-	100%	64	76	1,523	4.22%	4.22%	140	(853)	(713)	590
2052	11,581	11,581	-	100%	65	78	1,552	4.21%	4.21%	143	(836)	(693)	584
2053	11,488	11,488	-	100%	66	79	1,583	4.20%	4.20%	145	(821)	(676)	579

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 5.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire, but the total active population is assumed to decrease by 2% each year over the next 30 years.

The contribution rate established in the Commonwealth's biennium budget is based on the calculated actuarially determined contribution rate.

The 64.26% employer contribution rate for FY 2020 is the effective contribution rate after reflecting HB 1 (passed during the 2019 Special Session) which provided that Regional Mental Health/Mental Retardation Boards, Local and District Health Departments, State Universities, Community Colleges and any other agency eligible to voluntarily cease participating in the KERS to contribute a 41.06% of pay contribution rate for FY 2019. Collectively these entities reflect approximately 23% of the covered payroll in the System.

Kentucky Retirement Systems
Exhibit 2-2
KERS Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 1,226	\$ 672	\$ 554	55%	\$ 52	\$ 12	\$ 150	34.39%	34.42%	\$ 64	\$ (74)	\$ (10)	\$ 42
2020	1,255	703	552	56%	58	12	150	38.71%	38.71%	70	(77)	(7)	44
2021	1,281	749	532	58%	59	12	152	38.71%	38.35%	71	(79)	(8)	47
2022	1,307	790	517	60%	57	12	152	37.30%	37.30%	69	(82)	(13)	49
2023	1,331	825	506	62%	57	12	153	37.30%	36.77%	69	(84)	(15)	51
2024	1,354	861	493	64%	56	12	154	36.44%	36.44%	68	(86)	(18)	53
2025	1,376	897	479	65%	56	12	155	36.44%	36.07%	68	(89)	(21)	55
2026	1,397	933	464	67%	56	12	156	35.76%	35.76%	68	(91)	(23)	58
2027	1,417	967	450	68%	56	12	156	35.76%	35.46%	68	(93)	(25)	60
2028	1,435	1,002	433	70%	55	13	157	35.15%	35.15%	68	(95)	(27)	62
2029	1,452	1,037	415	71%	56	13	158	35.15%	34.88%	69	(95)	(26)	64
2030	1,471	1,074	397	73%	55	13	160	34.58%	34.58%	68	(96)	(28)	66
2031	1,489	1,113	376	75%	56	13	161	34.58%	34.27%	69	(96)	(27)	69
2032	1,509	1,154	355	76%	55	13	163	33.94%	33.94%	68	(97)	(29)	71
2033	1,529	1,196	333	78%	56	13	165	33.94%	33.64%	69	(97)	(28)	74
2034	1,550	1,242	308	80%	56	13	167	33.30%	33.30%	69	(98)	(29)	77
2035	1,572	1,290	282	82%	56	13	168	33.30%	33.02%	69	(99)	(30)	80
2036	1,595	1,341	254	84%	56	14	170	32.74%	32.74%	70	(100)	(30)	83
2037	1,618	1,393	225	86%	56	14	171	32.74%	32.55%	70	(101)	(31)	86
2038	1,641	1,447	194	88%	56	14	172	32.35%	32.35%	70	(103)	(33)	89
2039	1,664	1,503	161	90%	56	14	172	32.35%	32.25%	70	(104)	(34)	93
2040	1,687	1,562	125	93%	56	14	173	32.19%	32.19%	70	(105)	(35)	96
2041	1,709	1,622	87	95%	56	14	174	32.19%	32.30%	70	(107)	(37)	100
2042	1,732	1,686	46	97%	57	14	174	32.92%	32.92%	71	(108)	(37)	104
2043	1,756	1,756	-	100%	10	14	175	5.87%	5.87%	24	(109)	(85)	107
2044	1,779	1,779	-	100%	10	14	175	5.84%	5.84%	24	(111)	(87)	108
2045	1,802	1,802	-	100%	10	14	174	5.82%	5.82%	24	(113)	(89)	110
2046	1,825	1,825	-	100%	10	14	174	5.81%	5.81%	24	(115)	(91)	111
2047	1,846	1,846	-	100%	10	14	173	5.80%	5.80%	24	(117)	(93)	112
2048	1,867	1,867	-	100%	10	14	173	5.79%	5.79%	24	(119)	(95)	113
2049	1,887	1,887	-	100%	10	14	173	5.79%	5.79%	24	(121)	(97)	114
2050	1,906	1,906	-	100%	10	14	176	5.79%	5.79%	24	(124)	(100)	115
2051	1,925	1,925	-	100%	10	14	178	5.79%	5.79%	24	(126)	(102)	116
2052	1,944	1,944	-	100%	11	15	182	5.79%	5.79%	26	(128)	(102)	117
2053	1,961	1,961	-	100%	11	15	185	5.79%	5.79%	26	(130)	(104)	118

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire, but the total active population is assumed to decrease by 2% each year over the next 30 years.

The contribution rate established in the Commonwealth's biennium budget is based on the calculated actuarially determined contribution rate.

Kentucky Retirement Systems
Exhibit 2-3
CERS Non-Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 14,356	\$ 7,050	\$ 7,306	49%	\$ 487	\$ 126	\$ 2,522	19.30%	22.52%	\$ 613	\$ (818)	\$ (205)	\$ 441
2020	14,726	7,281	7,445	49%	558	129	2,581	21.62%	26.21%	687	(855)	(168)	457
2021	15,079	7,669	7,410	51%	648	132	2,638	24.58%	26.14%	780	(890)	(110)	477
2022	15,418	8,061	7,357	52%	692	135	2,694	25.67%	25.67%	827	(926)	(99)	500
2023	15,742	8,454	7,288	54%	697	138	2,751	25.35%	25.35%	835	(962)	(127)	524
2024	16,049	8,851	7,198	55%	707	140	2,809	25.16%	25.16%	847	(999)	(152)	548
2025	16,339	9,248	7,091	57%	716	143	2,866	24.97%	24.97%	859	(1,036)	(177)	572
2026	16,609	9,644	6,965	58%	725	146	2,924	24.80%	24.80%	871	(1,073)	(202)	596
2027	16,859	10,039	6,820	60%	735	149	2,983	24.64%	24.64%	884	(1,109)	(225)	620
2028	17,088	10,434	6,654	61%	746	152	3,044	24.50%	24.50%	898	(1,143)	(245)	644
2029	17,299	10,833	6,466	63%	758	155	3,107	24.39%	24.39%	913	(1,169)	(256)	669
2030	17,499	11,246	6,253	64%	770	159	3,174	24.27%	24.27%	929	(1,198)	(269)	694
2031	17,685	11,671	6,014	66%	784	162	3,243	24.17%	24.17%	946	(1,225)	(279)	721
2032	17,858	12,114	5,744	68%	798	166	3,315	24.07%	24.07%	964	(1,249)	(285)	748
2033	18,021	12,577	5,444	70%	813	169	3,390	23.98%	23.98%	982	(1,271)	(289)	777
2034	18,176	13,065	5,111	72%	829	173	3,467	23.91%	23.91%	1,002	(1,291)	(289)	808
2035	18,326	13,584	4,742	74%	845	177	3,546	23.84%	23.84%	1,022	(1,308)	(286)	840
2036	18,473	14,139	4,334	77%	864	182	3,631	23.79%	23.79%	1,046	(1,321)	(275)	875
2037	18,622	14,738	3,884	79%	884	186	3,720	23.76%	23.76%	1,070	(1,330)	(260)	913
2038	18,778	15,391	3,387	82%	904	191	3,813	23.72%	23.72%	1,095	(1,336)	(241)	954
2039	18,946	16,105	2,841	85%	927	195	3,909	23.71%	23.71%	1,122	(1,340)	(218)	1,000
2040	19,128	16,887	2,241	88%	951	200	4,007	23.74%	23.74%	1,151	(1,343)	(192)	1,049
2041	19,327	17,745	1,582	92%	980	205	4,107	23.86%	23.86%	1,185	(1,345)	(160)	1,104
2042	19,545	18,689	856	96%	1,020	210	4,209	24.22%	24.22%	1,230	(1,348)	(118)	1,164
2043	19,783	19,783	-	100%	162	216	4,313	3.76%	3.76%	378	(1,350)	(972)	1,203
2044	20,043	20,043	-	100%	165	221	4,419	3.74%	3.74%	386	(1,353)	(967)	1,218
2045	20,326	20,326	-	100%	169	226	4,526	3.73%	3.73%	395	(1,357)	(962)	1,234
2046	20,633	20,633	-	100%	172	232	4,635	3.71%	3.71%	404	(1,361)	(957)	1,251
2047	20,965	20,965	-	100%	176	237	4,745	3.70%	3.70%	413	(1,368)	(955)	1,269
2048	21,322	21,322	-	100%	179	243	4,857	3.69%	3.69%	422	(1,375)	(953)	1,289
2049	21,705	21,705	-	100%	183	249	4,971	3.68%	3.68%	432	(1,384)	(952)	1,310
2050	22,113	22,113	-	100%	187	254	5,087	3.67%	3.67%	441	(1,395)	(954)	1,332
2051	22,548	22,548	-	100%	190	260	5,204	3.66%	3.66%	450	(1,407)	(957)	1,356
2052	23,009	23,009	-	100%	195	266	5,324	3.66%	3.66%	461	(1,422)	(961)	1,380
2053	23,497	23,497	-	100%	199	272	5,446	3.66%	3.66%	471	(1,439)	(968)	1,406

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire.

The total active population is assumed to remain constant through the entire projection.

The Board certified contribution rate paid by employers is based on the calculated actuarially determined contribution rate and reflects House Bill 362 passed during the 2018 legislative session that limits the contribution rate increases up to 12% per year over the prior fiscal year for the period of July 1, 2018 to June 30, 2028.

Kentucky Retirement Systems
Exhibit 2-4
CERS Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 5,245	\$ 2,375	\$ 2,870	45%	\$ 168	\$ 45	\$ 559	30.06%	36.98%	\$ 213	\$ (275)	\$ (62)	\$ 149
2020	5,407	2,462	2,945	46%	190	45	562	33.86%	46.31%	235	(293)	(58)	155
2021	5,557	2,592	2,965	47%	226	46	570	39.73%	47.18%	272	(308)	(36)	161
2022	5,700	2,726	2,974	48%	268	46	578	46.43%	47.06%	314	(322)	(8)	170
2023	5,837	2,885	2,952	49%	275	47	588	46.79%	46.79%	322	(336)	(14)	180
2024	5,968	3,052	2,916	51%	279	48	599	46.62%	46.62%	327	(349)	(22)	190
2025	6,093	3,220	2,873	53%	283	49	610	46.37%	46.37%	332	(361)	(29)	200
2026	6,214	3,391	2,823	55%	287	50	622	46.12%	46.12%	337	(373)	(36)	211
2027	6,329	3,565	2,764	56%	291	51	635	45.88%	45.88%	342	(384)	(42)	222
2028	6,441	3,745	2,696	58%	296	52	648	45.62%	45.62%	348	(394)	(46)	233
2029	6,550	3,930	2,620	60%	301	53	663	45.37%	45.37%	354	(402)	(48)	244
2030	6,658	4,126	2,532	62%	307	54	680	45.09%	45.09%	361	(409)	(48)	256
2031	6,768	4,335	2,433	64%	312	56	698	44.74%	44.74%	368	(415)	(47)	269
2032	6,880	4,557	2,323	66%	319	57	717	44.42%	44.42%	376	(420)	(44)	283
2033	6,995	4,796	2,199	69%	325	59	737	44.09%	44.09%	384	(425)	(41)	298
2034	7,115	5,053	2,062	71%	331	61	757	43.75%	43.75%	392	(431)	(39)	315
2035	7,239	5,328	1,911	74%	338	62	777	43.46%	43.46%	400	(437)	(37)	332
2036	7,366	5,623	1,743	76%	344	64	796	43.20%	43.20%	408	(445)	(37)	350
2037	7,495	5,936	1,559	79%	350	65	815	42.99%	42.99%	415	(455)	(40)	370
2038	7,625	6,266	1,359	82%	357	67	834	42.84%	42.84%	424	(465)	(41)	390
2039	7,753	6,615	1,138	85%	365	68	852	42.78%	42.78%	433	(475)	(42)	412
2040	7,881	6,985	896	89%	373	70	872	42.80%	42.80%	443	(484)	(41)	435
2041	8,009	7,379	630	92%	384	71	892	42.99%	42.99%	455	(492)	(37)	460
2042	8,141	7,802	339	96%	398	73	913	43.54%	43.54%	471	(498)	(27)	487
2043	8,277	8,277	-	100%	56	75	935	6.03%	6.03%	131	(505)	(374)	505
2044	8,417	8,417	-	100%	57	77	956	5.99%	5.99%	134	(514)	(380)	513
2045	8,561	8,561	-	100%	58	78	976	5.97%	5.97%	136	(523)	(387)	521
2046	8,708	8,708	-	100%	59	80	996	5.95%	5.95%	139	(533)	(394)	529
2047	8,856	8,856	-	100%	60	81	1,017	5.94%	5.94%	141	(544)	(403)	537
2048	9,006	9,006	-	100%	62	83	1,038	5.93%	5.93%	145	(554)	(409)	545
2049	9,159	9,159	-	100%	63	85	1,062	5.93%	5.93%	148	(565)	(417)	553
2050	9,314	9,314	-	100%	64	87	1,082	5.93%	5.93%	151	(577)	(426)	562
2051	9,470	9,470	-	100%	66	88	1,105	5.93%	5.93%	154	(589)	(435)	570
2052	9,626	9,626	-	100%	67	90	1,128	5.93%	5.93%	157	(601)	(444)	578
2053	9,784	9,784	-	100%	68	92	1,152	5.93%	5.93%	160	(613)	(453)	586

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire.

The total active population is assumed to remain constant through the entire projection.

The Board certified contribution rate paid by employers is based on the calculated actuarially determined contribution rate and reflects House Bill 362 passed during the 2018 legislative session that limits the contribution rate increases up to 12% per year over the prior fiscal year for the period of July 1, 2018 to June 30, 2028.

Kentucky Retirement Systems
Exhibit 2-5
State Police Retirement System Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 1,045	\$ 282	\$ 763	27%	\$ 57	\$ 4	\$ 48	119.05%	120.54%	\$ 61	\$ (63)	\$ (2)	\$ 15
2020	1,050	295	755	28%	64	4	47	136.12%	136.12%	68	(64)	4	16
2021	1,052	318	734	30%	64	4	47	136.12%	137.64%	68	(65)	3	17
2022	1,053	338	715	32%	64	4	47	137.06%	137.06%	68	(66)	2	18
2023	1,053	357	696	34%	63	4	46	137.06%	136.73%	67	(67)	-	19
2024	1,052	376	676	36%	63	4	46	136.63%	136.63%	67	(68)	(1)	20
2025	1,049	395	654	38%	63	4	46	136.63%	136.45%	67	(69)	(2)	21
2026	1,045	414	631	40%	63	4	46	136.73%	136.73%	67	(69)	(2)	22
2027	1,041	432	609	41%	63	4	46	136.73%	136.35%	67	(69)	(2)	23
2028	1,035	452	583	44%	62	4	46	135.45%	135.45%	66	(70)	(4)	24
2029	1,028	472	556	46%	62	4	46	135.45%	134.79%	66	(70)	(4)	25
2030	1,021	493	528	48%	62	4	46	133.84%	133.84%	66	(70)	(4)	26
2031	1,013	514	499	51%	63	4	47	133.84%	132.52%	67	(70)	(3)	27
2032	1,005	538	467	54%	62	4	47	130.81%	130.81%	66	(69)	(3)	28
2033	996	562	434	56%	63	4	48	130.81%	129.28%	67	(69)	(2)	29
2034	988	590	398	60%	61	4	48	127.16%	127.16%	65	(68)	(3)	31
2035	980	617	363	63%	62	4	49	127.16%	125.63%	66	(68)	(2)	32
2036	971	648	323	67%	61	4	49	123.92%	123.92%	65	(68)	(3)	34
2037	962	678	284	70%	61	4	49	123.92%	123.15%	65	(67)	(2)	36
2038	953	711	242	75%	60	4	49	121.90%	121.90%	64	(67)	(3)	37
2039	944	745	199	79%	60	4	49	121.90%	121.57%	64	(67)	(3)	39
2040	933	781	152	84%	59	4	49	120.67%	120.67%	63	(67)	(4)	41
2041	923	818	105	89%	59	4	49	120.67%	120.92%	63	(67)	(4)	43
2042	912	857	55	94%	60	4	49	122.14%	122.14%	64	(66)	(2)	45
2043	900	900	-	100%	4	4	49	8.51%	8.51%	8	(66)	(58)	46
2044	889	889	-	100%	4	4	49	8.30%	8.30%	8	(66)	(58)	45
2045	877	877	-	100%	4	4	48	8.13%	8.13%	8	(66)	(58)	44
2046	864	864	-	100%	4	4	48	7.97%	7.97%	8	(65)	(57)	44
2047	851	851	-	100%	4	4	48	7.85%	7.85%	8	(64)	(56)	43
2048	837	837	-	100%	4	4	48	7.76%	7.76%	8	(64)	(56)	42
2049	824	824	-	100%	4	4	48	7.70%	7.70%	8	(64)	(56)	42
2050	810	810	-	100%	4	4	49	7.67%	7.67%	8	(63)	(55)	41
2051	797	797	-	100%	4	4	49	7.66%	7.66%	8	(62)	(54)	40
2052	783	783	-	100%	4	4	50	7.66%	7.66%	8	(62)	(54)	39
2053	770	770	-	100%	4	4	51	7.66%	7.66%	8	(61)	(53)	39

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 5.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire, but the total active population is assumed to decrease by 2% each year over the next 30 years.

The contribution rate established in the Commonwealth's biennium budget is based on the calculated actuarially determined contribution rate.

The employer contribution amount shown does not include the \$1.086 million additional contribution budgeted to be paid in fiscal year ending 2020.

Kentucky Retirement Systems
Exhibit 2-6
KERS Non-Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 2,733	\$ 991	\$ 1,742	36%	\$ 165	\$ 6	\$ 1,431	11.50%	10.65%	\$ 171	\$ (133)	\$ 38	\$ 63
2020	2,808	1,090	1,718	39%	171	6	1,421	12.03%	12.03%	177	(137)	40	70
2021	2,882	1,209	1,673	42%	170	7	1,415	12.03%	11.99%	177	(145)	32	76
2022	2,951	1,318	1,633	45%	167	7	1,410	11.83%	11.83%	174	(153)	21	83
2023	3,015	1,420	1,595	47%	166	8	1,406	11.83%	11.73%	174	(161)	13	89
2024	3,072	1,522	1,550	50%	163	8	1,402	11.63%	11.63%	171	(170)	1	95
2025	3,123	1,618	1,505	52%	163	9	1,399	11.63%	11.53%	172	(180)	(8)	101
2026	3,165	1,711	1,454	54%	159	9	1,396	11.40%	11.40%	168	(189)	(21)	106
2027	3,200	1,797	1,403	56%	159	10	1,393	11.40%	11.28%	169	(199)	(30)	111
2028	3,224	1,878	1,346	58%	155	10	1,390	11.15%	11.15%	165	(208)	(43)	116
2029	3,239	1,951	1,288	60%	155	11	1,388	11.15%	11.03%	166	(217)	(51)	120
2030	3,245	2,020	1,225	62%	151	11	1,387	10.89%	10.89%	162	(224)	(62)	124
2031	3,244	2,083	1,161	64%	151	11	1,387	10.89%	10.78%	162	(229)	(67)	128
2032	3,235	2,145	1,090	66%	148	12	1,387	10.66%	10.66%	160	(233)	(73)	132
2033	3,221	2,203	1,018	68%	148	12	1,388	10.66%	10.58%	160	(236)	(76)	135
2034	3,203	2,263	940	71%	146	13	1,389	10.48%	10.48%	159	(238)	(79)	139
2035	3,180	2,322	858	73%	146	13	1,391	10.48%	10.40%	159	(238)	(79)	143
2036	3,156	2,386	770	76%	144	13	1,395	10.32%	10.32%	157	(236)	(79)	147
2037	3,132	2,453	679	78%	145	13	1,401	10.32%	10.23%	158	(234)	(76)	151
2038	3,108	2,527	581	81%	143	14	1,407	10.13%	10.13%	157	(232)	(75)	156
2039	3,085	2,607	478	85%	143	14	1,414	10.13%	10.05%	157	(229)	(72)	161
2040	3,063	2,695	368	88%	141	14	1,421	9.93%	9.93%	155	(226)	(71)	166
2041	3,043	2,791	252	92%	142	14	1,427	9.93%	9.87%	156	(223)	(67)	172
2042	3,024	2,896	128	96%	139	14	1,433	9.67%	9.67%	153	(219)	(66)	179
2043	3,009	3,009	-	100%	6	14	1,438	0.42%	0.42%	20	(216)	(196)	182
2044	2,995	2,995	-	100%	6	14	1,443	0.41%	0.41%	20	(214)	(194)	181
2045	2,983	2,983	-	100%	6	14	1,447	0.40%	0.40%	20	(212)	(192)	180
2046	2,971	2,971	-	100%	6	14	1,451	0.38%	0.38%	20	(212)	(192)	180
2047	2,960	2,960	-	100%	6	15	1,455	0.38%	0.38%	21	(212)	(191)	179
2048	2,947	2,947	-	100%	5	15	1,459	0.37%	0.37%	20	(212)	(192)	178
2049	2,934	2,934	-	100%	5	15	1,463	0.36%	0.36%	20	(213)	(193)	177
2050	2,919	2,919	-	100%	5	15	1,489	0.35%	0.35%	20	(213)	(193)	176
2051	2,903	2,903	-	100%	5	15	1,517	0.34%	0.34%	20	(214)	(194)	175
2052	2,885	2,885	-	100%	5	15	1,546	0.32%	0.32%	20	(214)	(194)	174
2053	2,867	2,867	-	100%	5	16	1,577	0.31%	0.31%	21	(214)	(193)	173

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire, but the total active population is assumed to decrease by 2% each year over the next 30 years.

The contribution rate established in the Commonwealth's biennium budget is based on the calculated actuarially determined contribution rate.

The 11.50% employer contribution rate for FY 2020 is the effective contribution rate after reflecting HB 1 (passed during the 2019 Special Session) which provided that

Regional Mental Health/Mental Retardation Boards, Local and District Health Departments, State Universities, Community Colleges and any other agency eligible to voluntarily cease participating in the KERS to contribute a 8.41% of pay contribution rate for FY 2019. Collectively these entities reflect approximately 23% of the covered payroll in the System.

Kentucky Retirement Systems
Exhibit 2-7
KERS Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 427	\$ 525	\$ (98)	123%	\$ 4	\$ 1	\$ 150	2.46%	0.00%	\$ 5	\$ (20)	\$ (15)	\$ 33
2020	440	543	(103)	123%	-	1	150	0.00%	0.00%	1	(22)	(21)	34
2021	453	563	(110)	124%	-	1	151	0.00%	0.00%	1	(24)	(23)	35
2022	464	577	(113)	124%	-	1	152	0.00%	0.00%	1	(26)	(25)	35
2023	473	587	(114)	124%	-	1	153	0.00%	0.00%	1	(27)	(26)	36
2024	480	596	(116)	124%	-	1	154	0.00%	0.00%	1	(29)	(28)	36
2025	486	605	(119)	124%	-	1	155	0.00%	0.00%	1	(30)	(29)	37
2026	491	613	(122)	125%	-	1	155	0.00%	0.00%	1	(32)	(31)	37
2027	495	620	(125)	125%	-	1	156	0.00%	0.00%	1	(32)	(31)	38
2028	498	627	(129)	126%	-	1	157	0.00%	0.00%	1	(33)	(32)	38
2029	500	633	(133)	127%	-	1	158	0.00%	0.00%	1	(34)	(33)	39
2030	501	639	(138)	128%	-	2	160	0.00%	0.00%	2	(34)	(32)	39
2031	502	645	(143)	128%	-	2	161	0.00%	0.00%	2	(34)	(32)	39
2032	504	652	(148)	129%	-	2	163	0.00%	0.00%	2	(34)	(32)	40
2033	505	659	(154)	130%	-	2	165	0.00%	0.00%	2	(34)	(32)	40
2034	507	667	(160)	132%	-	2	167	0.00%	0.00%	2	(34)	(32)	41
2035	508	675	(167)	133%	-	2	168	0.00%	0.00%	2	(34)	(32)	41
2036	511	684	(173)	134%	-	2	170	0.00%	0.00%	2	(33)	(31)	42
2037	513	694	(181)	135%	-	2	171	0.00%	0.00%	2	(33)	(31)	42
2038	517	705	(188)	136%	-	2	172	0.00%	0.00%	2	(33)	(31)	43
2039	520	717	(197)	138%	-	2	172	0.00%	0.00%	2	(33)	(31)	44
2040	525	730	(205)	139%	-	2	173	0.00%	0.00%	2	(32)	(30)	45
2041	529	744	(215)	141%	-	2	174	0.00%	0.00%	2	(32)	(30)	46
2042	535	760	(225)	142%	-	2	174	0.00%	0.00%	2	(32)	(30)	47
2043	540	776	(236)	144%	-	2	175	0.00%	0.00%	2	(32)	(30)	48
2044	546	793	(247)	145%	-	2	175	0.00%	0.00%	2	(33)	(31)	49
2045	552	811	(259)	147%	-	2	174	0.00%	0.00%	2	(33)	(31)	50
2046	557	829	(272)	149%	-	2	174	0.00%	0.00%	2	(34)	(32)	51
2047	562	848	(286)	151%	-	2	173	0.00%	0.00%	2	(34)	(32)	52
2048	567	868	(301)	153%	-	2	173	0.00%	0.00%	2	(35)	(33)	53
2049	571	888	(317)	156%	-	2	173	0.00%	0.00%	2	(36)	(34)	54
2050	575	908	(333)	158%	-	2	176	0.00%	0.00%	2	(37)	(35)	56
2051	578	929	(351)	161%	-	2	179	0.00%	0.00%	2	(37)	(35)	57
2052	581	950	(369)	164%	-	2	182	0.00%	0.00%	2	(38)	(36)	58
2053	583	973	(390)	167%	-	2	185	0.00%	0.00%	2	(38)	(36)	60

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire, but the total active population is assumed to decrease by 2% each year over the next 30 years.

The contribution rate established in the Commonwealth's biennium budget is based on the calculated actuarially determined contribution rate.

Kentucky Retirement Systems
Exhibit 2-8
CERS Non-Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 3,568	\$ 2,523	\$ 1,045	71%	\$ 119	\$ 12	\$ 2,498	4.76%	4.76%	\$ 131	\$ (149)	\$ (18)	\$ 160
2020	3,728	2,670	1,058	72%	136	14	2,558	5.33%	5.78%	150	(158)	(8)	169
2021	3,888	2,866	1,022	74%	146	15	2,615	5.60%	5.60%	161	(172)	(11)	179
2022	4,042	3,045	997	75%	143	16	2,672	5.34%	5.34%	159	(186)	(27)	189
2023	4,191	3,204	987	76%	141	18	2,728	5.16%	5.16%	159	(201)	(42)	199
2024	4,332	3,360	972	78%	140	19	2,786	5.03%	5.03%	159	(216)	(57)	208
2025	4,467	3,512	955	79%	139	20	2,843	4.89%	4.89%	159	(231)	(72)	217
2026	4,593	3,658	935	80%	138	22	2,901	4.76%	4.76%	160	(246)	(86)	226
2027	4,711	3,798	913	81%	136	23	2,959	4.61%	4.61%	159	(261)	(102)	234
2028	4,819	3,931	888	82%	136	24	3,018	4.49%	4.49%	160	(275)	(115)	242
2029	4,919	4,059	860	83%	135	26	3,080	4.37%	4.37%	161	(287)	(126)	250
2030	5,011	4,182	829	83%	134	27	3,143	4.25%	4.25%	161	(299)	(138)	257
2031	5,096	4,300	796	84%	134	29	3,210	4.16%	4.16%	163	(309)	(146)	264
2032	5,175	4,417	758	85%	134	30	3,280	4.07%	4.07%	164	(318)	(154)	271
2033	5,251	4,534	717	86%	134	31	3,353	4.00%	4.00%	165	(325)	(160)	278
2034	5,324	4,652	672	87%	135	32	3,430	3.94%	3.94%	167	(330)	(163)	286
2035	5,397	4,775	622	88%	137	34	3,509	3.89%	3.89%	171	(334)	(163)	293
2036	5,472	4,905	567	90%	138	35	3,594	3.85%	3.85%	173	(337)	(164)	301
2037	5,550	5,042	508	91%	140	36	3,682	3.80%	3.80%	176	(340)	(164)	310
2038	5,630	5,188	442	92%	142	37	3,771	3.77%	3.77%	179	(344)	(165)	319
2039	5,712	5,342	370	94%	145	38	3,863	3.75%	3.75%	183	(347)	(164)	329
2040	5,798	5,507	291	95%	148	39	3,957	3.73%	3.73%	187	(351)	(164)	339
2041	5,887	5,682	205	97%	151	40	4,049	3.74%	3.74%	191	(355)	(164)	350
2042	5,978	5,869	109	98%	155	41	4,146	3.75%	3.75%	196	(358)	(162)	362
2043	6,073	6,073	-	100%	45	42	4,243	1.06%	1.06%	87	(362)	(275)	371
2044	6,171	6,171	-	100%	45	43	4,343	1.04%	1.04%	88	(367)	(279)	377
2045	6,272	6,272	-	100%	45	44	4,443	1.02%	1.02%	89	(373)	(284)	383
2046	6,374	6,374	-	100%	46	45	4,546	1.01%	1.01%	91	(379)	(288)	389
2047	6,477	6,477	-	100%	46	46	4,651	0.99%	0.99%	92	(386)	(294)	395
2048	6,581	6,581	-	100%	46	48	4,758	0.97%	0.97%	94	(394)	(300)	401
2049	6,685	6,685	-	100%	47	49	4,868	0.96%	0.96%	96	(402)	(306)	407
2050	6,789	6,789	-	100%	47	50	4,980	0.94%	0.94%	97	(411)	(314)	413
2051	6,891	6,891	-	100%	47	51	5,093	0.92%	0.92%	98	(419)	(321)	419
2052	6,993	6,993	-	100%	47	52	5,208	0.91%	0.91%	99	(427)	(328)	425
2053	7,095	7,095	-	100%	47	53	5,327	0.89%	0.89%	100	(434)	(334)	431

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire.

The total active population is assumed to remain constant through the entire projection.

The Board certified contribution rate paid by employers is based on the calculated actuarially determined contribution rate and reflects House Bill 362 passed during the 2018 legislative session that limits the contribution rate increases up to 12% per year over the prior fiscal year for the period of July 1, 2018 to June 30, 2028.

Kentucky Retirement Systems
Exhibit 2-9
CERS Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 1,733	\$ 1,314	\$ 419	76%	\$ 53	\$ 2	\$ 559	9.52%	9.52%	\$ 55	\$ (79)	\$ (24)	\$ 83
2020	1,795	1,377	418	77%	59	3	562	10.47%	10.47%	62	(86)	(24)	87
2021	1,852	1,459	393	79%	56	3	569	9.92%	9.92%	59	(94)	(35)	90
2022	1,901	1,521	380	80%	53	4	578	9.18%	9.18%	57	(103)	(46)	94
2023	1,941	1,566	375	81%	51	4	588	8.63%	8.63%	55	(112)	(57)	96
2024	1,974	1,605	369	81%	49	4	599	8.23%	8.23%	53	(120)	(67)	98
2025	1,999	1,637	362	82%	48	5	610	7.90%	7.90%	53	(126)	(73)	100
2026	2,018	1,664	354	82%	47	5	622	7.61%	7.61%	52	(132)	(80)	101
2027	2,032	1,685	347	83%	47	5	635	7.37%	7.37%	52	(137)	(85)	103
2028	2,040	1,702	338	83%	46	6	648	7.17%	7.17%	52	(141)	(89)	104
2029	2,045	1,717	328	84%	46	6	663	7.00%	7.00%	52	(143)	(91)	104
2030	2,048	1,731	317	85%	47	6	680	6.87%	6.87%	53	(145)	(92)	105
2031	2,048	1,743	305	85%	47	6	698	6.74%	6.74%	53	(146)	(93)	106
2032	2,048	1,757	291	86%	48	7	717	6.66%	6.66%	55	(146)	(91)	107
2033	2,048	1,772	276	87%	48	7	737	6.57%	6.57%	55	(146)	(91)	108
2034	2,049	1,790	259	87%	49	7	757	6.51%	6.51%	56	(145)	(89)	109
2035	2,051	1,811	240	88%	50	8	778	6.46%	6.46%	58	(143)	(85)	111
2036	2,056	1,837	219	89%	51	8	798	6.41%	6.41%	59	(140)	(81)	112
2037	2,065	1,868	197	90%	52	8	818	6.37%	6.37%	60	(138)	(78)	114
2038	2,077	1,905	172	92%	53	8	838	6.37%	6.37%	61	(136)	(75)	117
2039	2,092	1,948	144	93%	55	9	858	6.36%	6.36%	64	(133)	(69)	120
2040	2,112	1,998	114	95%	56	9	878	6.37%	6.37%	65	(131)	(66)	123
2041	2,135	2,055	80	96%	57	9	898	6.39%	6.39%	66	(129)	(63)	126
2042	2,162	2,118	44	98%	60	9	918	6.51%	6.51%	69	(128)	(59)	131
2043	2,192	2,192	-	100%	16	9	939	1.72%	1.72%	25	(127)	(102)	134
2044	2,226	2,226	-	100%	16	10	959	1.70%	1.70%	26	(127)	(101)	136
2045	2,262	2,262	-	100%	16	10	977	1.68%	1.68%	26	(128)	(102)	138
2046	2,300	2,300	-	100%	16	10	996	1.65%	1.65%	26	(130)	(104)	140
2047	2,339	2,339	-	100%	16	10	1,016	1.62%	1.62%	26	(132)	(106)	142
2048	2,377	2,377	-	100%	17	10	1,037	1.60%	1.60%	27	(135)	(108)	145
2049	2,416	2,416	-	100%	17	11	1,060	1.57%	1.57%	28	(139)	(111)	147
2050	2,453	2,453	-	100%	17	11	1,081	1.55%	1.55%	28	(143)	(115)	149
2051	2,489	2,489	-	100%	17	11	1,103	1.52%	1.52%	28	(147)	(119)	151
2052	2,524	2,524	-	100%	17	11	1,127	1.50%	1.50%	28	(150)	(122)	153
2053	2,556	2,556	-	100%	17	12	1,151	1.48%	1.48%	29	(154)	(125)	155

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire.

The total active population is assumed to remain constant through the entire projection.

The Board certified contribution rate paid by employers is based on the calculated actuarially determined contribution rate and reflects House Bill 362 passed during the 2018 legislative session that limits the contribution rate increases up to 12% per year over the prior fiscal year for the period of July 1, 2018 to June 30, 2028.

Kentucky Retirement Systems
Exhibit 2-10
State Police Retirement System Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Current Plan (Amortization Period = 24 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 277	\$ 197	\$ 80	71%	\$ 13	\$ -	\$ 48	27.23%	19.50%	\$ 13	\$ (14)	\$ (1)	\$ 13
2020	284	210	74	74%	10	-	47	20.85%	20.85%	10	(15)	(5)	13
2021	291	221	70	76%	10	-	47	20.85%	20.19%	10	(16)	(6)	14
2022	297	230	67	77%	9	-	46	18.96%	18.96%	9	(17)	(8)	14
2023	301	236	65	78%	9	-	46	18.96%	18.16%	9	(18)	(9)	14
2024	304	241	63	79%	8	-	46	17.47%	17.47%	8	(19)	(11)	15
2025	306	245	61	80%	8	-	46	17.47%	16.94%	8	(20)	(12)	15
2026	307	248	59	81%	8	-	46	16.49%	16.49%	8	(21)	(13)	15
2027	307	250	57	81%	8	-	46	16.49%	16.09%	8	(22)	(14)	15
2028	306	252	54	82%	7	-	46	15.70%	15.70%	7	(22)	(15)	15
2029	304	252	52	83%	7	-	46	15.70%	15.42%	7	(23)	(16)	15
2030	302	252	50	83%	7	-	46	15.14%	15.14%	7	(23)	(16)	15
2031	299	252	47	84%	7	-	47	15.14%	14.90%	7	(23)	(16)	15
2032	295	251	44	85%	7	-	47	14.65%	14.65%	7	(23)	(16)	15
2033	292	251	41	86%	7	-	48	14.65%	14.45%	7	(23)	(16)	15
2034	288	250	38	87%	7	-	49	14.21%	14.21%	7	(23)	(16)	15
2035	285	250	35	88%	7	-	49	14.21%	14.06%	7	(22)	(15)	15
2036	281	250	31	89%	7	-	49	13.92%	13.92%	7	(22)	(15)	15
2037	278	251	27	90%	7	-	50	13.92%	13.87%	7	(21)	(14)	15
2038	276	252	24	91%	7	-	50	13.80%	13.80%	7	(21)	(14)	15
2039	273	254	19	93%	7	-	50	13.80%	13.82%	7	(20)	(13)	15
2040	271	256	15	94%	7	-	50	13.82%	13.82%	7	(20)	(13)	16
2041	270	259	11	96%	7	-	50	13.82%	13.94%	7	(19)	(12)	16
2042	268	263	5	98%	7	-	50	14.28%	14.28%	7	(19)	(12)	16
2043	268	268	-	100%	1	-	50	2.68%	2.68%	1	(18)	(17)	16
2044	267	267	-	100%	1	-	50	2.65%	2.65%	1	(18)	(17)	16
2045	267	267	-	100%	1	-	49	2.61%	2.61%	1	(18)	(17)	16
2046	267	267	-	100%	1	-	49	2.56%	2.56%	1	(18)	(17)	16
2047	268	268	-	100%	1	-	49	2.52%	2.52%	1	(18)	(17)	16
2048	268	268	-	100%	1	-	49	2.48%	2.48%	1	(18)	(17)	16
2049	269	269	-	100%	1	-	49	2.41%	2.41%	1	(18)	(17)	16
2050	269	269	-	100%	1	-	49	2.34%	2.34%	1	(18)	(17)	16
2051	268	268	-	100%	1	1	50	2.30%	2.30%	2	(19)	(17)	16
2052	268	268	-	100%	1	1	51	2.26%	2.26%	2	(19)	(17)	16
2053	267	267	-	100%	1	1	52	2.23%	2.23%	2	(19)	(17)	16

Notes and assumptions:

The projection is based on the results of the June 30, 2019 actuarial valuation and assumes that all actuarial assumptions are realized, including the assumed annual asset return of 6.25%.

New active members are assumed to be hired to replace the current active members as they are assumed to terminate employment or retire, but the total active population is assumed to decrease by 2% each year over the next 30 years.

The contribution rate established in the Commonwealth's biennium budget is based on the calculated actuarially determined contribution rate.

SB 249
Section 3.
Projected Cost of the Retirement and Insurance
Proposed Legislation

Kentucky Retirement Systems
Exhibit 3-1
KERS Non-Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 16,466	\$ 2,206	\$ 14,260	13%	\$ 924	\$ 72	\$ 1,438	64.26%	74.54%	\$ 996	\$ (1,008)	\$ (12)	\$ 117
2020	16,493	2,301	14,192	14%	1,046	71	1,428	73.28%	73.28%	1,117	(1,024)	93	125
2021	16,500	2,548	13,952	15%	1,042	71	1,422	73.28%	73.51%	1,113	(1,038)	75	136
2022	16,489	2,768	13,721	17%	1,040	71	1,417	73.43%	73.43%	1,111	(1,051)	60	147
2023	16,459	2,976	13,483	18%	1,037	71	1,412	73.43%	73.40%	1,108	(1,065)	43	157
2024	16,410	3,176	13,234	19%	1,034	70	1,409	73.39%	73.39%	1,104	(1,077)	27	167
2025	16,342	3,370	12,972	21%	1,032	70	1,406	73.39%	73.36%	1,102	(1,089)	13	177
2026	16,255	3,561	12,694	22%	1,028	70	1,402	73.31%	73.31%	1,098	(1,100)	(2)	187
2027	16,149	3,746	12,403	23%	1,026	70	1,399	73.31%	73.28%	1,096	(1,110)	(14)	196
2028	16,024	3,929	12,095	25%	1,023	70	1,396	73.26%	73.26%	1,093	(1,118)	(25)	206
2029	15,880	4,109	11,771	26%	1,021	70	1,394	73.26%	73.23%	1,091	(1,121)	(30)	215
2030	15,724	4,294	11,430	27%	1,019	70	1,393	73.17%	73.17%	1,089	(1,126)	(37)	224
2031	15,552	4,481	11,071	29%	1,019	70	1,393	73.17%	73.11%	1,089	(1,128)	(39)	234
2032	15,366	4,676	10,690	30%	1,016	70	1,393	72.97%	72.97%	1,086	(1,128)	(42)	244
2033	15,168	4,878	10,290	32%	1,017	70	1,394	72.97%	72.84%	1,087	(1,127)	(40)	255
2034	14,959	5,093	9,866	34%	1,014	70	1,395	72.68%	72.68%	1,084	(1,124)	(40)	266
2035	14,740	5,318	9,422	36%	1,015	70	1,397	72.68%	72.52%	1,085	(1,119)	(34)	278
2036	14,515	5,563	8,952	38%	1,013	70	1,401	72.32%	72.32%	1,083	(1,109)	(26)	291
2037	14,286	5,828	8,458	41%	1,017	70	1,406	72.32%	72.05%	1,087	(1,097)	(10)	306
2038	14,056	6,124	7,932	44%	1,013	71	1,413	71.70%	71.70%	1,084	(1,082)	2	322
2039	13,830	6,447	7,383	47%	1,018	71	1,420	71.70%	71.33%	1,089	(1,067)	22	339
2040	13,608	6,808	6,800	50%	1,012	71	1,426	70.93%	70.93%	1,083	(1,049)	34	358
2041	13,392	7,200	6,192	54%	1,016	72	1,433	70.93%	70.59%	1,088	(1,032)	56	379
2042	13,183	7,636	5,547	58%	1,010	72	1,438	70.21%	70.21%	1,082	(1,014)	68	403
2043	12,980	8,106	4,874	62%	1,014	72	1,444	70.21%	69.94%	1,086	(996)	90	428
2044	12,785	8,623	4,162	67%	1,009	72	1,448	69.64%	69.64%	1,081	(979)	102	455
2045	12,599	9,181	3,418	73%	1,012	73	1,453	69.64%	69.46%	1,085	(961)	124	485
2046	12,421	9,790	2,631	79%	1,009	73	1,457	69.26%	69.26%	1,082	(943)	139	518
2047	12,252	10,447	1,805	85%	1,012	73	1,461	69.26%	69.21%	1,085	(925)	160	553
2048	12,093	11,160	933	92%	1,015	73	1,465	69.29%	69.29%	1,088	(907)	181	591
2049	11,944	11,944	-	100%	62	73	1,468	4.25%	4.25%	135	(888)	(753)	607
2050	11,809	11,809	-	100%	63	75	1,494	4.23%	4.23%	138	(870)	(732)	600
2051	11,687	11,687	-	100%	64	76	1,523	4.22%	4.22%	140	(853)	(713)	593
2052	11,581	11,581	-	100%	65	78	1,552	4.21%	4.21%	143	(836)	(693)	587
2053	11,488	11,488	-	100%	66	79	1,583	4.20%	4.20%	145	(821)	(676)	582

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019).

Kentucky Retirement Systems
Exhibit 3-2
KERS Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 1,226	\$ 672	\$ 554	55%	\$ 52	\$ 12	\$ 150	34.39%	34.42%	\$ 64	\$ (74)	\$ (10)	\$ 42
2020	1,255	703	552	56%	54	12	150	36.00%	36.00%	66	(77)	(11)	44
2021	1,281	745	536	58%	55	12	152	36.00%	35.65%	67	(79)	(12)	46
2022	1,307	781	526	60%	53	12	152	34.69%	34.69%	65	(82)	(17)	48
2023	1,331	812	519	61%	53	12	153	34.69%	34.18%	65	(84)	(19)	50
2024	1,354	843	511	62%	52	12	154	33.85%	33.85%	64	(86)	(22)	52
2025	1,376	873	503	63%	52	12	155	33.85%	33.50%	64	(89)	(25)	54
2026	1,397	903	494	65%	52	12	156	33.20%	33.20%	64	(91)	(27)	56
2027	1,417	932	485	66%	52	12	156	33.20%	32.90%	64	(93)	(29)	57
2028	1,435	961	474	67%	51	13	157	32.60%	32.60%	64	(95)	(31)	59
2029	1,452	989	463	68%	52	13	158	32.60%	32.33%	65	(95)	(30)	61
2030	1,471	1,019	452	69%	51	13	160	32.05%	32.05%	64	(96)	(32)	63
2031	1,489	1,050	439	71%	52	13	161	32.05%	31.75%	65	(96)	(31)	65
2032	1,509	1,083	426	72%	51	13	163	31.45%	31.45%	64	(97)	(33)	67
2033	1,529	1,117	412	73%	52	13	165	31.45%	31.16%	65	(97)	(32)	69
2034	1,550	1,153	397	74%	51	13	167	30.85%	30.85%	64	(98)	(34)	71
2035	1,572	1,191	381	76%	52	13	168	30.85%	30.58%	65	(99)	(34)	73
2036	1,595	1,231	364	77%	51	14	170	30.32%	30.32%	65	(100)	(35)	76
2037	1,618	1,273	345	79%	52	14	171	30.32%	30.10%	66	(101)	(35)	78
2038	1,641	1,315	326	80%	51	14	172	29.89%	29.89%	65	(103)	(38)	81
2039	1,664	1,359	305	82%	52	14	172	29.89%	29.73%	66	(104)	(38)	84
2040	1,687	1,404	283	83%	51	14	173	29.59%	29.59%	65	(105)	(40)	86
2041	1,709	1,450	259	85%	51	14	174	29.59%	29.49%	65	(107)	(42)	89
2042	1,732	1,498	234	86%	51	14	174	29.44%	29.44%	65	(108)	(43)	92
2043	1,756	1,547	209	88%	51	14	175	29.44%	29.48%	65	(109)	(44)	95
2044	1,779	1,599	180	90%	52	14	175	29.58%	29.58%	66	(111)	(45)	99
2045	1,802	1,652	150	92%	52	14	174	29.58%	29.79%	66	(113)	(47)	102
2046	1,825	1,706	119	93%	53	14	174	30.27%	30.27%	67	(115)	(48)	105
2047	1,846	1,763	83	96%	52	14	173	30.27%	30.83%	66	(117)	(51)	109
2048	1,867	1,820	47	97%	56	14	173	32.58%	32.58%	70	(119)	(49)	112
2049	1,887	1,887	-	100%	10	14	173	5.79%	5.79%	24	(121)	(97)	115
2050	1,906	1,906	-	100%	10	14	176	5.79%	5.79%	24	(124)	(100)	116
2051	1,925	1,925	-	100%	10	14	178	5.79%	5.79%	24	(126)	(102)	117
2052	1,944	1,944	-	100%	11	15	182	5.79%	5.79%	26	(128)	(102)	118
2053	1,961	1,961	-	100%	11	15	185	5.79%	5.79%	26	(130)	(104)	118

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019).

Kentucky Retirement Systems
Exhibit 3-3
CERS Non-Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 14,356	\$ 7,050	\$ 7,306	49%	\$ 487	\$ 126	\$ 2,522	19.30%	22.52%	\$ 613	\$ (818)	\$ (205)	\$ 441
2020	14,726	7,281	7,445	49%	498	129	2,581	19.30%	23.81%	627	(855)	(228)	455
2021	15,079	7,607	7,472	50%	572	132	2,638	21.68%	23.70%	704	(890)	(186)	471
2022	15,418	7,916	7,502	51%	628	135	2,694	23.29%	23.29%	763	(926)	(163)	489
2023	15,742	8,234	7,508	52%	632	138	2,751	22.99%	22.99%	770	(962)	(192)	509
2024	16,049	8,551	7,498	53%	640	140	2,809	22.79%	22.79%	780	(999)	(219)	528
2025	16,339	8,860	7,479	54%	648	143	2,866	22.60%	22.60%	791	(1,036)	(245)	546
2026	16,609	9,162	7,447	55%	656	146	2,924	22.42%	22.42%	802	(1,073)	(271)	564
2027	16,859	9,455	7,404	56%	664	149	2,983	22.26%	22.26%	813	(1,109)	(296)	582
2028	17,088	9,740	7,348	57%	673	152	3,044	22.12%	22.12%	825	(1,143)	(318)	599
2029	17,299	10,021	7,278	58%	683	155	3,107	21.99%	21.99%	838	(1,169)	(331)	616
2030	17,499	10,307	7,192	59%	694	159	3,174	21.87%	21.87%	853	(1,198)	(345)	633
2031	17,685	10,595	7,090	60%	706	162	3,243	21.76%	21.76%	868	(1,225)	(357)	651
2032	17,858	10,889	6,969	61%	718	166	3,315	21.65%	21.65%	884	(1,249)	(365)	669
2033	18,021	11,193	6,828	62%	730	169	3,390	21.55%	21.55%	899	(1,271)	(372)	688
2034	18,176	11,510	6,666	63%	744	173	3,467	21.47%	21.47%	917	(1,291)	(374)	708
2035	18,326	11,844	6,482	65%	759	177	3,546	21.39%	21.39%	936	(1,308)	(372)	729
2036	18,473	12,201	6,272	66%	774	182	3,631	21.31%	21.31%	956	(1,321)	(365)	751
2037	18,622	12,586	6,036	68%	790	186	3,720	21.25%	21.25%	976	(1,330)	(354)	776
2038	18,778	13,009	5,769	69%	808	191	3,813	21.18%	21.18%	999	(1,336)	(337)	803
2039	18,946	13,474	5,472	71%	825	195	3,909	21.11%	21.11%	1,020	(1,340)	(320)	832
2040	19,128	13,986	5,142	73%	844	200	4,007	21.06%	21.06%	1,044	(1,343)	(299)	865
2041	19,327	14,553	4,774	75%	863	205	4,107	21.01%	21.01%	1,068	(1,345)	(277)	901
2042	19,545	15,176	4,369	78%	883	210	4,209	20.98%	20.98%	1,093	(1,348)	(255)	941
2043	19,783	15,863	3,920	80%	905	216	4,313	20.97%	20.97%	1,121	(1,350)	(229)	984
2044	20,043	16,618	3,425	83%	928	221	4,419	20.99%	20.99%	1,149	(1,353)	(204)	1,032
2045	20,326	17,445	2,881	86%	953	226	4,526	21.05%	21.05%	1,179	(1,357)	(178)	1,085
2046	20,633	18,353	2,280	89%	981	232	4,635	21.16%	21.16%	1,213	(1,361)	(148)	1,142
2047	20,965	19,346	1,619	92%	1,015	237	4,745	21.38%	21.38%	1,252	(1,368)	(116)	1,206
2048	21,322	20,436	886	96%	1,065	243	4,857	21.92%	21.92%	1,308	(1,375)	(67)	1,275
2049	21,705	21,705	-	100%	183	249	4,971	3.68%	3.68%	432	(1,384)	(92)	1,323
2050	22,113	22,113	-	100%	187	254	5,087	3.67%	3.67%	441	(1,395)	(954)	1,346
2051	22,548	22,548	-	100%	190	260	5,204	3.66%	3.66%	450	(1,407)	(957)	1,370
2052	23,009	23,009	-	100%	195	266	5,324	3.66%	3.66%	461	(1,422)	(961)	1,396
2053	23,497	23,497	-	100%	199	272	5,446	3.66%	3.66%	471	(1,439)	(968)	1,423

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019) and the employer contribution rate for FY 2020/2021 is assumed to remain at 19.30% of pay.

Kentucky Retirement Systems
Exhibit 3-4
CERS Hazardous Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 5,245	\$ 2,375	\$ 2,870	45%	\$ 168	\$ 45	\$ 559	30.06%	36.98%	\$ 213	\$ (275)	\$ (62)	\$ 149
2020	5,407	2,462	2,945	46%	169	45	562	30.06%	42.02%	214	(293)	(79)	154
2021	5,557	2,570	2,987	46%	199	46	570	35.00%	42.68%	245	(308)	(63)	159
2022	5,700	2,674	3,026	47%	237	46	578	41.02%	42.54%	283	(322)	(39)	166
2023	5,837	2,799	3,038	48%	249	47	588	42.31%	42.31%	296	(336)	(40)	174
2024	5,968	2,932	3,036	49%	252	48	599	42.10%	42.10%	300	(349)	(49)	182
2025	6,093	3,066	3,027	50%	255	49	610	41.84%	41.84%	304	(361)	(57)	190
2026	6,214	3,198	3,016	51%	259	50	622	41.57%	41.57%	309	(373)	(64)	198
2027	6,329	3,331	2,998	53%	262	51	635	41.32%	41.32%	313	(384)	(71)	206
2028	6,441	3,466	2,975	54%	266	52	648	41.05%	41.05%	318	(394)	(76)	214
2029	6,550	3,604	2,946	55%	270	53	663	40.79%	40.79%	323	(402)	(79)	223
2030	6,658	3,748	2,910	56%	275	54	680	40.50%	40.50%	329	(409)	(80)	232
2031	6,768	3,901	2,867	58%	280	56	698	40.18%	40.18%	336	(415)	(79)	241
2032	6,880	4,063	2,817	59%	286	57	717	39.87%	39.87%	343	(420)	(77)	252
2033	6,995	4,238	2,757	61%	292	59	737	39.55%	39.55%	351	(425)	(74)	263
2034	7,115	4,425	2,690	62%	297	61	757	39.22%	39.22%	358	(431)	(73)	274
2035	7,239	4,626	2,613	64%	302	62	777	38.94%	38.94%	364	(437)	(73)	287
2036	7,366	4,840	2,526	66%	308	64	796	38.67%	38.67%	372	(445)	(73)	300
2037	7,495	5,067	2,428	68%	313	65	815	38.44%	38.44%	378	(455)	(77)	314
2038	7,625	5,305	2,320	70%	319	67	834	38.25%	38.25%	386	(465)	(79)	329
2039	7,753	5,555	2,198	72%	325	68	852	38.10%	38.10%	393	(475)	(82)	345
2040	7,881	5,817	2,064	74%	331	70	872	37.98%	37.98%	401	(484)	(83)	361
2041	8,009	6,095	1,914	76%	338	71	892	37.91%	37.91%	409	(492)	(83)	378
2042	8,141	6,391	1,750	79%	346	73	913	37.84%	37.84%	419	(498)	(79)	397
2043	8,277	6,708	1,569	81%	354	75	935	37.82%	37.82%	429	(505)	(76)	417
2044	8,417	7,048	1,369	84%	362	77	956	37.84%	37.84%	439	(514)	(75)	438
2045	8,561	7,411	1,150	87%	370	78	976	37.97%	37.97%	448	(523)	(75)	461
2046	8,708	7,797	911	90%	382	80	996	38.31%	38.31%	462	(533)	(71)	485
2047	8,856	8,210	646	93%	395	81	1,017	38.82%	38.82%	476	(544)	(68)	511
2048	9,006	8,653	353	96%	414	83	1,038	39.89%	39.89%	497	(554)	(57)	539
2049	9,159	9,159	-	100%	63	85	1,062	5.93%	5.93%	148	(565)	(417)	558
2050	9,314	9,314	-	100%	64	87	1,082	5.93%	5.93%	151	(577)	(426)	566
2051	9,470	9,470	-	100%	66	88	1,105	5.93%	5.93%	154	(589)	(435)	575
2052	9,626	9,626	-	100%	67	90	1,128	5.93%	5.93%	157	(601)	(444)	583
2053	9,784	9,784	-	100%	68	92	1,152	5.93%	5.93%	160	(613)	(453)	592

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019) and the employer contribution rate for FY 2020/2021 is assumed to remain at 30.06% of pay.

Kentucky Retirement Systems
Exhibit 3-5
State Police Retirement System Retirement Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 1,045	\$ 282	\$ 763	27%	\$ 57	\$ 4	\$ 48	119.05%	120.54%	\$ 61	\$ (63)	\$ (2)	\$ 15
2020	1,050	295	755	28%	58	4	47	123.79%	123.79%	62	(64)	(2)	16
2021	1,052	312	740	30%	58	4	47	123.79%	125.08%	62	(65)	(3)	16
2022	1,053	326	727	31%	58	4	47	124.48%	124.48%	62	(66)	(4)	17
2023	1,053	339	714	32%	58	4	46	124.48%	124.12%	62	(67)	(5)	18
2024	1,052	351	701	33%	57	4	46	123.96%	123.96%	61	(68)	(7)	18
2025	1,049	362	687	35%	57	4	46	123.96%	123.72%	61	(69)	(8)	19
2026	1,045	373	672	36%	57	4	46	123.88%	123.88%	61	(69)	(8)	19
2027	1,041	383	658	37%	57	4	46	123.88%	123.46%	61	(69)	(8)	20
2028	1,035	394	641	38%	56	4	46	122.60%	122.60%	60	(70)	(10)	20
2029	1,028	405	623	39%	56	4	46	122.60%	121.94%	60	(70)	(10)	21
2030	1,021	416	605	41%	56	4	46	121.05%	121.05%	60	(70)	(10)	22
2031	1,013	428	585	42%	57	4	47	121.05%	119.84%	61	(70)	(9)	22
2032	1,005	441	564	44%	56	4	47	118.34%	118.34%	60	(69)	(9)	23
2033	996	454	542	46%	57	4	48	118.34%	116.97%	61	(69)	(8)	24
2034	988	470	518	48%	56	4	48	115.16%	115.16%	60	(68)	(8)	24
2035	980	485	495	49%	56	4	49	115.16%	113.79%	60	(68)	(8)	25
2036	971	503	468	52%	55	4	49	112.37%	112.37%	59	(68)	(9)	26
2037	962	520	442	54%	55	4	49	112.37%	111.65%	59	(67)	(8)	27
2038	953	539	414	57%	54	4	49	110.60%	110.60%	58	(67)	(9)	28
2039	944	557	387	59%	54	4	49	110.60%	110.22%	58	(67)	(9)	29
2040	933	578	355	62%	54	4	49	109.45%	109.45%	58	(67)	(9)	30
2041	923	599	324	65%	54	4	49	109.45%	109.42%	58	(67)	(9)	31
2042	912	621	291	68%	54	4	49	109.59%	109.59%	58	(66)	(8)	32
2043	900	645	255	72%	54	4	49	109.59%	109.22%	58	(66)	(8)	34
2044	889	670	219	75%	54	4	49	109.27%	109.27%	58	(66)	(8)	35
2045	877	697	180	79%	52	4	48	109.27%	109.27%	56	(66)	(10)	36
2046	864	724	140	84%	54	4	48	112.37%	112.37%	58	(65)	(7)	38
2047	851	754	97	89%	54	4	48	112.37%	112.90%	58	(64)	(6)	39
2048	837	787	50	94%	54	4	48	112.99%	112.99%	58	(64)	(6)	41
2049	824	824	-	100%	4	4	48	7.70%	7.70%	8	(64)	(56)	42
2050	810	810	-	100%	4	4	49	7.67%	7.67%	8	(63)	(55)	41
2051	797	797	-	100%	4	4	49	7.66%	7.66%	8	(62)	(54)	40
2052	783	783	-	100%	4	4	50	7.66%	7.66%	8	(62)	(54)	40
2053	770	770	-	100%	4	4	51	7.66%	7.66%	8	(61)	(53)	39

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019).

Kentucky Retirement Systems
Exhibit 3-6
KERS Non-Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 2,733	\$ 991	\$ 1,742	36%	\$ 165	\$ 6	\$ 1,431	11.50%	10.65%	\$ 171	\$ (133)	\$ 38	\$ 63
2020	2,808	1,090	1,718	39%	158	6	1,421	11.15%	11.15%	164	(137)	27	69
2021	2,882	1,196	1,686	41%	158	7	1,415	11.15%	11.09%	165	(145)	20	75
2022	2,951	1,291	1,660	44%	154	7	1,410	10.94%	10.94%	161	(153)	8	81
2023	3,015	1,379	1,636	46%	154	8	1,406	10.94%	10.84%	162	(161)	1	86
2024	3,072	1,465	1,607	48%	151	8	1,402	10.74%	10.74%	159	(170)	(11)	91
2025	3,123	1,545	1,578	49%	150	9	1,399	10.74%	10.64%	159	(180)	(21)	96
2026	3,165	1,621	1,544	51%	147	9	1,396	10.51%	10.51%	156	(189)	(33)	100
2027	3,200	1,688	1,512	53%	146	10	1,393	10.51%	10.38%	156	(199)	(43)	104
2028	3,224	1,750	1,474	54%	143	10	1,390	10.25%	10.25%	153	(208)	(55)	108
2029	3,239	1,802	1,437	56%	142	11	1,388	10.25%	10.13%	153	(217)	(64)	111
2030	3,245	1,849	1,396	57%	139	11	1,387	10.00%	10.00%	150	(224)	(74)	113
2031	3,244	1,888	1,356	58%	139	11	1,387	10.00%	9.89%	150	(229)	(79)	116
2032	3,235	1,925	1,310	60%	136	12	1,387	9.77%	9.77%	148	(233)	(85)	118
2033	3,221	1,957	1,264	61%	136	12	1,388	9.77%	9.70%	148	(236)	(88)	120
2034	3,203	1,988	1,215	62%	133	13	1,389	9.60%	9.60%	146	(238)	(92)	121
2035	3,180	2,018	1,162	63%	134	13	1,391	9.60%	9.53%	147	(238)	(91)	123
2036	3,156	2,050	1,106	65%	132	13	1,395	9.45%	9.45%	145	(236)	(91)	125
2037	3,132	2,083	1,049	67%	132	13	1,401	9.45%	9.37%	145	(234)	(89)	127
2038	3,108	2,122	986	68%	131	14	1,407	9.29%	9.29%	145	(232)	(87)	130
2039	3,085	2,164	921	70%	131	14	1,414	9.29%	9.22%	145	(229)	(84)	133
2040	3,063	2,213	850	72%	130	14	1,421	9.13%	9.13%	144	(226)	(82)	136
2041	3,043	2,266	777	74%	130	14	1,427	9.13%	9.08%	144	(223)	(79)	139
2042	3,024	2,327	697	77%	129	14	1,433	9.00%	9.00%	143	(219)	(76)	143
2043	3,009	2,394	615	80%	129	14	1,438	9.00%	8.95%	143	(216)	(73)	147
2044	2,995	2,468	527	82%	128	14	1,443	8.90%	8.90%	142	(214)	(72)	152
2045	2,983	2,549	434	85%	129	14	1,447	8.90%	8.86%	143	(212)	(69)	157
2046	2,971	2,637	334	89%	128	14	1,451	8.79%	8.79%	142	(212)	(70)	163
2047	2,960	2,730	230	92%	128	15	1,455	8.79%	8.77%	143	(212)	(69)	168
2048	2,947	2,829	118	96%	127	15	1,459	8.71%	8.71%	142	(212)	(70)	175
2049	2,934	2,934	-	100%	5	15	1,463	0.36%	0.36%	20	(213)	(193)	177
2050	2,919	2,919	-	100%	5	15	1,489	0.35%	0.35%	20	(213)	(193)	176
2051	2,903	2,903	-	100%	5	15	1,517	0.34%	0.34%	20	(214)	(194)	175
2052	2,885	2,885	-	100%	5	15	1,546	0.32%	0.32%	20	(214)	(194)	174
2053	2,867	2,867	-	100%	5	16	1,577	0.31%	0.31%	21	(214)	(193)	173

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019).

Kentucky Retirement Systems
Exhibit 3-7
KERS Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 427	\$ 525	\$ (98)	123%	\$ 4	\$ 1	\$ 150	2.46%	0.00%	\$ 5	\$ (20)	\$ (15)	\$ 33
2020	440	543	(103)	123%	-	1	150	0.00%	0.00%	1	(22)	(21)	34
2021	453	563	(110)	124%	-	1	151	0.00%	0.00%	1	(24)	(23)	35
2022	464	577	(113)	124%	-	1	152	0.00%	0.00%	1	(26)	(25)	35
2023	473	587	(114)	124%	-	1	153	0.00%	0.00%	1	(27)	(26)	36
2024	480	596	(116)	124%	-	1	154	0.00%	0.00%	1	(29)	(28)	36
2025	486	605	(119)	124%	-	1	155	0.00%	0.00%	1	(30)	(29)	37
2026	491	613	(122)	125%	-	1	155	0.00%	0.00%	1	(32)	(31)	37
2027	495	620	(125)	125%	-	1	156	0.00%	0.00%	1	(32)	(31)	38
2028	498	627	(129)	126%	-	1	157	0.00%	0.00%	1	(33)	(32)	38
2029	500	633	(133)	127%	-	1	158	0.00%	0.00%	1	(34)	(33)	39
2030	501	639	(138)	128%	-	2	160	0.00%	0.00%	2	(34)	(32)	39
2031	502	645	(143)	128%	-	2	161	0.00%	0.00%	2	(34)	(32)	39
2032	504	652	(148)	129%	-	2	163	0.00%	0.00%	2	(34)	(32)	40
2033	505	659	(154)	130%	-	2	165	0.00%	0.00%	2	(34)	(32)	40
2034	507	667	(160)	132%	-	2	167	0.00%	0.00%	2	(34)	(32)	41
2035	508	675	(167)	133%	-	2	168	0.00%	0.00%	2	(34)	(32)	41
2036	511	684	(173)	134%	-	2	170	0.00%	0.00%	2	(33)	(31)	42
2037	513	694	(181)	135%	-	2	171	0.00%	0.00%	2	(33)	(31)	42
2038	517	705	(188)	136%	-	2	172	0.00%	0.00%	2	(33)	(31)	43
2039	520	717	(197)	138%	-	2	172	0.00%	0.00%	2	(33)	(31)	44
2040	525	730	(205)	139%	-	2	173	0.00%	0.00%	2	(32)	(30)	45
2041	529	744	(215)	141%	-	2	174	0.00%	0.00%	2	(32)	(30)	46
2042	535	760	(225)	142%	-	2	174	0.00%	0.00%	2	(32)	(30)	47
2043	540	776	(236)	144%	-	2	175	0.00%	0.00%	2	(32)	(30)	48
2044	546	793	(247)	145%	-	2	175	0.00%	0.00%	2	(33)	(31)	49
2045	552	811	(259)	147%	-	2	174	0.00%	0.00%	2	(33)	(31)	50
2046	557	829	(272)	149%	-	2	174	0.00%	0.00%	2	(34)	(32)	51
2047	562	848	(286)	151%	-	2	173	0.00%	0.00%	2	(34)	(32)	52
2048	567	868	(301)	153%	-	2	173	0.00%	0.00%	2	(35)	(33)	53
2049	571	888	(317)	156%	-	2	173	0.00%	0.00%	2	(36)	(34)	54
2050	575	908	(333)	158%	-	2	176	0.00%	0.00%	2	(37)	(35)	56
2051	578	929	(351)	161%	-	2	179	0.00%	0.00%	2	(37)	(35)	57
2052	581	950	(369)	164%	-	2	182	0.00%	0.00%	2	(38)	(36)	58
2053	583	973	(390)	167%	-	2	185	0.00%	0.00%	2	(38)	(36)	60

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019).

Kentucky Retirement Systems
Exhibit 3-8
CERS Non-Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 3,568	\$ 2,523	\$ 1,045	71%	\$ 119	\$ 12	\$ 2,498	4.76%	4.76%	\$ 131	\$ (149)	\$ (18)	\$ 160
2020	3,728	2,670	1,058	72%	122	14	2,558	4.76%	5.43%	136	(158)	(22)	169
2021	3,888	2,851	1,037	73%	138	15	2,615	5.27%	5.27%	153	(172)	(19)	178
2022	4,042	3,020	1,022	75%	134	16	2,672	5.03%	5.03%	150	(186)	(36)	187
2023	4,191	3,169	1,022	76%	132	18	2,728	4.85%	4.85%	150	(201)	(51)	196
2024	4,332	3,314	1,018	77%	131	19	2,786	4.72%	4.72%	150	(216)	(66)	205
2025	4,467	3,454	1,013	77%	130	20	2,843	4.58%	4.58%	150	(231)	(81)	213
2026	4,593	3,588	1,005	78%	129	22	2,901	4.45%	4.45%	151	(246)	(95)	221
2027	4,711	3,714	997	79%	128	23	2,959	4.31%	4.31%	151	(261)	(110)	229
2028	4,819	3,833	986	80%	126	24	3,018	4.18%	4.18%	150	(275)	(125)	236
2029	4,919	3,945	974	80%	125	26	3,080	4.06%	4.06%	151	(287)	(136)	242
2030	5,011	4,050	961	81%	124	27	3,143	3.95%	3.95%	151	(299)	(148)	249
2031	5,096	4,151	945	81%	124	29	3,210	3.86%	3.86%	153	(309)	(156)	255
2032	5,175	4,248	927	82%	123	30	3,280	3.76%	3.76%	153	(318)	(165)	260
2033	5,251	4,344	907	83%	124	31	3,353	3.69%	3.69%	155	(325)	(170)	266
2034	5,324	4,440	884	83%	125	32	3,430	3.64%	3.64%	157	(330)	(173)	272
2035	5,397	4,539	858	84%	126	34	3,509	3.59%	3.59%	160	(334)	(174)	278
2036	5,472	4,643	829	85%	127	35	3,594	3.54%	3.54%	162	(337)	(175)	285
2037	5,550	4,753	797	86%	129	36	3,682	3.50%	3.50%	165	(340)	(175)	292
2038	5,630	4,869	761	86%	130	37	3,771	3.46%	3.46%	167	(344)	(177)	299
2039	5,712	4,991	721	87%	133	38	3,863	3.44%	3.44%	171	(347)	(176)	306
2040	5,798	5,122	676	88%	135	39	3,957	3.40%	3.40%	174	(351)	(177)	315
2041	5,887	5,259	628	89%	137	40	4,049	3.39%	3.39%	177	(355)	(178)	323
2042	5,978	5,405	573	90%	140	41	4,146	3.37%	3.37%	181	(358)	(177)	332
2043	6,073	5,560	513	92%	142	42	4,243	3.35%	3.35%	184	(362)	(178)	342
2044	6,171	5,724	447	93%	145	43	4,343	3.33%	3.33%	188	(367)	(179)	352
2045	6,272	5,897	375	94%	148	44	4,443	3.32%	3.32%	192	(373)	(181)	363
2046	6,374	6,078	296	95%	151	45	4,546	3.32%	3.32%	196	(379)	(183)	374
2047	6,477	6,269	208	97%	154	46	4,651	3.31%	3.31%	200	(386)	(186)	386
2048	6,581	6,469	112	98%	159	48	4,758	3.34%	3.34%	207	(394)	(187)	398
2049	6,685	6,685	-	100%	47	49	4,868	0.96%	0.96%	96	(402)	(306)	408
2050	6,789	6,789	-	100%	47	50	4,980	0.94%	0.94%	97	(411)	(314)	414
2051	6,891	6,891	-	100%	47	51	5,093	0.92%	0.92%	98	(419)	(321)	420
2052	6,993	6,993	-	100%	47	52	5,208	0.91%	0.91%	99	(427)	(328)	426
2053	7,095	7,095	-	100%	47	53	5,327	0.89%	0.89%	100	(434)	(334)	432

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019) and

Kentucky Retirement Systems
Exhibit 3-9
CERS Hazardous Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 1,733	\$ 1,314	\$ 419	76%	\$ 53	\$ 2	\$ 559	9.52%	9.52%	\$ 55	\$ (79)	\$ (24)	\$ 83
2020	1,795	1,377	418	77%	53	3	562	9.52%	9.86%	56	(86)	(30)	87
2021	1,852	1,454	398	79%	53	3	569	9.33%	9.33%	56	(94)	(38)	90
2022	1,901	1,511	390	79%	50	4	578	8.63%	8.63%	54	(103)	(49)	93
2023	1,941	1,553	388	80%	47	4	588	8.08%	8.08%	51	(112)	(61)	95
2024	1,974	1,588	386	80%	46	4	599	7.69%	7.69%	50	(120)	(70)	97
2025	1,999	1,615	384	81%	45	5	610	7.36%	7.36%	50	(126)	(76)	99
2026	2,018	1,637	381	81%	44	5	622	7.07%	7.07%	49	(132)	(83)	100
2027	2,032	1,653	379	81%	43	5	635	6.83%	6.83%	48	(137)	(89)	101
2028	2,040	1,665	375	82%	43	6	648	6.63%	6.63%	49	(141)	(92)	101
2029	2,045	1,674	371	82%	43	6	663	6.45%	6.45%	49	(143)	(94)	102
2030	2,048	1,681	367	82%	43	6	680	6.33%	6.33%	49	(145)	(96)	102
2031	2,048	1,687	361	82%	43	6	698	6.20%	6.20%	49	(146)	(97)	102
2032	2,048	1,693	355	83%	44	7	717	6.11%	6.11%	51	(146)	(95)	103
2033	2,048	1,700	348	83%	44	7	737	6.03%	6.03%	51	(146)	(95)	103
2034	2,049	1,709	340	83%	45	7	757	5.97%	5.97%	52	(145)	(93)	104
2035	2,051	1,721	330	84%	46	8	778	5.91%	5.91%	54	(143)	(89)	105
2036	2,056	1,737	319	84%	47	8	798	5.86%	5.86%	55	(140)	(85)	106
2037	2,065	1,758	307	85%	48	8	818	5.82%	5.82%	56	(138)	(82)	107
2038	2,077	1,783	294	86%	49	8	838	5.80%	5.80%	57	(136)	(79)	109
2039	2,092	1,814	278	87%	50	9	858	5.78%	5.78%	59	(133)	(74)	111
2040	2,112	1,850	262	88%	51	9	878	5.76%	5.76%	60	(131)	(71)	113
2041	2,135	1,892	243	89%	52	9	898	5.75%	5.75%	61	(129)	(68)	116
2042	2,162	1,939	223	90%	53	9	918	5.75%	5.75%	62	(128)	(66)	119
2043	2,192	1,993	199	91%	54	9	939	5.74%	5.74%	63	(127)	(64)	123
2044	2,226	2,052	174	92%	55	10	959	5.74%	5.74%	65	(127)	(62)	126
2045	2,262	2,116	146	94%	56	10	977	5.75%	5.75%	66	(128)	(62)	130
2046	2,300	2,184	116	95%	57	10	996	5.76%	5.76%	67	(130)	(63)	135
2047	2,339	2,256	83	96%	59	10	1,016	5.80%	5.80%	69	(132)	(63)	139
2048	2,377	2,333	44	98%	61	10	1,037	5.92%	5.92%	71	(135)	(64)	144
2049	2,416	2,416	-	100%	17	11	1,060	1.57%	1.57%	28	(139)	(111)	147
2050	2,453	2,453	-	100%	17	11	1,081	1.55%	1.55%	28	(143)	(115)	149
2051	2,489	2,489	-	100%	17	11	1,103	1.52%	1.52%	28	(147)	(119)	152
2052	2,524	2,524	-	100%	17	11	1,127	1.50%	1.50%	28	(150)	(122)	153
2053	2,556	2,556	-	100%	17	12	1,151	1.48%	1.48%	29	(154)	(125)	155

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019) and

Kentucky Retirement Systems
Exhibit 3-10
State Police Retirement System Insurance Fund
Actuarial Analysis of Proposed Legislation SB 249
Proposed Plan (Amortization Period = 30 Years at June 30, 2019)
(\$ in Millions)

Fiscal Year Beginning July 1,	Actuarial Accrued Liability	Actuarial Value of Assets	Unfunded Actuarial Accrued Liability	Funded Ratio (3) / (2)	Total Employer Contribution	Member Contribution	Covered Payroll	Total Employer Contribution as % of Covered Payroll	Employer Actuarial Determined Contribution Rate	Annual Cash Flow Analysis			
										Member and Employer Contributions	Benefit Payments and Expenses	Net External Cash Flow	Investment Income
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2019	\$ 277	\$ 197	\$ 80	71%	\$ 13	\$ -	\$ 48	27.23%	19.50%	\$ 13	\$ (14)	\$ (1)	\$ 13
2020	284	210	74	74%	9	-	47	19.69%	19.69%	9	(15)	(6)	13
2021	291	221	70	76%	9	-	47	19.69%	19.03%	9	(16)	(7)	14
2022	297	229	68	77%	8	-	46	17.86%	17.86%	8	(17)	(9)	14
2023	301	234	67	78%	8	-	46	17.86%	17.07%	8	(18)	(10)	14
2024	304	239	65	79%	8	-	46	16.39%	16.39%	8	(19)	(11)	15
2025	306	242	64	79%	8	-	46	16.39%	15.86%	8	(20)	(12)	15
2026	307	244	63	79%	7	-	46	15.41%	15.41%	7	(21)	(14)	15
2027	307	246	61	80%	7	-	46	15.41%	15.01%	7	(22)	(15)	15
2028	306	246	60	80%	7	-	46	14.63%	14.63%	7	(22)	(15)	15
2029	304	246	58	81%	7	-	46	14.63%	14.35%	7	(23)	(16)	15
2030	302	245	57	81%	7	-	46	14.08%	14.08%	7	(23)	(16)	15
2031	299	244	55	82%	7	-	47	14.08%	13.85%	7	(23)	(16)	15
2032	295	242	53	82%	6	-	47	13.62%	13.62%	6	(23)	(17)	15
2033	292	241	51	83%	7	-	48	13.62%	13.43%	7	(23)	(16)	15
2034	288	239	49	83%	6	-	49	13.21%	13.21%	6	(23)	(17)	14
2035	285	238	47	84%	6	-	49	13.21%	13.08%	6	(22)	(16)	14
2036	281	236	45	84%	6	-	49	12.95%	12.95%	6	(22)	(16)	14
2037	278	236	42	85%	6	-	50	12.95%	12.89%	6	(21)	(15)	14
2038	276	236	40	86%	6	-	50	12.83%	12.83%	6	(21)	(15)	14
2039	273	236	37	86%	6	-	50	12.83%	12.82%	6	(20)	(14)	14
2040	271	236	35	87%	6	-	50	12.79%	12.79%	6	(20)	(14)	14
2041	270	238	32	88%	6	-	50	12.79%	12.83%	6	(19)	(13)	14
2042	268	240	28	90%	6	-	50	12.86%	12.86%	6	(19)	(13)	15
2043	268	242	26	90%	6	-	50	12.86%	12.86%	6	(18)	(12)	15
2044	267	245	22	92%	6	-	50	12.88%	12.88%	6	(18)	(12)	15
2045	267	249	18	93%	6	-	49	12.88%	12.88%	6	(18)	(12)	15
2046	267	253	14	95%	6	-	49	13.17%	13.17%	6	(18)	(12)	15
2047	268	258	10	96%	6	-	49	13.17%	13.24%	6	(18)	(12)	16
2048	268	263	5	98%	6	-	49	13.32%	13.32%	6	(18)	(12)	16
2049	269	269	-	100%	1	-	49	2.41%	2.41%	1	(18)	(17)	16
2050	269	269	-	100%	1	-	49	2.34%	2.34%	1	(18)	(17)	16
2051	268	268	-	100%	1	1	50	2.30%	2.30%	2	(19)	(17)	16
2052	268	268	-	100%	1	1	51	2.26%	2.26%	2	(19)	(17)	16
2053	267	267	-	100%	1	1	52	2.23%	2.23%	2	(19)	(17)	16

Notes and assumptions:

The projection is based on the same methods and assumptions as the projection under the Current Plan, except that the funding period is 30 years at June 30, 2019 (rather than the current funding period of 24 years at June 30, 2019).

Kentucky Retirement Systems

**Independent Actuarial Audit of the
June 30, 2019 Actuarial Valuations
and the 2014-2018 Experience Study**

DRAFT



101 North Wacker Drive
Suite 500
Chicago, IL 60606-1724
segalco.com

October 29, 2020

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

Re: **Independent Actuarial Audit of the June 30, 2019 Actuarial Valuations and the 2004 -2018 Experience Study**

Ladies and Gentlemen:

We are pleased to present the results of Segal's actuarial audit of the June 30, 2019, actuarial valuations and review of the 2014-2018 experience study. The purpose of this audit is to conduct a review of the actuarial methods, assumptions, and procedures employed by the Kentucky Retirement Systems (KRS) and the Systems' actuary Gabriel, Roeder, Smith & Company (GRS). This audit includes the following:

1. **Report review** – a review of the valuation results and reports for the Kentucky Employees Retirement System (KERS), the County Employees Retirement System (CERS), and the State Police Retirement System (SPRS). The results were reviewed to determine if they comply with actuarial standards and whether such valuation reports reflect appropriate disclosure information under any required reporting.
2. **Validation of benefits valued through test lives and data review** – discussion of the procedures used to validate the participant data and the test lives selected, with a detailed review of the findings.
3. **Methods and assumptions review** – an analysis and benchmarking of the actuarial assumptions and a review of the actuarial methods utilized in determining the funded status and accrued liability as of June 30, 2019, for compliance with generally accepted actuarial principles, as well as a review of the experience study report for the five-year period ending June 30, 2018.

This review was conducted under the supervision of Kim Nicholl, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA, and Matthew Strom, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA. This review was conducted in accordance with the standards of practice prescribed by the Actuarial Standards Board.

The assistance of the KRS staff and GRS is gratefully acknowledged.



We appreciate the opportunity to serve as an independent actuarial advisor for KRS and we are available to answer any questions you may have on this report.

Sincerely,

Kim Nicholl, FSA, MAAA, EA
Senior Vice President & Actuary

Matthew A. Strom, FSA, MAAA, EA
Senior Vice President & Actuary

DRAFT

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Executive Summary

The Board of Trustees of the Kentucky Retirement Systems (KRS) retained Segal to conduct an independent actuarial audit of the Systems' June 30, 2019, actuarial valuations and the 2014-2018 experience study, as performed by the KRS Consulting Actuary, Gabriel, Roeder, Smith & Company (GRS). The Board requested an opinion on the reasonableness, consistency, and accuracy of the following:

- Demographic and financial data used in the actuarial valuations;
- Methods, procedures, and assumptions used in the actuarial valuations;
- Format of the actuarial valuation reports;
- Adequacy and reasonableness of the actuarial valuations; and
- Results and the actuarial assumptions generated from the experience study.

The objective of a **limited scope audit** (actuarial review) of any system is to provide validation that the liabilities and costs of the system are reasonable and being calculated as intended. This audit is not a full replication of the actuarial valuation results, but rather is a review of the key components in the valuation process that encompass the derivation of the liabilities and costs for the Systems. These key components are the data, the benefits valued, the actuarial assumptions and funding method used, and the asset valuation method employed. The valuation reports and the valuation output for a select group of test lives provide the detail necessary to validate each of these key components.

We reviewed all information supplied to us. We also requested and reviewed additional information provided by GRS. Finally, we considered the reasonableness of the actuarial assumptions and methods in the context of our own experience, and those of other state and local pension systems.

In summary, we found the following:

1. More detail on the calculation of the Recommended Employer Contribution Rates should be included in the report;
2. The economic assumptions are within norms for the peer group, with the aggregate investment return assumption below the peer group range;
3. The demographic actuarial assumptions recommended in the 2014-2018 experience study are for the most part sound and appropriate;
4. The valuation reports for KERS, CERS and SPRS provide sufficient detail upon which to render opinions; and
5. The review of selected test lives identified a modification to the valuation programming that could be made.

These items and recommendations are described in more detail throughout this report.

Executive Summary

Conclusions

This audit reviewed the findings of the June 30, 2019, actuarial valuations and 2014-2018 experience study. We have made a few recommendations for the valuation report and test lives that may improve the usefulness and accuracy, which are described in detail in Section II of this report. We generally agree with the results of the experience study, with a few recommendations for improvement, as described in Section III. We found the actuarial cost method and asset valuation method conform with the Actuarial Standards of Practice.

The data appears complete and with a cursory analysis of the information supplied by KRS staff, we were able to closely match the participant counts reported by GRS.

Finally, we offer ideas to improve the quality and understanding of the valuation reports and experience review process. Several suggestions and recommendations are made throughout this document. We would classify them as either: a) "presentation" suggestions to enhance the valuation process or report; b) something to be examined during the next experience review; and c) something that may affect the cost of the Systems. Where we make a comment in this regard in this report, we have identified the location in the margin with the following icons:



Enhancement to valuation process or report



Examine during next experience review



May affect the cost of the Systems

Section I: Purpose, Scope and Methodology of the Audit

Purpose of the Audit

The KRS Board retained Segal to conduct an independent review of the Systems' current actuarial calculations, assumptions and methods. The Board requested an assessment of the validity of the data used in the valuations, a review of the appropriateness of the current funding method and procedures, an evaluation of both economic and non-economic assumptions, a test of the valuation results, and a review of the actuarial reports to determine if there is consistency in the presentation of the actuarial results and whether they are consistent with professional standards.

Scope of the Audit

This actuarial audit has a specified, limited scope in its review. A full scope audit would include performing the 2019 actuarial valuations from start to finish, in essence, a parallel valuation for each of the three Systems. This limited scope audit reviews the valuations already performed, through reviewing the benefits, assumptions, and methods, without a full replication of the actuarial valuation results. This review is conducted by analyzing detailed output of certain selected test lives from each membership group.

By not performing a full parallel valuation for each System, the following assumptions are made:

1. The current actuary's valuation system is accurately applying each assumption consistent with the test life review; and
2. The valuation system is adding together liabilities appropriately for each decrement (retirement, turnover, disability, and death), for each member, and over the entire population (meaning no participant group is being "dropped off" and no particular liabilities are being omitted).

What a limited scope audit can provide is:

1. Assurance that appropriate benefits are being valued;
2. Confirmation that the valuation system is accurately applying decrements to the test lives;
3. Confirmation that the program is valuing benefits as described in the valuation reports and consistent with applicable statutes;
4. A measurement of economic actuarial assumptions against a peer group and hence an assessment of their reasonableness;

Section I: Purpose, Scope and Methodology of the Audit

5. A review of the reasonableness of actuarial funding and asset valuation methods;
6. An indication as to whether the liabilities and contribution rates shown are not reasonable or are incorrectly calculated; and
7. An assessment of whether the valuation appropriately reflects information required to be disclosed under required reporting standards (GASB, etc.).

Methodology of the Audit for the 2019 Actuarial Valuation

The purpose of this audit is to express an opinion regarding the reasonableness and accuracy of the actuarial assumptions, methods, valuation results, and contribution rates. The limited scope review is not the same as an actuarial valuation, but represents a “second opinion” of the findings and processes included in the valuation.

The measurement of the reasonableness of the funding levels encompasses three key analyses:

1. A verification of the benefits being projected for future payment;
2. A verification of the appropriateness of the actuarial assumptions that are used in calculating the liability; and
3. A verification of the appropriateness of the funding and asset valuation methods.

Benefits Analysis

Critical to projecting future benefits is receiving complete and accurate data. We reviewed the process by which data is prepared for the actuarial valuation, including:

1. An assessment of the completeness of the data;
2. A review of the data screening process employed; and
3. An examination of individual test life calculations.

We developed computer models that generated test life output, which enabled us to compare our test life results with GRS’s results. These models also allowed us to confirm that the GRS valuations project benefits in a manner consistent with the Summary of Plan Provisions in the valuation reports. For purposes of this study, we regard differences of less than 3% to be acceptable for the Total Present Value of Benefits (PVB) and for the review of census data.

Section I: Purpose, Scope and Methodology of the Audit

Assumptions Analysis

The second critical component in assessing the reasonableness of the funding levels is in the selection and the application of the actuarial assumptions. With respect to the assumptions, we:

1. Reviewed the 2014-2018 experience study report;
2. Independently determined the reasonability of the investment return assumption by using Segal Marco Advisors' capital market assumptions; and
3. Benchmarked the economic assumptions against a survey of state and local employee retirement systems.

Methods Analysis

The third component in assessing funding levels is the selection and application of the actuarial cost method (including the method for amortizing the unfunded actuarial accrued liability) and the asset valuation method (including smoothing techniques).

Section II: Review of Reports and Validation of Benefits Valued

Data Used in the Valuation

We independently obtained data files directly from KRS and GRS. With minimal data scrubbing, we found that the counts for the active and retired files were relatively close, and well within the 3% threshold we established for determining materiality of differences.

All data for actives, inactives, annuitants and beneficiaries was provided as of the valuation date (June 30, 2019). In situations where there is missing or invalid data, we assume the GRS valuation software applies adjustments to the data records for completeness. Given the large size of the data, this shortens the amount of staff time spent on data reconciliation (for both GRS and KRS) without sacrificing any material accuracy in the valuation results.

The tables that follow summarize our determination of key data elements as compared to those shown in the valuation report.

Section II: Review of Reports and Validation of Benefits Valued

June 30, 2019 Analysis of Participant Data – KERS

	Non-Hazardous			Hazardous		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Active Members:						
Number	33,696	33,697	1.00	3,705	3,705	1.00
Total payroll (in thousands)	1,437,647	1,437,647	1.00	150,446	150,446	1.00
Average Salary	42,665	42,664	1.00	40,606	40,606	1.00
Average Age	45.4	45.4	1.00	39.8	39.8	1.00
Average Service	11.0	11.0	1.00	7.3	7.3	1.00
Vested Inactive Members:						
Number	31,544	31,545	1.00	2,178	2,178	1.00
Annual Benefits (in thousands)	82,692	82,695	1.00	4,407	4,407	1.00
Average Benefit	2,621	2,622	1.00	2,023	2,023	1.00
Average Age	51.3	51.3	1.00	46.5	46.5	1.00
Nonvested Inactive Members:						
Number	20,370	20,353	1.00	4,070	4,065	1.00
Average Contributions with Interest	1,722	1,723	1.00	1,752	1,754	1.00
Retirees:						
Number	40,519	40,519	1.00	3,913	3,915	1.00
Annual Benefits (in thousands)	870,243	870,243	1.00	61,454	61,473	1.00
Average Benefit	21,477	21,477	1.00	15,705	15,702	1.00
Average Age	69.4	69.4	1.00	64.8	64.8	1.00
Disability Retirees:						
Number	1,949	1,949	1.00	162	162	1.00
Annual Benefits (in thousands)	25,745	25,745	1.00	1,541	1,541	1.00
Average Benefit	13,209	13,209	1.00	9,510	9,510	1.00
Average Age	65.8	65.8	1.00	60.3	60.4	1.00
Beneficiaries:						
Number	4,942	4,941	1.00	462	462	1.00
Annual Benefits (in thousands)	72,718	72,683	1.00	4,528	4,528	1.00
Average Benefit	14,714	14,710	1.00	9,801	9,801	1.00
Average Age	70.6	70.6	1.00	66.0	66.0	1.00

Section II: Review of Reports and Validation of Benefits Valued

June 30, 2019 Analysis of Participant Data – CERS

	Non-Hazardous			Hazardous		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Active Members:						
Number	81,506	81,535	1.00	9,474	9,474	1.00
Total payroll (in thousands)	2,521,860	2,521,860	1.00	559,353	559,353	1.00
Average Salary	30,941	30,930	1.00	59,041	59,041	1.00
Average Age	47.7	47.7	1.00	38.6	38.6	1.00
Average Service	9.1	9.1	1.00	10.1	10.1	1.00
Vested Inactive Members:						
Number	50,768	50,771	1.00	1,782	1,784	1.00
Annual Benefits (in thousands)	77,396	77,395	1.00	7,387	7,421	1.00
Average Benefit	1,525	1,524	1.00	4,145	4,160	1.00
Average Age	52.3	52.3	1.00	45.3	45.4	1.00
Nonvested Inactive Members:						
Number	40,775	40,746	1.00	1,640	1,638	1.00
Average Contributions with Interest	1,179	1,180	1.00	3,344	3,347	1.00
Retirees:						
Number	54,493	54,494	1.00	8,275	8,277	1.00
Annual Benefits (in thousands)	644,546	644,546	1.00	231,301	231,318	1.00
Average Benefit	11,828	11,828	1.00	27,952	27,947	1.00
Average Age	70.6	70.6	1.00	62.0	62.0	1.00
Disability Retirees:						
Number	4,198	4,198	1.00	576	576	1.00
Annual Benefits (in thousands)	48,289	48,289	1.00	9,697	9,697	1.00
Average Benefit	11,503	11,503	1.00	16,835	16,835	1.00
Average Age	65.5	65.5	1.00	57.1	57.1	1.00
Beneficiaries:						
Number	5,848	5,849	1.00	1,172	1,173	1.00
Annual Benefits (in thousands)	54,282	54,312	1.00	17,815	17,822	1.00
Average Benefit	9,282	9,286	1.00	15,200	15,194	1.00
Average Age	68.2	68.2	1.00	58.6	58.6	1.00

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June 30, 2019 Analysis of Participant Data – SPRS

	Hazardous		Ratio of Segal/GRS
	GRS	Segal	
Active Members:			
Number	883	883	1.00
Total payroll (in thousands)	47,752	47,752	1.00
Average Salary	54,079	54,079	1.00
Average Age	36.7	36.7	1.00
Average Service	10.0	10.0	1.00
Vested Inactive Members:			
Number	289	289	1.00
Annual Benefits (in thousands)	811	811	1.00
Average Benefit	2,806	2,806	1.00
Average Age	43.5	43.5	1.00
Nonvested Inactive Members:			
Number	268	268	1.00
Average Contributions with Interest	1,264	1,264	1.00
Retirees:			
Number	1,363	1,363	1.00
Annual Benefits (in thousands)	54,142	54,142	1.00
Average Benefit	39,723	39,723	1.00
Average Age	63.0	63.0	1.00
Disability Retirees:			
Number	54	54	1.00
Annual Benefits (in thousands)	959	959	1.00
Average Benefit	17,757	17,757	1.00
Average Age	58.0	58.0	1.00
Beneficiaries:			
Number	230	231	1.00
Annual Benefits (in thousands)	6,303	6,307	1.00
Average Benefit	27,404	27,301	1.00
Average Age	67.1	66.9	1.00

As previously mentioned, we were able to match most information reported by GRS to within 1% with minimal data scrubbing.

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Valuation Results

We have reviewed the Recommended Employer Contribution Rate for each System and have the following observation:



1. The required employer contributions are equal to the sum of the employer's share of normal cost (i.e., total normal cost, less expected member contributions), plus administrative expenses, plus an unfunded accrued liability amortization payment. We were unable to exactly replicate the Recommended Employer Contribution Rates shown in the valuation report, although our independent calculations are reasonably close. Providing additional detail with respect to how the unfunded liability amortization payment is calculated would be beneficial and would provide a degree of transparency as to the mechanics of that calculation.

Valuation Report

While the accuracy of the actuarial valuation is the primary focus of an actuarial review, the content and presentation of the actuarial valuation results to a layperson and professional are also important. Our report recommendations are to provide clarity to the existing report. Based on our review of the actuarial valuation report, we offer the following comments:



1. The July 1, 2019 valuation reports included the recommended assumptions in the experience study for the period ending June 30, 2018. All of the assumptions that were updated were identified in the beginning of the valuation reports and the reports included the effect of the assumption changes in all the calculations. The reports disclosed the effect of the assumption changes on the actuarial accrued liabilities. However, the effect of the assumption changes on other funding metrics, such as the funded percentage and the Actuarially Determined Contribution Rate, were not disclosed. Since these changes could provide useful insight to users of the reports, we recommend showing the impact of assumption changes on these funding metrics.
2. In the tables labeled as "Experience Gain or (Loss)," plan changes and assumption changes are identified as actuarial gains and losses. In addition, the footnotes to the tables also describe these changes in liabilities as actuarial losses. As these changes in liabilities are not actuarial losses, we recommend that the descriptions in the tables and the footnotes be modified.
3. Also related to the liability gain or (loss), it would be informative to show the gain or loss attributable to each source as well as to actual contributions that are more or less than expected.
4. Section 5 of the Annual Actuarial Valuation Report contains information related to discussion of risks, which is required information for funding valuations and pricing valuations pursuant to Actuarial Standards of Practice Statement No. 51 (ASOP 51). The discussion of risk includes two and a half pages of relatively generic language that outlines the general risks that affect a pension system. This section also includes two tables with ratios and other calculations specific to KRS. In general, we believe this section complies with the spirit of ASOP 51 and the risk discussion. However, these disclosures may not help the intended users of the actuarial

Section II: Review of Reports and Validation of Benefits Valued

valuation reports gain a better understanding of risks inherent in the measurements of liabilities and actuarially determined contributions.

Some observations and suggestions for improvement in the June 30, 2019 Actuarial Valuation Reports are as follows:

- a. Section 3.6 of ASOP 51 states, *“If, in the actuary’s professional judgment, a more detailed assessment would be significantly beneficial for the intended user to understand the risks identified by the actuary, the actuary should recommend to the intended user that such an assessment be performed.”* Section 5 does not contain such a recommendation. This implies that the actuary does not believe a more detailed risk assessment is necessary or that one would not be useful to the intended user. However, we believe there is enough risk inherent in KRS that a more detailed risk assessment would be useful.
 - b. One suggestion to improve the usefulness of this section would be to keep (and expand) the existing language and add commentary specific to KRS when discussing each risk element. For example, the information in this section could be reformatted to explain each risk, show the particular KRS metric related to that risk, and provide commentary. The current format makes it challenging for the intended user to grasp the concepts and understand the risks inherent in KRS.
5. The reports do not include any projections of future funded percentages or contribution requirements. Adding a projection of liabilities, assets, and required contribution rates throughout the remaining amortization period (24 years for the 2019 valuation reports) could be helpful for the long-term planning for the future funding requirements of the System.

Projected Benefits in the Valuation

We requested test lives in order to compare the benefit amounts projected in the valuations against our understanding of the CERS, KERS and SPRS benefits summarized in the valuation report. We did not run “parallel” valuations of each System, which is beyond the scope of this audit. We reproduced the present value of future salary, present value of future benefits, actuarial accrued liability, and normal cost for the test lives received to determine whether GRS correctly projected plan benefits and whether the costs and liabilities were determined in accordance with the actuary’s stated methods and assumptions.

Based on our review of the individual test life calculations, we have the following observations and/or recommendations:



1. There is an inconsistency between how service to determine benefit eligibility and service to determine benefit amounts are calculated. Service for eligibility purposes is calculated as a rounded amount and service for benefit amount purposes is calculated as an exact amount. We would expect both to be calculated with the same methodology. Furthermore, using rounded service for benefit eligibility may not be appropriate, as it would allow some participants to retire within the valuation program at an age when they are not actually eligible. For example, if a participant needs 10 credits to retire at a certain age, they would not be able to retire at that age

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if they only had 9.9 credits. Rounding the 9.9 credits to 10 allows the valuation program to treat them as retiring earlier than actually allowable. We recommend using exact service for eligibility purposes.

The individual test life comparison exhibits on the following pages summarize the calculations performed by Segal and GRS and show the differences by each liability category, as well as the ratio of Segal's results to GRS's results.

As shown in the following tables, we have generally matched the GRS calculations to within our 3% threshold. In the handful of instances where the ratio of Segal to GRS is outside of that tolerance, we have reviewed these test lives in further detail. Primarily, these discrepancies are due to different rounding of ages during interim step in the valuation process that, in aggregate across all members, should net out to an immaterial amount.

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June 30, 2019 Valuation of the Kentucky Employees Retirement System – Non-Hazardous Test Life Comparison

Test Life Description	Present Value of Future Salary			Present Value of Benefits			Accrued Liability			Normal Cost Rate		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Pension Retiree 1				164,202	164,645	1.00						
Pension Disabled Retiree				285,110	285,649	1.00						
Pension Surviving Spouse				114,508	117,025	1.02						
Pension Vested Terminated				38,064	38,643	1.02						
Pension Due Refund				298	298	1.00						
Pension Active Tier 1	254,261	260,645	1.03	222,698	223,160	1.00	186,901	185,082	0.99	14.08%	14.61%	1.04
Pension Active Tier 2	193,779	198,595	1.02	50,304	50,078	1.00	27,783	27,493	0.99	11.62%	11.37%	0.98
Insurance Retiree 1				67,531	66,212	0.98						
Insurance Retiree 2				15,691	15,987	1.02						
Insurance Vested Terminated				27,694	27,838	1.01						
Insurance Active 1	244,108	251,393	1.03	130,166	127,385	0.98	110,944	106,987	0.96	7.87%	8.38%	1.06
Insurance Active 2	186,762	193,970	1.04	4,038	3,960	0.98	2,236	2,169	0.97	0.97%	0.97%	1.00

* Items above that are blank are not applicable to that test life.

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June 30, 2019 Valuation of the Kentucky Employees Retirement System – Hazardous Test Life Comparison

Test Life Description	Present Value of Future Salary			Present Value of Benefits			Accrued Liability			Normal Cost		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Pension Retiree 1				133,573	134,522	1.01						
Pension Surviving Spouse				113,256	114,193	1.01						
Pension Active Tier 1	228,380	235,143	1.03	191,905	191,865	1.00	145,768	143,059	0.98	20.20%	20.76%	1.03
Pension Active Tier 3	394,293	398,700	1.01	78,828	77,028	0.98	27,748	28,367	1.02	12.95%	12.20%	0.94
Insurance Retiree 1				45,733	46,513	1.02						
Insurance Surviving Spouse				26,920	26,991	1.00						
Insurance Active 1	228,380	235,143	1.03	60,241	60,206	1.00	47,309	46,905	0.99	5.66%	5.86%	1.03
Insurance Active 2	394,293	403,875	1.02	25,345	25,625	1.01	11,225	11,164	0.99	3.58%	3.76%	1.05

* Items above that are blank are not applicable to that test life.

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June 30, 2019 Valuation of the County Employees Retirement System – Non-Hazardous Test Life Comparison

Test Life Description	Present Value of Future Salary			Present Value of Benefits			Accrued Liability			Normal Cost		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Pension Retiree 1				40,980	41,143	1.00						
Pension Surviving Spouse 1				12,379	12,593	1.02						
Pension Surviving Spouse 2				18,432	18,227	0.99						
Pension Vested Terminated				47,246	48,926	1.04						
Pension Due Refund				3,146	3,146	1.00						
Pension Active Tier 1	162,134	167,000	1.03	41,933	41,996	1.00	20,324	20,125	0.99	13.32%	13.10%	0.98
Pension Active Tier 3	445,156	454,901	1.02	58,672	59,139	1.01	23,047	20,535	0.89	8.00%	8.49%	1.06
Insurance Retiree 1				30,187	30,250	1.00						
Insurance Vested Terminated				25,230	25,612	1.02						
Insurance Active 1	445,156	458,265	1.03	12,003	11,924	0.99	4,856	4,768	0.98	1.61%	1.63%	1.01
Insurance Active 2	162,134	168,233	1.04	17,694	17,297	0.98	9,159	8797	0.96	5.26%	5.25%	1.00

* Items above that are blank are not applicable to that test life.

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June 30, 2019 Valuation of the County Employees Retirement System – Hazardous Test Life Comparison

Test Life Description	Present Value of Future Salary			Present Value of Benefits			Accrued Liability			Normal Cost		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Pension Retiree 1				541,594	544,587	1.01						
Pension Surviving Spouse				360,419	360,628	1.00						
Pension Active Tier 1	333,511	343,288	1.03	486,338	487,050	1.00	409,471	408,280	1.00	23.05%	22.95%	1.00
Pension Active Tier 2	648,791	668,327	1.03	270,809	272,323	1.01	155,823	154,801	0.99	17.72%	17.58%	0.99
Insurance Retiree 1				287,718	287,352	1.00						
Insurance Surviving Spouse				124,737	121,106	0.97						
Insurance Active 1	333,511	344,128	1.03	314,592	303,321	0.96	264,958	256,489	0.97	14.88%	14.09%	0.95
Insurance Active 2	648,791	668,327	1.03	46,161	44,917	0.97	27,532	26,810	0.97	2.87%	2.81%	0.98

* Items above that are blank are not applicable to that test life.

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June 30, 2019 Valuation of the State Police Retirement System Test Life Comparison

Test Life Description	Present Value of Future Salary			Present Value of Benefits			Accrued Liability			Normal Cost		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Pension Retiree 1				900,573	902,217	1.00						
Pension Surviving Spouse				714,979	719,225	1.01						
Pension Vested Terminated				288,226	291,466	1.01						
Pension Due Refund				661	661	1.00						
Pension Active Tier 1	327,240	335,327	1.02	485,133	484,668	1.00	383,022	370,904	0.97	31.20%	33.93%	1.09
Pension Active Tier 1	427,582	432,552	1.01	391,589	390,132	1.00	268,685	266,182	0.99	28.75%	28.66%	1.00
Pension Active Tier 2	731,157	749,876	1.03	268,940	268,805	1.00	58,329	56,774	0.97	28.80%	28.28%	0.98
Pension Active Tier 3	222,465	231,013	1.04	38,386	38,607	1.01	396	0	N/A	17.07%	16.71%	0.98
Insurance Retiree 1				93,366	93,898	1.01						
Insurance Surviving Spouse				52,997	53,253	1.00						
Insurance Vested Termination				219,665	217,741	0.99						
Insurance Active 1	412,213	419,126	1.02	62,640	62,257	0.99	44,329	44,020	0.99	4.44%	4.51%	1.01
Insurance Active 2	209,926	206,098	0.98	2,614	2,657	1.02	0	0	1.00	1.25%	1.29%	1.03
Insurance Active 3	317,264	326,582	1.03	319,612	314,773	0.98	259,330	262,112	1.01	19.00%	18.16%	0.96
Insurance Active 4	669,526	674,778	1.01	47,462	48,151	1.01	19,842	21,194	1.07	4.13%	4.00%	0.97

* Items above that are blank are not applicable to that test life.

Section III: Analysis of Actuarial Assumptions Employed

Economic Assumptions

Actuarial Standard of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations* (ASOP No. 27), provides guidance for setting economic assumptions used in actuarial valuations. GRS references ASOP No. 27 in its Experience Study report, and appears to have taken the guidance into account when making its recommendations for the economic assumptions.

As part of our review, we also compared the recommended set of economic assumptions to those used by a peer group of 200 pension plans covering state and local employees, the Public Plans Data (PPD). The PPD is maintained by the Center for Retirement Research at Boston College in partnership with the Center for State and Local Government Excellence and the National Association of State Retirement Administrators (NASRA). The current database is populated with information from Comprehensive Annual Financial Reports through the 2019 fiscal year.

Economic assumptions have a significant effect on the development of KRS liabilities. Changes to these assumptions can substantially alter the results determined by the actuary. The goal is to have a consistent set of economic assumptions that appropriately reflect expected future economic trends. However, economic assumptions are uncertain, and, as a result, there may be a reasonable range of potential recommendations. Different actuaries will apply different professional judgment and may choose different reasonable assumptions.

Inflation

The underlying inflation assumption of 2.30% is at the low end of the range of 2.25% to 3.28% (based on the 5th to 95th percentile range from valuations primarily covering fiscal years ending in 2019). The Experience Study report cited several sources of data that supports the reasonableness of the 2.3% inflation assumption.

Investment Return

KRS maintains five retirement and five health insurance plans. Due to differences in external liquidity requirements of the systems, there are differences in how plan assets are invested. The investment return assumption is 6.25% for the CERS retirement system (non-hazardous and hazardous), KERS hazardous retirement system, and all five health insurance plans. The return assumption for the KERS non-hazardous retirement system and SPRS is 5.25%. These assumptions, when compared to the peer group, are below the low end of the range of 6.67% to 7.66% (based on the 5th to 95th percentile range). 5.25% and 6.25% represent two of the lowest investment return assumptions in use for public sector systems. The asset allocation policy for the severely underfunded systems (i.e., KERS non-hazardous and SPRS) is an allocation that has approximately a 60% likelihood of achieving an assumed rate of return of 5.25%, while decreasing short-term volatility by 10% and lowering the

Section III: Analysis of Actuarial Assumptions Employed

portfolio's sensitivity to the economic growth cycle by 14%. The asset allocation policy for the other systems has approximately a 50% likelihood of achieving a 6.25% rate of return, while increasing projected liquidity and maintaining a similar investment risk profile as the prior allocation. Given the analysis presented by GRS and the characteristics of KRS, the 5.25% and 6.25% investment return assumptions recommended by GRS appear to be reasonable.

The data presented in the Experience Study Report relies on capital market assumptions covering 7 to 10 year expectations for most of the investment consultants considered. These relatively short-term expectations were used to model distributions of 20-year geometric nominal returns. Applying the 7 to 10 year assumptions to a 20-year period typically would understate the expected geometric returns (assuming an environment where longer time horizons have higher expected returns).

Payroll Growth

In 2017, the KRS Board decreased the payroll growth assumption from 4.0% to 0.0% for both KERS systems (non-hazardous and hazardous) and the SPRS. The Board also decreased the payroll growth assumption from 4.0% to 2.0% for both CERS systems (non-hazardous and hazardous). GRS recommended that these assumptions be maintained. GRS also recommended that KRS work with the General assembly to enact legislation modifying the method by which employers collect employer contributions toward the unfunded actuarial accrued liability such that the System invoices the employer the required amortization payment and the employer contributes only the normal cost as a percentage of payroll. Given the funded status of KRS, we believe the payroll growth assumptions are reasonable and the recommendation is appropriate.

Salary Scale

For all members, the salary scale assumption is comprised of inflation, productivity, and step rate/promotional. Inflation is 2.3% for all systems. Productivity is 1% for non-hazardous members and 1.25% for hazardous members. The report does not include an analysis of the method for determining the proposed productivity increase.

The step rate/promotional increase analysis was performed by reviewing year-over-year increases, net of the actual inflation experienced in each year of the study period. The proposed assumptions look reasonable.

Demographic Assumptions

The demographic assumptions used to value KRS reflect the expected occurrence of various events among participants. The assumptions should reflect specific characteristics of the System and produce reasonable results. A reasonable assumption is one that is expected to model the contingency being measured and not expected to produce significant gains and losses. The types of demographic assumptions used to measure pension obligations include, but are not limited to the following:

- Mortality;
- Termination of employment;
- Retirement;

Section III: Analysis of Actuarial Assumptions Employed

- Disability;
- Retiree medical participation; and
- Others, including refunds, marriage assumptions, and health care trend.

Actuarial Standard of Practice No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations* provides guidance for setting noneconomic assumptions used in actuarial valuations. The standard recommends that the actuary follow a general process for selecting demographic assumptions.

The first step of this general process is to identify the types of assumptions to use. The actuary should consider relevant system provisions that will affect timing and value of any potential benefit payments, all contingencies that give rise to benefits or loss of benefits, and the characteristics of the covered group.

The next step in the process is to identify the relevant assumption universe. The assumption universe may include prior experience studies or general studies of trends relevant to the specific type of demographic assumption and system experience to the extent that it is credible.

The third step in the process is to consider the assumption format. The format may include different tables for different segments of the covered population (such as different turnover rates for general employees versus public safety).

The final step in the process is to select the assumptions and evaluate the reasonableness of each assumption. The specific experience of KRS should be incorporated but not given undue weight if recent experience is attributable to a phenomenon that is unlikely to continue. For example, if recent rates of termination were due to a one-time reduction in workforce it may be unreasonable to assume that such rates will continue.

Overall, the methodology that GRS used to review experience and set proposed assumptions is similar to the approach that Segal would take for an experience review.

Mortality

The base mortality rates for retirees age 58 to 94 are based on the System's experience, using a benefits weighted approach and a polynomial model to provide a smooth fit to the midpoint of the experience. Mortality rates for ages under 58 and over 98 are equal to the most recently published Pub-2010 mortality assumptions for general employees. The preliminary mortality table was projected from the center point of the analysis period (2015) to 2019 using the MP-Ultimate mortality improvement assumption. Future mortality improvements are projected using the MP-Ultimate scale. The base mortality rates for disabled retirees is the Pub-2010 Disabled mortality table, with a four-year set forward for both male and female rates. The Pub-2010 mortality table is used for active employees. The General Employees table is used for non-hazardous systems and the Public Safety table if used for the hazardous and State Police Systems. Future improvements in mortality are based on the MP-Ultimate mortality improvement assumption.

GRS assumes that the number of total death by gender indicates that System experience is fully credible. Segal believes that if the base mortality table is based on System experience, every age would need to have some threshold of deaths. In addition, with roughly the same number of deaths for males and females over the experience period (5,078 and 5,060, respectively), it is unclear why the

Section III: Analysis of Actuarial Assumptions Employed

female data is considered more credible than the male data (99% confidence that experience is within 5% for males, but within 3% for females).

Although the employee groups are allocated between “hazardous and non-hazardous” categories, the mortality data is not studied separately for retirees in former hazardous occupations. While it is conceivable that upon achieving retirement age, all retirees would exhibit the same mortality experience, it would be worth studying the information separately and have the conclusion drawn from the data. We note that there is no mention of this distinction in the report.

Generational mortality improvement is reflected by using only the flat 1% improvement rate per year beyond the first 15 years from the Society of Actuaries’ Retirement Plans Experience Committee mortality improvement tables (MP series). We believe this is a non-standard approach and should be supported with analysis as to why 1% mortality improvement across the board is appropriate for the System.

Retirement Rates

Retirement liability is the most significant portion of the liability for active employees, and therefore the assumed rates of retirement are important. The valuation employs retirement rates for some groups that are based on age (KERS and CERS non-hazardous) and other groups that are based on years of service (KERS and CERS hazardous and SPRS members).

The retirement experience was analyzed on a benefits-weighted basis and modifications were proposed to better reflect experience. In general, we believe the retirement rates proposed by GRS are reasonable. However, it would be useful to provide some analysis or graphs in this section to better understand the rationale for the recommended retirement rates.

Termination Rates

Separate unisex, service-based tables for separation from active service apply to the various membership groups. Termination experience was analyzed on a salary-weighted basis and modifications were proposed to better reflect experience. It is unclear whether termination rates were studied net of rehires; that distinction should be outlined in the report. In general, we believe the termination rates proposed by GRS are reasonable.

Disability Rates

Age-based, unisex disability rates are applied only to eligible members. Based on the analysis in the Experience Study Report, we believe the current and proposed disability rates are reasonable.

Other Comments

To improve the usefulness of the analysis and communicate how the rates were developed, it would be beneficial to include additional analysis and/or graphs to understand why there were recommended changes to rates.



Section III: Analysis of Actuarial Assumptions Employed

Overall, the economic and demographic actuarial assumptions adopted by the KRS Board are reasonable and consistent with generally accepted actuarial standards and practices contained in Actuarial Standard of Practice No. 27 covering economic assumptions and Actuarial Standard of Practice No. 35 covering demographic and non-economic assumptions.

Funding Method for Liabilities

The funding method employed is the entry age normal (EAN) actuarial cost method and is the same method used by the majority of plans in the Public Plans Database. We find the current method to be reasonable.

Asset Valuation Method

The June 30, 2019 actuarial valuation uses an “actuarial” value of assets for purposes of establishing the required employer contributions. The current method smooths investment gains and losses for each fiscal year by recognizing these gains and losses evenly over a five-year period. This method does not impose a corridor, which would place a limit on the spread between actuarial value of assets (AVA) and market value of assets (MVA).

An essential part of the public sector budgeting process is that material budget items, including pension contributions, should have a level cost pattern from year to year to the extent possible. Segal recognizes the importance of this requirement and assists clients in establishing reasonable methodologies for recognizing investment gains and losses and limiting the potential volatility that may result in increased contributions due to investment results.

The actuary’s guide for determining the reasonableness of an asset smoothing method is ASOP No. 44. The following is an excerpt from this ASOP that establishes the qualities a reasonable asset smoothing method must exhibit.

From the Actuarial Standard of Practice No. 44:

- 3.3 *Selecting Methods Other Than Market Value -- If the considerations in section 3.2 have led the actuary to conclude that an asset valuation method other than market value may be appropriate, the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:*
- a. *The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.*
 - b. *The asset valuation method is likely to produce actuarial values of assets that, in the actuary’s professional judgment, satisfy both of the following:*
 1. *The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside*

Section III: Analysis of Actuarial Assumptions Employed

of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.

2. *Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.*

In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary's professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period.

Two key principles arise from ASOP 44. These are that acceptable asset smoothing must create asset values that fall within a reasonable range around market value and are recognized in a reasonable period of time. In lieu of satisfying both of these principles, a smoothing method could satisfy the requirements if, in the actuary's professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a sufficiently short period.

Segal has established an internal policy, which is consistent with others in the actuarial community, that five years is a sufficiently short period to constitute a reasonable asset smoothing method even if no corridor is used. Therefore, it is our opinion that the method utilized by KRS is reasonable.

Funding Policy Contribution

By statute, the KRS Board of Trustees must approve the employer contribution rates for the two upcoming fiscal years for KERS and SPRS and for the upcoming fiscal year for CERS, based upon the results of the most recent actuarial valuation. The funding policy set by the Board of Trustees provides that the contribution rate consists of the normal cost and an amortization payment (level percentage of payroll) on the unfunded accrued liability (UAL). The amortization period was reestablished as a closed 30 year period beginning with the June 30, 2013, actuarial valuation. The amortization period will decrease by one each year in the future. This type of closed period amortization provides a contribution schedule that, if actual experience is reasonably close to expected, will amortize the existing unfunded liability over time.

However, House Bill 362 passed during the 2018 legislative session provides for a phase-in of contributions to the CERS systems. In addition, the funded ratio for KERS Non-Hazardous was 13.4% as of June 30, 2019. For the remaining systems, we believe this funding policy is sufficient and provides a reasonable contribution rate schedule for adequately funding the Systems. For CERS, we recommend that the employers pay the actuarially determined contribution rates. For KERS Non-Hazardous, we recommend that contributions continue to exceed benefit payments and that the actuarially determined contributions be contributed in order to avoid the risk of insolvency.

Section III: Analysis of Actuarial Assumptions Employed

Insurance Assumptions

Health Care Trend Rate

Trend is a measure of the rate of change, over time, of the per capita health care rates. It includes factors such as medical inflation, utilization, plan design, and technology improvements. GRS currently bases their assumption on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Costs Trends for the SOA;" Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries. GRS has developed separate assumptions for Medicare and non-Medicare plans. We agree with their approach. Additionally, the trend rates developed are reasonable and produce results consistent with trend rates used for other similar plans.

Age-Related Morbidity

Morbidity or aging factors are used to estimate variation in per capita health care rates by age for the benefits being modeled. To model the impact of aging on the underlying health care costs for Medicare retirees, GRS relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death" Table 4 (Development of Plan Specific Medicare Age Curve) to model the impact of aging for ages 65 and over. For Medicare retirees, this approach and the aging factors used by GRS are reasonable and appropriate for the valuation.

As GRS correctly noted, Actuarial Standards of Practice No. 6 requires aging subsidies to be recognized and GASB Statements No. 74 and No. 75 require adhering to ASOP No. 6. However, no aging factors are applied to non-Medicare retirees. Since the health insurance trusts are designed to reimburse the employer's portion of the non-Medicare premium, this approach is reasonable solely for the purposes of a funding valuation.

Plan Election

GRS assumes that the proportion of current retirees electing each coverage option will remain unchanged. There are separate assumptions for Medicare and non-Medicare retirees. This approach is supported by the data, reasonable and appropriate for the valuation.

Participation

The participation assumption is used to project what percentage of members elect retiree health care coverage upon retirement.

For members retiring from active status who were hired before July 1, 2003, GRS has continued their approach to base participation on retiree contribution percentage, which is based on service at retirement. This approach is reasonable and appropriate for the valuation.

Section III: Analysis of Actuarial Assumptions Employed

For members retiring from active or inactive vested status who were hired after July 1, 2003, GRS recommends continuing to use the current assumptions of 100% participation. We believe this assumption may be conservative, especially for non-hazardous non-Medicare retirees. We would suggest that when the experience is next reviewed, in addition to considering service-based participation rates, rates of participation may also vary by Medicare status at retirement.

Members who become disabled in the line of duty, and surviving spouses and dependents of members who die in the line of duty, receive 100% of their health care paid by KRS. Continuing to assume that 100% will participate is reasonable and appropriate for the valuation.



DRAFT

Section IV: Conclusions and Recommendations

This limited scope audit reviewed the data used, the benefits valued, the valuation results, and the actuarial methods and assumptions employed in the June 30, 2019, actuarial valuations. We provided a few recommendations for the valuation report and test lives, and we generally agree with the results of the experience study, with a few recommendations for improvement. We found the actuarial cost method and asset valuation method conform with the Actuarial Standards of Practice. The data appears complete and with a cursory analysis of the information supplied by KRS staff, we were able to closely match the participant counts reported by GRS.

Below we summarize our comments and recommendations for your consideration:

A. Valuation Results

1. Additional detail relative to the calculation of Recommended Employer Contribution Rates would be beneficial to the user and improve transparency.

B. Valuation Report

1. The report disclosed the effect of the assumption changes on the actuarial accrued liabilities. However, the effect of the assumption changes on other funding metrics, such as the funded percentage and the Actuarially Determined Contribution Rate, were not disclosed. Since these changes could provide useful insight to users of the reports, we recommend showing the impact of assumption changes on these funding metrics.
2. In the tables labeled as "Experience Gain or (Loss)," we believe it is clearer and more appropriate that plan changes and assumption changes not be classified as actuarial gains and losses.
3. Also related to the liability gain or (loss), it would be informative to show the gain or loss attributable to each source as well as to actual contributions that are more or less than expected.
4. Section 5 of the Annual Actuarial Valuation Report contains information related to discussion of risks, which is required information for funding valuations and pricing valuations pursuant to Actuarial Standards of Practice Statement No. 51 (ASOP 51). We recommend this section be expanded to add commentary specific to KRS when discussing each risk element. In addition, we believe this section should contain a recommendation for a more detailed risk assessment since there is, in our opinion, enough risk inherent in KRS that a more detailed risk assessment would be useful.

- The reports do not include any projections of future funded percentages or contribution requirements. Adding a projection of liabilities, assets, and required contribution rates throughout the remaining amortization period (24 years for the 2019 valuation reports) could be helpful for the long-term planning for the future funding requirements of the System.

C. Projected Benefits

- There is an inconsistency between how service to determine benefit eligibility and service to determine benefit amounts are calculated. Service for eligibility purposes is calculated as a rounded amount and service for benefit amount purposes is calculated as an exact amount. We would expect both to be calculated with the same methodology. Furthermore, using rounded service for benefit eligibility may not be appropriate, as it would allow some participants to retire within the valuation program at an age when they are not actually eligible. For example, if a participant needs 10 credits to retire at a certain age, they would not be able to retire at that age if they only had 9.9 credits. Rounding the 9.9 credits to 10 allows the valuation program to treat them as retiring earlier than actually allowable. We recommend using exact service for eligibility purposes.
- The trend rates for insurance test lives appears to include the adjustment for known 2020 Medicare premiums for current retirees but not for future retirees.

D. Assumptions and Methods

- We believe that the investment return assumption recommendations are reasonable.
- The experience study report does not include an analysis of the method for determining the proposed productivity increase.
- GRS should expand their analysis of post-retirement mortality to verify mortality experience after retirement is similar for both hazardous and non-hazardous employees.
- There is no documented support that 1% mortality improvement across the board is appropriate for the System.
- It is unclear whether termination rates were studied net of rehires; that distinction should be outlined in the report.
- To improve the usefulness of the analysis and communicate how the rates were developed, it would be beneficial to include additional analysis and/or graphs to understand why there were recommended changes to rates.

In this report, we have noted areas that we believe will improve the usefulness and clarity of the KRS annual actuarial valuations and experience study, and improve the valuation results. We are available to discuss any aspect of our review with KRS staff or the Systems' actuary.

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Kentucky Retirement Systems

2018 Actuarial Experience Study
for the Period Ending June 30, 2018





April 18, 2019

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

Dear Members of the Board:

Subject: Results of 2018 Experience Study

We are pleased to present our report of the 2018 Experience Investigation Study for the Kentucky Retirement Systems (i.e. Kentucky Employees Retirement System, County Employees Retirement System, and the State Police Retirement System) for the five-year period ending June 30, 2018. 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, 2019 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. Using the recommended set of actuarial assumptions should present a more accurate portrayal of the Systems' financial condition and should reduce the magnitude of future experience gains and losses.

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 KRS staff for their assistance in this project.

Sincerely,

A handwritten signature in black ink, appearing to read "Joe Newton".

Joseph P. Newton, FSA, EA, MAAA
Senior Consultant and Actuary

A handwritten signature in black ink, appearing to read "Daniel J. White".

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

A handwritten signature in black ink, appearing to read "Janie Shaw".

Janie Shaw, ASA, MAAA
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 Retirement Systems. 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 the System 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
- 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 boom or bust 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 increases the difficulty of identifying changes in behavior that may be occurring, such as mortality improvement or a change in the ages at which members retire. In our view, using a five-year period ending June 30, 2018 is generally reasonable. 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 15% 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. The fiscal impact of adopting our recommendations on liabilities and contribution rates is shown in Section IV. Sections V through VII show a summary of the recommended assumptions for each System. Finally, Section VIII presents detailed summaries of the data and comparisons of the A/E ratios.

SECTION VIII EXHIBITS

The exhibits in Section VIII should generally be self-explanatory. For example, on page 83, 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

Our recommendations to the actuarial assumptions used the actuarial valuation for KRS may be summarized as follows:

Economic Assumptions

1. Inflation Assumption: Recommend continued use of a 2.30% price inflation assumption.
2. Investment Return Assumption: Recommend continued use of a 5.25% investment return assumption for the KERS Non-Hazardous Retirement System and the State Police Retirement System. The current 6.25% investment return assumption for the CERS Retirement Systems (Non-Hazardous and Hazardous), KERS Hazardous Retirement System, and for all five health insurance plans remains reasonable. However, it would also be reasonable if the Board wanted to decrease the assumed rate of return from 6.25% to 6.00% for these systems.
3. Salary Increases for Individual Members: Recommend an overall increase to the salary increase assumption applicable to individual members and increasing the consistency in the assumptions for various groups. The recommended changes include an increase to some of the step-rate and promotional component of the salary increase assumption for shorter service employees as well as a recommended increase to the salary increase assumption for the CERS Hazardous and State Police Retirement System for those members with more than 10 years of service. However, we are also recommending a slight decrease to the rate of salary increase for long-service active members in the KERS Non-Hazardous System.
4. Payroll growth rate (used for amortizing the UAAL): Recommend no immediate change to the 0% payroll growth rate assumption for both KERS Systems (Non-Hazardous and Hazardous) and the State Police Retirement System. We also recommend no immediate change the current 2.0% payroll growth assumption for both CERS Systems (Non-Hazardous and Hazardous).

Rather, we recommend that legislation be enacted to change the employers' method of making contributions to the System such that the dollar amount of the System's amortization cost be allocated to the participating employers based a fixed percentage of the total amortization cost and the employers only contribute the normal cost rate on covered payroll. If legislation is not enacted to redefine how the System collects contributions from the participating employers, then we recommend the Board monitor the emerging change in active membership count and change in covered payroll to identify if a reduction in the payroll growth assumption for any System is warranted.

Demographic Assumptions:

5. **Mortality:** Recommend replacing the base retiree mortality tables with a Kentucky Retirement Systems-specific mortality table developed using the actual mortality experience of non-disabled retirees in KERS, CERS, and SPRS. We also recommend replacing the current mortality tables for disabled retirees and active members with a variation of the Public Retirement Mortality Tables (PUB-2010 Tables) recently released by the Society of Actuaries. Finally, we also recommend using a generational mortality improvement assumption based on the ultimate rates of the published MP improvement scales (“MP-Ultimate”) to explicitly project future improvement in life expectancy.
6. **Retirement:** For members with a participation date prior to July 1, 2003, we are recommending an overall slight decrease in the rates of retirement for the KERS and CERS Systems. For members with a participation date on or after July 1, 2003, we recommend using retirement rates that are equal to 80% of the retirement rates applicable for the pre July 1, 2003 participants for ages below age 65. We are also recommending a decrease to the retirement rates for members in SPRS whose participation date is on or after July 1, 2003.
7. **Termination/Withdrawal:** We recommend increasing the termination rates for both KERS Systems (Non-Hazardous and Hazardous) as well as the CERS Non-Hazardous System, and decreasing the termination rates for CERS Hazardous and SPRS Systems.
8. **Disability Incidence:** Recommend increasing the rates of disability incidence for the KERS and CERS Systems (Non-Hazardous and Hazardous), and no change to the disability incidence assumption for SPRS.
9. **Participation in the Retiree Health Insurance Plan:** We recommend no change the current assumption regarding participation in the retiree health insurance plan.

Actuarial Methods and Policies

10. **Asset Valuation Method:** 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. However, for the purpose of increased transparency and comparability we recommend a modification to the presentation of the smoothing calculations in the report to be consistent with the format that is commonly used by other Systems. This modification will not have a cost impact.
11. **Actuarial Cost Method:** 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)	System				SPRS (6)
	KERS		CERS		
	Non-Haz (2)	Haz (3)	Non-Haz (4)	Haz (5)	
<i>Economic Assumptions</i>					
1. Inflation	No Change	No Change	No Change	No Change	No Change
2. Investment Return (Pension / Ins)	No Change	No Change	No Change	No Change	No Change
3. Short-Service Salary Increase	Increase	Increase	Increase	Increase	Increase
4. Long-Service Salary Increase	Decrease	No Change	No Change	Increase	Increase
5. Payroll Growth Assumption	No Change ¹	No Change ¹	No Change	No Change	No Change
<i>Demographic Assumptions</i>					
6. Retiree Mortality	KRS Specific	KRS Specific	KRS Specific	KRS Specific	KRS Specific
7. Termination	Increase	Significant Increase	Slight Increase	Significant Decrease	Decrease
8. Retirement	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease
9. Disability	Increase	Increase	Increase	Increase	No Change
10. Health Insurance Participation	No Change	No Change	No Change	No Change	No Change
<i>Other Assumptions and Methods</i>					
11. Asset Method	5-Year Smoothing	5-Year Smoothing	5-Year Smoothing	5-Year Smoothing	5-Year Smoothing

¹ We recommend legislative action to change method for allocating the required contribution to employers.

Summary of Financial Impact of Recommendations

(\$thousands)

The following tables highlight the impact of the recommended changes on the unfunded actuarial accrued liabilities (UAAL), funded ratio and employer contribution rates for the five systems for both the pension and insurance funds. Additional information on the financial impact on the Systems can be found in Section IV.

System	Pension		Insurance	
	Before Change	After Change	Before Change	After Change
KERS Non-Hazardous				
UAL	\$ 13,655,954	\$ 14,321,191	\$ 1,548,384	\$ 1,658,097
Funded Ratio	12.9%	12.4%	36.4%	34.9%
Employer Rate	74.5%	78.0%	10.7%	11.2%
KERS Hazardous				
UAL	\$ 512,661	\$ 559,986	\$ (117,960)	\$ (102,741)
Funded Ratio	55.5%	53.3%	130.0%	125.1%
Employer Rate	34.4%	37.2%	0.0%	0.0%
CERS Non-Hazardous				
UAL	\$ 6,241,280	\$ 6,902,382	\$ 721,194	\$ 882,018
Funded Ratio	52.7%	50.2%	76.7%	72.9%
Employer Rate	22.5%	25.4%	4.8%	5.4%
CERS Hazardous				
UAL	\$ 2,470,827	\$ 2,702,563	\$ 427,722	\$ 458,277
Funded Ratio	48.4%	46.2%	74.6%	73.3%
Employer Rate	37.0%	45.9%	9.5%	11.7%
SPRS				
UAL	\$ 721,269	\$ 761,380	\$ 74,553	\$ 79,973
Funded Ratio	27.1%	26.1%	71.6%	70.1%
Employer Rate	120.5%	131.7%	19.5%	21.3%

Note: Contribution rates shown for CERS are without regard to the phase-in provision.

SECTION III

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, expenses, the investment return 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.

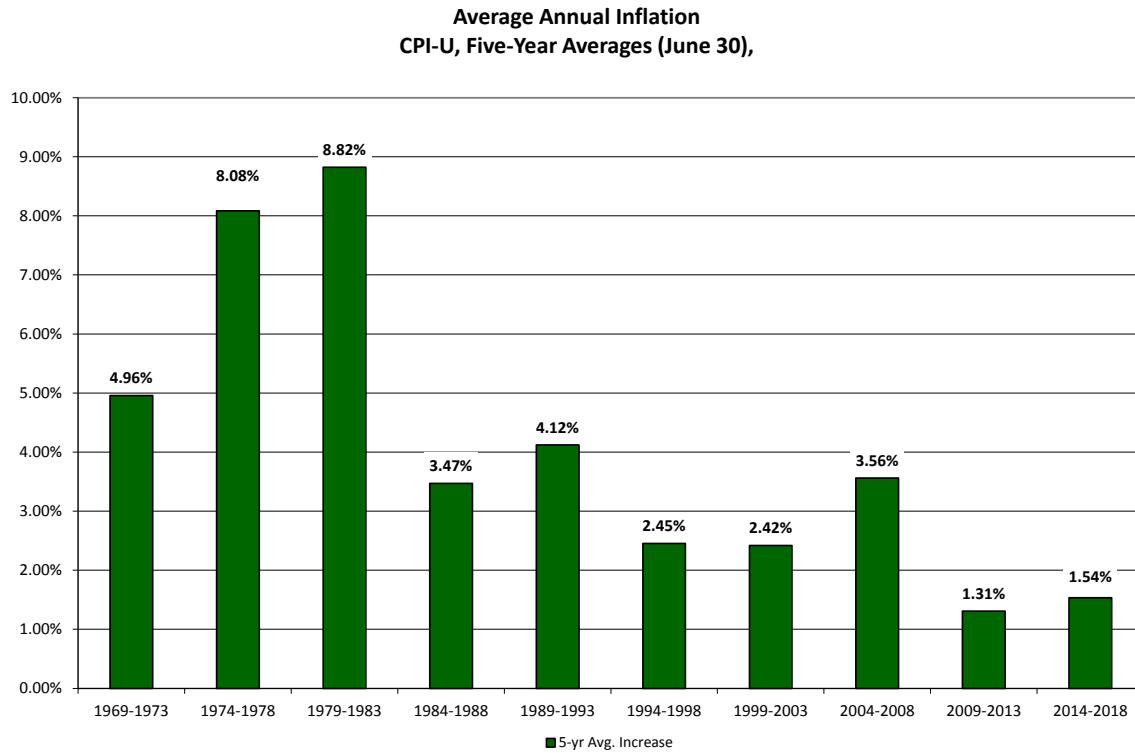
Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Nevertheless, the economic assumptions are much more subjective in 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). This inflation assumption underlies most of the other economic assumptions. It impacts investment return, salary increases, and the rate of payroll growth for amortizing the unfunded actuarial accrued liability. The current annual inflation assumption is 2.30%.

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 table shows the average inflation over various periods, ending June 30, 2018:

Periods Ending June 30, 2018	Average Annual Increase in CPI-U
Last five (5) years	1.54%
Last ten (10) years	1.42%
Last fifteen (15) years	2.13%
Last twenty (20) years	2.20%
Last twenty-five (25) years	2.25%
Last thirty (30) years	2.56%
Since 1913 (first available year)	3.12%

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

As you can see, inflation has been relatively low over the last thirty years.

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 2018 survey of capital market assumptions of eleven investment consulting firms, the average expected price inflation for the next ten years is 2.20%. Of those firms, three of them develop longer-term assumptions (20 years or more) and have an average expected rate of inflation of 2.4%.

Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. For example, the June 30, 2018 yield for 20-year inflation indexed Treasury bonds was 0.84% plus actual inflation. The yield for 20-year non-indexed US Treasury bonds was 2.61%. Simplistically, this means that on that day the bond market was predicting that inflation over the next twenty years would average 1.76% $[(1 + 2.61\%) / (1 + 0.84\%) - 1]$ per year. The difference in yield for 30-year bonds implies 1.83% inflation over the next 30 years. This is consistent with most forecasts of inflation and overall economic growth being lower over the next decade. 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 2018 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.6% under the intermediate cost assumption. The Chief Actuary for the Social Security Administration kept this assumption unchanged from the prior year and the low cost and high cost scenarios are 2.0% and 3.2%, respectively.

Survey of Professional Forecasters and Fed Policy

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their forecast for the fourth quarter of 2018 was for inflation over the next ten years (2019 to 2028) to average 2.21%. Additionally, the Fed has openly stated that they have a target 2.00% inflation rate.

Recommendation

Using these sources, we recommend continued use of a 2.30% assumption.

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.

KRS maintains five retirement and five health insurance plans. 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 are material enough to warrant the use of different investment return assumptions. Specifically, the current investment return assumption is 6.25% for the CERS retirement system (non-hazardous and hazardous), KERS retirement hazardous system, and all five health insurance plans. On the other hand, the investment return assumption for the KERS Non-Hazardous retirement system and SPRS 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.

Actual Investment Performance

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

System	Historical Average Annual Return			
	FY 2018	3-Year	5-Year	10-Year
KERS Non-Hazardous	7.50%	6.17%	7.19%	5.96%
KERS Hazardous	8.68%	7.14%	7.70%	6.21%
CERS Non-Hazardous	8.75%	7.18%	7.71%	6.22%
CERS Hazardous	8.77%	7.21%	7.73%	6.23%
SPRS	7.65%	6.06%	7.04%	5.89%

Source: Comprehensive Annualized Financial Report for the fiscal year ending June 30, 2018.

However, past performance is not a reliable indicator of future investment performance, even when returns are averaged over a long time (e.g. twenty-year period or more). 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 KRS's 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 June 7, 2018 Board material that had the following objectives. For the severely underfunded systems (i.e. the KERS Non-Hazardous and SPRS Retirement Systems), they recommended an allocation that has approximately a 60% likelihood of achieving an assumed rate of return of 5.25%, while decreasing short-term volatility by 10% and lowering the portfolio's sensitivity to the economic growth cycle by about 14%. Wilshire Associates also recommended a different asset allocation policy for the other systems maintained by KRS (i.e. the KERS Hazardous, CERS Non-Hazardous and Hazardous



Retirement Systems, and all five Retiree Health Insurance Systems) that has approximately a 50% likelihood of achieving a 6.25% rate of return, while increasing projected liquidity and maintaining a similar investment risk profile as the prior allocation.

Both these asset allocation policies were adopted by the Board in June 2018 and used in our analysis. The following table provides a summary of these two asset allocation policies.

Asset Class	KERS Non-Haz and SPRS Retirement	Other KRS Systems
US Equity	15.75%	18.75%
Non-US Equity	15.75%	18.75%
Private Equity	7.00%	10.00%
High Yield / Credit Fixed Inc.	15.00%	15.00%
Core Fixed Income	20.50%	13.50%
Cash	3.00%	1.00%
Real Estate	5.00%	5.00%
Hedge Funds / Opportunistic	3.00%	3.00%
Real Return	15.00%	15.00%
Total	100.00%	100.00%

It's our understanding that the Board slightly modified these target allocations in December 2018, but the changes were insignificant for this analysis.

GRS is a benefits consulting firm and does not provide investment consulting advice, we do not develop or maintain our own forecasts of capital market expectations. Instead, we utilized 2018 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
- Marquette
- NEPC (7-Year and 30-Year)
- RV Kuhns
- Wilshire (KRS's Investment Consultant)
- BNY Mellon
- JP Morgan
- Mercer (10-Year and 20-Year)
- PCA
- Summit

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

KRS theoretically has 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 KRS is expected to have an indefinite life span, this system is relatively mature with material shorter-term liability attributable to current retirees. For example, as of the last actuarial

valuation \$11.4 billion of the \$15.7 billion total actuarial accrued liability in the KERS Non-Hazardous System is attributable to members who are currently receiving a retirement benefit (i.e. 72% of the total liability). Similarly, \$7.8 billion of the \$13.2 billion total actuarial accrued liability in the CERS Non-Hazardous System is attributable to members who are currently receiving a retirement benefit (i.e. 59% of the total liability). Due to the Systems' maturity, we believe an appropriate return assumption for these Systems should account for short-term expectations.

The tables below provide the 40th, 50th, and 60th percentiles of the geometric average of the expected nominal return, as well as the probability of exceeding the current investment return assumption.

**Table 1. CERS, KERS Hazardous, and All Health Insurance Funds
Expected Annual Geometric Returns and Return Probabilities**

	Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding 6.25%
		40th	50th	60th	
	(1)	(2)	(3)	(4)	(5)
7 to 10 Year Expectations	1	4.87%	5.37%	5.88%	33.1%
	2	5.01%	5.51%	6.02%	35.7%
	3	4.64%	5.31%	5.98%	36.1%
	4	5.25%	5.78%	6.32%	41.3%
	5	5.04%	5.66%	6.28%	40.5%
	6	5.28%	5.87%	6.46%	43.5%
	7	5.19%	5.91%	6.63%	45.3%
	8	5.50%	6.07%	6.65%	46.9%
	9	5.56%	6.37%	7.19%	51.5%
	10	6.15%	6.75%	7.35%	58.3%
	11	6.56%	7.09%	7.62%	65.7%
20-30 Year	1	5.86%	6.47%	7.08%	53.6%
	2	6.01%	6.63%	7.25%	56.1%
	3	6.10%	6.69%	7.28%	57.5%
	Average	5.50%	6.11%	6.71%	47.5%

Source: GRS

**Table 2. KERS Non-Hazardous, and SPRS Retirement Funds
Expected Annual Geometric Returns and Return Probabilities**

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding 5.25%	
	40th	50th	60th		
(1)	(2)	(3)	(4)	(5)	
7 to 10 Year Expectations	1	4.43%	5.01%	5.59%	45.8%
	2	4.63%	5.05%	5.48%	45.4%
	3	4.73%	5.16%	5.59%	47.8%
	4	4.72%	5.26%	5.80%	50.1%
	5	5.01%	5.45%	5.89%	54.5%
	6	4.99%	5.49%	5.99%	54.9%
	7	4.90%	5.50%	6.11%	54.2%
	8	5.14%	5.62%	6.11%	57.7%
	9	5.37%	6.09%	6.81%	61.7%
	10	5.83%	6.35%	6.87%	70.5%
	11	6.07%	6.53%	6.99%	76.1%
20-30 Year	1	5.80%	6.30%	6.80%	70.4%
	2	5.63%	6.17%	6.72%	66.8%
	3	5.52%	6.04%	6.57%	64.9%
Average	5.20%	5.72%	6.24%	58.6%	

Source: GRS

When developing the expected return for each assumption set we normalized the expected portfolio return for any difference between the investment consultant's price inflation assumption and the 2.30% price inflation assumption used in the actuarial valuation.

Recommendation

CERS (Non-Hazardous and Hazardous), KERS Hazardous Retirement, and All Insurance Funds

Based on our broader survey, the average of the 50th percentile return expectations of all assumption sets is 6.11%. This is reasonably close to the current 6.25% assumption and the results provided by Wilshire, and as a result, we find the current assumption reasonable. However, only three of the eleven

short-term assumptions result in a greater than 50% probability of exceeding the current 6.25% return assumption. Thus, if the Board is uncomfortable with a lower than 50% probability of achieving the assumption over the next decade, they may want to consider lowering the assumption to 6.00%..

KERS Non-Hazardous and SPRS Retirement Funds

These two retirement funds are invested differently than the other systems maintained by KRS because they require increased liquidity to have funds available to provide the benefit payments due to current retirees. Specifically, as of the last actuarial valuation the funded ratio of the KERS Non-Hazardous and SPRS Retirement funds were 12.8% and 27.1%, respectively.

As the results in Table 2 shows, the average 50th percentile is 5.72% and the average probability of exceeding the current 5.25% return assumption is 58.6%. In absolute terms, this may result in a conclusion that the current return assumption may be too conservative. However, given the very low funded ratios of the systems where this assumption is used, it is more prudent to use an investment return assumption that has a greater than 50% probability of emerging experience being greater than expected. Therefore, we also recommend no change the current 5.25% return assumption for these systems.

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 increases 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	KERS Non-Hazardous	KERS Hazardous	CERS Non-Hazardous	CERS Hazardous	SPRS
2014	2.9%	3.1%	3.5%	5.0%	3.3%
2015	4.0%	6.5%	4.3%	4.3%	3.0%
2016	4.9%	18.3%*	5.1%	5.9%	6.4%
2017	4.4%	11.1%	4.3%	9.0%	9.8%
2018	4.5%	6.1%	4.1%	5.5%	7.0%
Average	4.1%	8.9%	4.3%	5.9%	5.9%

* 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 at around 10 years for the hazardous duty groups, 11 years for the KERS Non-Hazardous and 15 years for the CERS Non-Hazardous and those are the lengths of service used to classify someone as a Long Service Employee. The relatively high average salary increase for the KERS Hazardous employees is due to the one-time pay adjustment in fiscal year 2015/2016. As a result, the average salary increase is not representative of the prospective expected average increase.

We are proposing the new assumption set has the same increases applied to members in similar job classifications. In summary, the assumed rate of annual salary increases for long-service employees will be 1.00% per year over inflation for Non-Hazardous members and 1.25% per year over inflation for the members in the Hazardous and State Police Systems.

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, CERS non-hazardous members with four years of service received an average increase of 4.64%, which was 1.84% more than the average increase of 2.80% for the same type of employee with fifteen 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. Step-rate assumptions were generally increased for all five Systems. Details of our analysis are shown in Section VIII beginning on page 74.

Salary Increases – Combined Effect

The table below shows the average expected increase in compensation for continuing members for the last five years, reconciling the changes from the current to proposed assumptions:

Summary of Actual Salary Experience Compared to Current and Recommended Salary Assumption for All Employees

System	Actual Nominal Increase	Actual Inflation	Salary Increase over Price Inflation		
			Actual ¹	Current Assumption ²	Proposed Assumption ³
KERS Non-Hazardous	4.1%	1.5%	2.6%	1.9%	2.1%
KERS Hazardous	8.9%	1.5%	7.4%	2.3%	2.4%
CERS Non-Hazardous	4.3%	1.5%	2.8%	1.7%	2.0%
CERS Hazardous	5.9%	1.5%	4.4%	1.4%	2.2%
SPRS	5.9%	1.5%	4.4%	1.8%	2.2%

¹ The actual salary increase in excess of actual inflation for all continuing active members during the five-year observation period.

² The expected average increase in salary in excess of the 2.30% assumed rate of inflation.

³ The expected average increase in salary in excess of the 2.30% recommended assumed rate of inflation.

The overall effect of the changes to the salary increase assumption will result in slightly higher assumed rate of salary increases (and actuarial accrued liability) for all Systems. Note, while the actual experience over inflation for Hazardous duty employees appears materially larger than the proposed assumptions, wages are slower to move than actual inflation and thus the differences appear wider than they actually are. In addition, it is likely pension and retiree-medical costs will dampen the amount of resources available for salary increases over the short to intermediate term.

PAYROLL GROWTH RATE

The salary increase rates discussed above are assumptions applied to individuals and are used in projecting future benefits.

Current State Statutes requires that participating employers in the Systems maintained by KRS to make contributions to the system as a percentage of covered payroll. Therefore, it is necessary to make an

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, as well as the change in the recently enacted contribution rates, it is appropriate to review the change in total payroll and membership in developing this assumption.

Average Annual Payroll and Active Membership Change				
	Change in Membership		Change in Payroll	
Averaging Period	5 Years	10 Years	5 Years	10 Years
KERS Non-Hazardous	-3.61%	-3.09%	-2.20%	-2.20%
KERS Hazardous	-.98%	-1.11%	3.69%	0.62%
CERS Non-Hazardous	0.00%	-0.41%	1.98%	1.31%
CERS Hazardous	0.31%	-0.93%	2.94%	1.19%
SPRS	-0.36%	-1.13%	1.52%	-0.87%

In 2017 the KRS Board decreased the payroll growth assumption from 4.00% to 0.00% for both KERS Systems (Non-Hazardous and Hazardous) and the SPRS. At the same time, the Board also decreased the payroll growth assumption from 4.00% to 2.00% for both CERS Systems (non-hazardous and hazardous).

Our recommendation is for the Board to maintain the current payroll growth assumption for all the systems for use in the June 30, 2019 actuarial valuation. Note, since the CERS Systems are phasing into the full actuarially determined contribution rate over the next three or four years, the Board has more time to observe the experience to identify whether a change in the payroll growth assumption for the Systems is needed.

The recent increases in the employer contribution rates have greatly incentivized the participating employers to reduce their pension cost by reducing the number of covered members (which also reduces their covered payroll). However, this employer behavior requires the System to further increase the contribution rate to maintain the same contribution dollar amount to fund the System. As a result, we believe that the long-term solution is for the General Assembly to enact legislation to change the method the System collects contributions from the participating employers such that the System invoices the employer the required amortization payment and the employer just contributes the normal cost rate on the payroll of their employees.

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

KRS'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 the System.

The current mortality assumption is gender distinct, but there is no distinction between retirees in KERS or CERS, or the Non-Hazardous and Hazardous Systems. Separate mortality tables are used for active members and disabled retirees; and discussed separately in a following subsection. The currently mortality assumption used in the actuarial valuation for non-disabled retirees is a variation of the RP-2000 Combined mortality table. The life expectancy for an age 65 retiree is 19.0 years for males and 22.1 years for females. The current mortality assumption does not include an explicit assumption for future improvement in life expectancy. Rather, this mortality assumption is implicitly stating that the life expectancy for a member who retires 20, 30, or 40 years from now will have the same life expectancy of current retiree of the same age.

The issue of mortality improvement is one that our profession has increasingly become more focused on studying and ensuring that the actuarial profession remains on the forefront of this issue. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, and published practice notes to increase the disclosure regarding expected mortality improvement after the valuation date. As a result, it is becoming industry practice to use a mortality assumption that explicitly incorporates mortality improvement. By doing this, future life expectancy will be projected to continually increase each year in the future and the life expectancy of someone who will reach age 65 in 2035 will have a slightly longer life expectancy compared to someone who is currently age 65.

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 increases, 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, the statistical credibility of its experience, and the anticipated rate of future mortality improvement.

In our analysis of the mortality experience for KRS, 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. Based on a practice note issued by the American Academy of Actuaries in June 2015, a dataset needs 96 expected deaths for each gender to be within +/- 20% of the actual pattern with 95% confidence. However, we believe a +/- 20% range to be too large to be considered fully credible, for mortality section. Other sources suggest higher requirements, such as 1,000 deaths per gender is necessary to be considered fully credible. 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

Using this information, 1,082 deaths are needed by gender to have 90% confidence that the data is within +/- 5% of the actual pattern. The Kentucky Retirement Systems (all Systems combined) had 5,078 male deaths and 5,060 female deaths during the five-year period ending June 30, 2018. Based on the statistical credibility table, we are 99% confident that the experience for the 5-year observation period are within 5% and 3% of the true mortality experience for males and females, respectively. While the use of more years of experience would provide more data (and higher credibility), the additional years of experience would temper real changes that have occurred in the mortality assumption due to improvements in life expectancy during the time period.

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 (e.g. a report issued by the American Human Development Reports "*The Measure of America, 2013-2014*", states that Kentucky residents ranked 44th in life expectancy compared to people in the other US States). However, members in KRS predominately have formal education beyond high school or a profession 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.

Furthermore, we have also concluded it is appropriate to utilize the System's experience and develop a system-specific mortality assumption. 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.

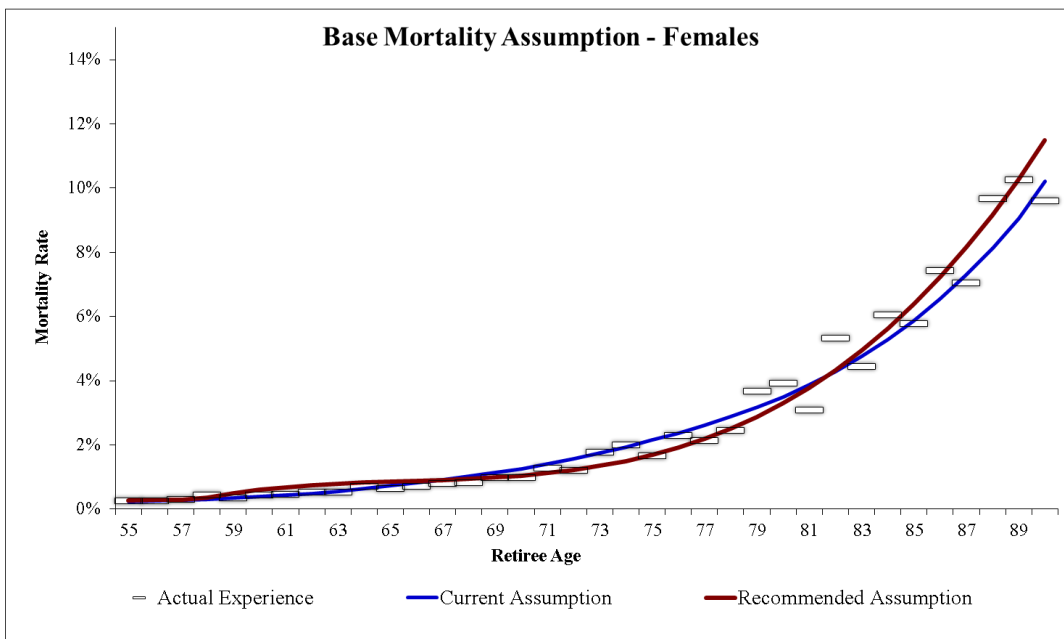
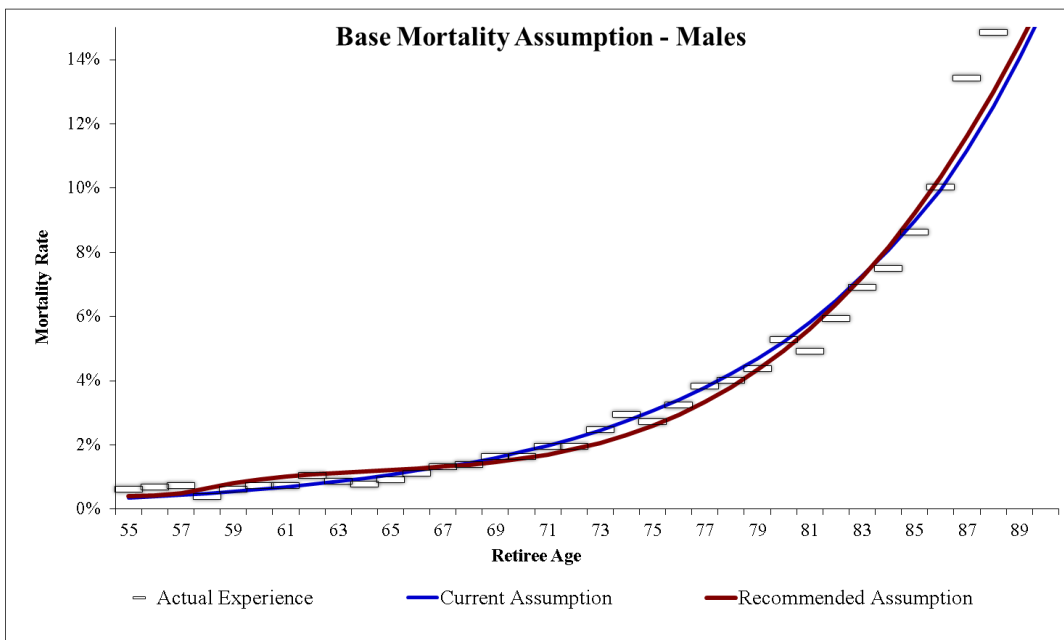
Recommended Base Mortality Assumption

We performed our analysis using a benefit-weighted approach, where we measure the exposures and actual deaths as 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.

Mortality rates for the core ages of retirees, age 58 to 94, are based on the Retirement System's experience, using a polynomial model to provide a smooth fit to the midpoint of the experience. Mortality rates for ages under 58 and over 98, are equal to the most recently published Pub-2010 mortality assumptions for general members (adjusted from a base year to the central point of the experience period using projection scale MP-Ultimate). Finally, the mortality rates for the transitional age ranges, ages 94 to 98, were developed by a 5-year blending method to orderly transition from the rates based on the System's experience to the published mortality table. The R^2 for the fit of the tables to actual experience in five-year age bands was .9988 and .9978 for males and females, respectively.

The final step in the creation of the base mortality assumption was to project the preliminary table from the center point of the analysis period (i.e., the year 2015) to the year 2019 using the MP-Ultimate mortality improvement assumption. We will refer to this new table as the 2019 Public Retirees of Kentucky Mortality Table (2019 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.



As the charts show, the current assumption tracks relatively closely to the recommended base mortality assumption. As a result, the cost impact of changing to a recommended base table based on the Systems’ experience is minor. However, the recommended mortality assumption also includes an explicit assumption for future improvement in mortality (and life expectancy) that is discussed on the following page, which will have a material impact on the liability and cost.

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 and that the assumptions underlying mortality improvement reflect some degree of subjectivity. Generational mortality improvement assumption Scale AA was released by the Society of Actuaries along with the release of the RP-2000 mortality tables in the year 2000. In October 2014, the Society of Actuaries issued final reports of the mortality study that included the release of the RP-2014 mortality tables and the MP-2014 mortality improvement assumption. MP-2014 is a two-dimensional improvement assumption that is a function of the age and calendar year. In 2015, 2016, 2017, and 2018, the Society of Actuaries issued mortality improvement assumptions MP-2015, MP-2016, MP-2017, and MP-2018, respectively. In each of these updates, the rates of improvement during the selection period were decreased compared to the prior year improvement assumption, which means that the original MP-2014 assumption was shown to be too conservative.

After approximately 15 years, all of the versions of the MP improvement assumptions have the same rate of improvement at each future calendar year (the ultimate rate of mortality improvement). In general, the assumed rate of improvement after 15 years is a flat 1% per year across most ages. This general 1% is in line with other demographer sources and we prefer a more consistent technique for this assumption that doesn't give the appearance of more precision than actually is possible. Given the fact that actual improvement in mortality has not tracked well during the select period of the MP tables, we believe it is reasonable to use the ultimate mortality improvement rates in the MP tables for all years. Therefore, we recommend the use of "MP-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				
	2020	2025	2030	2035	2040
Current Assumption – Male	19.0	19.0	19.0	19.0	19.0
Recommended Assumption – Male	21.0	21.4	21.8	22.2	22.6
Current Assumption – Female	22.1	22.1	22.1	22.1	22.1
Recommended Assumption – Female	24.0	24.4	24.8	25.2	25.6

As shown, the life expectancies under the new assumption are longer than the current assumption, and the generational approach to projecting longevity is built into the liability stream. A 65 year old in 2040 is assumed to have longer life expectancies than a 65 year old in 2020.

DISABLED RETIREE MORTALITY RATES

This is a less significant assumption than the mortality assumption for non-disabled retirees, because only one out of fifteen retirees is classified as disability retirement. 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 RP-2000 Disabled Mortality table, with various adjustments to appropriately fit to the experience.

The analysis shows that the current assumption tracked reasonably well to the experience, especially for disabled male retirees. However, we recommend updating this assumption as a new published disabled mortality table has been published by the Society of Actuaries. Specifically, we recommend using the PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates. We also recommend applying the MP-Ultimate mortality improvement assumption to this assumption as well.

Mortality Experience for Disabled Retirees for the Five-Year Period Ending June 30, 2018 (Amounts are benefit-weighted and scaled)					
		Current		Recommended	
Group	Actual	Expected	A/E	Expected	A/E
Male	75	70	108%	70	107%
Female	59	48	123%	55	108%

Details are provided in Section VIII on pages 79-82.

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 a variation of the RP-2000 Mortality Table for Employees, with multipliers applied to provide a better fit for the genders. We were only able to readily identify the active membership deaths for the years 2016/2017 and 2017/2018, as the data we received for the years prior to 2017 did not include a code to identify the members who died while employed.

We believe that two years of experience is not statistically credible, therefore did not compare the actual to the expected number deaths based on the current assumption. That said, we still recommend updating this assumption a newly published employee mortality table by the Society of Actuaries. Specifically, we recommend using the Public Retirement Plan (PUB-2010) Mortality table for employees. The assumption for the Non-Hazardous Systems would use the published table for General Employees and the assumption for the Hazardous and State Police Systems would use the published table developed using experience of Public Safety members. Finally, we also recommend using the MP-Ultimate mortality improvement assumption in conjunction with these base mortality tables.

The following table compares the expected number of deaths, by system, for the last five-year period using the current and recommended mortality assumption. Overall, the number of expected deaths will be slightly higher with the recommended mortality assumption.

Expected Deaths for the 5-Year Observation Period (Headcount Basis)		
System	Current Assumption	Recommended Assumption
KERS Non-Hazardous	325	384
KERS Hazardous	23	26
CERS Non-Hazardous	827	941
CERS Hazardous	24	26
SPRS	4	5

Since the death benefit provided to a beneficiary is different (i.e. more generous) if an active member dies while in the line of duty, it is relevant to make 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 occur in the line of duty (same assumption for each system). Over the last five years there were a total of ten active members who died in the line of duty (1 KERS Non-Hazardous, 0 KERS Hazardous, 4 CERS Non-Hazardous, 2 CERS Hazardous, and 1 SPRS). This assumption is likely higher than the actual experience, but we don't know for sure because we were unable to identify the total number of in service deaths during the entire observation period. However, we believe the current line-of-duty death assumption is reasonable when compared to the assumption used by other comparable statewide retirement systems. As a result, we 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 separately by System, but combined the males and females experience to increase the statistical credibility of the analysis. 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, 2018.

Disability Incidence for the Five-Year Period Ending June 30, 2018							
Group	Census Data	Processing Time-Lag	Actual for Analysis	Current		Recommended	
				Exp.	A/E	Exp.	A/E
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
KERS Non-Hazardous	279	135	414	235	176%	424	98%
KERS Hazardous	16	26	42	23	186%	41	102%
CERS Non-Hazardous	785	354	1,139	527	216%	1,106	103%
CERS Hazardous	77	46	123	95	129%	125	98%
SPRS	4	0	4	7	57%	7	57%

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 follow: 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 from “Inactive” to “Disabled Retiree” in a subsequent year. Together, these represent the number of disability retirements that occurred during the measurement period.

As a result of the observed processing time-lag, we significantly increased the rate of disability incidence for both KERS Systems, and the CERS Non-Hazardous System. We also slightly increased the rate of disability incidence for the CERS Hazardous System and recommended no change in the disability rates for SPRS.

Since there are minimum benefits provided to members who become disabled as a direct result of an act in the line of duty, it is important to review the System’s experience regarding disability retirements due to duty-related events.

Currently, the actuarial valuation assumes that 0% of the disabilities are to occur in the line of duty for all Systems. We are recommending updates to this assumption for all the Systems. Since the number of actual disabilities and duty disabilities is relatively small, we are not assigning complete credibility to the actual experience during the observation period.

Prevalence of Duty-Related Disability Incidence for the Five-Year Period Ending June 30, 2018				
Group	Total Disabilities	Duty-Related	Actual Percent	Recommended Assumption
(1)	(2)	(3)	(4)	(5)
KERS Non-Hazardous	279	0	0%	2%
KERS Hazardous	16	4	25%	10%
CERS Non-Hazardous	785	2	0%	2%
CERS Hazardous	77	57	74%	50%
SPRS	4	4	100%	70%

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 System. The valuation uses the same termination assumption for males and females, but different assumptions for non-hazardous and hazardous members. The current assumption is structured as a function of service. No terminations are assumed once a member becomes eligible to commence their retirement benefit.

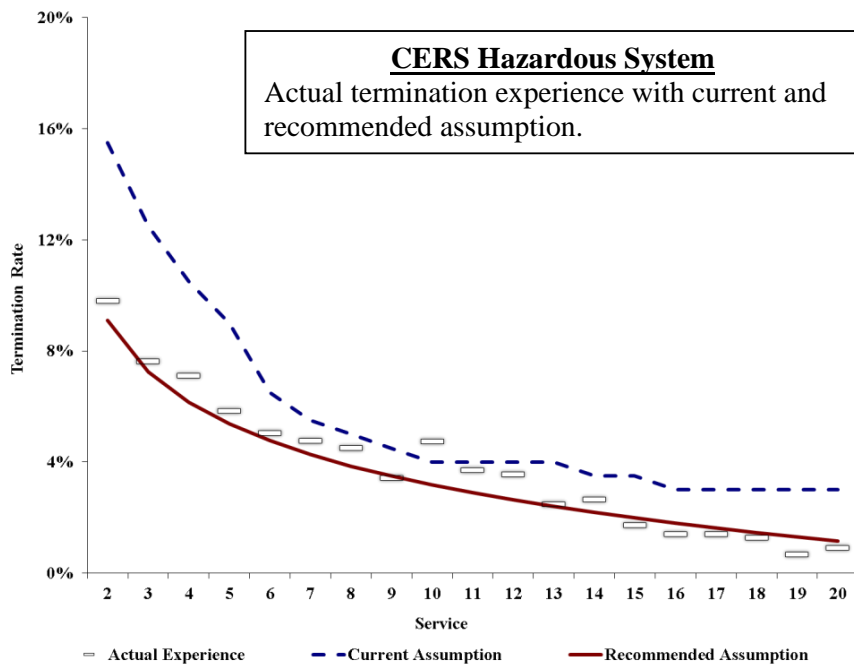
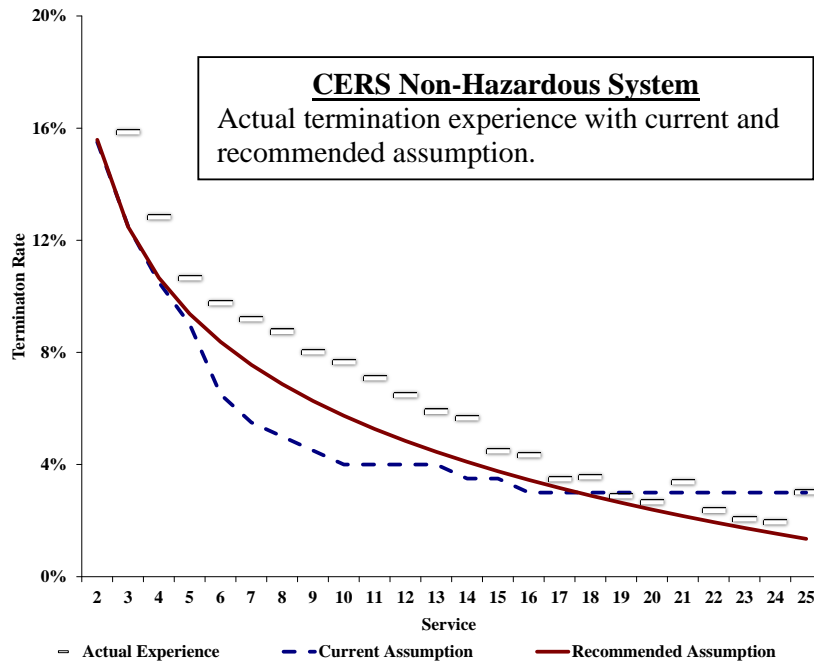
A higher paid member has a greater liability relative to a lower paid member, and has shown to have lower turnover. Along those lines the termination pattern for the higher paid members will have more impact on the future liabilities of the plan. Therefore, we have weighted the experience by salary and are counting the payroll and the portion of the payroll that terminates employment (versus headcount) for the last 5 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 System:

Summary of Termination Analysis (Hundreds of Thousands of Payroll)					
System	Actual Experience	Current Assumption		Recommended Assumption	
		Expected	A/E	Expected	A/E
(1)	(2)	(3)	(4)	(5)	(6)
KERS Non-Hazardous	15,528	8,548	182%	11,031	141%
KERS Hazardous	1,935	801	242%	1,343	144%
CERS Non-Hazardous	12,831	9,373	137%	10,218	126%
CERS Hazardous	2,003	4,418	45%	1,899	106%
SPRS	170	256	66%	124	137%

In summary, the rates of termination were significantly increased for both KERS Systems, and slightly increased for the CERS Non-Hazardous System. On the other hand, the rates of termination were decreased for the CERS Hazardous and SPRS Systems. We did not increase the termination rates for the KERS Systems and the CERS Non-Hazardous System match the observed experience to avoid possibly over-adjusting the assumption. The recommended termination rates for the CERS Hazardous and SPRS were decreased to result in an "A/E" ratio that is above 100% to provide some margin or conservatism in the assumption. Note, the recommended change to the CERS Hazardous System had a large fiscal impact to the System, but is also the assumption with the least amount of conservatism as it has the lowest "A/E" ratio compared to the other recommended termination assumption for the other Systems.

The charts below provide an illustration of the actual experience and the current and recommended assumption for the CERS Systems (Non-Hazardous and Hazardous).



Details of the termination experience are provided in Section VIII on pages 83-87. Note, since active membership deaths were included in the termination data for the experience prior to June 30, 2016, we performed the analysis treating all active deaths as terminations and then the recommended termination rates will be adjusted (i.e. reduced) in the model by the pre-retirement mortality probabilities so as not to double count the decrements.

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 withdraw their member contributions at any time and forfeit the monthly annuity. Currently, the valuation assumes that members in each System 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 for Non-Hazardous and Hazardous members. Also, there is a variation in the retirement assumption for Tier 1 members whose participation date is before September 1, 2008 and for members whose participation date is on and after September 1, 2008 due to differences in retirement benefits.

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. Below are comments regarding the recommended retirement assumption for members with a participation date before July 1, 2003 for each System.

KERS Non-Hazardous System

We recommend the continued use of an age based assumption, but the experience for males and females were sufficiently different for us to recommend the use of gender-distinct retirement assumption. We are recommending a decrease in the retirement rates below age 65 for males and females, but are recommending higher retirement rates at and above age 65. We are also recommending a slight decrease in the retirement rates for members (males and females) electing an early retirement. Overall this change will slightly increase the expected average retirement age from age 57 to age 58 for males and from age 56 to age 57 for females.

KERS Hazardous System

We recommend continued use of the service based assumption and the use of the same retirement assumption for males and females. We also recommend an increase in the retirement rate when a member attains 20 years of service, but a decrease retirement rate when the member has more than 20 years of service. Overall this will slightly decrease the average age a member is expected to retire by approximately a half year.

CERS Non-Hazardous System

We recommend the continued use of an age based assumption. The experience for males and females was sufficiently different that we are recommending the use of gender-distinct retirement assumption. We are recommending an increase in the retirement rates below age 50 and above age 65 for males. We are also recommending a decrease in the retirement rates below age 62 and an increase in the retirement rates at and above age 62 for females. Finally, we are also recommending a slight decrease in the retirement rates for members (males and females) electing an early retirement. Overall this change will slightly change the expected average retirement age for males and increase the female expected average retirement age for approximately one year to age 61.

CERS Hazardous System

We recommend continued use of the service based assumption and the use of the same retirement assumption for males and females. We also recommend an increase in the retirement rate when a member attains 20 years of service, but a slight decrease in the retirement assumption when the member has more than 20 years of service. The recommended update will result in a minimal change in the expected retirement age.

SPRS

We recommend no change to the retirement rates for members with a participation date prior to July 1, 2003. We are recommending an adjustment to the retirement rates for members with a participation date on or after July 1, 2003 (discussed below).

Adjustment to Retirement Rates for Members Participating in KRS 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 the maximum retirement age are 80% of the recommended retirement rates that are developed for the members with a participation date prior to July 1, 2003. Please note that we must rely on our professional judgement regarding this recommended adjustment as it will be many years into the future before there is sufficient experience to analyze their actual retirement pattern.

The new rates are shown in Sections V, VI, and VII.

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 make an assumption 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 as eligibility, plan choices, and retiree contribution requirements 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

Service at Retirement (Years)	System	
	KERS and CERS	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 inactive vested members with a participation date before July 1, 2003 and 100% inactive vested members with a participation date on or after July 1, 2003 are assumed to elect health coverage.

We reviewed the actual participation experience for the five-year period for each System. The actual election rate was relatively close to the expected election rate for those retirees with 20 or more years of service. On the other hand, the difference between the actual and expected election rate was greater for those retirees with less than 20 years of service. When establishing a recommendation it is important to take into account the materiality of the assumption and the election rate for those retirees with 20 or more years of service is by far the most important assumption as this group of retirees represents the largest number of future retirees and has the largest potential cost impact because the employer cost subsidy is the greatest for this retiree group. To that point the participation assumption for the retirees with less than 20 years of service is relatively immaterial because the number of retirees with less than 20 years of service is relatively smaller as well as the employer subsidy on retiree health cost.

As a result, we recommend no change to the participation assumption for the health insurance systems.

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, the likelihood that a terminating employee will take a refund, 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 some other 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, excise tax, and baseline claims cost. Each of these assumptions are reviewed on an annual basis and may be periodically updated as each year of claim experience is reviewed, as well as with possible plan design changes that are adopted by KRS.

ACTUARIAL COST METHOD

The individual Entry Age Normal cost method (EAN) is the current funding method being used to allocate the actuarial costs of the System. 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.

For members who have correlated service with another employer, the cost method will assume the member has no accrued liability at the date of hire and will accrue all benefits from the hire date with the current employer. Service from the other employers will be used in determining retirement eligibilities, but not in allocating the accruals over the career of the employee.

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.

We recommend continued use of this asset smoothing method. However, we recommend a modification to the presentation of the smoothing method calculations in the valuation report to be consistent with the format that is commonly used by other Systems for increased transparency and comparability to stakeholders. This modification will not have a cost impact.

SECTION IV

ACTUARIAL IMPACT OF RECOMMENDATIONS

Fiscal Impact – KERS (\$ thousands)

The following pages provide the actuarial impact of the recommended assumptions for each retirement system based on the June 30, 2018 actuarial valuation. In actuality, these recommended assumptions will be first used when preparing the June 30, 2019 actuarial valuation, which identifies the employer contribution requirements for the biennium period beginning July 1, 2020 and ending June 30, 2022 (FYE 2020/2021 and FYE 2022/2022).

For informational purposes, the tables show the changes in the contribution requirement, unfunded actuarial accrued liability, and funded ratio due to the recommended assumption changes. The exhibits identify the financial effect due to the change in mortality, individual salary increase assumption, and all other recommended assumptions. The mortality assumption and individual salary increase assumption are illustrated separately so stakeholders can identify the financial impact of these individual assumption changes on the liability and contributions. 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. Stated another way, we do not recommend changes in individual assumptions be selectively picked based on their financial impact.

Fiscal Impact – KERS (\$ thousands)

Pension

	KERS Non-Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	8.0%	8.7%	8.6%	8.0%
UAAL	<u>66.6%</u>	<u>70.1%</u>	<u>69.8%</u>	<u>70.0%</u>
Total Employer Rate	74.5%	78.8%	78.4%	78.0%
Actuarial Accrued Liability	\$ 15,675,232	\$ 16,343,793	\$ 16,296,449	\$ 16,340,469
Actuarial Value of Assets	\$ 2,019,278	\$ 2,019,278	\$ 2,019,278	\$ 2,019,278
UAAL	\$ 13,655,954	\$ 14,324,515	\$ 14,277,171	\$ 14,321,191
Funded Ratio	12.9%	12.4%	12.4%	12.4%

	KERS Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	9.2%	9.8%	10.0%	9.5%
UAAL	<u>25.2%</u>	<u>27.2%</u>	<u>27.1%</u>	<u>27.7%</u>
Total Employer Rate	34.4%	36.9%	37.1%	37.2%
Actuarial Accrued Liability	\$ 1,151,923	\$ 1,187,956	\$ 1,186,212	\$ 1,199,248
Actuarial Value of Assets	\$ 639,262	\$ 639,262	\$ 639,262	\$ 639,262
UAAL	\$ 512,661	\$ 548,694	\$ 546,950	\$ 559,986
Funded Ratio	55.5%	53.8%	53.9%	53.3%

Insurance

	KERS Non-Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	2.5%	2.6%	2.4%
UAAL	<u>8.2%</u>	<u>8.8%</u>	<u>8.8%</u>
Total Employer Rate	10.7%	11.4%	11.2%
Actuarial Accrued Liability	\$ 2,435,505	\$ 2,535,588	\$ 2,545,218
Actuarial Value of Assets	\$ 887,121	\$ 887,121	\$ 887,121
UAAL	\$ 1,548,384	\$ 1,648,467	\$ 1,658,097
Funded Ratio	36.4%	35.0%	34.9%

	KERS Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	5.2%	5.5%	4.6%
UAAL	<u>-6.1%</u>	<u>-5.4%</u>	<u>-5.3%</u>
Total Employer Rate	0.0%	0.0%	0.0%
Actuarial Accrued Liability	\$ 393,481	\$ 405,719	\$ 408,700
Actuarial Value of Assets	\$ 511,441	\$ 511,441	\$ 511,441
UAAL	\$ (117,960)	\$ (105,722)	\$ (102,741)
Funded Ratio	130.0%	126.1%	125.1%

Fiscal Impact – CERS

(\$ thousands)

Pension

	CERS Non-Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	5.8%	6.2%	6.4%	6.8%
UAAL	<u>16.7%</u>	<u>18.2%</u>	<u>18.2%</u>	<u>18.6%</u>
Total Employer Rate	22.5%	24.5%	24.6%	25.4%
Actuarial Accrued Liability	\$ 13,191,505	\$ 13,718,916	\$ 13,705,225	\$ 13,852,607
Actuarial Value of Assets	\$ 6,950,225	\$ 6,950,225	\$ 6,950,225	\$ 6,950,225
UAAL	\$ 6,241,280	\$ 6,768,691	\$ 6,755,000	\$ 6,902,382
Funded Ratio	52.7%	50.7%	50.7%	50.2%

	CERS Hazardous			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	6.4%	6.8%	7.5%	11.9%
UAAL	<u>30.6%</u>	<u>32.4%</u>	<u>32.7%</u>	<u>34.0%</u>
Total Employer Rate	37.0%	39.1%	40.2%	45.9%
Actuarial Accrued Liability	\$ 4,792,548	\$ 4,923,349	\$ 4,947,683	\$ 5,024,284
Actuarial Value of Assets	\$ 2,321,721	\$ 2,321,721	\$ 2,321,721	\$ 2,321,721
UAAL	\$ 2,470,827	\$ 2,601,628	\$ 2,625,962	\$ 2,702,563
Funded Ratio	48.4%	47.2%	46.9%	46.2%

Insurance

	CERS Non-Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	2.9%	3.1%	3.0%
UAAL	<u>1.9%</u>	<u>2.3%</u>	<u>2.3%</u>
Total Employer Rate	4.8%	5.4%	5.4%
Actuarial Accrued Liability	\$ 3,092,624	\$ 3,235,596	\$ 3,253,448
Actuarial Value of Assets	\$ 2,371,430	\$ 2,371,430	\$ 2,371,430
UAAL	\$ 721,194	\$ 864,166	\$ 882,018
Funded Ratio	76.7%	73.3%	72.9%

	CERS Hazardous		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	4.4%	4.6%	6.1%
UAAL	<u>5.1%</u>	<u>5.7%</u>	<u>5.6%</u>
Total Employer Rate	9.5%	10.3%	11.7%
Actuarial Accrued Liability	\$ 1,684,028	\$ 1,727,549	\$ 1,714,583
Actuarial Value of Assets	\$ 1,256,306	\$ 1,256,306	\$ 1,256,306
UAAL	\$ 427,722	\$ 471,243	\$ 458,277
Funded Ratio	74.6%	72.7%	73.3%

Note: Contribution rates shown for CERS are without regard to the phase-in provision.

Fiscal Impact – SPRS

(\$ thousands)

Pension

	SPRS			
	Valuation 06/30/2018	Mortality Assumption Changes	Mortality and Salary Assumption Changes	All Assumption Changes
Employer Contribution Rate				
Normal Cost Rate and Admin Expense	15.8%	16.8%	17.6%	20.4%
UAAL	<u>104.7%</u>	<u>110.1%</u>	<u>110.7%</u>	<u>111.4%</u>
Total Employer Rate	120.5%	126.9%	128.3%	131.7%
Actuarial Accrued Liability	\$ 989,528	\$ 1,023,694	\$ 1,026,990	\$ 1,029,639
Actuarial Value of Assets	\$ 268,259	\$ 268,259	\$ 268,259	\$ 268,259
UAAL	\$ 721,269	\$ 755,435	\$ 758,731	\$ 761,380
Funded Ratio	27.1%	26.2%	26.1%	26.1%

Insurance

	SPRS		
	Valuation 06/30/2018	Mortality Assumption Changes	All Assumption Changes
Employer Contribution Rate			
Normal Cost Rate and Admin Expense	8.1%	8.3%	8.9%
UAAL	<u>11.4%</u>	<u>12.7%</u>	<u>12.5%</u>
Total Employer Rate	19.5%	21.0%	21.3%
Actuarial Accrued Liability	\$ 262,088	\$ 269,095	\$ 267,508
Actuarial Value of Assets	\$ 187,535	\$ 187,535	\$ 187,535
UAAL	\$ 74,553	\$ 81,560	\$ 79,973
Funded Ratio	71.6%	69.7%	70.1%

SECTION V

SUMMARY OF NEW ASSUMPTIONS – KERS

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the Kentucky Employees Retirement System.

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, non-hazardous insurance fund, and hazardous insurance fund

Price Inflation:

Assumed annual rate of 2.30%

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	
	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%

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

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 that are prior to age 65 are multiplied by 80% 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 that are prior the member's assumed maximum retirement age multiplied by 80% to reflect the different retiree health insurance benefit.

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

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	0.06%	0.06%	0.08%	0.08%
40	0.12%	0.12%	0.18%	0.18%
50	0.34%	0.34%	0.50%	0.50%
60	0.88%	0.88%	1.32%	1.32%

Withdrawal rates (for causes other than death, disability or retirement):

Assumed annual rates of withdrawal are shown below and are prior to offset for pre-retirement mortality.

Service Years	Annual Rates of Withdrawal	
	Non-Hazardous	Hazardous
1	20.00%	25.00%
2	16.45%	19.68%
3	13.39%	15.12%
4	11.61%	12.45%
5	10.34%	10.56%
6	9.35%	9.09%
7	8.55%	7.89%
8	7.87%	6.87%
9	7.28%	5.99%
10	6.76%	5.22%
11	6.30%	4.53%
12	5.88%	3.90%
13	5.49%	3.33%
14	5.14%	2.80%
15	4.81%	2.31%
16	4.51%	1.86%
17	4.22%	1.43%
18	3.96%	1.03%
19	3.70%	0.66%
20	3.47%	0.30%
21	3.24%	0.00%
22	3.02%	0.00%
23	2.82%	0.00%
24	2.62%	0.00%
25	2.43%	0.00%

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

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-2014 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2018, projected with the ultimate rates from MP-2014 mortality improvement scale using a base year of 2019.

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				
	2020	2025	2030	2035	2040
Male	21.0	21.4	21.8	22.2	22.6
Female	24.0	24.4	24.8	25.2	25.6

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates, projected with the ultimate rates from the MP-2014 mortality improvement scale 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

Non-Hazardous: 2% of disabilities are assumed to occur in the line of duty

Hazardous: 10% of disabilities are assumed to occur in the line of duty

Line of Duty Death

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

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death 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 Age Related Morbidity/Claims Utilization:

To model the impact of aging on the underlying health care costs for Medicare retirees, the valuation relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death". Table 4 (Development of Plan Specific Medicare Age Curve) was used to model the impact of aging for ages 65 and over.

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Health Care Cost Trend Rates¹:

January 1	Non-Medicare Plans	Medicare Plans	Dollar Contribution ²
2020	7.00%	5.00%	1.50%
2021	6.75%	4.90%	1.50%
2022	6.50%	4.80%	1.50%
2023	6.25%	4.70%	1.50%
2024	6.00%	4.60%	1.50%
2025	5.75%	4.50%	1.50%
2026	5.50%	4.40%	1.50%
2027	5.25%	4.30%	1.50%
2028	5.00%	4.20%	1.50%
2029	4.75%	4.10%	1.50%
2030	4.50%	4.05%	1.50%
2031	4.25%	4.05%	1.50%
2032 & Beyond	4.05%	4.05%	1.50%

¹All increases are assumed to occur on January 1. The 2019 premiums were known at the time of the valuation and were incorporated into the liability measurement.

²Applies to members participating on or after July 1, 2003

Health care trend assumptions are based on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Cost Trends for the SOA; Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries.

The underlying assumptions used to develop the health care trend rates include:

- A short run period-this is a period for which anticipated health care trend rates are manually set based on local information as well as plan-specific and carrier information.
- Long-term real GDP growth – 1.75%
- Long-term rate of inflation – 2.30%
- Long-term nominal GDP growth – 4.05%
- Year that excess rate converges to 0 – 15 years from the valuation

Health care trend rates are thus the manually set rates for the short run period and rates which decline to an ultimate trend rate which equals the assumed nominal long-term GDP growth rate.

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Health Care Participation Assumptions:

- 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
Medical Only	7%
Essential	8%
Premium	85%

Non-Medicare Plan	Participation Percentage
LivingWell Limited	2%
LivingWell Basic	13%
LivingWell CDHP	27%
LivingWell PPO	58%

Kentucky Employees Retirement System Summary of Actuarial Methods and 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 with non-hazardous service are assumed to begin health coverage at age 55 for members participating before September 1, 2008, and at age 60 for members participating on or after September 1, 2008. Deferred vested members with hazardous service are assumed to begin health coverage at age 50.

- 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.

Excise ("Cadillac") Tax:

For taxable years beginning after December 31, 2021, a 40% excise tax will be required to be paid (by the employer and/or insurer) on the aggregate cost of the health plan in excess of certain legislated thresholds. For 2018, the thresholds are \$850 per month for individual coverage and \$2,292 per month for family coverage.

Both Actuarial Standard of Practice No. 6 and GASB Statement Nos. 74 and 75 reference this tax, and, in accordance with these standards an estimate of the impact of the Cadillac tax has been included in this valuation.

Assumptions and methods used to determine the impact of the Cadillac Tax include:

- 2018 thresholds of \$850/\$2,292 were indexed annually by 2.30%.
- Premium data submitted was not adjusted for permissible exclusions to the Cadillac Tax.
- There were no special adjustments to the dollar limit other than those permissible for non-Medicare retirees over 55.

In this valuation, the impact of the Cadillac Tax has been calculated by increasing the employer paid premiums for Non-Medicare retirees, who became participants before July 1, 2003, by 3.6%. Non-Medicare retirees who became participants after July 1, 2003 receive dollar subsidies per year of service, which are not expected to exceed the overall Non-Medicare premiums. As a result, the costs attributable to the Cadillac Tax for members who became participants after July 1, 2003 will be paid by the retirees.

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.
2. Individual salaries used to project benefits: Actual salaries from the past fiscal year are used to determine the final average salary as of the valuation date. 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 ended on the valuation date.
4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an immediate life annuity.
5. Inactive Population: All non-vested members are assumed to take an immediate refund. Vested members are assumed to elect a refund at the time of their termination if the value of their account balance exceeds the present value of their deferral benefit.
6. There will be no recoveries once disabled.
7. Decrement timing: Decrements of all types are assumed to occur mid-year.
8. 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.
9. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
10. 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.
11. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.
12. Payroll Growth Assumption: In determining the level percent of payroll amortization rate, payroll is assumed to grow annually at 0.00% percent for the Non-Hazardous and Hazardous systems.
13. Cash Balance Interest Crediting Rate: The cash balance interest crediting rate assumption for years after the valuation date is equal to 4.9375% for the Non-Hazardous System and 5.6875% for the Hazardous System.

Kentucky Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Participant Data

Participant data was supplied in electronic text files. There were separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included birthdate, gender, service with the current city and total vesting service, salary, and employee contribution account balances. For retired members and beneficiaries, the data included date of birth, gender, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and form of payment code.

Salary supplied for the current year was based on the annualized earnings for the year preceding the valuation date.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

Changes from the June 30, 2018 Valuation

- Annual salary increases were updated based on the 2018 Experience Study
- Annual rates of retirement, disability, withdrawal, and mortality were updated based on the 2018 Experience Study
- The percent of disabilities assumed to occur in the line of duty was updated from 0% to 2% for non-hazardous members and 10% for hazardous members

SECTION VI

SUMMARY OF NEW ASSUMPTIONS – CERS

County Employees Retirement System Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the County Employees Retirement System.

Investment return rate:

Assumed annual rate of 6.25% net of investment expenses for the retirement funds and the insurance funds

Price Inflation:

Assumed annual rate of 2.30%

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	
	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous	Non-Hazardous	Hazardous
0	7.00%	15.50%	3.30%	3.55%	10.30%	19.05%
1	4.00%	4.00%	3.30%	3.55%	7.30%	7.55%
2	3.00%	2.00%	3.30%	3.55%	6.30%	5.55%
3	1.50%	1.25%	3.30%	3.55%	4.80%	4.80%
4	1.25%	1.00%	3.30%	3.55%	4.55%	4.55%
5	1.25%	1.00%	3.30%	3.55%	4.55%	4.55%
6	1.00%	1.00%	3.30%	3.55%	4.30%	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	0.75%	0.00%	3.30%	3.55%	4.05%	3.55%
10	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
11	0.50%	0.00%	3.30%	3.55%	3.80%	3.55%
12	0.25%	0.00%	3.30%	3.55%	3.55%	3.55%
13	0.25%	0.00%	3.30%	3.55%	3.55%	3.55%
14	0.25%	0.00%	3.30%	3.55%	3.55%	3.55%
15 & Over	0.00%	0.00%	3.30%	3.55%	3.30%	3.55%

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

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				
Under 45	35.0%	27.0%			5	17.0%		
45	35.0%	27.0%			6	17.0%		
46	35.0%	27.0%			7	17.0%		
47	35.0%	27.0%			8	17.0%		
48	35.0%	27.0%			9	17.0%		
49	35.0%	27.0%			10	17.0%		
50	30.0%	27.0%			11	17.0%		
51	30.0%	27.0%			12	17.0%		
52	30.0%	27.0%			13	17.0%		
53	30.0%	27.0%			14	17.0%		
54	30.0%	27.0%			15	17.0%		
55	30.0%	27.0%	4.0%	5.0%	16	17.0%		
56	30.0%	27.0%	4.0%	5.0%	17	17.0%		
57	30.0%	27.0%	4.0%	5.0%	18	17.0%		
58	30.0%	27.0%	4.0%	5.0%	19	17.0%		
59	30.0%	27.0%	4.0%	5.0%	20	30.0%		
60	30.0%	27.0%	4.0%	8.0%	21	22.5%		
61	30.0%	27.0%	4.0%	9.0%	22	18.0%		
62	30.0%	40.0%	15.0%	20.0%	23	21.0%		
63	30.0%	35.0%	15.0%	18.0%	24	24.0%		
64	30.0%	30.0%	15.0%	16.0%	25	27.0%	21.6%	16.0%
65	30.0%	30.0%			26	30.0%	24.0%	16.0%
66	30.0%	27.0%			27	33.0%	26.4%	16.0%
67	30.0%	27.0%			28	36.0%	28.8%	16.0%
68	30.0%	27.0%			29	39.0%	31.2%	16.0%
69	30.0%	27.0%			30	39.0%	31.2%	100.0%
70	30.0%	27.0%						
71	30.0%	27.0%						
72	30.0%	27.0%						
73	30.0%	27.0%						
74	30.0%	27.0%						
75	100.0%	100.0%						

¹ The annual rate of retirement is 11% for male members and 12% for female members with 25-26 years of service.

² The annual rate of retirement is 100% at age 62.

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 that are prior to age 65 are multiplied by 80% 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 that are prior the member's assumed maximum retirement age multiplied by 80% to reflect the different retiree health insurance benefit.

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Disability rates:

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

Age	Non-Hazardous		Hazardous	
	Male	Female	Male	Female
20	0.04%	0.04%	0.07%	0.07%
30	0.06%	0.06%	0.12%	0.12%
40	0.14%	0.14%	0.26%	0.26%
50	0.39%	0.39%	0.73%	0.73%
60	1.02%	1.02%	1.90%	1.90%

Withdrawal rates (for causes other than death, disability or retirement):

Assumed annual rates of withdrawal are shown below and are prior to offset for pre-retirement mortality.

Service Years	Annual Rates of Withdrawal	
	Non-Hazardous	Hazardous
1	20.00%	20.00%
2	15.58%	9.11%
3	12.48%	7.24%
4	10.66%	6.14%
5	9.37%	5.37%
6	8.37%	4.76%
7	7.56%	4.27%
8	6.87%	3.85%
9	6.27%	3.49%
10	5.74%	3.18%
11	5.27%	2.89%
12	4.84%	2.63%
13	4.45%	2.40%
14	4.09%	2.18%
15	3.76%	1.98%
16	3.45%	1.80%
17	3.16%	1.62%
18	2.89%	1.46%
19	2.64%	1.30%
20	2.39%	1.16%
21	2.16%	0.00%
22	1.94%	0.00%
23	1.74%	0.00%
24	1.54%	0.00%
25	1.35%	0.00%
26	0.00%	0.00%

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

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-2014 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2018, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2019.

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				
	2020	2025	2030	2035	2040
Male	21.0	21.4	21.8	22.2	22.6
Female	24.0	24.4	24.8	25.2	25.6

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates, projected with the ultimate rates from the MP-2014 mortality improvement scale 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

Non-Hazardous: 2% of disabilities are assumed to occur in the line of duty

Hazardous: 50% of disabilities are assumed to occur in the line of duty

Line of Duty Death

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

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death 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 Age Related Morbidity/Claims Utilization:

To model the impact of aging on the underlying health care costs for Medicare retirees, the valuation relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death". Table 4 (Development of Plan Specific Medicare Age Curve) was used to model the impact of aging for ages 65 and over.

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Health Care Cost Trend Rates¹:

January 1	Non-Medicare Plans	Medicare Plans	Dollar Contribution ²
2020	7.00%	5.00%	1.50%
2021	6.75%	4.90%	1.50%
2022	6.50%	4.80%	1.50%
2023	6.25%	4.70%	1.50%
2024	6.00%	4.60%	1.50%
2025	5.75%	4.50%	1.50%
2026	5.50%	4.40%	1.50%
2027	5.25%	4.30%	1.50%
2028	5.00%	4.20%	1.50%
2029	4.75%	4.10%	1.50%
2030	4.50%	4.05%	1.50%
2031	4.25%	4.05%	1.50%
2032 & Beyond	4.05%	4.05%	1.50%

¹All increases are assumed to occur on January 1. The 2019 premiums were known at the time of the valuation and were incorporated into the liability measurement.

²Applies to members participating on or after July 1, 2003

Health care trend assumptions are based on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Cost Trends for the SOA; Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries.

The underlying assumptions used to develop the health care trend rates include:

- A short run period – this is a period for which anticipated health care trend rates are manually set based on local information as well as plan-specific and carrier information.
- Long-term real GDP growth – 1.75%
- Long-term rate of inflation – 2.30%
- Long-term nominal GDP growth – 4.05%
- Year that excess rate converges to 0 – 15 years from the valuation

Health care trend rates are thus the manually set rates for the short run period and rates which decline to an ultimate trend rate which equals the assumed nominal long-term GDP growth rate.

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Health Care Participation Assumptions:

- 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
Medical Only	7%
Essential	8%
Premium	85%

Non-Medicare Plan	Participation Percentage
LivingWell Limited	2%
LivingWell Basic	13%
LivingWell CDHP	27%
LivingWell PPO	58%

County Employees Retirement System Summary of Actuarial Methods and 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 with non-hazardous service are assumed to begin health coverage at age 55 for members participating before September 1, 2008, and at age 60 for members participating on or after September 1, 2008. Deferred vested members with hazardous service are assumed to begin health coverage at age 50.
- 75% 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.

Excise ("Cadillac") Tax:

For taxable years beginning after December 31, 2021, a 40% excise tax will be required to be paid (by the employer and/or insurer) on the aggregate cost of the health plan in excess of certain legislated thresholds. For 2018, the thresholds are \$850 per month for individual coverage and \$2,292 per month for family coverage.

Both Actuarial Standard of Practice No. 6 and GASB Statement Nos. 74 and 75 reference this tax, and, in accordance with these standards an estimate of the impact of the Cadillac tax has been included in this valuation.

Assumptions and methods used to determine the impact of the Cadillac Tax include:

- 2018 thresholds of \$850/\$2,292 were indexed annually by 2.30%.
- Premium data submitted was not adjusted for permissible exclusions to the Cadillac Tax.
- There were no special adjustments to the dollar limit other than those permissible for non-Medicare retirees over 55.

In this valuation, the impact of the Cadillac Tax has been calculated by increasing the employer paid premiums for Non-Medicare retirees, who became participants before July 1, 2003, by 3.6%. Non-Medicare retirees who became participants after July 1, 2003 receive dollar subsidies per year of service, which are not expected to exceed the overall Non-Medicare premiums. As a result, the costs attributable to the Cadillac Tax for members who became participants after July 1, 2003 will be paid by the retirees.

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.
2. Individual salaries used to project benefits: Actual salaries from the past fiscal year are used to determine the final average salary as of the valuation date. 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 ended on the valuation date.
4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an immediate life annuity.
5. Inactive Population: All non-vested members are assumed to take an immediate refund. Vested members are assumed to elect a refund at the time of their termination if the value of their account balance exceeds the present value of their deferral benefit.
6. There will be no recoveries once disabled.
7. Decrement timing: Decrements of all types are assumed to occur mid-year.
8. 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.
9. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
10. 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.
11. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.
12. Payroll Growth Assumption: In determining the level percent of payroll amortization rate, payroll is assumed to grow annually at 2.00% percent for the Non-Hazardous and Hazardous systems.
13. Cash Balance Interest Crediting Rate: The cash balance interest crediting rate assumption for years after the valuation date is equal to 5.6875% for the Non-Hazardous and Hazardous Systems.

County Employees Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Participant Data

Participant data was supplied in electronic text files. There were separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included birthdate, gender, service with the current city and total vesting service, salary, and employee contribution account balances. For retired members and beneficiaries, the data included date of birth, gender, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and form of payment code.

Salary supplied for the current year was based on the annualized earnings for the year preceding the valuation date.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

Changes from the June 30, 2018 Valuation

- Annual salary increases were updated based on the 2018 Experience Study
- Annual rates of retirement, disability, withdrawal, and mortality were updated based on the 2018 Experience Study
- The percent of disabilities assumed to occur in the line of duty was updated from 0% to 2% for non-hazardous members and 50% for hazardous members

SECTION VII

SUMMARY OF NEW ASSUMPTIONS – SPRS

State Police Retirement System Summary of Actuarial Methods and Assumptions

The following presents a summary of the actuarial assumptions and methods used in the valuation of the State Police Retirement System.

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 2.30%

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%

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

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 between 9/1/2008 and 1/1/2014 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 that are prior the member's assumed maximum retirement age multiplied by 80% to reflect the different retiree health insurance benefit.

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Disability rates:

An abbreviated table with assumed rates of disability is shown 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 or retirement):

Assumed annual rates of withdrawal are shown below and are prior to offset for pre-retirement mortality.

Service	Annual Rates of Withdrawal
1	15.00%
2	4.82%
3	3.76%
4	3.15%
5	2.71%
6	2.37%
7	2.09%
8	1.86%
9	1.66%
10	1.48%
11	1.32%
12	1.17%
13	1.04%
14	0.92%
15	0.80%
16	0.70%
17	0.60%
18	0.51%
19	0.42%
20	0.34%

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Mortality Assumption:

Pre-retirement mortality: PUB-2010 Public Safety Mortality, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2010.

Post-retirement mortality (non-disabled): System-specific mortality table based on mortality experience from 2013-2018, projected with the ultimate rates from the MP-2014 mortality improvement scale using a base year of 2019.

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				
	2020	2025	2030	2035	2040
Male	21.0	21.4	21.8	22.2	22.6
Female	24.0	24.4	24.8	25.2	25.6

Post-retirement mortality (disabled): PUB-2010 Disabled Mortality table, with a 4-year set-forward for both male and female rates, projected with the ultimate rates from the mortality improvement scale 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

Line of Duty Death

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

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Dependent Children:

For members in the Hazardous Plan who receive a duty-related death 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 Age Related Morbidity/Claims Utilization:

To model the impact of aging on the underlying health care costs for Medicare retirees, the valuation relied on the Society of Actuaries' 2013 Study "Health Care Costs – From Birth to Death". Table 4 (Development of Plan Specific Medicare Age Curve) was used to model the impact of aging for ages 65 and over.

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Health Care Cost Trend Rates¹:

Year	Non-Medicare Plans	Medicare Plans	Dollar Contribution ²
2020	7.00%	5.00%	1.50%
2021	6.75%	4.90%	1.50%
2022	6.50%	4.80%	1.50%
2023	6.25%	4.70%	1.50%
2024	6.00%	4.60%	1.50%
2025	5.75%	4.50%	1.50%
2026	5.50%	4.40%	1.50%
2027	5.25%	4.30%	1.50%
2028	5.00%	4.20%	1.50%
2029	4.75%	4.10%	1.50%
2030	4.50%	4.05%	1.50%
2031	4.25%	4.05%	1.50%
2032 & Beyond	4.05%	4.05%	1.50%

¹All increases are assumed to occur on January 1. The 2019 premiums were known at the time of the valuation and were incorporated into the liability measurement.

²Applies to members participating on or after July 1, 2003

Health care trend assumptions are based on the model issued by the Society of Actuaries "Getzen model of Long-Run Medical Cost Trends for the SOA; Thomas E. Getzen, iHEA and Temple University 2014 © Society of Actuaries.

The underlying assumptions used to develop the health care trend rates include:

- A short run period – this is a period for which anticipated health care trend rates are manually set based on local information as well as plan-specific and carrier information.
- Long-term real GDP growth – 1.75%
- Long-term rate of inflation – 2.30%
- Long-term nominal GDP growth – 4.05%
- Year that excess rate converges to 0 – 15 years from the valuation

Health care trend rates are thus the manually set rates for the short-run period and rates which decline to an ultimate trend rate which equals the assumed nominal long-term GDP growth rate.

State Police Retirement System

Summary of Actuarial Methods and Assumptions (Continued)

Health Care Participation Assumptions:

- 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
Medical Only	7%
Essential	8%
Premium	85%

Non-Medicare Plan	Participation
LivingWell Limited	2%
LivingWell Basic	13%
LivingWell CDHP	27%
LivingWell PPO	58%

- 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.
- 75% 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.

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Excise (“Cadillac”) Tax:

For taxable years beginning after December 31, 2021, a 40% excise tax will be required to be paid (by the employer and/or insurer) on the aggregate cost of the health plan in excess of certain legislated thresholds. For 2018, the thresholds are \$850 per month for individual coverage and \$2,292 per month for family coverage.

Both Actuarial Standard of Practice No. 6 and GASB Statement Nos. 74 and 75 reference this tax, and, in accordance with these standards an estimate of the impact of the Cadillac tax has been included in this valuation.

Assumptions and methods used to determine the impact of the Cadillac Tax include:

- 2018 thresholds of \$850/\$2,292 were indexed annually by 2.30%.
- Premium data submitted was not adjusted for permissible exclusions to the Cadillac Tax.
- There were no special adjustments to the dollar limit other than those permissible for non-Medicare retirees over 55.

In this valuation, the impact of the Cadillac Tax has been calculated by increasing the employer paid premiums for Non-Medicare retirees, who became participants before July 1, 2003, by 3.6%. Non-Medicare retirees who became participants after July 1, 2003 receive dollar subsidies per year of service, which are not expected to exceed the overall Non-Medicare premiums. As a result, the costs attributable to the Cadillac Tax for members who became participants after July 1, 2003 will be paid by the retirees

State Police Retirement System

Summary of Actuarial Methods and Assumptions (Continued)

Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): Current fiscal year payroll.
2. Individual salaries used to project benefits: Actual salaries from the past fiscal year are used to determine the final average salary as of the valuation date. 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 ended on the valuation date.
4. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an immediate life annuity.
5. Inactive Population: All non-vested members are assumed to take an immediate refund. Vested members are assumed to elect a refund at the time of their termination if the value of their account balance exceeds the present value of their deferral benefit.
6. There will be no recoveries once disabled.
7. Decrement timing: Decrements of all types are assumed to occur mid-year.
8. 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.
9. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
10. 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.
11. Service: All members are assumed to accrue 1 year of benefit and eligibility service each year.
12. Payroll Growth Assumption: In determining the level percent of payroll amortization rate, payroll is assumed to grow annually at 0.00% percent
13. Cash Balance Interest Crediting Rate: The cash balance interest crediting rate assumption for years after the valuation date is equal to 4.9375%.

State Police Retirement System Summary of Actuarial Methods and Assumptions (Continued)

Participant Data

Participant data was supplied in electronic text files. There were separate files for (i) active and inactive members, and (ii) members and beneficiaries receiving benefits.

The data for active members included birthdate, gender, service with the current city and total vesting service, salary, and employee contribution account balances. For retired members and beneficiaries, the data included date of birth, gender, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and form of payment code.

Salary supplied for the current year was based on the annualized earnings for the year preceding the valuation date.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

Changes from the June 30, 2018 prior valuation:

- Annual salary increases were updated based on the 2018 Experience Study
- Annual rates of retirement, disability, withdrawal, and mortality were updated based on the 2018 Experience Study
- The percent of disabilities assumed to occur in the line of duty was updated from 0% to 70%

SECTION VIII

SUMMARY OF DATA AND EXPERIENCE

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Salary Experiences

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

Years of Service	Current Salary Scale		2013/2018 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)
0	15.55%	12.00%	13.50%	11.97%	11.22%	15.30%	12.00%
1	7.55%	4.00%	5.92%	4.38%	3.64%	6.80%	3.50%
2	5.05%	1.50%	5.37%	3.83%	3.09%	6.05%	2.75%
3	4.55%	1.00%	5.15%	3.61%	2.87%	5.80%	2.50%
4	4.55%	1.00%	4.56%	3.03%	2.28%	5.30%	2.00%
5	4.55%	1.00%	4.11%	2.58%	1.83%	4.80%	1.50%
6	4.05%	0.50%	3.69%	2.15%	1.41%	4.55%	1.25%
7	4.05%	0.50%	3.42%	1.88%	1.14%	4.30%	1.00%
8	4.05%	0.50%	3.38%	1.85%	1.10%	4.05%	0.75%
9	3.55%	0.00%	2.86%	1.32%	0.58%	3.80%	0.50%
10	3.55%	0.00%	2.88%	1.35%	0.60%	3.80%	0.50%
11 & Over	3.55%	0.00%	2.28%	0.74%	0.00%	3.30%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	1.25%	Proposed Productivity Component	1.00%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.30%
Apparent Productivity Component	0.74%		

Salary Experiences

Kentucky Retirement System Kentucky Employees Retirement System (KERS) Hazardous Salary Increase Experience

Years of Service	Current Salary Scale		2013/2018 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)
0	19.55%	16.00%	23.02%	21.49%	17.72%	20.05%	16.50%
1	7.55%	4.00%	8.82%	7.28%	3.52%	7.55%	4.00%
2	5.55%	2.00%	8.27%	6.73%	2.97%	6.55%	3.00%
3	5.05%	1.50%	8.51%	6.98%	3.21%	6.55%	3.00%
4	4.55%	1.00%	6.91%	5.38%	1.61%	5.55%	2.00%
5	4.05%	0.50%	7.50%	5.96%	2.20%	5.05%	1.50%
6	3.55%	0.00%	6.30%	4.76%	1.00%	4.55%	1.00%
7	3.55%	0.00%	5.49%	3.96%	0.19%	4.05%	0.50%
8	3.55%	0.00%	6.27%	4.73%	0.96%	4.05%	0.50%
9	3.55%	0.00%	5.30%	3.77%	0.00%	3.55%	0.00%
10 & Over	3.55%	0.00%	5.30%	3.77%	0.00%	3.55%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	1.25%	Proposed Productivity Component	1.25%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.55%
Apparent Productivity Component	0.74%		

Salary Experiences

Kentucky Retirement System County Employees Retirement System (CERS) Non-Hazardous Salary Increase Experience

Years of Service	Current Salary Scale		2013/2018 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)
0	11.55%	8.25%	9.02%	7.48%	6.23%	10.30%	7.00%
1	8.05%	4.75%	5.97%	4.44%	3.18%	7.30%	4.00%
2	4.55%	1.25%	5.23%	3.70%	2.44%	6.30%	3.00%
3	4.55%	1.25%	4.76%	3.23%	1.97%	4.80%	1.50%
4	4.05%	0.75%	4.64%	3.10%	1.84%	4.55%	1.25%
5	4.05%	0.75%	4.20%	2.67%	1.41%	4.55%	1.25%
6	3.80%	0.50%	3.99%	2.46%	1.20%	4.30%	1.00%
7	3.80%	0.50%	3.62%	2.08%	0.83%	4.30%	1.00%
8	3.55%	0.25%	3.65%	2.12%	0.86%	4.05%	0.75%
9	3.55%	0.25%	3.77%	2.24%	0.98%	4.05%	0.75%
10	3.30%	0.00%	3.22%	1.68%	0.43%	3.80%	0.50%
11	3.30%	0.00%	3.36%	1.83%	0.57%	3.80%	0.50%
12	3.30%	0.00%	3.07%	1.54%	0.28%	3.55%	0.25%
13	3.30%	0.00%	3.05%	1.52%	0.26%	3.55%	0.25%
14	3.30%	0.00%	3.01%	1.47%	0.22%	3.55%	0.25%
15 & Over	3.30%	0.00%	2.79%	1.26%	0.00%	3.30%	0.00%
Current Inflation Assumption			2.30%	Proposed Inflation Assumption			2.30%
Current Productivity Component			1.00%	Proposed Productivity Component			1.00%
Actual CPI-U Inflation for June 2013 - June 2018			1.54%	Proposed Wage Inflation			3.30%
Apparent Productivity Component			1.26%				



Salary Experiences

Kentucky Retirement System County Employees Retirement System (CERS) Hazardous Salary Increase Experience

Years of Service	Current Salary Scale		2013/2018 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)
0	18.55%	15.50%	19.40%	17.87%	15.15%	19.05%	15.50%
1	9.05%	6.00%	8.41%	6.88%	4.16%	7.55%	4.00%
2	5.05%	2.00%	6.41%	4.87%	2.15%	5.55%	2.00%
3	4.30%	1.25%	5.49%	3.96%	1.24%	4.80%	1.25%
4	4.05%	1.00%	5.18%	3.65%	0.93%	4.55%	1.00%
5	3.55%	0.50%	5.54%	4.00%	1.28%	4.55%	1.00%
6	3.05%	0.00%	5.19%	3.66%	0.94%	4.55%	1.00%
7	3.05%	0.00%	4.75%	3.22%	0.50%	4.05%	0.50%
8	3.05%	0.00%	4.56%	3.02%	0.30%	4.05%	0.50%
9	3.05%	0.00%	4.26%	2.72%	0.00%	3.55%	0.00%
10 & Over	3.05%	0.00%	4.26%	2.72%	0.00%	3.55%	0.00%

Current Inflation Assumption	2.30%	Proposed Inflation Assumption	2.30%
Current Productivity Component	0.75%	Proposed Productivity Component	1.25%
Actual CPI-U Inflation for June 2013 - June 2018	1.54%	Proposed Wage Inflation	3.55%
Apparent Productivity Component	2.72%		

Salary Experiences

Kentucky Retirement System State Police Retirement System (SPRS) Salary Increase Experience

Years of Service	Current Salary Scale		2013/2018 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)
0	15.55%	12.50%	43.91%	42.38%	39.93%	16.05%	12.50%
1	10.55%	7.50%	8.21%	6.67%	4.23%	8.55%	5.00%
2	8.55%	5.50%	7.79%	6.25%	3.81%	7.55%	4.00%
3	7.55%	4.50%	5.61%	4.08%	1.63%	5.55%	2.00%
4	6.55%	3.50%	5.58%	4.05%	1.60%	5.55%	2.00%
5	5.55%	2.50%	4.19%	2.66%	0.21%	5.55%	2.00%
6	5.05%	2.00%	6.15%	4.61%	2.17%	5.55%	2.00%
7	5.05%	2.00%	4.92%	3.38%	0.94%	4.55%	1.00%
8	4.05%	1.00%	2.50%	0.97%	-1.48%	4.55%	1.00%
9	3.55%	0.50%	3.98%	2.45%	0.00%	3.55%	0.00%
10 & Over	3.05%	0.00%	3.98%	2.45%	0.00%	3.55%	0.00%
Current Inflation Assumption			2.30%	Proposed Inflation Assumption		2.30%	
Current Productivity Component			0.75%	Proposed Productivity Component		1.25%	
Actual CPI-U Inflation for June 2013 - June 2018			1.54%	Proposed Wage Inflation		3.55%	
Apparent Productivity Component			2.45%				

Mortality Experiences

Kentucky Retirement System Post-Retirement Mortality Experience - Male

Age (1)	Actual Deaths (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Deaths		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
50-54	14	3,844	0.0035	0.26%	0.32%	10	13	133.81%	105.84%
55-59	38	6,298	0.0061	0.44%	0.47%	29	36	133.18%	105.68%
60-64	76	9,072	0.0084	0.74%	1.05%	72	97	104.61%	77.98%
65-69	125	9,848	0.0127	1.25%	1.29%	131	131	94.81%	95.03%
70-74	126	5,913	0.0213	2.08%	1.81%	131	110	95.89%	114.01%
75-79	122	3,444	0.0354	3.57%	3.24%	131	114	93.31%	107.21%
80-84	110	1,851	0.0594	6.13%	6.19%	120	116	91.64%	94.98%
85-89	99	843	0.1178	10.56%	11.29%	92	94	107.41%	105.21%
90-94	49	246	0.1971	18.41%	19.17%	45	46	108.03%	105.37%
95-99	8	33	0.2419	27.90%	27.12%	9	9	90.97%	89.55%
100-104	1	3	0.4415	35.85%	34.87%	1	1	128.08%	132.08%
105-109	0	0	N/A	40.00%	44.40%	0	0	N/A	N/A
Total	767	41,395				772	768	99.39%	99.93%

Actual, expected and exposures are in thousands of benefit.

Mortality Experiences

Kentucky Retirement System Post-Retirement Mortality Experience - Female

Age (1)	Actual Deaths (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Deaths		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
50-54	4	2,116	0.0017	0.19%	0.22%	4	5	93.84%	73.05%
55-59	16	5,116	0.0031	0.32%	0.29%	15	18	106.88%	87.90%
60-64	42	7,800	0.0054	0.57%	0.72%	40	57	104.82%	73.58%
65-69	66	8,385	0.0078	1.04%	0.89%	78	77	84.39%	85.41%
70-74	78	5,545	0.0140	1.77%	1.19%	87	68	89.31%	114.05%
75-79	76	3,225	0.0235	2.92%	2.13%	84	70	90.14%	108.50%
80-84	75	1,683	0.0444	4.81%	4.20%	72	72	103.58%	104.20%
85-89	71	916	0.0772	8.23%	7.92%	66	73	106.63%	96.90%
90-94	48	337	0.1438	14.01%	13.81%	41	46	118.03%	106.28%
95-99	14	65	0.2146	20.43%	21.44%	12	13	117.30%	103.55%
100-104	2	7	0.3446	24.80%	30.81%	2	2	148.87%	118.31%
105-109	0	0	0.6386	32.27%	41.24%	0	0	206.95%	165.56%
Total	491	35,193				501	501	98.05%	98.01%

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

Mortality Experiences

Kentucky Retirement System Post-Retirement Mortality Experience - Disabled Male

Age (1)	Actual Deaths (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Deaths		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
50-54	4	240	0.0158	2.54%	2.03%	6	5	61.56%	75.84%
55-59	7	335	0.0195	3.12%	2.38%	10	8	62.60%	79.55%
60-64	17	419	0.0403	3.50%	2.95%	15	13	115.24%	133.64%
65-69	14	364	0.0373	3.88%	3.80%	14	14	96.02%	96.50%
70-74	11	209	0.0546	4.68%	5.11%	10	11	117.19%	105.40%
75-79	12	126	0.0934	6.02%	7.32%	8	9	155.98%	126.39%
80-84	8	61	0.1325	8.02%	10.78%	5	7	169.06%	124.20%
85-89	2	14	0.1298	10.68%	16.35%	1	2	125.96%	81.76%
90-94	1	3	0.2613	14.42%	23.47%	0	1	189.53%	115.68%
95-99	0	0	0.0000	22.18%	32.56%	0	0	0.00%	0.00%
100-104	0	0	N/A	30.72%	42.21%	0	0	N/A	N/A
105-109	0	0	N/A	38.30%	48.66%	0	0	N/A	N/A
Total	75	1,772				70	70	107.67%	107.25%

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

Mortality Experiences

Kentucky Retirement System Post-Retirement Mortality Experience - Disabled Female

Age (1)	Actual Deaths (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Deaths		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
50-54	6	176	0.0325	1.29%	1.65%	2	3	247.27%	192.32%
55-59	8	332	0.0235	1.70%	1.85%	6	6	136.66%	123.64%
60-64	10	405	0.0246	2.06%	2.16%	8	9	118.60%	110.96%
65-69	9	365	0.0249	2.68%	2.80%	10	10	93.16%	87.08%
70-74	12	238	0.0488	3.66%	3.99%	9	10	133.38%	119.78%
75-79	8	158	0.0530	5.09%	6.04%	8	10	105.84%	87.48%
80-84	4	52	0.0780	7.03%	9.38%	4	5	114.05%	84.65%
85-89	2	13	0.1408	9.79%	13.52%	1	2	149.41%	105.87%
90-94	1	2	0.2571	14.22%	19.33%	0	0	194.18%	136.81%
95-99	0	0	0.5425	20.43%	28.45%	0	0	290.80%	207.71%
100-104	0	0	N/A	24.80%	38.86%	0	0	N/A	N/A
105-109	0	0	N/A	32.27%	47.88%	0	0	N/A	N/A
Total	59	1,742				48	55	123.49%	107.62%

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

Termination Experiences

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

Service (1)	Actual Terminations (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Terminations		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
1	322	1,269	0.2541	22.50%	20.00%	286	254	112.70%	126.90%
2	888	4,181	0.2124	15.50%	16.45%	651	688	136.40%	129.07%
3	964	4,910	0.1963	12.50%	13.39%	618	658	155.94%	146.46%
4	898	5,293	0.1696	10.50%	11.61%	560	614	160.29%	146.20%
5	847	5,881	0.1440	9.00%	10.34%	530	608	159.79%	139.29%
6	855	6,180	0.1383	6.50%	9.35%	399	578	214.30%	147.93%
7	887	6,919	0.1282	5.50%	8.55%	377	591	235.29%	150.09%
8	898	7,556	0.1188	5.00%	7.87%	374	595	239.99%	150.85%
9	912	8,267	0.1103	4.50%	7.28%	368	602	247.80%	151.48%
10	896	8,245	0.1087	4.50%	6.76%	367	557	244.24%	160.93%
11	873	8,514	0.1025	4.00%	6.30%	337	536	259.07%	162.88%
12	774	8,693	0.0890	4.00%	5.88%	344	511	224.86%	151.37%
13	784	9,012	0.0870	4.00%	5.49%	357	495	219.54%	158.34%
14	654	9,450	0.0692	3.50%	5.14%	327	486	200.01%	134.57%
15	665	10,229	0.0650	3.50%	4.81%	353	492	188.48%	135.23%
16	578	10,220	0.0565	3.00%	4.51%	302	461	191.28%	125.31%
17	536	9,703	0.0552	3.00%	4.22%	286	410	187.24%	130.61%
18	443	9,078	0.0488	3.00%	3.96%	268	359	165.28%	123.38%
19	419	8,426	0.0497	3.00%	3.70%	248	312	169.00%	134.33%
20	301	8,108	0.0371	3.00%	3.47%	239	281	125.77%	106.97%
21	361	7,827	0.0461	3.00%	3.24%	230	254	156.79%	141.97%
22	268	7,395	0.0363	3.00%	3.02%	217	224	123.69%	119.83%
23	170	7,250	0.0234	3.00%	2.82%	213	204	79.59%	83.10%
24	194	6,935	0.0280	3.00%	2.62%	204	182	95.20%	106.71%
25	144	3,237	0.0443	3.00%	2.43%	93	79	154.30%	181.65%
Total	15,528	182,778				8,548	11,031	181.66%	140.77%

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



Termination Experiences

**Kentucky Retirement System
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	134	324	0.4136	25.00%	25.00%	81	81	165.29%	165.29%
2	310	1,104	0.2807	10.50%	19.68%	117	217	264.88%	142.81%
3	237	1,108	0.2143	7.50%	15.12%	84	167	282.67%	142.18%
4	187	1,017	0.1843	6.50%	12.45%	67	127	279.82%	147.62%
5	154	956	0.1610	5.50%	10.56%	53	101	290.57%	152.48%
6	126	941	0.1341	4.50%	9.09%	42	86	300.51%	146.76%
7	132	977	0.1354	3.00%	7.89%	29	77	456.11%	171.78%
8	83	1,017	0.0815	3.00%	6.87%	30	70	276.15%	118.35%
9	97	1,201	0.0810	3.00%	5.99%	35	72	278.14%	135.21%
10	73	1,264	0.0579	2.50%	5.22%	31	66	236.24%	110.96%
11	60	1,309	0.0456	2.50%	5.43%	32	59	186.74%	101.28%
12	54	1,304	0.0414	2.00%	3.90%	25	51	215.77%	105.77%
13	58	1,285	0.0450	2.00%	3.33%	25	43	231.21%	134.42%
14	63	1,214	0.0519	2.00%	2.80%	23	34	274.19%	185.48%
15	40	1,220	0.0331	2.00%	2.31%	23	28	175.43%	144.10%
16	47	1,230	0.0385	2.00%	1.86%	24	23	197.42%	206.00%
17	34	1,254	0.0270	2.00%	1.43%	24	18	141.08%	188.10%
18	22	1,210	0.0181	2.00%	1.03%	23	13	95.18%	168.40%
19	10	1,150	0.0091	2.00%	0.66%	22	8	47.54%	130.72%
20	12	589	0.0199	2.00%	0.30%	11	2	106.74%	587.07%
Total	1,935	21,674				801	1,343	241.56%	144.07%

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

Termination Experiences

**Kentucky Retirement System
County Employees Retirement System (CERS)
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	468	1,864	0.2511	28.00%	20.00%	524	373	89.33%	125.49%
2	1,205	5,895	0.2044	16.00%	15.58%	949	919	126.94%	131.09%
3	996	6,278	0.1586	12.00%	12.48%	760	783	131.01%	127.16%
4	852	6,644	0.1282	10.00%	10.66%	672	708	126.78%	120.33%
5	727	6,836	0.1064	8.00%	9.37%	548	641	132.74%	113.48%
6	694	7,112	0.0975	6.00%	8.37%	422	596	164.34%	116.36%
7	685	7,461	0.0918	5.00%	7.56%	368	564	186.15%	121.46%
8	678	7,751	0.0874	5.00%	6.87%	382	532	177.36%	127.35%
9	645	8,039	0.0802	4.00%	6.27%	317	504	203.34%	127.89%
10	642	8,381	0.0766	4.00%	5.74%	330	481	194.54%	133.47%
11	602	8,499	0.0708	4.00%	5.27%	336	448	179.13%	134.35%
12	574	8,853	0.0649	4.00%	4.84%	350	429	164.12%	133.90%
13	548	9,302	0.0589	4.00%	4.45%	367	414	149.32%	132.36%
14	568	10,037	0.0566	4.00%	4.09%	396	411	143.49%	138.25%
15	477	10,681	0.0447	3.00%	3.76%	315	402	151.49%	118.70%
16	477	10,973	0.0435	3.00%	3.45%	323	379	147.62%	125.81%
17	372	10,708	0.0348	3.00%	3.16%	315	339	118.19%	109.82%
18	364	10,241	0.0356	3.00%	2.89%	301	296	120.97%	123.01%
19	276	9,580	0.0288	3.00%	2.64%	281	252	98.26%	109.56%
20	235	8,872	0.0265	3.00%	2.39%	260	212	90.57%	111.08%
21	265	7,849	0.0338	3.00%	2.16%	230	170	115.43%	156.18%
22	163	6,895	0.0236	3.00%	1.94%	202	134	80.57%	121.45%
23	130	6,306	0.0206	3.00%	1.74%	185	109	70.33%	119.37%
24	109	5,641	0.0193	3.00%	1.54%	165	87	66.04%	125.25%
25	79	2,633	0.0300	3.00%	1.35%	75	35	105.46%	225.99%
Total	12,831	193,329				9,373	10,218	136.90%	125.58%

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



Termination Experiences

**Kentucky Retirement System
County Employees Retirement System (CERS)
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	57	356	0.1605	20.50%	20.00%	73	71	78.19%	80.40%
2	103	1,049	0.0979	13.00%	9.11%	138	96	74.46%	107.04%
3	98	1,291	0.0762	10.50%	7.24%	137	93	71.79%	105.76%
4	102	1,434	0.0712	9.00%	6.14%	131	88	77.87%	115.93%
5	96	1,645	0.0583	8.00%	5.37%	132	88	72.68%	109.02%
6	95	1,881	0.0505	7.00%	4.76%	131	90	72.45%	105.45%
7	104	2,183	0.0477	7.00%	4.27%	152	93	68.45%	111.87%
8	119	2,644	0.0451	6.00%	3.85%	157	102	75.92%	116.86%
9	109	3,188	0.0343	6.00%	3.49%	190	111	57.48%	98.40%
10	178	3,754	0.0474	6.00%	3.18%	223	119	79.72%	149.39%
11	148	3,978	0.0371	6.00%	2.89%	236	115	62.52%	128.29%
12	150	4,223	0.0355	6.00%	2.63%	251	111	59.65%	134.88%
13	108	4,359	0.0247	6.00%	2.40%	259	105	41.65%	102.72%
14	126	4,761	0.0265	6.00%	2.18%	283	104	44.61%	121.39%
15	91	5,262	0.0173	6.00%	1.98%	312	104	29.20%	87.59%
16	82	5,865	0.0140	6.00%	1.80%	348	105	23.53%	78.00%
17	86	6,124	0.0140	6.00%	1.62%	363	99	23.61%	86.58%
18	78	6,176	0.0127	6.00%	1.46%	366	90	21.38%	86.96%
19	41	6,196	0.0067	6.00%	1.30%	367	81	11.26%	51.03%
20	32	2,894	0.0111	6.00%	1.16%	169	34	19.09%	94.89%
Total	2,003	69,264				4,418	1,899	45.34%	105.49%

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

Termination Experiences

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

Service (1)	Actual Terminations (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Terminations		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
1	9	36	0.2533	20.00%	15.00%	7	5	131.78%	184.50%
2	11	164	0.0640	7.00%	4.82%	12	8	87.71%	131.56%
3	9	245	0.0366	3.00%	3.76%	8	9	112.24%	99.77%
4	12	312	0.0394	3.00%	3.15%	10	10	123.25%	123.25%
5	14	305	0.0459	3.00%	2.71%	9	8	155.59%	175.04%
6	7	298	0.0237	3.00%	2.37%	9	7	78.58%	101.03%
7	13	369	0.0358	3.00%	2.09%	11	8	120.20%	165.28%
8	7	336	0.0201	3.00%	1.86%	10	6	67.52%	112.53%
9	10	407	0.0242	3.00%	1.66%	12	7	82.15%	140.83%
10	5	467	0.0116	2.50%	1.48%	12	7	45.13%	77.36%
11	8	568	0.0134	2.50%	1.32%	14	7	54.48%	108.97%
12	16	600	0.0265	2.50%	1.17%	15	7	105.84%	226.80%
13	6	646	0.0094	2.50%	1.04%	16	7	38.17%	87.25%
14	10	693	0.0143	2.50%	0.92%	17	6	58.38%	165.42%
15	3	680	0.0050	2.50%	0.80%	17	5	19.90%	67.66%
16	7	743	0.0093	2.50%	0.70%	18	5	38.51%	138.64%
17	7	667	0.0098	2.50%	0.60%	16	4	40.80%	163.19%
18	7	736	0.0089	2.50%	0.51%	18	4	36.22%	163.00%
19	10	738	0.0130	2.50%	0.42%	18	3	53.36%	320.16%
20	0	308	0.0000	2.50%	0.34%	7	1	0.00%	0.00%
Total	170	9,319				256	124	66.36%	137.00%

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

Retirement Experiences

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

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹	Proposed ²	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	71	371	0.1902		20.00%	130	74	54.33%	95.44%
45	43	267	0.1594		21.00%	93	56	45.74%	75.96%
46	83	375	0.2217		22.00%	131	83	63.49%	100.21%
47	126	527	0.2385		23.00%	185	121	67.97%	103.93%
48	148	735	0.2008		24.00%	257	176	57.40%	83.82%
49	154	891	0.1725		25.00%	312	223	49.28%	68.95%
50	228	1,230	0.1854		26.00%	430	320	53.02%	71.25%
51	325	1,459	0.2226		27.00%	511	394	63.56%	82.43%
52	324	1,423	0.2276		28.00%	498	399	65.04%	81.18%
53	408	1,441	0.2832		29.00%	505	418	80.84%	97.66%
54	362	1,338	0.2703		30.00%	468	401	77.26%	90.17%
55	243	1,175	0.2071	8.00%	30.00%	411	353	59.20%	68.93%
56	299	1,070	0.2790	8.00%	30.00%	375	321	79.64%	93.04%
57	232	1,001	0.2319	8.00%	30.00%	350	300	66.36%	77.42%
58	232	953	0.2431	8.00%	30.00%	334	286	69.36%	81.00%
59	201	989	0.2033	8.00%	30.00%	346	297	58.08%	67.66%
60	284	970	0.2923	10.00%	30.00%	339	291	83.65%	97.44%
61	219	836	0.2618	20.00%	30.00%	293	251	74.67%	87.17%
62	272	781	0.3481	20.00%	35.00%	273	273	99.61%	99.61%
63	167	563	0.2974	20.00%	30.00%	197	169	84.98%	99.06%
64	116	420	0.2756	20.00%	30.00%	147	126	78.76%	91.89%
65	330	1,420	0.2322	20.00%	30.00%	345	426	95.55%	77.38%
66	340	1,150	0.2961	20.00%	30.00%	280	345	121.58%	98.67%
67	248	836	0.2962	20.00%	30.00%	204	251	121.34%	98.62%
68	150	615	0.2441	20.00%	30.00%	144	184	104.24%	81.58%
69	129	491	0.2637	20.00%	30.00%	113	147	114.58%	88.08%
70	71	344	0.2062	20.00%	30.00%	79	103	89.73%	68.83%
71	50	256	0.1961	20.00%	30.00%	61	77	82.36%	65.25%
72	35	210	0.1647	20.00%	30.00%	51	63	67.75%	54.84%
73	54	160	0.3360	20.00%	30.00%	41	48	131.46%	112.29%
74	34	116	0.2959	20.00%	30.00%	28	35	122.58%	98.06%
Total	5,975	24,412				7,931	7,011	75.34%	85.23%
75 & Over	114	404	0.2825	100.00%	100.00%	404	404	28.25%	28.25%
Total	6,089	24,816				8,335	7,415	73.06%	82.12%

¹ For members hired before 09/01/2008, if service is at least 27 years, the rate is 35%.

¹ For members hired after 09/01/2008, if age plus service is at least 87, the rate is 35%.

² 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 Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Female

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹	Proposed ²	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	125	401	0.3114		33.00%	140	132	89.27%	94.68%
45	132	365	0.3625		33.00%	128	121	103.44%	109.43%
46	132	511	0.2587		33.00%	179	169	73.82%	78.19%
47	225	722	0.3115		33.00%	253	238	88.93%	94.53%
48	293	1,027	0.2856		33.00%	359	339	81.71%	86.53%
49	401	1,365	0.2938		33.00%	478	450	83.91%	89.13%
50	476	1,504	0.3166		33.00%	527	496	90.38%	96.02%
51	465	1,490	0.3124		33.00%	521	492	89.35%	94.61%
52	406	1,492	0.2721		33.00%	522	492	77.79%	82.53%
53	493	1,516	0.3255		33.00%	530	500	93.08%	98.66%
54	423	1,468	0.2880		33.00%	514	484	82.27%	87.36%
55	480	1,375	0.3493	8.00%	33.00%	481	454	99.84%	105.78%
56	358	1,180	0.3039	8.00%	33.00%	413	389	86.80%	92.16%
57	304	1,132	0.2688	8.00%	33.00%	396	373	76.81%	81.54%
58	272	1,043	0.2604	8.00%	33.00%	365	344	74.40%	78.94%
59	213	1,002	0.2128	8.00%	33.00%	351	331	60.74%	64.41%
60	300	984	0.3050	10.00%	33.00%	344	325	87.25%	92.35%
61	286	913	0.3132	20.00%	33.00%	319	301	89.59%	94.95%
62	253	718	0.3522	20.00%	35.00%	251	251	100.80%	100.80%
63	184	536	0.3434	20.00%	33.00%	188	177	97.91%	103.99%
64	139	448	0.3102	20.00%	33.00%	157	148	88.43%	93.81%
65	495	1,568	0.3155	20.00%	33.00%	366	517	135.11%	95.65%
66	368	1,102	0.3336	20.00%	33.00%	260	364	141.40%	101.00%
67	262	809	0.3238	20.00%	33.00%	193	267	135.73%	98.11%
68	116	535	0.2168	20.00%	33.00%	128	176	90.57%	65.87%
69	89	431	0.2064	20.00%	33.00%	104	142	85.53%	62.64%
70	116	358	0.3250	20.00%	33.00%	87	118	133.68%	98.56%
71	58	223	0.2584	20.00%	33.00%	53	74	108.96%	78.04%
72	25	156	0.1619	20.00%	33.00%	39	51	64.63%	49.42%
73	36	127	0.2881	20.00%	33.00%	32	42	113.94%	86.81%
74	37	91	0.4025	20.00%	33.00%	23	30	158.81%	121.75%
Total	7,964	26,590				8,701	8,787	91.53%	90.63%
75 & Over	72	214	0.3368	100.00%	100.00%	214	214	33.68%	33.68%
Total	8,036	26,804				8,915	9,001	90.14%	89.28%

¹ For members hired before 09/01/2008, if service is at least 27 years, the rate is 35%.

¹ For members hired after 09/01/2008, if age plus service is at least 87, the rate is 35%.

² 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 Retirement System
Kentucky Employees Retirement System (KERS)
Hazardous
Unreduced Retirement Experience - Service Based**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ² (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
20	170	359	0.4735	40.00%	50.00%	144	180	118.38%	94.44%
21	62	203	0.3054	40.00%	32.00%	81	65	76.35%	95.38%
22	32	146	0.2192	40.00%	32.00%	58	47	54.79%	68.09%
23	37	127	0.2913	40.00%	32.00%	51	41	72.83%	90.24%
24	20	99	0.2020	40.00%	32.00%	40	32	50.51%	62.50%
25	31	104	0.2981	47.00%	32.00%	49	33	63.42%	93.94%
26	22	77	0.2857	47.00%	32.00%	36	25	60.79%	88.00%
27	18	56	0.3214	47.00%	32.00%	26	18	68.39%	100.00%
28	9	39	0.2308	47.00%	32.00%	18	12	49.10%	75.00%
29	13	28	0.4643	47.00%	32.00%	13	9	98.78%	144.44%
30	2	15	0.1333	47.00%	32.00%	7	5	28.37%	40.00%
31	3	16	0.1875	47.00%	32.00%	8	5	39.89%	60.00%
32	3	14	0.2143	50.00%	32.00%	7	4	42.86%	75.00%
33	4	11	0.3636	50.00%	32.00%	6	4	72.73%	100.00%
34	0	7	0.0000	50.00%	32.00%	4	2	0.00%	0.00%
35	2	9	0.2222	60.00%	32.00%	5	3	37.04%	66.67%
36	1	5	0.2000	60.00%	32.00%	3	2	33.33%	50.00%
37	0	3	0.0000	60.00%	32.00%	2	1	0.00%	0.00%
38	1	4	0.2500	60.00%	32.00%	2	1	41.67%	100.00%
39	2	2	1.0000	60.00%	32.00%	1	1	166.67%	200.00%
40	1	4	0.2500	60.00%	32.00%	2	1	41.67%	100.00%
Total	433	1,328				563	491	76.88%	88.19%

^{1,2} For members hired before 09/01/2008, the annual rate of service retirement is 100% at age 65. For members hired after 09/01/2008, the annual rate of service retirement is 100% at age 60.

² 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.

² 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 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 Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Male**

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹	Proposed ²	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	68	216	0.3162		35.00%	65	76	105.22%	90.00%
45	46	122	0.3746		35.00%	37	43	123.33%	106.12%
46	58	188	0.3062		35.00%	56	66	102.88%	87.29%
47	156	386	0.4051		35.00%	116	135	134.66%	115.71%
48	113	506	0.2233		35.00%	152	177	74.31%	63.82%
49	197	621	0.3167		35.00%	186	217	105.72%	90.62%
50	214	796	0.2683		30.00%	239	239	89.40%	89.40%
51	305	1,040	0.2935		30.00%	312	312	97.83%	97.83%
52	249	1,076	0.2319		30.00%	323	323	77.24%	77.24%
53	342	1,274	0.2683		30.00%	382	382	89.49%	89.49%
54	376	1,359	0.2764		30.00%	408	408	92.06%	92.06%
55	378	1,373	0.2753	5.00%	30.00%	412	412	91.71%	91.71%
56	332	1,213	0.2737	6.00%	30.00%	364	364	91.23%	91.23%
57	337	1,144	0.2941	7.00%	30.00%	343	343	98.11%	98.11%
58	357	1,102	0.3238	7.00%	30.00%	330	330	108.10%	108.10%
59	294	1,004	0.2930	8.00%	30.00%	301	301	97.77%	97.77%
60	260	993	0.2621	9.00%	30.00%	298	298	87.32%	87.32%
61	219	944	0.2319	15.00%	30.00%	283	283	77.36%	77.36%
62	332	818	0.4061	18.00%	30.00%	246	246	135.08%	135.08%
63	203	656	0.3100	18.00%	30.00%	197	197	103.17%	103.17%
64	144	523	0.2747	18.00%	30.00%	157	157	91.47%	91.47%
65	545	2,234	0.2441	18.00%	30.00%	450	670	121.18%	81.39%
66	482	1,707	0.2825	18.00%	30.00%	345	512	139.81%	94.21%
67	275	1,251	0.2200	18.00%	30.00%	257	375	107.09%	73.39%
68	222	877	0.2533	18.00%	30.00%	178	263	124.85%	84.50%
69	140	710	0.1977	18.00%	30.00%	146	213	96.09%	65.86%
70	128	555	0.2313	18.00%	30.00%	115	167	111.67%	76.90%
71	101	457	0.2207	18.00%	30.00%	93	137	108.48%	73.64%
72	86	351	0.2461	18.00%	30.00%	70	105	123.42%	82.28%
73	61	292	0.2080	18.00%	30.00%	58	87	104.57%	69.72%
74	44	239	0.1823	18.00%	30.00%	47	72	92.75%	60.55%
Total	7,064	26,027				6,966	7,910	101.41%	89.31%
75 & Over	200	737	0.2710	100.00%	100.00%	732	737	27.28%	27.10%
Total	7,264	26,763				7,698	8,647	94.36%	84.01%

¹ For members hired before 09/01/2008, if service is at least 27 years, the rate is 30%.

¹ For members hired after 09/01/2008, if age plus service is at least 87, the rate is 30%.

² 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 Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Unreduced Retirement Experience - Age Based - Female**

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹	Proposed ²	Current	Proposed	Current (2)/(7)	Proposed (2)/(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Under 45	37	163	0.2299		27.00%	49	44	76.24%	84.91%
45	32	149	0.2139		27.00%	45	40	70.72%	79.56%
46	58	277	0.2093		27.00%	83	75	69.75%	77.19%
47	99	384	0.2592		27.00%	115	104	86.50%	95.64%
48	132	496	0.2663		27.00%	149	134	88.66%	98.58%
49	158	634	0.2495		27.00%	190	171	83.18%	92.42%
50	165	691	0.2391		27.00%	207	187	79.85%	88.39%
51	159	837	0.1895		27.00%	251	226	63.16%	70.15%
52	251	1,011	0.2485		27.00%	303	273	82.93%	92.04%
53	248	984	0.2520		27.00%	295	266	84.03%	93.19%
54	289	1,007	0.2872		27.00%	302	272	95.72%	106.27%
55	255	1,026	0.2488	5.00%	27.00%	308	277	82.85%	92.12%
56	231	1,079	0.2140	6.00%	27.00%	324	291	71.27%	79.35%
57	286	1,178	0.2427	7.00%	27.00%	353	318	80.97%	89.89%
58	307	1,262	0.2431	7.00%	27.00%	379	341	80.96%	89.98%
59	332	1,219	0.2725	8.00%	27.00%	366	329	90.76%	100.96%
60	307	1,210	0.2540	9.00%	27.00%	363	327	84.63%	93.95%
61	277	1,154	0.2403	15.00%	27.00%	346	312	80.18%	88.91%
62	412	1,055	0.3909	18.00%	40.00%	316	422	130.52%	97.73%
63	303	845	0.3589	18.00%	35.00%	254	296	119.43%	102.49%
64	198	719	0.2749	18.00%	30.00%	216	216	91.47%	91.47%
65	840	3,133	0.2681	18.00%	30.00%	631	940	133.11%	89.36%
66	693	2,360	0.2936	18.00%	27.00%	486	637	142.59%	108.79%
67	439	1,701	0.2584	18.00%	27.00%	353	459	124.50%	95.75%
68	284	1,257	0.2255	18.00%	27.00%	267	339	106.19%	83.64%
69	238	1,022	0.2332	18.00%	27.00%	219	276	108.79%	86.32%
70	191	824	0.2315	18.00%	27.00%	178	223	107.20%	85.57%
71	170	634	0.2687	18.00%	27.00%	138	171	123.44%	99.62%
72	94	438	0.2138	18.00%	27.00%	95	118	98.58%	79.36%
73	78	342	0.2282	18.00%	27.00%	73	92	106.74%	84.70%
74	55	251	0.2177	18.00%	27.00%	52	68	105.00%	80.29%
Total	7,619	29,338				7,706	8,244	98.87%	92.42%
75 & Over	213	788	0.2702	100.00%	100.00%	783	788	27.21%	27.02%
Total	7,832	30,127				8,489	9,032	92.26%	86.71%

¹ For members hired before 09/01/2008, if service is at least 27 years, the rate is 30%.

¹ For members hired after 09/01/2008, if age plus service is at least 87, the rate is 30%.

² 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 Retirement System
County Employees Retirement System (CERS)
Hazardous
Unreduced Retirement Experience - Service Based**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ² (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
20	1,451	5,808	0.2498	22.50%	30.00%	1,307	1,742	111.02%	83.26%
21	981	4,470	0.2195	22.50%	22.50%	1,006	1,006	97.57%	97.56%
22	608	3,601	0.1688	22.50%	18.00%	810	648	75.04%	93.82%
23	561	3,052	0.1837	22.50%	21.00%	687	641	81.65%	87.48%
24	580	2,790	0.2077	30.00%	24.00%	837	670	69.25%	86.52%
25	585	2,529	0.2313	33.00%	27.00%	834	683	70.10%	85.65%
26	623	2,231	0.2794	33.00%	30.00%	736	669	84.65%	93.16%
27	533	1,763	0.3025	36.00%	33.00%	635	582	84.02%	91.62%
28	431	1,353	0.3182	39.00%	36.00%	528	487	81.60%	88.42%
29	359	1,028	0.3493	55.00%	39.00%	566	401	63.50%	89.56%
30	233	784	0.2971	33.00%	39.00%	259	306	90.04%	76.08%
31	127	537	0.2364	33.00%	39.00%	177	210	71.65%	60.50%
32	164	454	0.3611	50.00%	39.00%	227	177	72.22%	92.71%
33	81	260	0.3128	40.00%	39.00%	104	101	78.21%	80.61%
34	36	192	0.1901	40.00%	39.00%	77	75	47.52%	48.56%
35	63	132	0.4748	40.00%	39.00%	53	52	118.71%	120.97%
36	28	94	0.2979	40.00%	39.00%	38	37	74.48%	76.02%
37	40	86	0.4673	40.00%	39.00%	35	34	116.81%	118.59%
38	8	68	0.1160	40.00%	39.00%	27	27	29.00%	29.43%
39	9	53	0.1697	40.00%	39.00%	21	21	42.43%	43.10%
40	22	42	0.5090	40.00%	39.00%	17	17	127.25%	127.16%
Total	7,523	31,330				8,980	8,586	83.78%	87.62%

^{1,2} For members hired before 09/01/2008, the annual rate of service retirement is 100% at age 62. For members hired after 09/01/2008, the annual rate of service retirement is 100% at age 60.

² 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 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 Retirement System
State Police Retirement System (SPRS)
Members hired before 09/01/2008
Unreduced Retirement Experience - Service Based - M&F**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current ¹ (5)	Proposed ² (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
20	92	731	0.1263	22.00%	22.00%	161	161	57.41%	57.41%
21	122	652	0.1870	22.00%	22.00%	143	143	85.00%	85.00%
22	104	580	0.1795	22.00%	22.00%	128	128	81.58%	81.58%
23	96	488	0.1970	28.00%	28.00%	137	137	70.34%	70.34%
24	162	401	0.4035	28.00%	28.00%	112	112	144.09%	144.09%
25	59	261	0.2251	28.00%	28.00%	73	73	80.40%	80.40%
26	59	232	0.2530	28.00%	28.00%	65	65	90.37%	90.37%
27	85	222	0.3808	28.00%	28.00%	62	62	136.01%	136.01%
28	22	114	0.1902	44.00%	44.00%	50	50	43.22%	43.22%
29	60	89	0.6748	44.00%	44.00%	39	39	153.37%	153.37%
30	6	31	0.2087	44.00%	44.00%	14	14	47.43%	47.43%
31	7	40	0.1874	58.00%	58.00%	23	23	32.31%	32.31%
32	0	17	0.0000	58.00%	58.00%	10	10	0.00%	0.00%
33	28	28	1.0000	58.00%	58.00%	16	16	172.41%	172.41%
Total	902	3,886				1,033	1,033	87.27%	87.27%

^{1,2}The annual rate of service retirement is 100% at age 55.

² 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 Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Male**

Age (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	102	2,181	0.0466	8.00%	5.00%	174	109	58.43%	93.28%
56	85	2,047	0.0416	8.00%	5.00%	164	102	51.87%	83.40%
57	84	2,009	0.0418	8.00%	5.00%	161	100	52.19%	84.03%
58	78	1,947	0.0398	8.00%	5.00%	156	97	49.69%	79.91%
59	70	1,814	0.0384	8.00%	5.00%	145	91	48.05%	76.56%
60	80	1,671	0.0480	10.00%	5.00%	167	84	48.06%	95.54%
61	113	1,593	0.0711	20.00%	8.00%	319	127	35.49%	89.14%
62	212	1,474	0.1436	20.00%	15.00%	295	221	71.73%	95.75%
63	179	1,308	0.1370	20.00%	15.00%	262	196	68.40%	91.44%
64	159	1,090	0.1460	20.00%	15.00%	218	164	73.01%	97.05%
Total	1,161	17,135				2,061	1,291	56.35%	89.96%

**Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Female**

Age (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	189	3,882	0.0487	8.00%	5.00%	311	194	60.79%	97.44%
56	178	3,699	0.0482	8.00%	5.00%	296	185	60.24%	96.39%
57	196	3,520	0.0558	8.00%	5.00%	282	176	69.67%	111.64%
58	164	3,356	0.0489	8.00%	5.00%	268	168	61.22%	97.66%
59	178	3,089	0.0576	8.00%	5.00%	247	154	72.01%	115.49%
60	210	2,780	0.0755	10.00%	8.00%	278	222	75.49%	94.53%
61	224	2,490	0.0899	20.00%	9.00%	498	224	44.94%	99.90%
62	423	2,232	0.1893	20.00%	20.00%	446	446	94.77%	94.77%
63	308	1,832	0.1679	20.00%	18.00%	366	330	84.03%	93.20%
64	221	1,474	0.1500	20.00%	16.00%	295	236	74.92%	93.65%
Total	2,291	28,353				3,287	2,335	69.69%	98.10%

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

Retirement Experiences

**Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Male**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	388	3,971	0.0978	3.47%	12.00%	138	477	281.45%	81.42%
56	506	3,811	0.1328	3.91%	12.00%	149	457	339.67%	110.75%
Total	895	7,782				287	934	311.67%	95.77%

**Kentucky Retirement System
Kentucky Employees Retirement System (KERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Female**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	618	5,759	0.1074	3.61%	14.00%	208	806	297.31%	76.73%
56	884	5,399	0.1637	3.95%	14.00%	213	756	414.82%	116.87%
Total	1,502	11,157				421	1,562	356.76%	96.16%

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

Retirement Experiences

**Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Male**

Age (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	145	3,886	0.0373	5.00%	4.00%	194	155	74.74%	93.55%
56	122	3,680	0.0332	6.00%	4.00%	221	147	55.34%	83.19%
57	109	3,602	0.0302	7.00%	4.00%	252	144	43.10%	75.43%
58	118	3,522	0.0335	7.00%	4.00%	247	141	47.74%	83.63%
59	118	3,379	0.0349	8.00%	4.00%	270	135	43.64%	87.29%
60	130	3,168	0.0410	9.00%	4.00%	285	127	45.56%	102.23%
61	137	2,963	0.0462	15.00%	4.00%	444	119	30.83%	115.03%
62	436	2,857	0.1526	18.00%	15.00%	514	429	84.84%	101.65%
63	313	2,361	0.1327	18.00%	15.00%	425	354	73.72%	88.51%
64	267	1,993	0.1340	18.00%	15.00%	359	299	74.39%	89.32%
Total	1,895	31,411				3,211	2,050	59.01%	92.43%

**Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Age Based - Female**

Age (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	264	6,960	0.0379	5.00%	5.00%	348	348	75.75%	75.75%
56	285	6,742	0.0423	6.00%	5.00%	405	337	70.45%	84.67%
57	281	6,607	0.0426	7.00%	5.00%	463	330	60.78%	85.28%
58	326	6,365	0.0512	7.00%	5.00%	446	318	73.11%	102.54%
59	321	5,988	0.0537	8.00%	5.00%	479	299	67.12%	107.52%
60	404	5,620	0.0718	9.00%	8.00%	506	450	79.76%	89.69%
61	427	5,134	0.0832	15.00%	9.00%	770	462	55.45%	92.42%
62	807	4,617	0.1747	18.00%	20.00%	831	923	97.09%	87.41%
63	624	3,705	0.1683	18.00%	18.00%	667	667	93.48%	93.48%
64	433	2,967	0.1458	18.00%	16.00%	534	475	81.02%	91.08%
Total	4,171	54,706				5,449	4,609	76.56%	90.51%

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

Retirement Experiences

**Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Male**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	388	4,654	0.0833	3.93%	11.00%	183	512	211.77%	75.69%
56	489	4,413	0.1108	4.15%	11.00%	183	485	267.08%	100.77%
Total	876	9,067				366	997	239.42%	87.89%

**Kentucky Retirement System
County Employees Retirement System (CERS)
Non-Hazardous
Reduced Retirement Experience - Service Based - Female**

Service (1)	Actual Retirements (2)	Total Exposures (3)	Actual Rate (4)	Assumed Rate		Expected Retirements		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2)/(7) (9)	Proposed (2)/(8) (10)
55	583	5,715	0.1020	6.14%	12.00%	351	686	166.09%	84.98%
56	670	5,147	0.1302	6.31%	12.00%	325	618	206.25%	108.47%
Total	1,253	10,862				676	1,304	185.40%	96.11%

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