Bickmore

EXHIBIT 3
DATE 3.15.2019
SB 160

Montana Municipal Interlocal Authority
Analysis of Proposed Legislation - DRAFT

Firefighter Presumptions (SB 1060)

March 13, 2019

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Exhibits

I. Executive Summary

The purpose of this report is to discuss our findings regarding the potential impact of Senate Bill 1060 (SB 1060). SB 1060 creates a presumption such that certain illnesses are presumed to be occupational for firefighters. Firefighters must meet certain requirements to be eligible for this presumption, and a statute of limitation applies. Our goal is to investigate the financial impact of SB 1060 on the Montana Municipal Interlocal Authority (MMIA), which is a pool of municipalities that covers workers' compensation costs for a large share of firefighters in Montana.

A. Summary of our Findings

SB 1060 creates a presumption that certain types of cancer as well as for cardiovascular disease and pulmonary/respiratory disease are occupational. The presumption applies to active and inactive firefighters, but there is a statute of limitations that firefighters must be within 10 years of active service to be eligible for the presumption. In addition, SB 1060 outlines other criteria for eligibility, such as minimum years of service (which varies by disease) and requirements regarding filing claims on a timely basis, obtaining physical exams, and the use of tobacco products. Using these parameters, we estimate SB 1060 will add approximately of $1,972,000 to MMIA's workers' compensation annual costs. The following table summarizes our findings.

Table 1
Estimated Annual Impact of SB 1060 for MMIA
($000s)

	Annual Impact		
	Active	Inactive	Total
Medical	459	1,036	1,495
Indemnity	321	n/a	321
Loss Adjustment Expense	78	78	156
Total Annual Cost	858	1,114	1,972

The above results are presented on an undiscounted basis, meaning there has been no adjustment for net present value. Also, the results reflect that firefighter cancer risk factors differ from those of the general population, as reported in a study released by NIOSH in 2013[1]. While our results reflect the projected incidence of the cancers listed in SB 1060, we have only reflected deaths from cardiovascular and lung/pulmonary diseases. The incidence of cardiovascular disease in the adult population is very high, and so the cost of non-fatal cardiovascular disease is likey to be quite high.

[1] Daniels RD, Kubale TL, Yiin JH, et al. Occup Environ Med Published Online First Oct. 14, 2013, "Mortality and cancer incidence in a pooled cohort of US firefighters from San Francisco, Chicago, and Philadelphia (1950-2009)."

II. Background

SB 1060 creates a presumption such that certain illnesses are presumed to be occupational for firefighters. Firefighters must meet certain requirements to be eligible for this presumption, and a statute of limitation applies.

The conditions under which certain illnesses and diseases are presumed to be occupational and the death benefits are summarized as follows.

1. Statute of Limitations: Firefighters must be within 10 years of active duty as a firefighter.

2. Minimum Years of Service: Firefighters must have a served a minimum number of years. The minimum number of years varies by disease, as follows:

Table 2
Eligibility Requirement
Minimum Number of Service Years

Disease	Minimum # of Years As Firefighter
Bladder cancer after	12
Brain cancer of any type	10
Breast cancer if the diagnosis occurs before the firefighter is 40 years old and is not known to be associated with a genetic predisposition to breast cancer	5
Cardiovascular disease	10
Colorectal cancer	10
Esophageal cancer	10
Kidney cancer	15
Leukemia	5
Mesothelioma	10
Multiple myeloma	15
Non-Hodgkin's lymphoma	15
Pulmonary or respiratory disease (that can reasonably be caused by firefighting activities)	4

3. Filing of Claim: The firefighter must file a claim on a timely basis.

4. Medical Exams: Firefighters must undergo medical exams, as follows:

    a. At Time of Hire: Firefighter have a medical examination within 90 days of hiring, with no substantial objective medical evidence of the presumptive occupational disease
    b. Subsequent: Firefighter must have subsequent periodic medical examinations at least once every 2 years after being hired.

5. Tobacco Use: Firefighters may not

    a. Be a regular user of tobacco products
    b. Have a history of regular tobacco use in the 10 years preceding the filing of the claim
    c. Have been exposed by a cohabitant who regularly and habitually used tobacco products within the home for a period of 10 or more years prior to the diagnosis.

For the purposes of this study we reflected the statute of limitation and minimum number of years of service. We did not reflect criteria related to the timely filing of a claim, medical exams, and tobacco use.

III. Methodology

Our approach to estimating the annual cost is based on first projecting the number of claims and then multiplying by the expected claim size. It should be noted that whereas we quantified the cost of cancer incidences, we only included the impact of fatalities associated with cardiovascular and lung/pulmonary disease. The incidence of cardiovascular disease is quite large in the adult population, so it is possible that substantial costs are missing from this analysis. Our methodology is outlined in the following steps:

1. Expected Number of Annual Claims: In this step we estimate the annual number of claims, represented by cancer incidences and heart & lung/pulmonary disease fatalities. Annual claims are based on exposure (the number of firefighters) times incidence rates.

    a. Number of Firefighters: In order to estimate the number of firefighters eligible for the proposed presumptions, we separately considered active and inactive firefighters. We based the total number of active firefighters on MMIA (600 active), and we utilized the latest available FURS actuarial report to estimate the number of inactive firefighters (665 at 6/30/18). The active and inactive populations are shown in Exhibit 5, Page 2 and Exhibit 6, Page 3, respectively.

    b. Applying Eligibility Criteria: The distributions of both active and inactive firefighters by age and by years of service are based on the FURS actuarial report as of 6/30/18. We estimated the number of active with various years of service in Exhibit 5, Page 1. We estimated the number of inactive who are within 10 years of active service based on retirement ages in Exhibit 6, Page 3.

    c. Incidence and Fatality Rates: Cancer incidence and heart & lung disease fatality rates were based on the general population and then adjusted to Montana firefighters. Rates were applied to the expected population of firefighters by age. Based on Montana statistics, we assumed that 83% of firefighters are male and 17% are female.

        i. Cancer incidence rates were based on the general population by age & gender from the National Cancer Institute: Surveillance, Epidemiology, and End Results Program (SEER) results (Exhibit 8, page 1). Predictions of incidence by type of cancer are in Exhibit 3, pages 1-11. In addition, we adjusted the general population incidence rates for firefighter-specific exposure by applying factors as indicated in NIOSH study (Exhibit 2, column 2).

ii. Heart and lung/pulmonary disease mortality rates were based on the general population by age and gender from the Center for Disease Control (Exhibit 8, page 2). General incidence rates were not measured.

d. Expected Claims: We projected future claims based on the number of active and inactive projected firefighters who are eligible for the presumption times disease incidence rates. These projections are shown in Exhibits 2 & 3.

2. Average Claim Size: We separately projected medical, indemnity and loss adjustment expense costs for each claim (Exhibit 7, page 1). Medical and indemnity costs were based on the average claim size of permanent total disability claims in Montana as reported by the National Council of Compensation Insurance (NCCI). Indemnity costs were adjusted to reflect the higher average wage of firefighters compared to the general Montana population. We also capped the maximum indemnity benefits to reflect Montana's maximum weekly permanent disability benefit. Loss adjustment expense (LAE) was projected based on the average LAE as a percent of loss (14.4%) for all claims in Montana as reported by the NCCI (Exhibit 2).

3. Total Cost: The projected cost is calculated based on the number of projected claims from step #1 times the projected cost per claim in step #2. Indemnity costs are not applied to inactive firefighters. This is shown in Exhibit 2 and summarized in Exhibit 1.

IV. Discussion of NIOSH Study

One key assumption in this report is the variance in cancer rates between firefighters and the general population. We have reviewed the results of the NIOSH study "Mortality and cancer incidence in a pooled cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950–2009)" and incorporated the findings into our report. The study was released in October 2013. The fact that this study focused on 3 urban areas does raise questions about its applicability to non-urban areas; however, we are not aware of a similar study focused on non-urban firefighters.

The NIOSH Study is directly relevant to the issues addressed in SB 1060 because it specifically analyzed the cancer incidence and mortality rates for firefighters. The study followed a cohort of 29,993 firefighters employed between 1950 and 2009, including 5,313 from San Francisco. Firefighter job classifications included in the study were as follows: "general classifications of firefighters, firefighter paramedics, and fire department arson investigator" (Page 2). The study cites concerns related to cancer risk for firefighters, because firefighters are potentially "exposed to many known carcinogens (e.g., polycyclic aromatic hydrocarbons (PAHs), formaldehyde, benzene, 1,3-butadiene, asbestos, and arsenic) in volatilized combustion and pyrolysis products or debris" (Page 1).

The study did not find elevated mortality rates for firefighters in general; however, it did find elevated incidence and mortality due to specific types of cancer. It is possible that the elevated rate of cancer is offset by the fact that firefighters are typically healthier than the general population, thus their overall mortality is not elevated. For example, the study cites that firefighters are less likely to smoke than the general population.

The key findings of the NIOSH study are summarized in the following table (Page 4 of NIOSH). This shows that the firefighters in this study had higher mortality rates than the general U.S. population for cancer in general and for most specific types of cancer. However, only eight of the nineteen types of cancer included in the study had at least a 95% confidence of elevated cancer mortality.

Table 3
Key Findings of NIOSH Study (Mortality)

Underlying Cause (Cancer)	# of Observations (Deaths)[1]	% of Observations Above/ (Below) Expected[2]	Range of 95% Confidence Level[3]	Likelihood That Cancer is Elevated, Based on LeMasters *et al*[4]
	(A)	(B)	(C)	(D)
All Cancers	3,285	14%	10% to 18%	Unlikely
Oesophagus	113	39%	14% to 67%	Unlikely
Stomach	110	10%	-9% to 33%	Possible
Intestine	326	30%	16% to 44%	NA
Large intestine	264	31%	16% to 48%	Possible
Small intestine	8	66%	-28% to 227%	NA
Rectum	89	45%	16% to 78%	Possible
Lung	1,046	10%	4% to 17%	Unlikely
Breast	8	39%	-40% to 173%	NA
Prostate	282	9%	-4% to 22%	Probable
Other male genital	<5	-53%	-87% to 20%	NA
Testes	<5	-27%	-85% to 114%	Possible
Kidney	94	29%	5% to 58%	Unlikely
Bladder	84	-1%	-21% to 22%	Unlikely
Brain	73	1%	-21% to 27%	Possible
Non-Hodgkin lymphoma	123	17%	-3% to 40%	Probable
Leukaemia	122	10%	-9% to 31%	Possible
Multiple myeloma	42	-11%	-36% to 20%	Probable
Mesothelioma	12	100%	3% to 249%	NA
Buccal and pharynx	94	40%	13% to 72%	Possible

[1] The number of deaths of those included in the study.

[2] The percentage that the observed number of deaths was greater (or less) than expected. The expected number of deaths was based on mortality assumptions from the general U.S. population. The NIOSH study calculates Standardized Mortality Ratios (SMRs), which represents the number of observed divided by expected mortalities. Therefore, the SMR minus one equals the percentage that observed mortality is above or below expected mortality.

[3] This is the statistical range in which one can be 95% sure that cancers of firefighters are above or below the general population. For example, the range for all cancers is 10% to 18%. This means that based on the findings in this report, one can be 95% confident that firefighters such as those included in this study have a risk of mortality due to cancer that is between 10% and 18% above that of the general U.S. population.

[4] Prior to the release of the NIOSH article, LeMasters et al released a meta-analysis, which is essentially a review of other studies. The findings of this meta-analysis are summarized in this column.

In addition to the issue of whether firefighters generally have an elevated risk of cancer, there are several other issues discussed in the NIOSH study that are relevant to SB 1060.

1. Gender: About 3.3% of the firefighters included in the NIOSH study were female (Page 3). Females did not show an elevated risk for mortality due to cancer, but females did have a slightly elevated risk of the incidence of cancer (Page 5). However, it should be emphasized that females made up a relatively small sample size.

2. Race: About 16.7% of the firefighters included in the NIOSH study were non-Caucasian (Page 3). Non-Caucasians had a decreased risk of overall mortality and mortality due to cancer (Page 5). The incidence of cancer among non-Caucasians was close to expected levels.

3. Regional Differences: Since MMIA is specifically interested in the experience of firefighters in Montana, it is important to examine if the results varied by location. The NIOSH study did not find significant differences in cancer rates between the three locations analyzed: San Francisco, Chicago, and Philadelphia (Page 8).

4. Age Groups: The NIOSH study did not find substantial differences in the amount that firefighter cancer mortality varied from general U.S. cancer mortality by age group.

5. Amount That Observed Mortality Exceeds Expected: We believe the NIOSH study could be helpful to public policymakers in evaluating workers' compensation presumptions. For example, the NIOSH study recorded 3,285 firefighter cancer death observations, which was 14% higher than would have been expected using the general U.S. population as a reference. This means that if the group in the study had been the general U.S. population, then one would have expected about 2,880 cancer deaths. The additional 405 deaths (3,285 minus 2,880) are associated with risks and exposures faced by firefighters. For some types of cancer the firefighter mortality was slightly higher than expected, whereas for other types it was much higher than expected.

V. Limitations

There are several limitations in the findings of this report regarding the impact of SB 1060. Many of the key limitations are elaborated below.

1. Non-Fatal Heart and Lung/Pulmonary Disease Costs: This report excludes these codes, which could be substantial.

2. Cost per Claim: We have assumed that claims arising from the proposed presumptions will have costs similar to those of other permanent total disability claims in Montana. While the other permanent total disability claims may be similar in seriousness, they arise from different medical conditions and so may have differing costs.

3. Mortality due to Heart and Lung/Pulmonary Disease: We have assumed that firefighters and the general population have similar mortality rates related to these diseases, after adjusting for age and gender mix.

4. NIOSH Study: We have incorporated the results of the NIOSH study to adjust our expectation of firefighter cancer incidence. However, this study is based on data from urban centers and so may have limited applicability to non-urban firefighters.

Exhibits

Montana Municipal Interlocal Authority
Estimated Annual Cost of Cancer & Heart/Lung Disease Presumption

All Firefighters (Active and Inactive)

Cost	Active (1)	Inactive (2)	Total (3) (1) + (2)
Medical	459,000	1,036,000	1,495,000
Indemnity	321,000	-	321,000
Loss Adjustment Expense	78,000	78,000	156,000
Total	858,000	1,114,000	1,972,000

(1) Exhibit 2, Page 1
(2) Exhibit 2, Page 2

Montana Municipal Interlocal Authority

Estimated Annual Cost of Cancer & Heart/Lung Disease Presumption

Active Firefighters

Disease	Annual # of Firefighters Diagnosed Disease Unadjusted (1)	Adjustment for Firefighter Incidence Rates (2)	Annual # of Firefighters Diagnosed with Disease Adjusted (3)=(1)x(2)	Average Medical Cost/ Claim (4)	Average Indemnity Cost/ Claim (5)	Loss & LAE/ Loss (6)	Loss & LAE (7) (3)x[(4)+(5)]x(6)
Cancer (Incidence)							
Bladder/Urinary	0.03	1.12	0.03	640,000	448,000	1.144	36,036
Brain	0.02	1.02	0.02	640,000	448,000	1.144	21,758
Breast	0.08	1.26	0.10	640,000	448,000	1.144	124,915
Colorectal	0.08	1.18	0.10	640,000	448,000	1.144	123,182
Esophagus	0.01	1.62	0.02	640,000	448,000	1.144	20,543
Kidney	0.03	1.27	0.04	640,000	448,000	1.144	51,572
Leukemia	0.03	0.94	0.03	640,000	448,000	1.144	39,443
Lung	0.08	1.12	0.09	640,000	448,000	1.144	112,502
Mesothelioma	0.00	2.29	0.00	640,000	448,000	1.144	3,173
Myeloma	0.01	0.72	0.01	640,000	448,000	1.144	8,405
Non-Hodgkins Lymphoma	0.03	0.99	0.03	640,000	448,000	1.144	36,588
Other Disease (Mortality Only)							
Heart Disease	0.22	1.00	0.22	640,000	448,000	1.144	279,851
Chronic Lower Respiratory	0.03	1.00	0.03	640,000	448,000	1.144	35,105
Total	0.66	1.09	0.72	640,000	448,000	1.144	857,967

(1) Exhibit 3: Subject to proposed legislative constraints regarding years of service

(2) Based on Niosh Study: Mortality and cancer incidence in a pooled cohortof US firefighters from San Francisco, Chicago and Philadelphia (1950–2009)
Daniels RD,Kubale TL, Yiin JH, et al.Occup Environ MedPublished Online First: October 14, 2013 doi:10.1136/oemed-2013-101662

(4),(5) Exhibit 7, Page 1

(6) 2018 NCCI Statistical Bulletin (Permanent Total)

Montana Municipal Interlocal Authority

Exhibit 2
Page 2

Estimated Annual Cost of Cancer & Heart/Lung Disease Presumption

Inactive Firefighters (Retired and Disability)

Disease	Annual # of Firefighters Diagnosed with Disease Unadjusted (1)	Adjustment for Firefighter Incidence Rates (2)	Annual # of Firefighters Diagnosed with Disease Adjusted (3)=(1)x(2)	Average Medical Cost/ Claim (4)	Average Indemnity Cost/ Claim (5)	Loss & LAE/ Loss (6)	Loss & LAE (7) (3)x[(4)+(5)]x(6)
Cancer (Incidence)							
Bladder/Urinary	0.09	1.12	0.10	640,000	-	1.144	72,024
Brain	0.02	1.02	0.02	640,000	-	1.144	18,222
Breast	0.10	1.26	0.13	640,000	-	1.144	94,543
Colorectal	0.18	1.18	0.21	640,000	-	1.144	152,806
Esophagus	0.03	1.62	0.04	640,000	-	1.144	31,939
Kidney	0.09	1.27	0.11	640,000	-	1.144	82,475
Leukemia	0.05	0.94	0.05	640,000	-	1.144	34,370
Lung	0.22	1.12	0.25	640,000	-	1.144	180,633
Mesothelioma	0.00	2.29	0.01	640,000	-	1.144	5,646
Myeloma	0.03	0.72	0.02	640,000	-	1.144	15,696
Non-Hodgkins Lymphoma	0.08	0.99	0.08	640,000	-	1.144	57,522
Other Disease (Mortality Only)							
Heart Disease	0.50	1.00	0.50	640,000	-	1.144	368,002
Chronic Lower Respiratory	0.10	1.00	0.10	640,000	-	1.144	71,878
Total	1.49	1.09	1.62	640,000	-	1.144	1,113,877

(1) Exhibit 6: Subject to proposed legislative constraints regarding years of service

(2) Based on Niosh Study: Mortality and cancer incidence in a pooled cohortof US firefighters from San Francisco, Chicago and Philadelphia (1950–2009)
Daniels RD,Kubale TL, Yiin JH, et al.Occup Environ MedPublished Online First: October 14, 2013 doi:10.1136/oemed-2013-101662

(4),(5) Exhibit 7, Page 1

(6) 2018 NCCI Statistical Bulletin

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Bladder Cancer

Age	# with 12 or more Years of Service (1)	Incidence Rate Bladder Cancer (2)	# of Incidences of Bladder Cancer (3) (1) x (2)	Avg. Salary with 12 or more Yrs. of Service (4)
< 25	-	0.003%	-	-
25 to 29	-	0.003%	-	-
30 to 34	9	0.003%	0.000	74,580
35 to 39	30	0.003%	0.001	80,508
40 to 44	51	0.003%	0.001	86,007
45 to 49	71	0.003%	0.002	87,090
50 to 54	38	0.033%	0.012	91,326
55 to 59	22	0.033%	0.007	92,328
60 to 64	4	0.033%	0.001	96,391
65 to 69	-	0.127%	-	-
70 and up	1	0.127%	0.001	83,179
Total	224	0.012%	0.026	90,482

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Brain Cancer

Age	# with 10 or more Years of Service (1)	Incidence Rate Brain Cancer (2)	# of Incidences of Brain Cancer (3) (1) x (2)	Avg. Salary with 10 or more Yrs. of Service (4)
< 25	-	0.004%	-	-
25 to 29	-	0.004%	-	-
30 to 34	20	0.004%	0.001	75,383
35 to 39	61	0.004%	0.002	78,422
40 to 44	77	0.004%	0.003	83,768
45 to 49	82	0.004%	0.003	86,370
50 to 54	39	0.011%	0.004	91,131
55 to 59	23	0.011%	0.003	91,525
60 to 64	5	0.011%	0.000	97,672
65 to 69	-	0.020%	-	-
70 and up	1	0.020%	0.000	83,179
Total	308	0.006%	0.017	86,493

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Breast Cancer

Age	# with 5 or more Years of Service (1)	Incidence Rate Breast Cancer (2)	# of Incidences of Breast Cancer (3) (1) x (2)	Avg. Salary with 5 or more Yrs. of Service (4)
< 25	-	0.013%	-	-
25 to 29	14	0.013%	0.002	68,566
30 to 34	72	0.013%	0.009	69,346
35 to 39	88	0.013%	0.011	76,469
40 to 44	99	0.013%	0.012	81,637
45 to 49	89	0.013%	0.011	86,546
50 to 54	41	0.047%	0.019	91,321
55 to 59	23	0.047%	0.011	91,525
60 to 64	7	0.047%	0.003	95,175
65 to 69	-	0.080%	-	-
70 and up	1	0.080%	0.001	83,179
Total	434	0.018%	0.080	84,229

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Colorectal Cancer

Age	# with 10 or more Years of Service (1)	Incidence Rate Colorectal Cancer (2)	# of Incidences of Colorectal Cancer (3) (1) x (2)	Avg. Salary with 10 or more Yrs. of Service (4)
< 25	-	0.012%	-	-
25 to 29	-	0.012%	-	-
30 to 34	20	0.012%	0.002	75,383
35 to 39	61	0.012%	0.007	78,422
40 to 44	77	0.012%	0.010	83,768
45 to 49	82	0.012%	0.010	86,370
50 to 54	39	0.079%	0.031	91,131
55 to 59	23	0.079%	0.018	91,525
60 to 64	5	0.079%	0.004	97,672
65 to 69	-	0.161%	-	-
70 and up	1	0.161%	0.001	83,179
Total	308	0.027%	0.084	88,341

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Esophageal Cancer

Age	# with 10 or more Years of Service (1)	Incidence Rate Esphageal Cancer (2)	# of Incidences of Esphageal Cancer (3) (1) x (2)	Avg. Salary with 10 or more Yrs. of Service (4)
< 25	-	0.001%	-	-
25 to 29	-	0.001%	-	-
30 to 34	20	0.001%	0.000	75,383
35 to 39	61	0.001%	0.001	78,422
40 to 44	77	0.001%	0.001	83,768
45 to 49	82	0.001%	0.001	86,370
50 to 54	39	0.011%	0.005	91,131
55 to 59	23	0.011%	0.003	91,525
60 to 64	5	0.011%	0.001	97,672
65 to 69	-	0.029%	-	-
70 and up	1	0.029%	0.000	83,179
Total	308	0.003%	0.010	89,480

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Kidney Cancer

Age	# with 15 or more Years of Service (1)	Incidence Rate Kidney Cancer (2)	# of Incidences of Kidney Cancer (3) (1) x (2)	Avg. Salary with 15 or more Yrs. of Service (4)
< 25	-	0.007%	-	-
25 to 29	-	0.007%	-	-
30 to 34	1	0.007%	0.000	73,376
35 to 39	9	0.007%	0.001	83,637
40 to 44	33	0.007%	0.002	89,366
45 to 49	63	0.007%	0.005	88,168
50 to 54	37	0.039%	0.014	91,618
55 to 59	21	0.039%	0.008	93,531
60 to 64	4	0.039%	0.001	94,470
65 to 69	-	0.081%	-	-
70 and up	1	0.081%	0.001	83,179
Total	169	0.019%	0.033	91,191

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Leukemia

Age	# with 5 or more Years of Service (1)	Incidence Rate Leukemia (2)	# of Incidences of Leukemia (3) (1) x (2)	Avg. Salary with 5 or more Yrs. of Service (4)
< 25	-	0.005%	-	-
25 to 29	14	0.005%	0.001	68,566
30 to 34	72	0.005%	0.004	69,346
35 to 39	88	0.005%	0.005	76,469
40 to 44	99	0.005%	0.005	81,637
45 to 49	89	0.005%	0.005	86,546
50 to 54	41	0.020%	0.008	91,321
55 to 59	23	0.020%	0.005	91,525
60 to 64	7	0.020%	0.001	95,175
65 to 69	-	0.057%	-	-
70 and up	1	0.057%	0.001	83,179
Total	434	0.008%	0.034	84,372

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Lung Cancer

Age	# with 4 or more Years of Service (1)	Incidence Rate Lung Cancer (2)	# of Incidences of Lung Cancer (3) (1) x (2)	Avg. Salary with 4 or more Yrs. of Service (4)
< 25	-	0.005%	-	-
25 to 29	14	0.005%	0.001	66,923
30 to 34	72	0.005%	0.004	69,246
35 to 39	88	0.005%	0.004	75,677
40 to 44	99	0.005%	0.005	81,299
45 to 49	89	0.005%	0.004	86,546
50 to 54	41	0.085%	0.035	91,321
55 to 59	23	0.085%	0.019	91,525
60 to 64	7	0.085%	0.006	94,100
65 to 69	-	0.297%	-	-
70 and up	1	0.297%	0.003	83,179
Total	434	0.019%	0.081	88,467

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Mesothelioma

Age	# with 10 or more Years of Service (1)	Incidence Rate Mesothelioma (2)	# of Incidences of Mesothelioma (3) (1) x (2)	Avg. Salary with 10 or more Yrs. of Service (4)
< 25	-	0.000%	-	-
25 to 29	-	0.000%	-	-
30 to 34	20	0.000%	0.000	75,383
35 to 39	61	0.000%	0.000	78,422
40 to 44	77	0.000%	0.000	83,768
45 to 49	82	0.000%	0.000	86,370
50 to 54	39	0.001%	0.000	91,131
55 to 59	23	0.001%	0.000	91,525
60 to 64	5	0.001%	0.000	97,672
65 to 69	-	0.006%	-	-
70 and up	1	0.006%	0.000	83,179
Total	308	0.000%	0.001	88,625

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Multiple Myeloma

Age	# with 15 or more Years of Service (1)	Incidence Rate Multiple Myeloma (2)	# of Incidences of Multiple Myeloma (3) (1) x (2)	Avg. Salary with 15 or more Yrs. of Service (4)
< 25	-	0.001%	-	-
25 to 29	-	0.001%	-	-
30 to 34	1	0.001%	0.000	73,376
35 to 39	9	0.001%	0.000	83,637
40 to 44	33	0.001%	0.000	89,366
45 to 49	63	0.001%	0.001	88,168
50 to 54	37	0.012%	0.005	91,618
55 to 59	21	0.012%	0.003	93,531
60 to 64	4	0.012%	0.000	94,470
65 to 69	-	0.034%	-	-
70 and up	1	0.034%	0.000	83,179
Total	169	0.006%	0.009	91,420

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Active Firefighters
Non-Hodgkins Lymphoma

Age	# with 15 or more Years of Service (1)	Incidence Rate Non-Hodgkins Lymphoma (2)	# of Incidences of Non-Hodgkins Lymphoma (3) (1) x (2)	Avg. Salary with 15 or more Yrs. of Service (4)
< 25	-	0.008%	-	-
25 to 29	-	0.008%	-	-
30 to 34	1	0.008%	0.000	73,376
35 to 39	9	0.008%	0.001	83,637
40 to 44	33	0.008%	0.003	89,366
45 to 49	63	0.008%	0.005	88,168
50 to 54	37	0.034%	0.012	91,618
55 to 59	21	0.034%	0.007	93,531
60 to 64	4	0.034%	0.001	94,470
65 to 69	-	0.082%	-	-
70 and up	1	0.082%	0.001	83,179
Total	169	0.018%	0.030	90,977

(1) Exhibit 5, Page 1
(2) Exhibit 8
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Mortality from Heart Disease

Active Firefighters
Heart Disease (Mortality Only)

Age	# with 10 or more Years of Service (1)	Incidence Rate Heart Disease (2)	# of Incidences of Heart (3) (1) x (2)	Avg. Salary with 10 or more Yrs. of Service (4)
< 25	-	0.004%	-	-
25 to 29	-	0.006%	-	-
30 to 34	20	0.012%	0.002	75,383
35 to 39	61	0.023%	0.014	78,422
40 to 44	77	0.042%	0.032	83,768
45 to 49	82	0.074%	0.061	86,370
50 to 54	39	0.128%	0.050	91,131
55 to 59	23	0.201%	0.046	91,525
60 to 64	5	0.295%	0.013	97,672
65 to 69	-	0.409%	-	-
70 and up	1	0.609%	0.005	83,179
Total	308	0.073%	0.225	88,094

(1) Exhibit 5, Page 1
(2) Exhibit 8, Page 2
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Mortality from Lung Disease

Active Firefighters
Chronic Lower Respiratory Disease (Mortality)

Age	# with 10 or more Years of Service (1)	Incidence Rate Heart Disease (2)	# of Incidences of Heart (3) (1) x (2)	Avg. Salary with 10 or more Yrs. of Service (4)
< 25	1	0.001%	0.000	-
25 to 29	21	0.001%	0.000	-
30 to 34	76	0.001%	0.001	75,383
35 to 39	95	0.001%	0.001	78,422
40 to 44	100	0.002%	0.002	83,768
45 to 49	89	0.005%	0.004	86,370
50 to 54	41	0.014%	0.006	91,131
55 to 59	23	0.032%	0.007	91,525
60 to 64	8	0.059%	0.005	97,672
65 to 69	-	0.105%	-	-
70 and up	1	0.197%	0.002	83,179
Total	455	0.006%	0.028	89,104

(1) Exhibit 5, Page 1
(2) Exhibit 8, Page 2
(4) Exhibit 5, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Inactive Firefighters
Cancer Incidence Rates (Unadjusted for firefighter population)

Age	Bladder (1)	Brain (2)	Breast (3)	Colo-Rectal (4)	Esopha-geal (5)	Kidney (6)	Leuke-mia (7)	Lung (8)	Meso-thelioma (9)	Mye loma (10)	Non-Hodg. (11)	Total (12)
<50	0.003%	0.004%	0.013%	0.012%	0.001%	0.007%	0.005%	0.005%	0.000%	0.001%	0.008%	0.059%
50 to 54	0.033%	0.011%	0.047%	0.079%	0.011%	0.039%	0.020%	0.085%	0.001%	0.012%	0.034%	0.373%
55 to 59	0.033%	0.011%	0.047%	0.079%	0.011%	0.039%	0.020%	0.085%	0.001%	0.012%	0.034%	0.373%
60 to 64	0.033%	0.011%	0.047%	0.079%	0.011%	0.039%	0.020%	0.085%	0.001%	0.012%	0.034%	0.373%
65 to 69	0.127%	0.020%	0.080%	0.161%	0.029%	0.081%	0.057%	0.297%	0.006%	0.034%	0.082%	0.973%
70 to 74	0.127%	0.020%	0.080%	0.161%	0.029%	0.081%	0.057%	0.297%	0.006%	0.034%	0.082%	0.973%

Incidence Rates Based on Exhibit 8

Montana Municipal Interlocal Authority

# of Active Full-time Firefighters & Average Salary
Eligible for Presumption Based on Years of Service

Age	# of Full-time Firefighters					Average Salary				
	<========= Years of Service =========>					<========= Years of Service =========>				
	4 or more	5 or more	10 or more	12 or more	15 or more	4 or more	5 or more	10 or more	12 or more	15 or more
< 25	1	-	-	-	-	-	-	-	-	-
25 to 29	21	14	-	-	-	66,923	68,566	-	-	-
30 to 34	76	72	20	9	1	69,246	69,346	75,383	74,580	73,376
35 to 39	95	88	61	30	9	75,677	76,469	78,422	80,508	83,637
40 to 44	100	99	77	51	33	81,299	81,637	83,768	86,007	89,366
45 to 49	89	89	82	71	63	86,546	86,546	86,370	87,090	88,168
50 to 54	41	41	39	38	37	91,321	91,321	91,131	91,326	91,618
55 to 59	23	23	23	22	21	91,525	91,525	91,525	92,328	93,531
60 to 64	8	7	5	4	4	94,100	95,175	97,672	96,391	94,470
65 to 69	-	-	-	-	-	-	-	-	-	-
70 and up	1	1	1	1	1	83,179	83,179	83,179	83,179	83,179
Total	455	434	308	224	169	79,966	80,802	84,588	86,866	89,607

Based on Exhibit 5, Page 2 and Exhibit 5, Page 5

Montana Municipal Interlocal Authority
Reported by Bureau of Labor and Statistics

# of Active Full-time Firefighters
By Age and # of Years of Service

Age	<========== Years of Service ==========>												
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Total
< 25	9	6	5	2	-	-	-	-	-	-	-	-	21
25 to 29	14	10	17	14	14	-	-	-	-	-	-	-	68
30 to 34	11	9	11	8	52	19	1	-	-	-	-	-	112
35 to 39	6	8	6	15	28	51	9	-	-	-	-	-	122
40 to 44	1	4	2	3	22	44	29	4	-	-	-	-	108
45 to 49	-	2	1	-	6	19	39	23	2	-	-	-	92
50 to 54	1	-	1	-	2	3	9	17	11	-	-	-	43
55 to 59	-	-	1	-	-	2	1	6	9	5	-	-	24
60 to 64	-	-	1	2	3	1	1	-	2	1	-	-	10
65 to 69	-	-	-	-	-	-	-	-	-	-	-	-	-
70 and up	-	-	-	-	-	-	1	-	-	-	-	-	1
Total	41	39	43	43	126	139	90	50	24	6	-	-	600

Total Based on Total MMIA Active Firefighters as of 2019
Distribution Based on FURS Exhibit 5, Page 3

Montana Municipal Interlocal Authority
Reported by Montana Unified Firefighter Reporting System

Percent of Active Full-time Firefighters
By Age and # of Years of Service

Age	<========== Years of Service ==========>												
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Total
< 25	1.5%	0.9%	0.8%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.5%
25 to 29	2.3%	1.7%	2.7%	2.3%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.3%
30 to 34	1.8%	1.5%	1.8%	1.4%	8.7%	3.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	18.6%
35 to 39	0.9%	1.4%	0.9%	2.4%	4.6%	8.5%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	20.3%
40 to 44	0.2%	0.6%	0.3%	0.5%	3.7%	7.3%	4.9%	0.6%	0.0%	0.0%	0.0%	0.0%	18.0%
45 to 49	0.0%	0.3%	0.2%	0.0%	1.1%	3.2%	6.4%	3.8%	0.3%	0.0%	0.0%	0.0%	15.3%
50 to 54	0.2%	0.0%	0.2%	0.0%	0.3%	0.5%	1.5%	2.7%	1.8%	0.0%	0.0%	0.0%	7.2%
55 to 59	0.0%	0.0%	0.2%	0.0%	0.0%	0.3%	0.2%	1.1%	1.5%	0.8%	0.0%	0.0%	4.0%
60 to 64	0.0%	0.0%	0.2%	0.3%	0.5%	0.2%	0.2%	0.0%	0.3%	0.2%	0.0%	0.0%	1.7%
65 to 69	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
70 and up	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Total	6.9%	6.4%	7.2%	7.2%	21.1%	23.2%	15.0%	8.2%	4.0%	0.9%	0.0%	0.0%	100.0%

Distribution Based on Exhibit 5, Page 4

Montana Municipal Interlocal Authority
Reported by Montana Unified Firefighter Reporting System (FURS)

# of Active Full-time Firefighters
By Age and # of Years of Service

Age	<========== Years of Service ==========>											
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Total
< 25	10	6	5	2	0	0	0	0	0	0	0	0	23
25 to 29	15	11	18	15	15	0	0	0	0	0	0	0	74
30 to 34	12	10	12	9	57	21	1	0	0	0	0	0	122
35 to 39	6	9	6	16	30	56	10	0	0	0	0	0	133
40 to 44	1	4	2	3	24	48	32	4	0	0	0	0	118
45 to 49	0	2	1	0	7	21	42	25	2	0	0	0	100
50 to 54	1	0	1	0	2	3	10	18	12	0	0	0	47
55 to 59	0	0	1	0	0	2	1	7	10	5	0	0	26
60 to 64	0	0	1	2	3	1	1	0	2	1	0	0	11
65 to 69	0	0	0	0	0	0	0	0	0	0	0	0	0
70 and up	0	0	0	0	0	0	1	0	0	0	0	0	1
Total	45	42	47	47	138	152	98	54	26	6	0	0	655

FURS State of Montana Actuarial Valuation as of 6/30/18: Table D-1, Page 44

Montana Municipal Interlocal Authority
Reported by Montana Unified Firefighter Reporting System (FURS)

Average Salary of Active Firefighters
By Age and # of Years of Service

Age	<========== Years of Service ==========>											
	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Total
< 25	40,494	55,124	64,380	67,555	0	0	0	0	0	0	0	0	51,856
25 to 29	46,616	54,886	54,862	63,638	68,566	0	0	0	0	0	0	0	57,751
30 to 34	53,340	57,926	62,700	67,486	67,021	75,477	73,376	0	0	0	0	0	66,047
35 to 39	50,945	52,595	73,772	66,198	72,171	77,487	83,637	0	0	0	0	0	72,343
40 to 44	68,666	50,430	62,317	56,515	74,181	79,569	88,864	93,338	0	0	0	0	79,502
45 to 49	0	73,898	48,064	0	88,811	80,452	89,025	86,320	93,361	0	0	0	85,908
50 to 54	48,320	0	80,539	0	95,483	84,509	87,877	89,269	98,272	0	0	0	90,175
55 to 59	0	0	113,220	0	0	68,007	134,935	89,677	89,233	99,390	0	0	92,353
60 to 64	0	0	78,797	85,500	91,012	110,482	92,675	0	93,300	98,605	0	0	91,927
65 to 69	0	0	0	0	0	0	0	0	0	0	0	0	n/a
70 and up	0	0	0	0	0	0	83,179	0	0	0	0	0	83,179
Total	48,154	55,634	62,760	65,889	71,593	78,507	88,592	88,258	94,035	99,259	n/a	n/a	74,582

FURS State of Montana Actuarial Valuation as of 6/30/18: Table D-1, Page 44

Montana Municipal Interlocal Authority
Estimated Annual Incidence of Cancer

Inactive Firefighters
Estimated Incidence Count (Unadjusted for firefighter population)

Age	Bladder (1)	Brain (2)	Breast (3)	Colo-Rectal (4)	Esopha-geal (5)	Kidney (6)	Leuke-mia (7)	Lung (8)	Meso-thelioma (9)	Mye loma (10)	Non-Hodg. (11)	Total (12)
<50	0.0005	0.0008	0.0025	0.0025	0.0002	0.0014	0.0010	0.0010	0.0000	0.0003	0.0016	0.0118
50 to 54	0.0142	0.0048	0.0206	0.0344	0.0050	0.0172	0.0089	0.0370	0.0005	0.0054	0.0147	0.1626
55 to 59	0.0223	0.0075	0.0324	0.0542	0.0079	0.0271	0.0140	0.0582	0.0008	0.0084	0.0231	0.2559
60 to 64	0.0183	0.0061	0.0265	0.0444	0.0065	0.0221	0.0115	0.0476	0.0006	0.0069	0.0189	0.2094
65 to 69	0.0267	0.0042	0.0167	0.0339	0.0060	0.0171	0.0119	0.0626	0.0012	0.0072	0.0173	0.2050
70 to 74	0.0059	0.0009	0.0037	0.0075	0.0013	0.0038	0.0026	0.0138	0.0003	0.0016	0.0038	0.0453
Total	0.0878	0.0244	0.1025	0.1769	0.0269	0.0887	0.0499	0.2203	0.0034	0.0298	0.0794	0.8900

Based on # of Eligible Inactive (Exhibit 6, Page 2) times incidence rates (Exhibit 4, Page 1

Montana Municipal Interlocal Authority
Estimated Annual Mortality from Heart/Lung Disease

Inactive Firefighters
Estimated Incidence Count (Unadjusted for firefighter population)

Age	Heart Disease (1)	Chronic Lower Respiratory Disease (2)	Total (1)
<50	0.0148	0.0010	0.0158
50 to 54	0.0558	0.0061	0.0619
55 to 59	0.1378	0.0216	0.1595
60 to 64	0.1655	0.0334	0.1989
65 to 69	0.0860	0.0222	0.1082
70 to 74	0.0283	0.0092	0.0375
75 to 79	0.0143	0.0047	0.0191
Total	0.5026	0.0982	0.6008

Based on # of Eligible Inactive (Exhibit 6, Page 2) times incidence rates (Exhibit 8, Page 2)

Montana Municipal Interlocal Authority
Reported by Montana Unified Firefighter Reporting System

# of Retired & Inactive Firefighters
By Age

Age	Service Retirees (1)	Disability Retirees (2)	Total Service and Disability (3) (1)+(2)	% Within 10 Years of Last Service (4)	Total Count Within 10 Year of Last Service (5) (3)x(4)
<50	12	8	20	100.0%	20
50 to 54	40	6	46	94.8%	44
55 to 59	74	4	78	88.0%	69
60 to 64	85	7	92	61.1%	56
65 to 69	74	13	87	24.2%	21
70 to 74	68	11	79	5.9%	5
75 to 79	55	3	58	2.6%	2
80 to 84	27	5	32	0.8%	0
85 to 89	12	4	16	0.2%	0
90 to up	6	1	7	0.0%	-
Total	453	62	515	3.7765762	216

(1),(2) FURS State of Montana Actuarial Valuation as of 6/30/18: Page 48
(4) Judgment: Based on Average Retirement age of 51 (per FURST Actuarial study, page 54)

Montana Municipal Interlocal Authority
Average Cost per Claim

		Medical	
(1)		5-Year Average Medical Cost per Permanent Total Claim	640,000
		Based on 2018 NCCI Statistical Bulletin	
		Indemnity	
		5-Year Average Indemnity Cost per Permanent Total Claim	295,000
(2)		Based on 2018 NCCI Statistical Bulletin	
		Adjustment for Firefighter Wages	
		Average Weekly Wage	
(3)		Montana Total (2016)	760
(4)		Firefighter contracting cancer	1,687
		2/3 Average Weekly Wage	
(5)	2/3x(3)	Montana Total (2016)	507
(6)	2/3x(4)	Firefighter contracting cancer	1,124
		Subject to Max PT Benefit of $768	
(7)	capped (5)	Montana Total (2016)	507
(8)	capped (6)	Firefighter contracting cancer	768
(9)	(8) / (7)	Ratio	1.52
(10)	(2)x(9)	Selected Indemnity Cost	448,000

Cancer Incidence Rates per 100,000 Population Exhibit 8
National Cancer Institute: Surveillance, Epidemiology, and End Results Program Page 1
Actual (not model) results

Cancer Site	Age<20	Age 20-49	Age 50-64	Age 65-74	Age 75+
Bladder/Urinary	-	2.53	32.52	126.59	258.19
Brain	3.22	4.02	10.93	20.15	25.05
Breast	-	12.51	47.21	79.50	76.12
Colorectal	0.32	12.37	78.98	161.00	257.55
Esophagus	-	0.94	11.49	28.70	36.96
Kidney	0.69	7.25	39.40	81.21	86.42
Leukemia	4.96	5.16	20.40	56.58	99.10
Lung	-	4.86	84.78	297.48	441.43
Mesothelioma	-	0.14	1.10	5.80	13.60
Myeloma	-	1.44	12.29	34.18	51.86
Non-Hodgkins Lymphoma	1.58	7.81	33.64	82.16	132.47

https://seer.cancer.gov/faststats/selections.php?#Output
Rates are per 100,000 and are age-adjusted to the 2000 US Std Population (19 age groups - Census P25-1130).
Blank ("-"): not displayed due to less than 16 cases.
Cancer sites include invasive cases only unless otherwise noted.
Incidence source: SEER 18 areas (San Francisco, Connecticut, Detroit, Hawaii, Iowa, New Mexico, Seattle, Utah, Atlanta, San Jose-Monterey, Los Angeles, Alaska Native Registry, Rural Georgia, California excluding SF/SJM/LA, Kentucky, Louisiana, New Jersey and Georgia excluding ATL/RG).
Incidence per 100,000 (5-year average 2011-2015)
Gender Mix: Male: 83% Female: 17%

Heart & Lung Mortality Rates per 100,000 Population
CDC/NCHS, National Vital Statistics System, Mortality 2016
All Races, Gender-Weighted

Age	Heart Disease	Chronic Lower Respiratory Disease
20 to 24	3.56	0.65
25 to 29	6.44	0.67
30 to 34	12.43	1.00
35 to 39	22.91	1.25
40 to 44	42.03	2.30
45 to 49	74.03	4.79
50 to 54	127.98	13.93
55 to 59	200.73	31.52
60 to 64	294.50	59.47
65 to 69	408.58	105.30
70 to 74	608.92	197.42
75 to 79	947.32	312.78

https://www.cdc.gov/nchs/data/dvs/lcwk/lcwk1_hr_2016.pdf
Rates are per 100,000
Blank ("-"): not displayed due to less than 16 cases.
Gender Mix: Male: 83% Female: 17%