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March 21, 2017

CONFIDENTIAL

Ms. Ronda Stegmann
Legislative & Policy Coordinator
Missouri State Employees'
Retirement System
907 Wildwood Drive
Jefferson City, MO 65109

Re: Terminated-Vested Buyout

Dear Ronda:

Enclosed are the results of a supplemental actuarial valuation illustrating the potential impact of a "terminated vested buyout" on the Missouri State Employees' Retirement System as of the June 30, 2016.

If you have any questions or comments, please contact us.

Respectfully submitted,

Brad Lee Armstrong, ASA, EA, FCA, MAAA

David T. Kausch, FSA, EA, FCA, MAAA, PhD

BLA/DTK:sc
Enclosure

Missouri State Employees' Retirement System
Supplemental Actuarial Valuation
as of June 30, 2016

REQUESTED BY: Ms. Ronda Stegmann, Legislative & Policy Coordinator

SUBMITTED BY: Brad Lee Armstrong, ASA, EA, FCA, MAAA, and
David T. Kausch, FSA, EA, FCA, MAAA, PhD
Gabriel, Roeder, Smith & Company

DATE: March 21, 2017

This report presents results of a supplemental actuarial valuation to illustrate the impact of a "terminated vested buyout" in which members accepting the buyout receive 65% of the present value of their future benefit.

This report is intended to describe the financial effect of the proposed changes. The date of the valuation was June 30, 2016. Brad Lee Armstrong and David T. Kausch are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor.

If the scheduled contributions are made (subject to normal year-to-year experience fluctuations), then the System will be able to pay all benefits promised, when due. Our understanding is that the State is currently paying the appropriate total contribution rate.

Actuarial assumptions and methods were consistent with those used in the regular actuarial valuation of the Retirement System on the valuation date, unless otherwise noted. In particular:

- **The assumed rate of interest was 7.65%.** Note that the Board may adopt a lower assumed rate of return for the 2017 valuation.
- Payroll was assumed to increase 3% per year.
- For the regular valuation, the Unfunded Actuarial Accrued Liability is amortized over 30 years, beginning with the Fiscal Year Ending 2016.

We believe the assumptions are internally consistent and reasonable, based on the actual experience of MOSERS. These actuarial assumptions and methods comply with current actuarial standards of practice.

The active group size is assumed to remain constant.

A summary of the terminated vested membership is included below:

	Male	Female	Total
Count	6,898	12,614	19,512
Average Age	47.9	48.2	48.1
Average Benefit*	$6,010	$5,123	$5,437

* *Benefits based on MSEP 2000 benefits, except for those members who are only entitled to an MSEP benefit. For valuation purposes, all benefits will be tested. Benefits for terminated vested members are based on first eligibility for an unreduced benefit.*

Missouri State Employees' Retirement System
Supplemental Actuarial Valuation
as of June 30, 2016

Actuarial Statement

The following actuarial statement illustrates the impact of offering terminated vested members a lump sum distribution equivalent to 65% of the present value of their future benefits and assuming that 50% of the affected members on a liability-weighted basis exercise the option.

	Impact on MOSERS Employer Contributions		
	Present Benefits	**Proposed Benefits**	**Increase/ (Decrease)**
FY 2017-2018 Contribution			
Total Normal Cost	8.60 %	8.60 %	0.00 %
Member Contribution Rate	(1.41)	(1.41)	0.00
UAAL%	12.26	11.91	(0.35)
Total Employer Contribution Rate	19.45 %	19.10 %	(0.35) %
Employer Normal Cost ($ millions)	$ 146.6	$ 146.6	$ -
Estimated Employer Contribution ($ millions)*	$ 396.5	$ 389.4	$ (7.1)
Valuation Results as of June 30, 2016 ($ millions)			
Market Value of Assets (MVA)	$ 8,109.2	$ 7,916.6	$ (192.6)
Actuarial Accrued Liability (AAL)	12,751.2	12,454.9	(296.3)
Actuarial Value of Assets (AVA)	8,878.1	8,685.5	(192.6)
Unfunded Actuarial Accrued Liability (UAAL)	$ 3,873.1	$ 3,769.4	$ (103.7)
Percent Funded	69.6 %	69.7 %	0.1 %

* *Illustrative only. Estimated employer contribution amounts (shown in $ millions) are based on the Total Computed Employer Contribution Rate shown and valuation payroll projected three years to the applicable fiscal year using the valuation assumptions of 3% per year.*

Comment A: The results presented in the actuarial statement were estimated assuming 50% of the terminated vested members elect a buyout. For purposes of this analysis, it was assumed that those taking the buyout would have present value of benefits equal to the average of the group. We are unable to judge the reasonableness of the 50% election assumption. Moreover, if 50% of the vested deferred members do elect a buyout, the average present value of those taking the buyout may be higher or lower than the overall average. The actual impact of such a proposal will vary considerably.

Comment B: Actual lump sums will have to be calculated under a unisex mortality assumption. As of June 30, 2016, there were 19,512 terminated vested members with 6,898 being male and 12,614 being female. The unisex assumption could be selected based on the whole population. Any assumption may expose the system to anti-selection which would affect the results.

Comment C: When the option of choosing plans is available, terminated vested members are reported with two records, one with benefits under the MSEP plan and one with benefits under the MSEP 2000 plan. Because it is unknown what the member will elect at retirement, both records are valued and the plan that produces the higher present value of future benefits is used for valuation purposes. The proposal does not specifically address treatment of the MSEP/MSEP 2000 choice.

Comment D: Offering a lump sum less than the value of the benefit may be perceived as a benefit equity issue. This is a benefit policy decision which may require legal review.

Comment E: Benefits for terminated vested members are assumed to commence on the date of first eligibility for an unreduced benefit as indicted in the valuation data file.

Comment F: Terminated vested participants are allowed to commence benefits at eligibility for early retirement at a reduced amount. If the lump sum is calculated reflecting early retirement eligibility, the impact may vary.

Comment G: The Board adopted a schedule to reduce the assumed rate of return by 0.15% per year for the next four years but has not yet adopted a lower rate. For purposes of this valuation, the assumed rate of return is 7.65% for all years. The baseline results and contribution requirement may be higher if the Board reduces the rate of return assumption beginning with the June 30, 2017 valuation.

Comment H: The calculations are based upon assumptions regarding future events, which may or may not materialize. They are also based upon present and proposed assumptions that are outlined in the report. If you have reason to believe that the assumptions that were used are unreasonable, that the plan provisions are incorrectly described, that important plan provisions relevant to this proposal are not described, or that conditions have changed since the calculations were made, you should contact the authors of this report prior to relying on information in the report.

Comment I: If you have reason to believe that the information provided in this report is inaccurate, or is in any way incomplete, or if you need further information in order to make an informed decision on the subject matter of this report, please contact the authors of the report prior to making such decision.

Comment J: In the event that more than one plan change is being considered, it is very important to remember that the results of separate actuarial valuations cannot generally be added together to produce a correct estimate of the combined effect of all of the changes. The total can be considerably greater than the sum of the parts due to the interaction of various plan provisions with each other, and with the assumptions that must be used.

Comment K: This report is intended to describe the financial effect of the proposed plan changes on the Retirement System. Except as otherwise noted, potential effects on other benefit plans were not considered.

Comment L: The reader of this report should keep in mind that actuarial calculations are mathematical estimates based on current data and assumptions about future events (which may or may not materialize). Please note that actuarial calculations can and do vary from one valuation year to the next. As a result, the cost impact of a benefit change may fluctuate over time, as the demographics of the group changes. Fluctuations from one year to the next may be more pronounced when dealing with small group sizes.

All actuarial assumptions are expectations of future experience, not market measures. The rationale for the actuarial assumption is based on the System's investment policy, capital market expectations, and demographic experience as described in the experience study reports. Actuarial assumptions were last reviewed in conjunction with the July 1, 2010 through June 30, 2015 5-Year Experience Study dated March 28, 2016 and subsequent presentation.

- - - - - - - - - - -*Economic Assumptions* - - - - - - - - - -

The economic assumptions were adopted by the Board on July 16, 2016 to be first effective for the June 30, 2016 valuation.

The investment return rate used in the valuations was 7.65% per year, compounded annually (net after investment expenses). This assumption is used to account for the fact that equal amounts of money payable at different points in time in the future do not have the same value presently.

Pay increase assumptions for individual active members are shown for sample ages on page 11. Part of the assumption for each age is for merit and/or seniority increase, and the other 3.0% recognizes wage inflation. This assumption is used to project a member's current salary to the salaries upon which benefits will be based.

Price inflation is assumed to be 2.5% per year.

The active member payroll is assumed to increase 3.0% annually, which is the portion of the individual pay increase assumptions attributable to wage inflation.

The annual Cost-of-Living Adjustment (COLA) is assumed to be 4.00%, on a compounded basis, when a minimum COLA of 4% is in effect (4.0% for 12 years, 3.06% the next year to reach a cumulative 65% followed by 2.0%). When no minimum COLA is in effect, price inflation is assumed to be 2.5% and the annual COLA is assumed to be 2.0% (80% of 2.5%), on a compounded basis.

The demographic assumptions were adopted by the Board on June 16, 2016 to be first effective for the June 30, 2016 valuation.

The mortality table, for post-retirement mortality, used in evaluating allowances to be paid was the RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%. Related values are shown on page 9. This assumption is used to measure the probabilities of each benefit payment being made after retirement.

The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females. The pre-retirement mortality table used for Long-Term Disability (LTD) members was the RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females.

The probabilities of age and service retirement are shown on page 10. It was assumed that each member will be granted 4 months (5 months for 2011 plan members) of service credit for unused leave upon retirement and 4 months of military service purchases (0 months for 2011 plan members).

The probabilities of withdrawal from service, disability and death-in-service are shown for sample ages on page 8. For disability retirement, impaired longevity was recognized by use of special mortality tables.

The entry age normal actuarial cost method of valuation was used in determining liabilities and normal cost. Each member's normal cost was based on the benefit provisions applicable to that member. The normal cost is projected to the applicable fiscal year. Differences in the past between assumed experience and actuarial experience ("actuarial gains and losses") become part of actuarial accrued liabilities. Unfunded actuarial accrued liabilities are amortized to produce payments, (principal & interest) which are level percents of payroll contributions.

The amortization of the unfunded actuarial accrued liability is based on a closed 30-year amortization period, level percent-of-payroll amortization as adopted by the Board. This method was first effective with the June 30, 2014 valuation. As of the June 30, 2016 valuation, 28 years remain. The amortization is based on the projected unfunded actuarial accrued liability to the beginning of the fiscal year during which the contributions are expected to be made.

- - - - - - - - - - *Non-Economic Assumptions (concluded)* - - - - - - - - - -

Employer contribution dollars were assumed to be ***paid in equal installments*** throughout the employer's fiscal year.

Actuarial value of assets. Valuation assets recognize assumed investment return fully each year. Differences between actual and assumed investment return are phased-in over an open five-year period. Valuation assets are not permitted to deviate from the market value by less than 80% or more than 125%.

The data about persons now covered and about present assets were furnished by the System's administrative staff. Although examined for general reasonableness, the data was not audited by the Actuary.

The liabilities for active members hired on or after January 1, 2011 were based on MSEP 2011 benefits. The liabilities for active members hired on or after July 1, 2000 (April 26, 2005 for Administrative Law Judges) were based on MSEP 2000 benefits. The liabilities for active members hired before July 1, 2000 for Elected Officials, General Assembly, and Uniformed Water Patrol were based on MSEP benefits. The liabilities for all other active members hired before July 1, 2000 were based on the assumption that members would elect MSEP 2000 prior to age 62 and MSEP on or after age 62.

For members on long-term disability, the actuarial accrued liability is the present value of benefit under active assumptions and projecting salary by 3.0% (wage inflation assumption) per year from the year of disability to the current year to reflect indexing of pay in ultimate retirement benefits.

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The actuarial valuation computations were made by or under the supervision of a Member of the American Academy of Actuaries (MAAA).

Missouri State Employees' Retirement System
Separations from Active Employment Before Service Retirement
June 30, 2016

Sample Ages	Years of Service	Percent of Active Members - - - - - - Separating within the Next Year - - - - - Withdrawal ** Men	Withdrawal ** Women	Death* Men	Death* Women	Disability Men	Disability Women
	0	24.0 %	27.5 %				
	1	19.0	21.5				
	2	15.5	16.3				
	3	13.3	13.5				
	4	11.2	11.3				
25	5+	13.5	14.0	0.03 %	0.01 %	0.10 %	0.10 %
30		10.6	11.0	0.03	0.02	0.10	0.10
35		8.2	8.5	0.04	0.03	0.10	0.10
40		5.8	6.0	0.05	0.03	0.36	0.36
45		4.3	4.5	0.07	0.05	0.41	0.41
50		2.9	3.0	0.13	0.08	0.57	0.57
55		2.9	3.0	0.22	0.14	0.77	0.77
60		2.9	3.0	0.40	0.20	1.02	1.02
65		2.9	3.0	0.70	0.30	1.23	1.23
70		2.9	3.0	1.17	0.50	1.23	1.23

* *The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females. 2% of the deaths in active service are assumed to be duty related.*

** *Does not apply to Elected Officials and Legislators.*

Elected Officials and Legislators

Years of Service	Percent of Active Members Separating within the Next Year Withdrawal Male/Female
1	8.0 %
2	8.0
3	8.0
4	8.0
5	12.0
6	12.0
7	12.0
8+	35.0

Missouri State Employees' Retirement System
Post-Retirement and Pre-Retirement Long-Term Disability Mortality Rates

The mortality table for post-retirement mortality was the RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%. The pre-retirement mortality table used for Long-Term Disability (LTD) members was the RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females.

	Post-Retirement		Pre-Retirement LTD	
Age	Men	Women	Men	Women
45	0.0025	0.0021	0.0121	0.0069
50	0.0038	0.0028	0.0152	0.0090
55	0.0058	0.0040	0.0187	0.0121
60	0.0083	0.0058	0.0225	0.0142
65	0.0118	0.0086	0.0268	0.0167
70	0.0179	0.0136	0.0341	0.0223
75	0.0288	0.0223	0.0462	0.0327
80	0.0485	0.0382	0.0658	0.0502
85	0.0848	0.0679	0.0982	0.0761

Sample Attained Ages	Future Life Expectancy (Years)			
	Post-Retirement		Pre-Retirement LTD	
	Men	Women	Men	Women
40	40.95	43.52	31.67	37.37
45	36.33	38.90	28.24	33.43
50	31.84	34.33	25.02	29.63
55	27.52	29.85	21.99	26.06
60	23.38	25.49	19.08	22.66
65	19.40	21.29	16.23	19.25
70	15.62	17.28	13.44	15.89
75	12.13	13.56	10.80	12.77
80	9.03	10.22	8.40	10.01
85	6.42	7.37	6.33	7.71

Retirement Values - June 30, 2016

Sample Attained Ages	Present Value of $1/Month the First Year Increasing 4.0% / 2.0% Yearly (50% J & S)		Present Value of $1/Month the First Year Increasing 2.0% Yearly	
	Old Plan COLA		New Plan COLA	
	Men	Women	Men	Women
40	$232.55	$233.39	$188.71	$192.71
45	224.67	225.75	180.96	186.10
50	215.04	216.17	171.72	177.90
55	203.45	204.34	160.97	167.90
60	189.59	189.93	148.53	155.96
65	172.99	172.53	133.99	141.77
70	153.41	152.07	117.23	125.31
75	131.21	128.92	98.73	106.89
80	107.27	104.17	79.34	87.21
85	83.33	79.90	60.48	67.65

Missouri State Employees' Retirement System
Percent of Eligible Active Members Retiring Next Year

Normal Retirement Pattern					Early Retirement Pattern		
	MSEP and MSEP 2000*			MSEP 2011**		MSEP and MSEP 2000	MSEP 2011
Retirement Age	Percent Eligible 1st Year	Percent Eligible 2nd Year	Percent Eligible 3rd Year	Percent Eligible	Retirement Age	Percent Eligible	Percent Eligible
48	20%						
49	20%	10%					
50	20%	10%	21%				
51	20%	10%	21%				
52	20%	10%	21%				
53	20%	10%	21%				
54	20%	10%	21%				
55	20%	10%	21%	45%			
56	20%	10%	21%	45%			
57	20%	10%	21%	35%	57	2.4%	
58	20%	10%	21%	35%	58	3.1%	
59	20%	10%	21%	30%	59	3.0%	
60	20%	10%	21%	35%	60	5.1%	
61	19%	10%	21%	25%	61	6.0%	
62	18%	22%	29%	40%	62	6.0%	10%
63	16%	18%	24%	30%	63	6.0%	10
64	15%	17%	17%	20%	64	6.0%	10
65	19%	19%	27%	30%	65	6.0%	50
66	24%	25%	28%	25%	66	6.0%	50
67	10%	25%	23%	20%	67	6.0%	
68	20%	25%	23%	20%	68	6.0%	
69	20%	25%	23%	20%	69	6.0%	
70	20%	25%	23%	20%	70	6.0%	
71	20%	25%	23%	20%	71	6.0%	
72	20%	25%	23%	20%	72	6.0%	
73	20%	25%	23%	20%	73	6.0%	
74	20%	25%	23%	20%	74	6.0%	
75	50%	50%	23%	50%	75	6.0%	
76	50%	50%	23%	50%	76	6.0%	
77	75%	75%	23%	75%	77	6.0%	
78	100%	100%	100%	100%	78	100.0	

* *For members hired prior to January 1, 2011.*
** *For members hired on or after January 1, 2011.*

Missouri State Employees' Retirement System
Individual Pay Increase Assumptions
June 30, 2016

Service Index	Merit & Seniority*	Base (Economy)	Increase Next Year
1	5.75%	3.00%	8.75%
2	2.50%	3.00%	5.50%
3	1.50%	3.00%	4.50%
4	1.25%	3.00%	4.25%
5	1.00%	3.00%	4.00%
6	1.00%	3.00%	4.00%
7	1.00%	3.00%	4.00%
8	1.00%	3.00%	4.00%
9	0.75%	3.00%	3.75%
10	0.50%	3.00%	3.50%
15	0.50%	3.00%	3.50%
20	0.50%	3.00%	3.50%
25	0.25%	3.00%	3.25%
30	0.25%	3.00%	3.25%

* *Does not apply to members of the General Assembly.*