Section V. Independent Health Studies

A. Studies Indicate Risk at INL

"*Radio-ecological Effects on Animal and Human Populations Near the Idaho National Engineering Laboratory*" by Michael Blain, Ph.D., et al. presented to the American Association for the Advancement for Science annual meeting in May 1984 offers an evaluation of the radiological effects of INL operations.

Dr. Blain's 1984 study offered the first independent assessment of the health impact from INL operations. The Idaho Academy of Sciences as well as the State and DOE tried to discredit the analysis. American nuclear history is full of conscientious scientists who were subjected to pressure and discrimination by federal agencies because they told the truth. Dr. Blain's assessments are as true today as they were in 1984 and hopefully his work will receive the public credit it deserves. The following is the abstract in his report.

"Federal data on cancer mortality and state data on cancer incidence in the six counties near INL were analyzed. When the Idaho state population is employed as a control group, there was an excess number of deaths (1950-69) from cancer of the more radiosensitive organs (17 observed, 9.4 expected, P<.05) and minor excess of cancer cases (1971-80; 11 observed, 8.0 expected) in Clark county, Idaho downwind of INL. The minor excess is due to a lower than expected number of male cancers (2 observed, 2.8 expected) and a higher than expected number of female cancers (9 observed, 5.2 expected), particularly female breast tumors (6 observed, 2.8 expected). Mormons have a 23% lower rate of cancer than other populations and the six counties have large Mormon populations (range = 40% - 80%). When the cancer incidence in the counties is compared to a Mormon control population, there is an excess cancer incidence (1971-80) in Bannock (659 observed, 485.7 expected, P=.001), Bonneville (547 observed, 447.9 expected, p=.001), Butte (47 observed, 34.5 expected, p=.05), and Clark (11 observed, 6 expected) counties. There is a need for a comprehensive cohort study (1952-80) that considers membership in the Mormon Church." [Blain @I]

Due to the cancer latency period, which can be decades, a credible argument can be made to bring the study period to the present. Blain cites 1960 environmental monitoring data on milk samples of 2 x 10^{-7} mCi/cc for I-131 (cc=ml). The notation "m" in this sampling data appears to denote micro (10^{-6}) rather than the conventional m = mili (10^{-3}). This assumption is supported by the same reports citing the current standard at 100 x 10^{-9} mCi/ml (100 pCi/L). Proposed EPA Drinking Water Standard for I-131 is 108 pCi/L. The above sample of 2 x 10^{-6} mCi/ml converted would be 2,000 pCi/L. This represents 20 times more I-131 contamination than the current standard would allow. A 1961 Report cites I-131 in milk samples at 1 x 10^{-7} mCi/L [100 pCi/L]. Blain also cites 1963 reports that indicated Strontium-90 off-site milk samples of 230 mmc/L [230 pCi/L]. Wheat samples tested for Sr-90 for the same period were as high as 170 mmCi/kgm [170 pCi/kgm]; and for cesium-137 were 800 mmCi/kgm [800 pCi/kgm]. Gamma emitter manganese-54 samples were 560 mmc/kgm [560 pCi/kgm]. [Blain @ 24 , citing Monitoring Report No. 12 1963:1]

Animal studies found the "highest ratio in rabbit thyroids occurred near the ICPP and was 9.1 x 10^{-4}. Ratios from thyroids of rabbits collected off-site and adjacent to the INL were higher than the control area ratios (<4 x 10^{-7})." "During this same period mule deer thyroids collected at Craters of the Moon National Monument (54 km west of ICPP) had average I-129/I-127 ratios of 4.4 x 10^{-6} and were significantly ($P < 0.01$) higher than ratios in control animals (3.3 x 10^{-7}) [1983: Health Physics 45:31-38]." "I-129/I-127 ratios in vegetation on-site ranged from 1.5 x 10^{-3} to 1.9 x 10^{-5}." "From these data it seems probable that the increase ratios obtained from samples NE and SW of the INL are due to the atmospheric releases from the ICPP."[DOE/ID-12111,P.38] [no units offered for data] Blain also cites on-site antelope muscle samples for Sr-90 taken in 1959 having 31.1 pCi/g and samples taken between 1972 and 1976 having 9.6 p/Ci/g. 1982 samples taken for Cs-137 in antelope showed 382 pCi/g. [Blain @ 35- 37]

1974 INL Regional Radioactive Air Monitoring

City	Iodine-131	Strontium-90	Gross Beta
Carey, ID	3.6 uCi/ml (or) 3,600,000,000 pCi/L	9.0 uCi/ml (or) 9,000,000,000 pCi/L	810 x 10-15 uCi/ml .00081 pCi/L
Idaho Falls	3.9 uCi/ml (or) 3,900,000,000 pCi/L		[ERDA-1536 @III-45]

Animal Tissue Samples Containing Cesium-137 On and Off-site

	Muscle	Liver
Sheep		
On-site	96 pCi/kg	81 pCi/kg*
Off-site	599 pCi/kg	286 pCi/kg
Antelope		
On-site	1,520 pCi/kg	2,660 pCi/kg
Off-site	92 pCi/kg	139 pCi/kg

* One kilogram (kg) = 1,000 grams [ERDA-1536 @ III-39&53]

Plutonium-239&241 in soil samples outside INL boundary registered 1500 nCi/sq meter and inside INL at 2,000 nCi/sq. meter.[ERDA-1536 @ III-36&37] Converting to pico curies, the readings are 1,500,000 pCi/sq meter and 2,000,000 pCi/sq meter respectively.

Idaho's Division of Health is conducting a cancer survey in counties around INL and the agency is finding excessively higher rates than national averages. The 1995 study analyzed a 17-county area comparison of cancer incidence rates and compared it to the other 27 Idaho counties. The study counties include Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Cassia, Clark, Custer, Fremont, Jefferson, Jerome, Lincoln, Madison, Minidoka, Power, and Twin Falls. The aggregate 17 county study found cancer incidents (observed) compared to the other 27 county control group (expected). The results include stomach cancer (observed 390 with 383 expected); brain cancer (observed 385 with 378 expected); and leukemia (observed 461 with 438.7 expected). [IDH&W(d)] This comparison is believed to be understating the problem because the counties in northern Idaho (downwind) have high cancer rates possibly due to Hanford radioactivity. [1]

In 1996 the state narrowed the previous study down to six counties south and east of INL including, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison. The age-adjusted incidence rate for central nervous system cancers in the six-county area was 8.1 per 100,000. The rest of Idaho had a rate of 7.0 per 100,000 compared with national rates of 6.7 per 100,000 (SEER) and 6.3 (CBTRUS). The observed number of central nervous system cancers for the six-county area was 110 (89 expected, based on the rest of Idaho). The analysis was then confined to brain cancer (other central nervous system cancers such as chordoma and optic tumors were excluded) 182 were observed when 151 would be statistically expected in the six-county area for the years 1975 to 1994. A 1996 analysis of a reported cluster area around the town of Moreland in Bingham county revealed an increased rate of brain cancers, 4 observed with 1 expected between 1980 and 1995. [IDH&W(c)]

In Blaine county, a survey requested by a local physician found that the female population younger than 70 had significantly elevated rates of breast cancer. Epidemiologists are studying the same factors as in the ongoing eastern Idaho brain cancer study. In Clark County, the agency found eight cases of female breast cancer when only 3.2 cases were expected. In Minidoka County, the agency found 20 cases of stomach cancer when only 11.6 were expected. [Jackson]

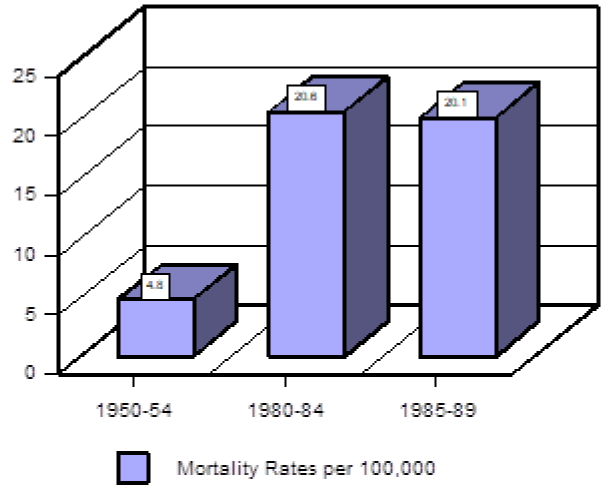
Allen Benson also offers credible challenges to current dose estimate methodology in his book Hanford Radioactive Fallout. Dr. Benson's continued health research has unearthed an Atomic Energy Commission report titled "Radiation Standards, Including Fallout". This 1962 report focused on bone lesions which were characteristic of radiation exposure. "In summary, in 235 radium-bearing patient's radio-graphed of the 264 measured for radium content, minimally significant radiographic lesions were seen with some degree of confidence when the radium level exceeded 0.01 micro curie." [AEC]

This finding is significant not only in terms of the AEC's early knowledge of measurable radiation exposure but also that it can be reliably measured through simple X-rays. Dr. Benson is currently developing a new "holistic" approach to dose-reconstruction. Testifying before the INL Health Effects Subcommittee in 1996, Benson offered these recommendations:

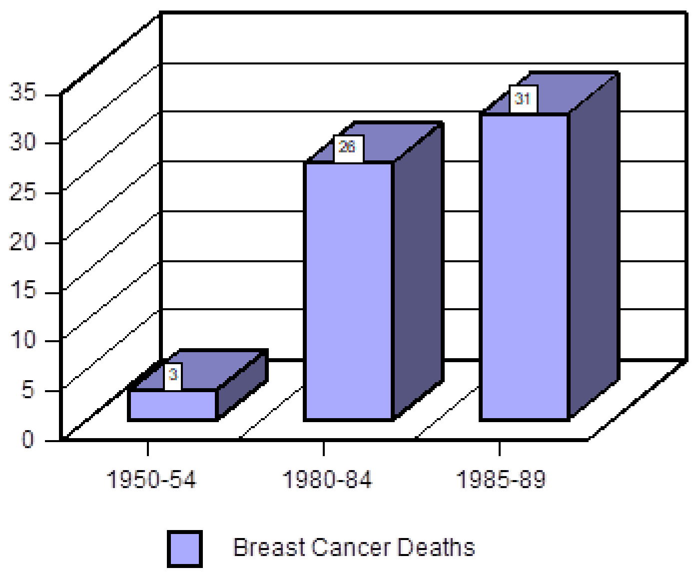
"You look at the terrain. You look at the meteorology. You look at when they made their release. And then you go look and see if there is any clusters. What you do then is you bring in integrated science; meteorology...and start testing. You go with gene marking, for example. You choose who are the likely highest dose people, and you gene mark them.... You test the environment, depending upon what the pollutant is...depending if that particular nuclide could have stayed in the area, it can be stockpiled, for example, in trees. So you bio-marker different parts, artifacts in the living system, to see if you can trap the agent that credibly caused the cluster." [IHES(b)]

[1] Comparison of Cancer Incidence Rates Between Selected Counties and the Remainder of the State of Idaho, Cancer Cluster Analysis Group, Idaho Department of Health and Welfare, March 1995

Age-Adjusted White Female Breast Cancer Rates 1950-89 Within 50 Miles of INL [2]



Breast Cancer Mortality Rates per 100,000 1950 to 1989 Within 100 Miles of INL [3]



[2] The Enemy Within, by Jay Gould with Members of The Radiation and Public Health Project, Ernest Sternglass, Joseph Mangano, William McDonnell, 1996.

[3] Ibid.

Age-Adjusted Incidence Rate per 100,000 1985-94 for Central Nervous System Cancers in Bingham, Bonneville, Butte, Clark, Jefferson, and Madison Counties around INL [4]

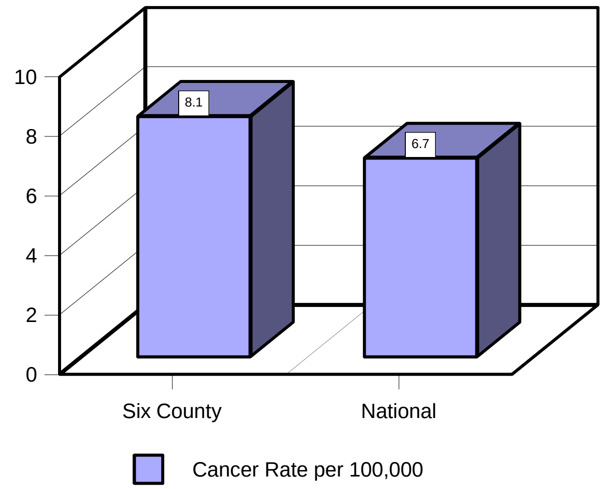


Figure 1

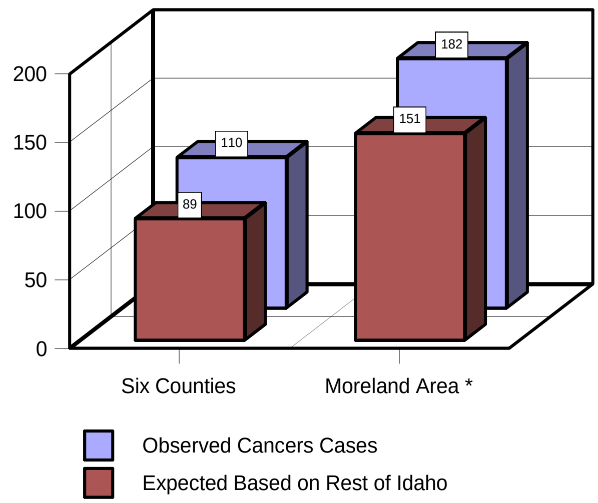


Figure 2

Figure 55

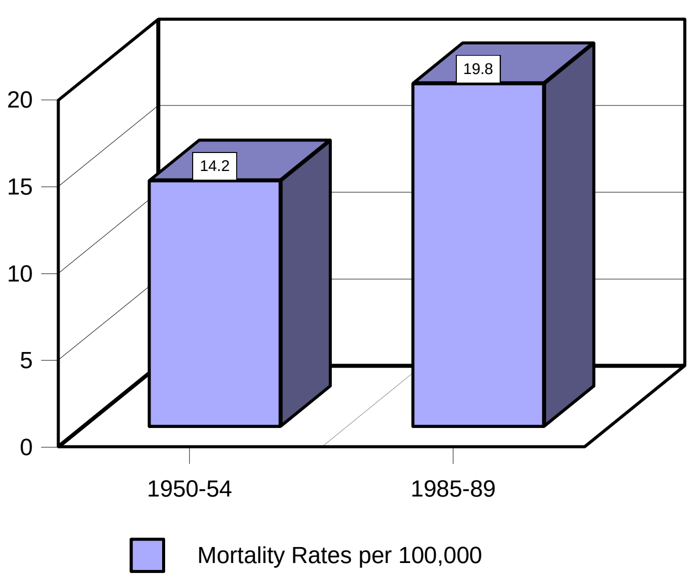
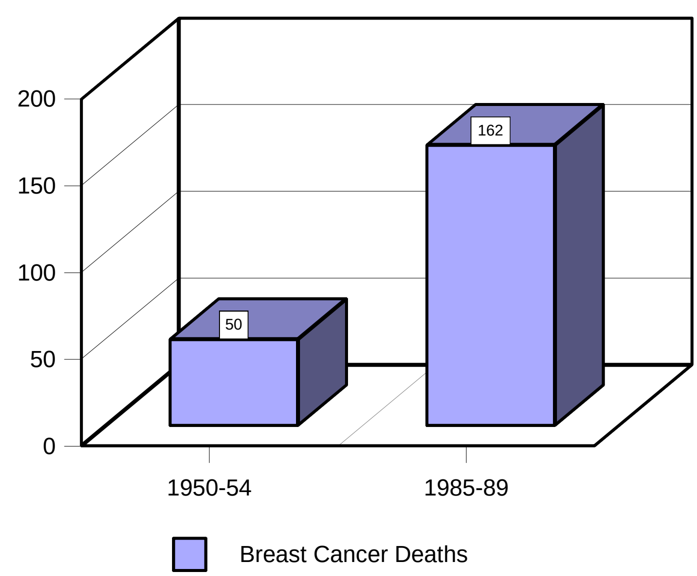


Figure 6 6



[4] Idaho Division of Health, "Idaho Public Health Brain Cancer Study" April 25, 1997 Idaho Department of Health Welfare, Division of Health, Idaho Public Health Brain Cancer Study, 8/8/97. Idaho Department of Health Welfare, Division of Health, Idaho Public Health Brain Cancer Study, 4/25/97. 1997 Idaho Public Health Brain Cancer Survey Eastern Idaho Cases, (1978-1997), Idaho Department of Health Welfare, Division of Health, Christine G. Hahn, MD, et.al. 11/28/97.

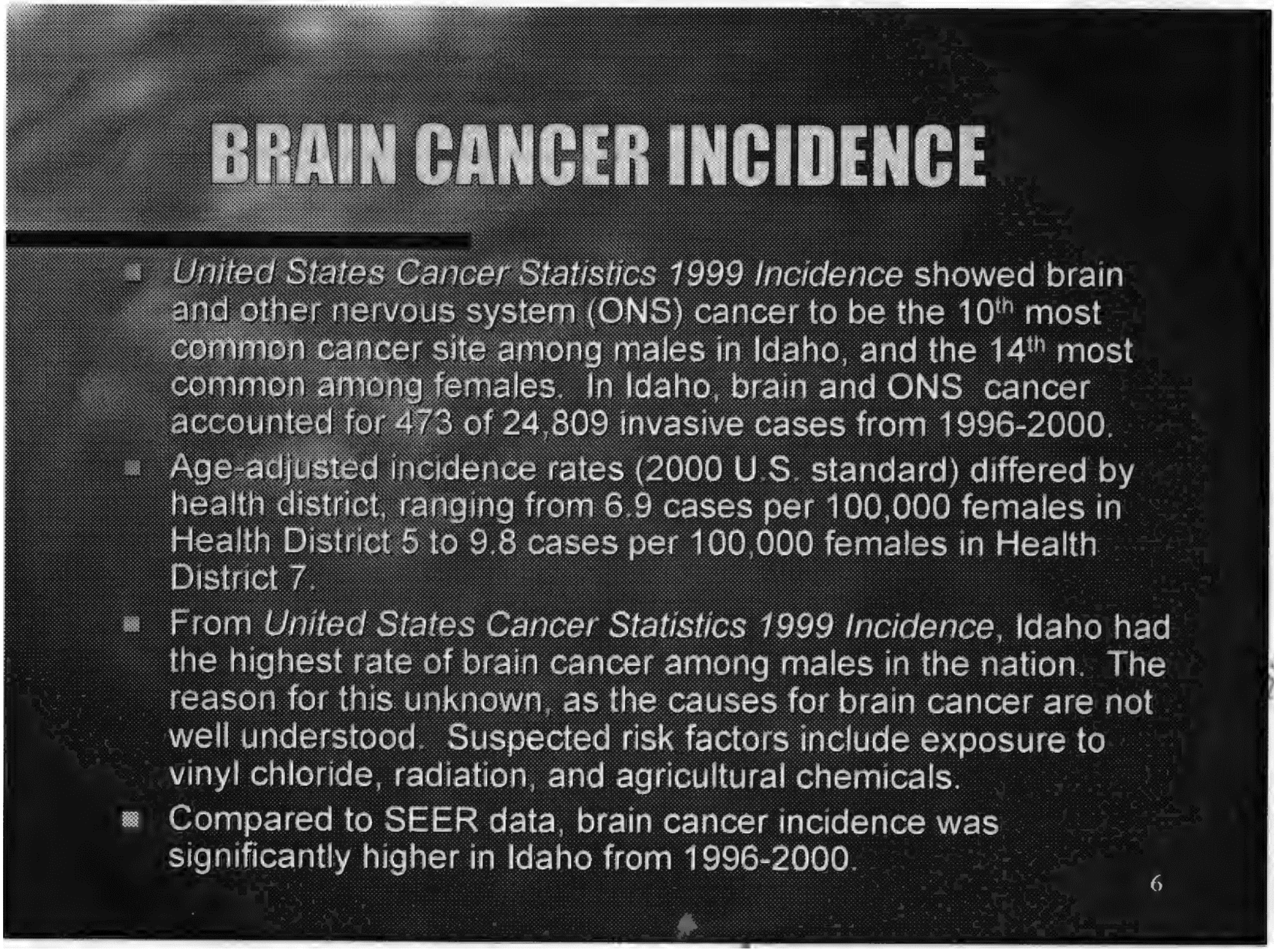
White female Breast Cancer Mortality Rates 1950-89
Counties Within 50 and 100 Miles of INEEL

	Age-Adjusted Mortality Rates Per 100,000			Percent Change		Number of Deaths		
	1950-54	**1980-84**	**1985-89**	**1980-84/ 1950-54**	**1985-89/ 1950-54**	**1950-54**	**1980-84**	**1985-89**
Gould 50 Mile 100 Mile	 4.8 14.2	 20.6 22.3	 20.1 19.8	 333% 57%	 322% 39%	 3 50	 26 161	 31 162
Land (NCI) 50 Mile	12.6	23.5	21.1	87%	67%			123
Idaho	18.9	22.3	18.9	18%	0%	242	585	571
United States	24.4	24.9	24.6	2%	2%			

Source: Enemy Within

Section V. B. below Cancer Data Registry of Idaho Reports [5]

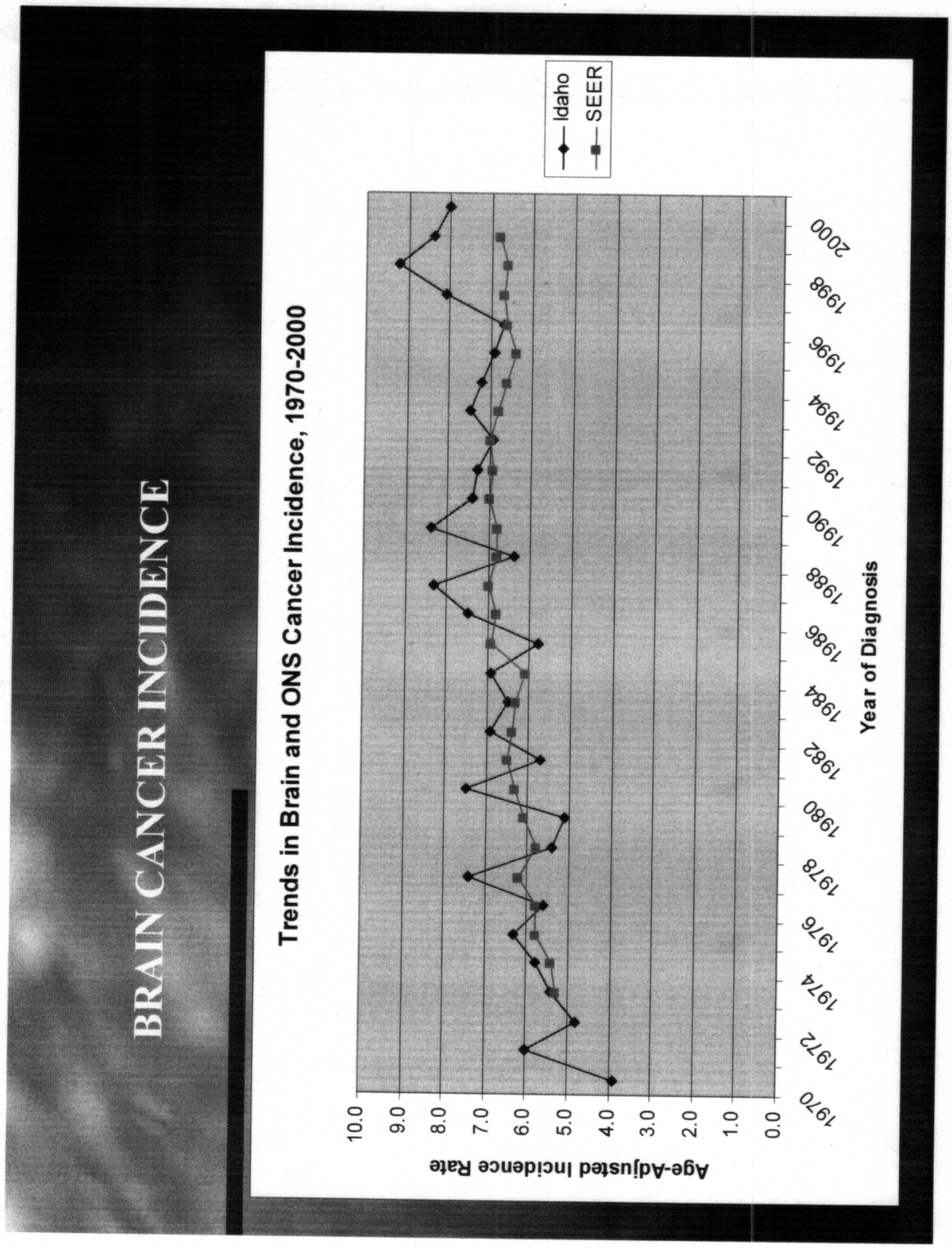
5 Cancer Data Registry of Idaho Cancer in Idaho – https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf



Above states:

"From United States Cancer Statistics 1999 Incidence, Idaho had the highest rate of brain cancer among males in the nation."

Source: Brain Cancer in Idaho 1996-2000, Pg. 6, Cancer Data Registry of Idaho. It must be noted how the Idaho Cancer Registry, like all Idaho agencies, nearly completely ignore the massive radioactivity released by DOE facilities at INL Idaho health districts [HD 6 &7]) and Hanford (effecting northern Idaho health districts. [HD 1 &2]).


BRAIN CANCER INCIDENCE
Trends in Brain and ONS Cancer Incidence, 1970-2000
Age-Adjusted Incidence Rate
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
Year of Diagnosis
Idaho
SEER

CANCER INCIDENCE 2009-2013
COMPARISON BETWEEN BINGHAM COUNTY AND THE REMAINDER OF THE STATE OF IDAHO

Cancer Site/Type	Sex	Bingham County						Remainder of Idaho		
		Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	Expected Cases (3)	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All Sites Combined	Total	922	227,608	405.1	438.9	992.3	0.025 <<	36,322	7,689,683	472.3
All Sites Combined	Male	487	114,327	426.0	458.1	**530.7**	0.058	19,225	3,850,623	499.3
All Sites Combined	Female	435	113,281	384.0	418.1	463.4	0.193	17,097	3,839,060	445.3
Bladder	Total	32	227,608	14.1	15.2	49.6	0.010 <<	1,817	7,689,683	23.6
Bladder	Male	24	114,327	21.0	22.5	39.9	0.009 <<	1,442	3,850,623	37.4
Bladder	Female	8	113,281	7.1	7.8	10.1	0.654	375	3,839,060	9.8
Brain - malignant	Total	16	227,608	7.0	7.3	13.7	0.593	482	7,689,683	6.3
Brain - malignant	Male	9	114,327	7.9	8.3	8.4	0.934	298	3,850,623	7.7
Brain - malignant	Female	7	113,281	6.2	6.4	5.2	0.536	184	3,839,060	4.8
Brain and other CNS - non-malignant	Total	20	227,608	8.8	9.5	22.6	0.685	824	7,689,683	10.7
Brain and other CNS - non-malignant	Male	6	114,327	5.2	5.6	8.0	0.616	291	3,850,623	7.6
Brain and other CNS - non-malignant	Female	14	113,281	12.4	13.4	14.5	1.000	533	3,839,060	13.9
Breast	Total	125	227,608	54.9	59.6	137.9	0.289	5,055	7,689,683	65.7
Breast	Male	1	114,327	0.9	0.9	1.4	1.000	52	3,850,623	1.4
Breast	Female	124	113,281	109.5	119.2	135.6	0.342	5,003	3,839,060	130.3
Breast - in situ	Total	15	227,608	6.6	7.2	28.1	0.010 <<	1,029	7,689,683	13.4
Breast - in situ	Male	-	114,327	-	-	0.1	1.000	4	3,850,623	0.1
Breast - in situ	Female	15	113,281	13.2	14.4	27.8	0.012 <<	1,025	3,839,060	26.7
Cervix	Female	6	113,281	5.3	5.7	6.3	1.000	228	3,839,060	5.9
Colorectal	Total	**99**	227,608	43.5	47.3	**80.5**	**0.050 >>**	2,953	7,689,683	38.4
Colorectal	Male	**65**	114,327	56.9	61.2	**43.9**	**0.003 >>**	1,592	3,850,623	41.3
Colorectal	Female	**34**	113,281	30.0	33.0	**36.6**	0.750	1,361	3,839,060	35.5
Corpus Uteri	Female	25	113,281	22.1	24.1	27.4	0.739	1,014	3,839,060	26.4
Esophagus	Total	12	227,608	5.3	5.7	**10.2**	0.645	373	7,689,683	4.9
Esophagus	Male	11	114,327	9.6	10.3	**8.5**	0.483	309	3,850,623	8.0
Esophagus	Female	1	113,281	0.9	1.0	**1.7**	0.985	64	3,839,060	1.7
Hodgkin Lymphoma	Total	3	227,608	1.3	1.4	5.9	0.325	211	7,689,683	2.7
Hodgkin Lymphoma	Male	2	114,327	1.7	1.9	3.2	0.772	114	3,850,623	3.0
Hodgkin Lymphoma	Female	1	113,281	0.9	0.9	2.7	0.499	97	3,839,060	2.5
Kidney and Renal Pelvis	Total	29	227,608	12.7	13.8	34.5	0.399	1,260	7,689,683	16.4
Kidney and Renal Pelvis	Male	20	114,327	17.5	18.8	21.9	0.796	790	3,850,623	20.5
Kidney and Renal Pelvis	Female	9	113,281	7.9	8.6	12.8	0.364	470	3,839,060	12.2
Larynx	Total	2	227,608	0.9	0.9	5.5	0.172	202	7,689,683	2.6
Larynx	Male	1	114,327	0.9	0.9	4.5	0.125	162	3,850,623	4.2
Larynx	Female	1	113,281	0.9	1.0	1.1	1.000	40	3,839,060	1.0
Leukemia	Total	27	227,608	11.9	12.5	36.1	0.143	1,288	7,689,683	16.7
Leukemia	Male	13	114,327	11.4	11.8	21.6	0.067	757	3,850,623	19.7
Leukemia	Female	14	113,281	12.4	13.2	14.6	1.000	531	3,839,060	13.8
Liver and Bile Duct	Total	12	227,608	5.3	5.7	13.2	0.886	479	7,689,683	6.2
Liver and Bile Duct	Male	6	114,327	5.2	5.6	9.8	0.280	353	3,850,623	9.2
Liver and Bile Duct	Female	6	113,281	5.3	5.8	3.4	0.259	126	3,839,060	3.3
Lung and Bronchus	Total	90	227,608	39.5	43.0	112.7	0.031 <<	4,138	7,689,683	53.8
Lung and Bronchus	Male	46	114,327	40.2	43.3	58.7	0.103	2,126	3,850,623	55.2
Lung and Bronchus	Female	44	113,281	38.8	42.5	54.2	0.181	2,012	3,839,060	52.4
Melanoma of the Skin	Total	37	227,608	16.3	17.6	57.8	0.005 <<	2,117	7,689,683	27.5
Melanoma of the Skin	Male	19	114,327	16.6	17.9	34.3	0.007 <<	1,245	3,850,623	32.3
Melanoma of the Skin	Female	18	113,281	15.9	17.2	23.7	0.279	872	3,839,060	22.7
Myeloma	Total	11	227,608	4.8	5.2	13.6	0.583	499	7,689,683	6.5
Myeloma	Male	7	114,327	6.1	6.6	8.7	0.724	315	3,850,623	8.2
Myeloma	Female	4	113,281	3.5	3.8	5.0	0.881	184	3,839,060	4.8
Non-Hodgkin Lymphoma	Total	**47**	227,608	20.6	22.3	**40.0**	**0.303**	1,462	7,689,683	19.0
Non-Hodgkin Lymphoma	Male	**28**	114,327	24.5	26.3	**21.7**	**0.218**	784	3,850,623	20.4
Non-Hodgkin Lymphoma	Female	**19**	113,281	16.8	18.3	**18.4**	**0.942**	678	3,839,060	17.7
Oral Cavity and Pharynx	Total	28	227,608	12.3	13.4	29.2	0.924	1,070	7,689,683	13.9
Oral Cavity and Pharynx	Male	16	114,327	14.0	15.1	20.3	0.405	736	3,850,623	19.1
Oral Cavity and Pharynx	Female	**12**	113,281	10.6	11.6	**9.0**	**0.393**	334	3,839,060	8.7
Ovary	Female	**15**	113,281	13.2	14.5	**13.1**	**0.664**	485	3,839,060	12.6
Pancreas	Total	**25**	227,608	11.0	12.0	**27.4**	**0.735**	1,014	7,689,683	13.2
Pancreas	Male	**15**	114,327	13.1	14.2	**14.6**	**0.984**	533	3,850,623	13.8
Pancreas	Female	**10**	113,281	8.8	9.7	**12.9**	**0.528**	481	3,839,060	12.5
Prostate	Male	**147**	114,327	128.6	139.6	**146.8**	**1.000**	5,366	3,850,623	139.4
Stomach	Total	10	227,608	4.4	4.8	**10.1**	**1.000**	373	7,689,683	4.9
Stomach	Male	6	114,327	5.2	5.6	7.0	0.887	255	3,850,623	6.6
Stomach	Female	**4**	113,281	3.5	3.9	**3.1**	**0.771**	118	3,839,060	3.1
Testis	Male	**8**	114,327	7.0	7.6	**6.3**	**0.591**	229	3,850,623	5.9
Thyroid	Total	**50**	227,608	22.0	23.6	**33.3**	**0.008 >>**	1,209	7,689,683	15.7
Thyroid	Male	**8**	114,327	7.0	7.6	**7.9**	**1.000**	287	3,850,623	7.5
Thyroid	Female	**42**	113,281	37.1	39.4	**25.6**	**0.004 >>**	922	3,839,060	24.0
Pediatric Age 0 to 19	Total	**16**	80,289	19.9	20.0	**13.5**	**0.565**	385	2,284,390	16.9
Pediatric Age 0 to 19	Male	7	41,497	16.9	16.9	7.6	1.000	216	1,168,829	18.5
Pediatric Age 0 to 19	Female	9	38,792	23.2	23.2	5.9	0.280	169	1,115,561	15.1

Bold emphasis added

CANCER INCIDENCE 2009-2013
COMPARISON BETWEEN JEFFERSON COUNTY AND THE REMAINDER OF THE STATE OF IDAHO

Cancer Site/Type	Sex	Jefferson County						Remainder of Idaho		
		Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	**Expected Cases (3)**	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All Sites Combined	Total	451	131,848	342.1	420.4	507.0	0.012 **<<**	36,793	7,785,443	472.6
All Sites Combined	Male	245	66,162	370.3	449.6	272.1	0.103	19,467	3,898,788	499.3
All Sites Combined	Female	206	65,686	313.6	388.6	236.3	0.048 **<<**	17,326	3,886,655	445.8
Bladder	Total	23	131,848	17.4	22.3	24.2	0.910	1,826	7,785,443	23.5
Bladder	Male	19	66,162	28.7	35.8	19.7	0.996	1,447	3,898,788	37.1
Bladder	Female	4	65,686	6.1	8.0	4.9	0.923	379	3,886,655	9.8
Brain - malignant	Total	**8**	131,848	6.1	6.8	**7.4**	0.924	490	7,785,443	6.3
Brain - malignant	Male	**5**	66,162	7.6	8.4	**4.6**	0.975	302	3,898,788	7.7
Brain - malignant	Female	**3**	65,686	4.6	5.1	**2.8**	1.000	188	3,886,655	4.8
Brain and other CNS - non-malignant	Total	**15**	131,848	11.4	13.6	**11.7**	0.407	829	7,785,443	10.6
Brain and other CNS - non-malignant	Male	**5**	66,162	7.6	8.9	**4.2**	0.829	292	3,898,788	7.5
Brain and other CNS - non-malignant	Female	**10**	65,686	15.2	18.5	**7.5**	0.440	537	3,886,655	13.8
Breast	Total	52	131,848	39.4	48.0	71.4	0.020 **<<**	5,128	7,785,443	65.9
Breast	Male	-	66,162	-	-	0.7	0.956	53	3,898,788	1.4
Breast	Female	52	65,686	79.2	97.6	69.6	0.034 **<<**	5,075	3,886,655	130.6
Breast - in situ	Total	10	131,848	7.6	9.0	14.7	0.268	1,034	7,785,443	13.3
Breast - in situ	Male	-	66,162	-	-	0.1	1.000	4	3,898,788	0.1
Breast - in situ	Female	10	65,686	15.2	18.4	14.4	0.299	1,030	3,886,655	26.5
Cervix	Female	1	65,686	1.5	1.7	3.5	0.265	233	3,886,655	6.0
Colorectal	Total	**41**	131,848	31.1	38.9	**40.7**	1.000	3,011	7,785,443	38.7
Colorectal	Male	**25**	66,162	37.8	46.0	**22.7**	0.690	1,632	3,898,788	41.9
Colorectal	Female	16	65,686	24.4	31.4	18.1	0.739	1,379	3,886,655	35.5
Corpus Uteri	Female	13	65,686	19.8	24.4	14.1	0.914	1,026	3,886,655	26.4
Esophagus	Total	3	131,848	2.3	2.8	5.2	0.472	382	7,785,443	4.9
Esophagus	Male	2	66,162	3.0	3.7	4.5	0.357	318	3,898,788	8.2
Esophagus	Female	1	65,686	1.5	2.0	0.8	1.000	64	3,886,655	1.6
Hodgkin Lymphoma	Total	4	131,848	3.0	3.3	3.3	0.820	210	7,785,443	2.7
Hodgkin Lymphoma	Male	2	66,162	3.0	3.3	1.8	1.000	114	3,898,788	2.9
Hodgkin Lymphoma	Female	2	65,686	3.0	3.3	1.5	0.875	96	3,886,655	2.5
Kidney and Renal Pelvis	Total	11	131,848	8.3	10.1	17.8	0.120	1,278	7,785,443	16.4
Kidney and Renal Pelvis	Male	7	66,162	10.6	12.7	11.4	0.241	803	3,898,788	20.6
Kidney and Renal Pelvis	Female	4	65,686	6.1	7.5	6.5	0.442	475	3,886,655	12.2
Larynx	Total	2	131,848	1.5	1.9	2.8	0.951	202	7,785,443	2.6
Larynx	Male	2	66,162	3.0	3.7	2.2	1.000	161	3,898,788	4.1
Larynx	Female	-	65,686	-	-	0.6	1.000	41	3,886,655	1.1
Leukemia	Total	**26**	131,848	19.7	23.3	**18.5**	0.113	1,289	7,785,443	16.6
Leukemia	Male	**13**	66,162	19.6	22.7	**11.1**	0.647	757	3,898,788	19.4
Leukemia	Female	**13**	65,686	19.8	24.0	**7.4**	0.079	532	3,886,655	13.7
Liver and Bile Duct	Total	3	131,848	2.3	2.8	6.7	0.193	488	7,785,443	6.3
Liver and Bile Duct	Male	2	66,162	3.0	3.6	5.1	0.237	357	3,898,788	9.2
Liver and Bile Duct	Female	1	65,686	1.5	2.0	1.7	0.969	131	3,886,655	3.4
Lung and Bronchus	Total	37	131,848	28.1	35.6	55.9	0.010 **<<**	4,191	7,785,443	53.8
Lung and Bronchus	Male	20	66,162	30.2	37.6	29.4	0.090	2,152	3,898,788	55.2
Lung and Bronchus	Female	17	65,686	25.9	33.5	26.7	0.063	2,039	3,886,655	52.5
Melanoma of the Skin	Total	30	131,848	22.8	27.3	30.0	1.000	2,124	7,785,443	27.3
Melanoma of the Skin	Male	20	66,162	30.2	36.2	**17.6**	0.632	1,244	3,898,788	31.9
Melanoma of the Skin	Female	10	65,686	15.2	18.0	12.6	0.584	880	3,886,655	22.6
Myeloma	Total	3	131,848	2.3	2.9	6.8	0.187	507	7,785,443	6.5
Myeloma	Male	2	66,162	3.0	3.7	4.4	0.374	320	3,898,788	8.2
Myeloma	Female	1	65,686	1.5	2.0	2.4	0.596	187	3,886,655	4.8
Non-Hodgkin Lymphoma	Total	22	131,848	16.7	20.7	20.3	0.758	1,487	7,785,443	19.1
Non-Hodgkin Lymphoma	Male	**12**	66,162	18.1	22.1	**11.2**	0.879	800	3,898,788	20.5
Non-Hodgkin Lymphoma	Female	**10**	65,686	15.2	19.3	**9.2**	0.865	687	3,886,655	17.7
Oral Cavity and Pharynx	Total	**17**	131,848	12.9	15.8	**14.9**	0.661	1,081	7,785,443	13.9
Oral Cavity and Pharynx	Male	**11**	66,162	16.6	19.9	**10.5**	0.965	741	3,898,788	19.0
Oral Cavity and Pharynx	Female	**6**	65,686	9.1	11.5	**4.5**	0.610	340	3,886,655	8.7
Ovary	Female	**9**	65,686	13.7	17.1	**6.7**	0.457	491	3,886,655	12.6
Pancreas	Total	**19**	131,848	14.4	18.5	**13.5**	0.182	1,020	7,785,443	13.1
Pancreas	Male	**13**	66,162	19.6	24.4	**7.3**	0.072	535	3,898,788	13.7
Pancreas	Female	6	65,686	9.1	12.1	6.2	1.000	485	3,886,655	12.5
Prostate	Male	66	66,162	99.8	122.5	75.2	0.313	5,447	3,898,788	139.7
Stomach	Total	3	131,848	2.3	2.9	5.1	0.503	380	7,785,443	4.9
Stomach	Male	3	66,162	4.5	5.6	3.6	1.000	258	3,898,788	6.6
Stomach	Female	-	65,686	-	-	1.6	0.408	122	3,886,655	3.1
Testis	Male	2	66,162	3.0	3.2	3.8	0.547	235	3,898,788	6.0
Thyroid	Total	**26**	131,848	19.7	22.0	**18.7**	0.128	1,233	7,785,443	15.8
Thyroid	Male	2	66,162	3.0	3.5	4.3	0.385	293	3,898,788	7.5
Thyroid	Female	**24**	65,686	36.5	40.3	**14.4**	**0.025 >>**	940	3,886,655	24.2
Pediatric Age 0 to 19	Total	3	49,787	6.0	6.1	8.5	0.060	398	2,314,892	17.2
Pediatric Age 0 to 19	Male	3	25,242	11.9	11.9	4.7	0.632	220	1,185,084	18.6
Pediatric Age 0 to 19	Female	-	24,545	-	-	3.9	**0.042 <<**	178	1,129,808	15.8

Bold emphasis added

Source for above two tables: *A fact sheet from the Cancer Data Registry of Idaho, Idaho Hospital Association* Cancer Incidence 2009-2013 Cancer Mortality 2010-2014 BRFSS 2011-2014. CANCER INCIDENCE 2009-2013 COMPARISON BETWEEN BINGHAM COUNTY; CANCER INCIDENCE 2009-2013 COMPARISON BETWEEN JEFFERSON COUNTY and state.

Notes: 1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).

2. Age and sex-adjusted incidence (A.A.I.) rates for county use age and sex-specific crude rates for the remainder of the state as standard.

3. Expected cases are based upon age and sex-specific rates for the remainder of the state of Idaho (compare to observed). Comparison between “Observed Cases” and “Expected Cases (3)” Bold Emphasis Added

4. P-values compare observed and expected cases, are two tailed, based upon the Poisson probability distribution. "<<" denotes significantly fewer cases observed than expected, **">>" denotes significantly more cases observed than expected (p=.05).**

Statistical Note: Rates based upon 12 or fewer cases (numerator) should be interpreted with caution. Pg.3

Cancer Screening and Risk Factor Prevalence Estimates, 2011-2014 by health district (HD #)

	State of Idaho	HD 1	HD 2	HD 3	HD 4	HD 5	HD 6	HD 7	Jefferson County
Access to Care									
Health Insurance, Age <65 (2012-2014)	77.8%	74.2%	83.7%	70.5%	82.7%	69.1%	80.1%	81.8%	78.2%
Not See Doctor Due to Cost Past Year (2012-2014)	16.3%	16.8%	12.9%	21.0%	15.4%	17.5%	14.1%	14.9%	13.9%
Cancer Screening									
Mammogram Past 2 Years, Age 50-74 (2012, 2014)	69.5%	72.4%	69.7%	62.0%	73.8%	68.5%	67.1%	68.1%	61.5%
Pap Test Past 3 Years, Cervix Intact Age 21-65 (2012, 2014)	76.4%	77.2%	80.8%	67.2%	80.9%	75.1%	75.7%	74.9%	81.4%
Colorectal Cancer Screening, Age 50-75 (2012, 2014)	61.6%	60.3%	65.0%	56.2%	67.5%	57.7%	59.4%	60.5%	70.3%
Tobacco Use									
Current Smoker (2012-2014)	16.5%	17.5%	15.0%	18.6%	17.1%	18.9%	15.7%	10.4%	7.4%
Current Smokeless Tobacco User, Males (2012-2014)	9.3%	10.8%	15.7%	11.4%	7.4%	11.1%	6.3%	6.6%	2.3%
Other Cancer-Related									
Sunburn in Previous 12 Months (2014)	50.4%	46.3%	52.2%	45.6%	53.4%	47.9%	52.3%	54.0%	52.9%
Artificial Tanning Appliance Use (2011, 2014)	5.1%	6.6%	3.9%	4.0%	3.4%	5.5%	6.6%	8.3%	3.2%
Weight Classification by Body Mass Index (2012-2014)	33.3%	35.4%	38.0%	26.8%	36.1%	31.7%	31.7%	32.6%	35.8%
Meet Physical Activity Guidelines (2011, 2013)	21.5%	20.7%	16.3%	20.3%	24.7%	21.0%	22.2%	18.8%	17.6%
Home Ever Tested for Radon (2012, 2014)	15.7%	22.7%	9.8%	11.0%	15.3%	14.0%	17.5%	18.1%	11.7%

Use Table below to identify the above Idaho health district (HD) numbers

Idaho Health Districts	Counties
District 1 (HD) 1	Benewah, Bonner, Boundary, Kootenai, Shoshone
District 2 (HD) 2	Clearwater, Latah, Lewis, Idaho, Nez Perce
District 3 (HD) 3	Adams, Canyon, Gem, Owyhee, Payette, Washington
District 4 (HD) 4	Ada, Boise, Elmore, Valley
District 5 (HD) 5	Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, Twin Falls
District 6 (HD) 6	Bannock, Bear Lake, Bingham, Butte, Caribou, Franklin, Oneida, Power
District 7 (HD) 7	Bonneville, Clark, Custer, Fremont, Jefferson, Lemhi, Madison, Teton

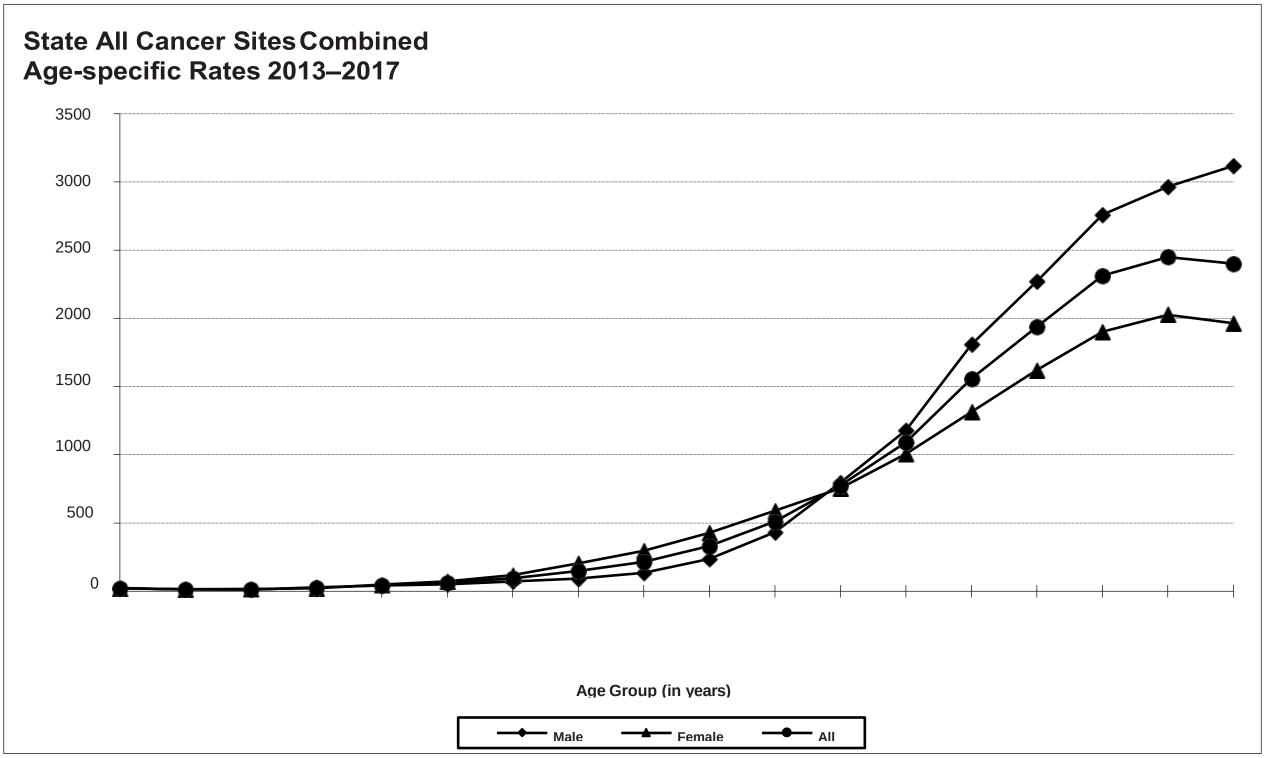
SUMMARY MEASURES OF CANCER BURDEN IN IDAHO — 2017

Primary Site	Incident Cases	Deaths	Median Age at Diagnosis	Median Age at Death	Estimated 10-Year Limited Duration Prevalence Count	Total Number of YPLL Before Age 75	Average Number of YPLL per Death, Persons Aged < 75 Years	% Change Incidence Rate, 2016 to 2017
All Sites	8,624	3,015	68.0	73.0	44,000	18,692	10.8	-0.7%
Bladder	418	95	73.0	78.0	2,400	218	6.1	2.0%
Brain	121	92	63.0	65.0	400	1,159	15.9	**11.9%**
Breast	1,333	225	64.0	69.0	8,600	2,003	13.1	**9.9%**
Cervix	60	14	48.0	61.0	400	207	17.3	-3.7%
Colorectal	648	256	68.0	72.5	3,500	1,869	12.6	-2.4%
Corpus Uteri	253	39	63.0	69.0	1,700	286	11.0	-10.6%
Esophagus	101	99	67.0	69.0	200	827	13.1	-0.2%
Hodgkin Lymphoma	44	7	48.0	-	300	-	-	**23.6%**
Kidney	334	83	67.0	75.0	1,800	433	10.3	**7.4%**
Larynx	37	9	70.0	76.0	200	44	11.0	-22.3%
Leukemia	300	131	70.0	77.0	1,500	783	12.6	**7.4%**
Liver and Bile Duct	149	121	68.0	70.0	200	824	9.9	-7.1%
Lung and Bronchus	961	605	72.0	73.0	2,000	3,165	8.7	-1.7%
Melanoma of Skin	522	48	65.0	69.5	3,500	418	12.7	-8.5%
Myeloma	137	76	71.0	77.5	500	216	7.7	**5.6%**
Non-Hodgkin Lymphoma	351	119	67.0	77.0	2,000	507	9.2	-10.8%
Oral Cavity and Pharynx	235	47	65.0	68.0	1,400	391	12.2	-15.5%
Ovary	97	68	63.0	70.5	400	477	11.6	-14.7%
Pancreas	298	244	72.0	73.0	300	1,315	9.3	**17.6%**
Prostate	1,159	164	68.0	82.0	8,700	264	5.4	**5.8%**
Stomach	90	40	69.0	73.5	300	260	10.8	-10.1%
Testis	46	1	33.5	-	500	-	-	-23.3%
Thyroid	217	10	51.0	73.5	2,400	98	16.3	-22.2%

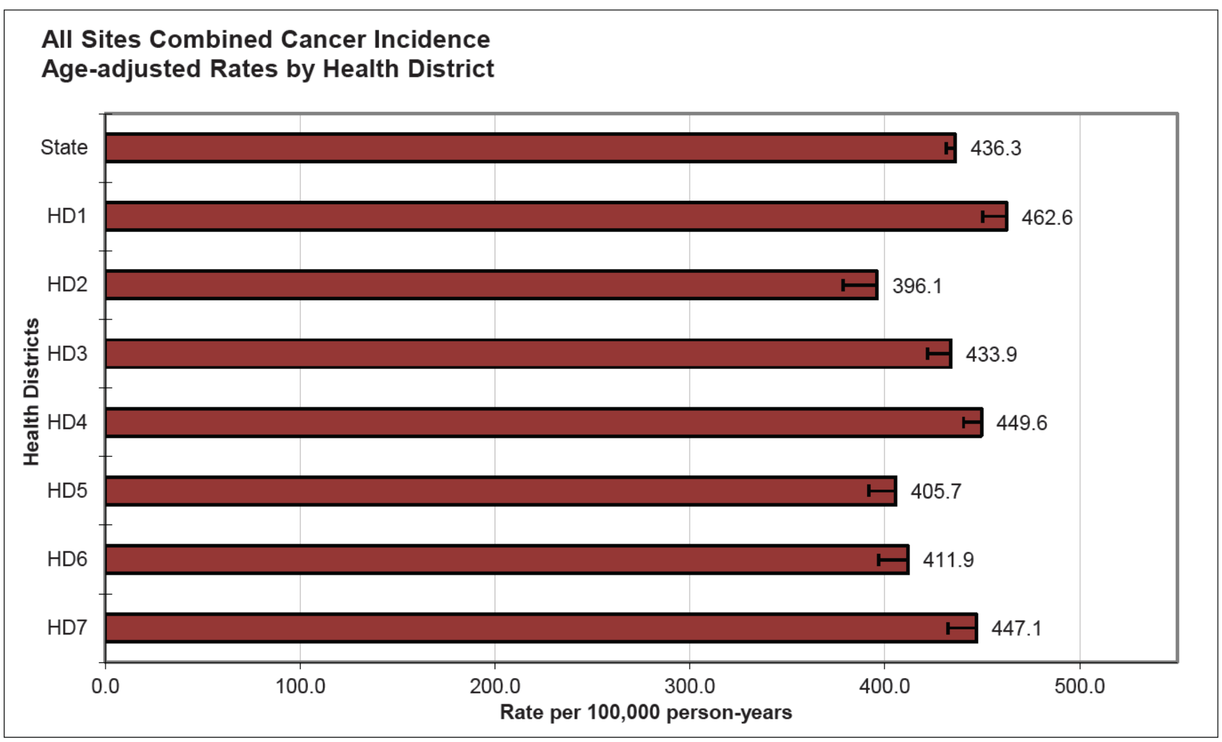
Pg.6 Notes: Incidence cases include all invasive and bladder in situ cases newly diagnosed among Idaho residents in 2017.
Years of potential life lost (YPLL) is a statistic used to measure the number of years of life lost in a population when persons in that population die prematurely (standard of 75 years of age used for this table). [Bold emphasis added]

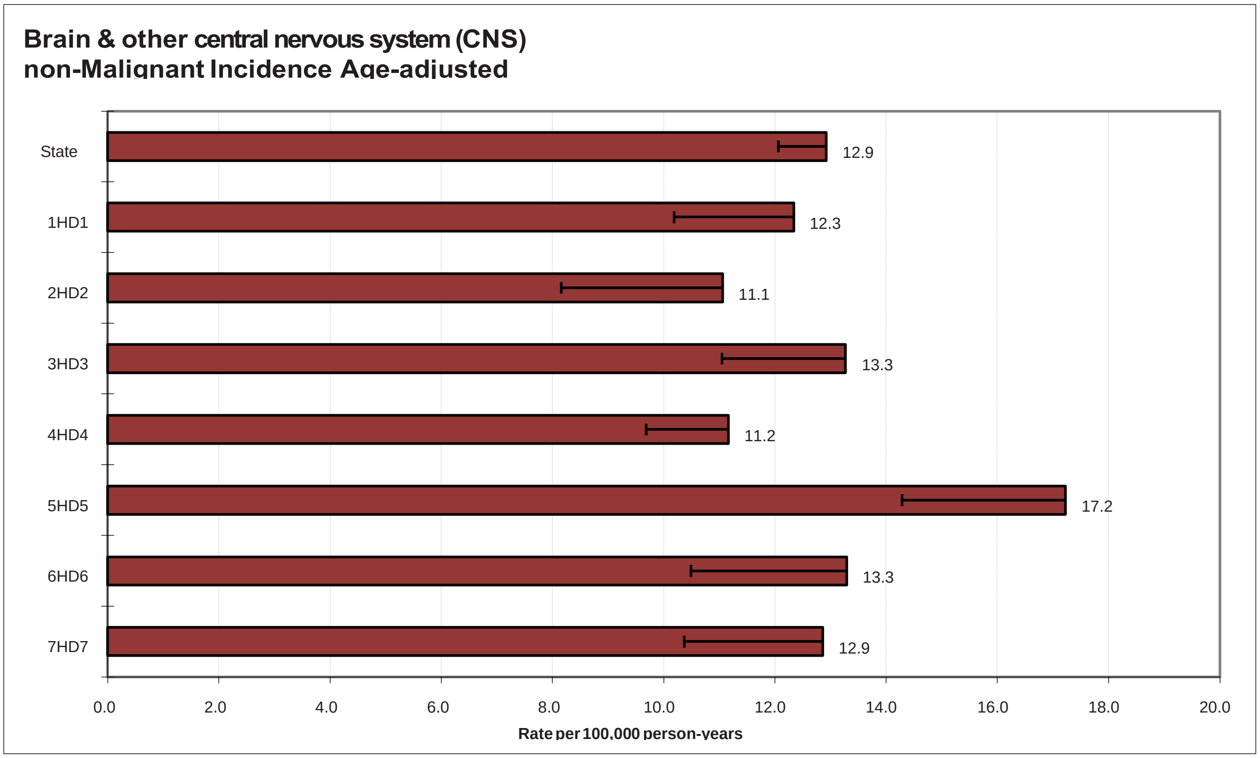
Mortality-related statistics are suppressed for Hodgkin lymphoma and testis primary sites due to small number of deaths.
Source: Annual Report of the Cancer Data Registry of Idaho Cancer in Idaho – 2017 December 2019
https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf

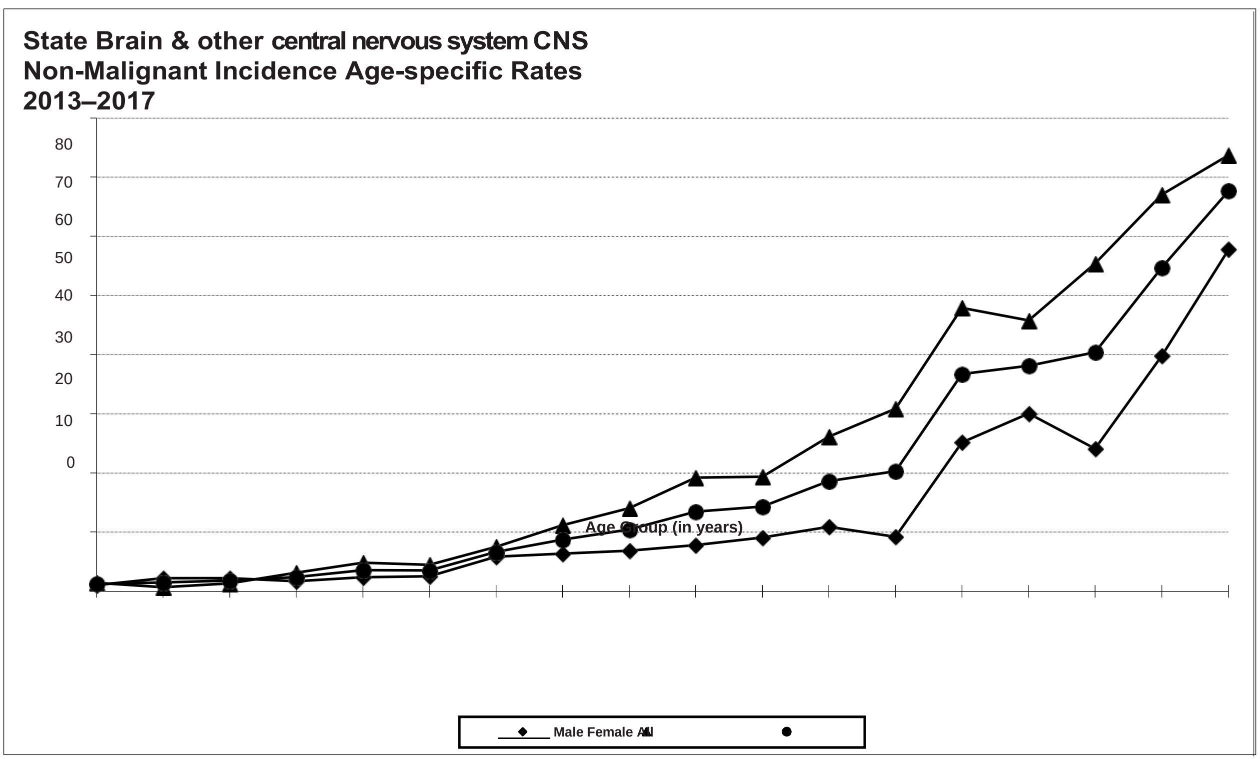
All Idaho Health Districts
All Sites Combined Cancer Incidence Age-adjusted Rates by Health District (H) State (Stat)



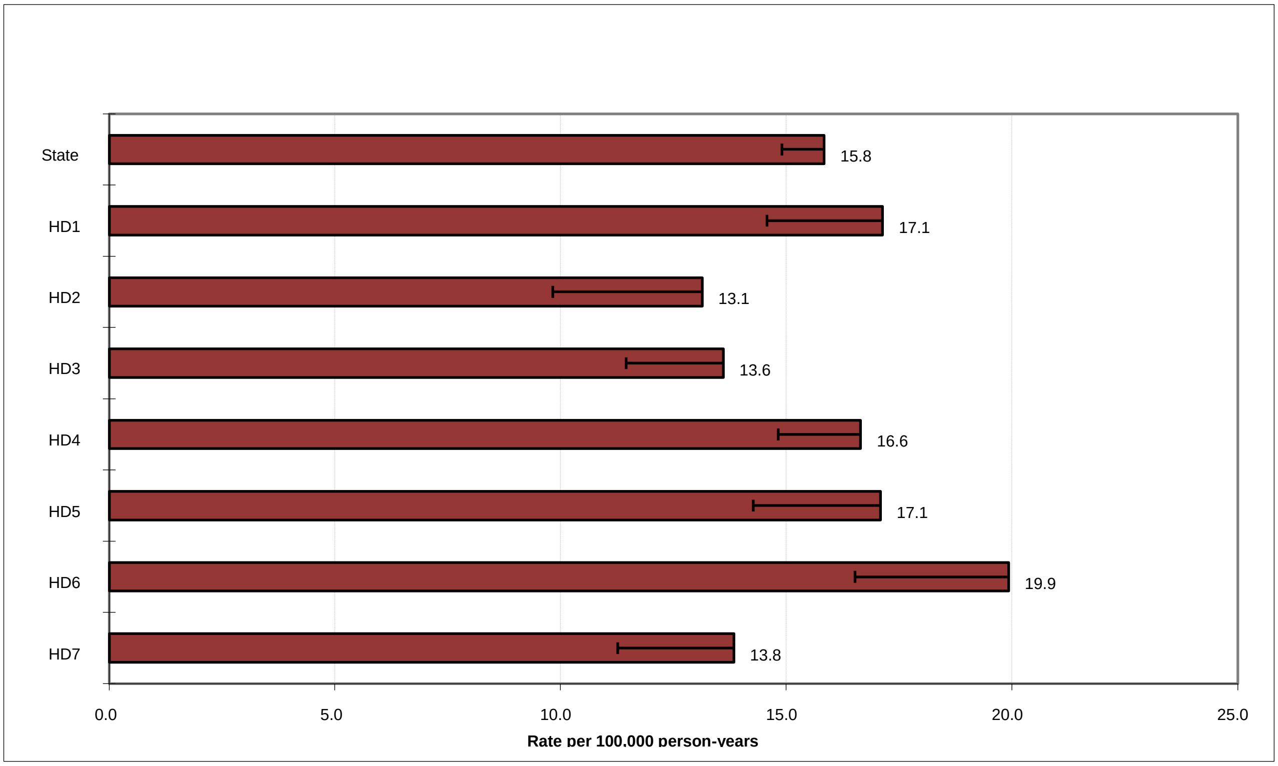
Brain Cancer Incidence
Age-adjusted Rates by Health District (H) State (Stat)



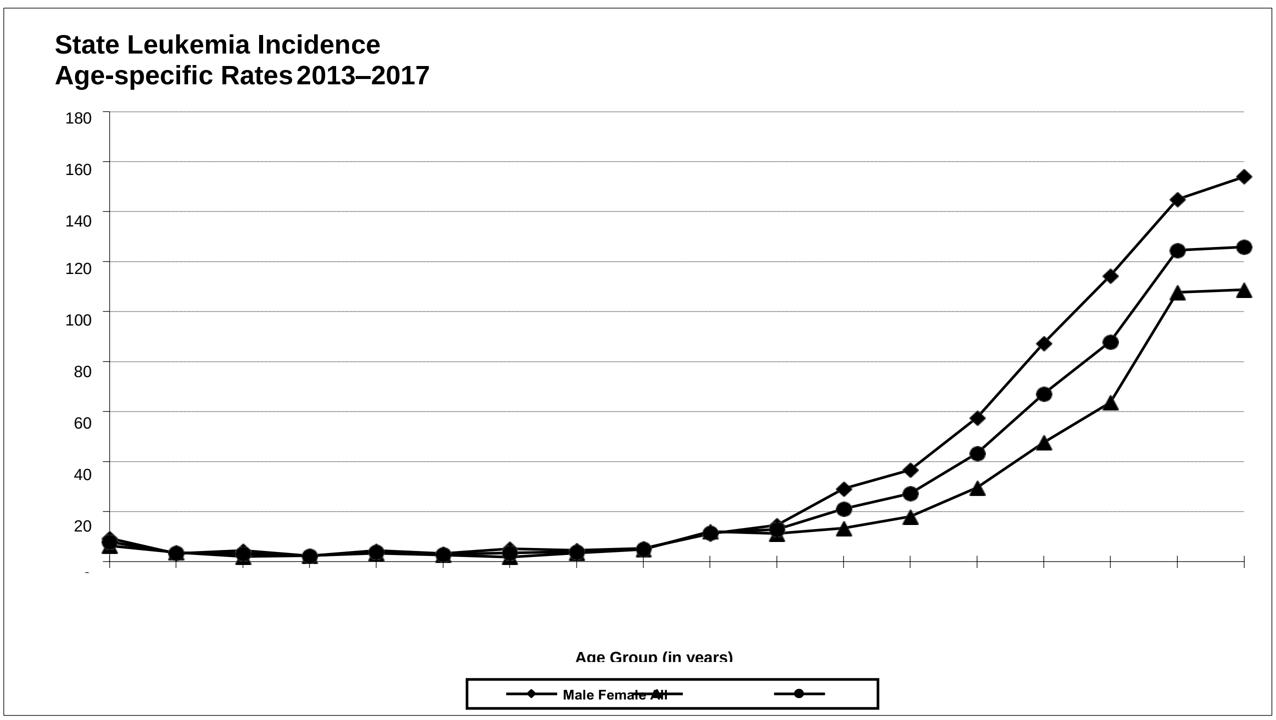

Brain & other central nervous system (CNS)
non-Malignant Incidence Age-adjusted
State
1HD1
2HD2
3HD3
4HD4
5HD5
6HD6
7HD7
12.9
12.3
11.1
13.3
11.2
17.2
13.3
12.9
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
Rate per 100,000 person-years


State Brain & other central nervous system CNS
Non-Malignant Incidence Age-specific Rates
2013–2017
80
70
60
50
40
30
20
10
0
Age Group (in years)
Male Female All

Leukemia Incidence Age-adjusted Rates by Health District



Leukemia Incidence Age-adjusted Rates by Health District



2017 OBSERVED VERSUS EXPECTED NUMBERS BY HEALTH DISTRICT FEMALES

	HD 1		HD 2		HD 3		HD 4		HD 5		HD 6		HD 7	
	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP
All Sites	**723**	**663.5+**	265	292.8	**671**	**658.5**	**1,191**	**1,170.7**	419	471.5 +	370	394.2	**461**	**440.0**
Bladder	**19**	**14.2**	5	6.6	14	14.1	**31**	**22.5**	8	10.3	2	9.0 +	9	9.3
Brain	**8**	**7.0**	2	3.2	7	7.3	13	13.0	3	5.5	**8**	**4.0**	4	5.2
Brain & CNS non-Malignant	**27**	**25.6**	11	11.1	19	27.2	38	49.4	**29**	**16.8 ***	**21**	**14.7**	15	17.7
Breast	**226**	**214.9**	**92**	**91.5**	212	214.7	**433**	**366.5 ***	107	154.6 *	110	127.9	**146**	**141.9**
Breast (in situ)	**50**	**38.0**	13	16.8	**42**	**39.2**	**78**	**68.8**	19	28.2	17	23.7	25	26.3
Cervix	**15**	**7.6 +**	**4**	**3.7**	**10**	**9.8**	15	19.8	4	7.0	**6**	**5.8**	6	6.9
Colorectal	**58**	**48.5**	22	22.3	**60**	**46.4**	70	92.8 +	34	35.1	23	29.9	**37**	**32.3**
Corpus Uteri	**50**	**40.9**	10	18.2	38	40.9	62	77.9	31	28.0	**27**	**23.7**	**35**	**26.0**
Esophagus	2	2.4	1	1.0	**4**	**1.9**	3	4.3	**2**	**1.6**	1	1.4	1	1.5
Hodgkin lymphoma	2	3.2	**2**	**1.3**	3	3.3	**6**	**5.6**	**3**	**2.1**	**3**	**1.8**	1	2.8
Kidney & renal pelvis	**24**	**17.9**	**9**	**8.2**	**21**	**18.1**	21	37.3 *	**17**	**12.7**	5	11.6	**18**	**11.7**
Larynx	0	1.2	**2**	**0.3**	0	1.2	**2**	**1.6**	**2**	**0.5**	0	0.6	0	0.7
Leukemia	**22**	**19.9**	**9**	**8.9**	19	19.9	**35**	**34.0**	**15**	**13.9**	**14**	**11.5**	8	13.9
Liver & bile duct	6	6.2	0	2.9	**6**	**5.7**	**14**	**8.6**	4	4.1	3	3.5	3	3.9
Lung & bronchus	**102**	**79.8 +**	**48**	**35.8**	70	80.3	**140**	**134.8**	51	57.1	33	48.3 +	46	52.3
Melanoma of skin	20	33.8 +	10	13.8	28	33.0	**81**	**48.4 ***	15	23.4	**21**	**18.8**	**24**	**21.5**
Myeloma	6	10.5	2	4.4	**13**	**8.4**	16	16.3	**7**	**6.4**	**7**	**5.3**	6	6.0
N-H Lymphoma	**28**	**23.5**	3	11.3*	**30**	**22.3**	33	45.0	16	16.8	**19**	**13.5**	**18**	**15.5**
Oral cavity & pharynx	**13**	**8.8**	3	4.2	7	9.5	15	16.8	**9**	**6.2**	**7**	**5.3**	3	6.5
Ovary	**20**	**15.1**	3	7.1	15	15.8	20	31.4 +	**15**	**10.4**	9	9.2	**15**	**10.1**
Pancreas	**29**	**22.2**	10	10.6	21	22.5	36	40.2	16	16.1	**17**	**12.9**	10	15.3
Stomach	2	5.1	1	2.2	**7**	**3.9**	10	7.1	3	3.3	**4**	**2.6**	1	3.3
Thyroid	14	23.2	8	9.6	21	24.5	41	45.6	14	16.6	13	14.3	**36**	**14.8 ***
Pediatric (age 0-19)	4	4.5	2	2.1	**7**	**6.7**	7	11.5	7	4.3	**6**	**3.9**	5	5.9

Bold emphasis added to show observed cancers exceeding expected

Also see TRENDS IN PANCREATIC CANCER IN IDAHO, 2013–2017, August 2019
https://www.idcancer.org/ContentFiles/special/Trends_in_Pancreatic_Cancer_in_Idaho_2013_2017.pdf

Cancer Data Registry of Idaho Incidence of Cancers Associated with Modifiable Risk Factors and Late Stage Diagnoses for Cancers Amenable to Screening Idaho 2013–2016 October2019, http://www.idcancer.org

Idaho Cancer Data Registry Cites for above tables:
https://www.idcancer.org/ https://www.idcancer.org/sitespecific

* Trends in Pancreatic Cancer in Idaho, 2013–2017 (PDF file)
* Evaluation of Potential Associations between Arsenic Concentrations in Ground Water and 2000-2004 Cancer Incidence Rates in Idaho by Zip Code (PDF file)
* Colorectal Cancer in Idaho 2002-2004 (PDF file)
* State and National Statistics: Basic Epidemiology of Skin Cancer (PDF file)
* Tobacco Facts and Figures 2003 (Lung Cancer) (PDF file)
* Breast Cancer in Idaho, 1997-2001 (PDF file)
* Idaho Breast Cancer Facts and Figures 2002 (PDF file)
* Idaho Colon and Rectum Cancer Facts and Figures 2002 (PDF file)
* Brain Cancer, 1996-2000 (PDF file)
* Brain Cancer in Eastern Idaho, 1976-96
* Brain Cancer in Shoshone County, 1990-2000 (PDF file)

https://www.idcancer.org/ContentFiles/special/Brain9600.pdf

Section V. C. Radiation Exposure Standards

Current radiation exposure standards are being challenged by researchers studying the health effects - particularly low-level exposure. Historical standards were set based on Hiroshima bomb victim studies of high-level exposure. These early government studies considered low-level exposure of little significance. Recent studies have found that rather than killing a cell, low-level exposure can damage or mutate the genetic structure of a cell. This damage can, in time, result in a wide range of effects from cancer to multiple generational birth defects.

Karl Z. Morgan, M.D. is the founder of the science of health physics and was Director of the Health Physics Division of the Oak Ridge National Laboratory from 1943 to 1972. Dr. Morgan states that, "the most significant damage from low-level radiation results from the direct interaction of the stream of ions produced by radiation with the nucleus of one of the billions of irradiated cells. The cell may be killed, the radiation may produce no damage, or such damage as is caused may be repaired. But there is a fourth possibility that concerns us: that the cell nucleus may be damaged but the cell survives and multiplies producing over a period of years, a clone of cells that is diagnosed as a malignancy." [Morgan,(a)]

"From 1960 to the present, an overwhelming amount of data has been accumulated that show there is no safe level of exposure and there is no dose of radiation so low that the risk of a malignancy is zero. Therefore, the question is not: Is there a risk from low level exposure? Or, what is a safe level of exposure? The question is: How great is this risk." [Morgan (b)]

In 1990, EPA set the standard to 10 mrem/yr. (0.01 rem/yr.) effective dose equivalent. Idaho standard for gross beta is 4 mrem/yr. That means the accumulation of all beta-emitters to an individual cannot exceed 4 millirem (mrem) per year. In 1991 EPA released new proposed standards for maximum concentrations of radionuclides in drinking water (40-CFR-141-142) that will greatly increase the allowable limits contrary to the scientific literature. For instance, EPA wants to raise the current limit for tritium from 20,000 pCi/L to 60,000 pCi/L. Tritium contamination is the most common groundwater problem around commercial and DOE reactor facilities.

“Tritium, even in low levels, has been linked to developmental problems, reproductive problems, genetic abnormalities, and other health problems in laboratory animals. Additionally, there is evidence of adverse health effects on populations near facilities which utilize tritium (e.g. Darlington tritium extraction facility in Ontario, Canada). Tritium most commonly enters the environment in gaseous form (T_2) or as a replacement for one of the hydrogen atoms in water (HTO, called tritiated water), instead of ordinary, non-radioactive H_2O). Tritiated water can replace ordinary water in human cells (approximately 70% of the soft tissue in the human body is water). It can also enter fetuses through the placenta due to its similarities to ordinary water. Once in living cells, tritium can replace hydrogen in the organic molecules in the body. Thus, despite tritium’s low radio toxicity in gaseous form and its tendency to pass out of the body rather rapidly as water, its health effects are more severe by its property of being chemically identical to hydrogen.” [IEER(g)]

Dieudonne Mewissen, professor of radiology at the University of Chicago, believes the International Commission for Radiation Protection (ICRP) sets high tritium limits because it is generally assumed that tritium is evenly distributed into body tissues. "In fact," says Mewissen, "tritium becomes predominantly incorporated into DNA thus irradiating selectively the cell nucleus at a relatively high dose rate as a consequence of the cell's very small volume."[Quigg,]

Dr. Mewissen's extensive studies of the long-term (ten-generation) genetic damage to mice caused by tritium exposure make for shocking reading. Researchers at Japan's National Institute of Radiological Sciences and Poland's Central Laboratory for Radiological Protection also document shocking genetic effects from tritium exposure. See Tritium listing in Reference Section. There can be little doubt that the US government's analysis of inconsequential effect from tritium exposure is driven by the fact that they simply cannot control tritium releases. Therefore, standards have been adopted that ensure continued operation of nuclear facilities that are not based on the actual health risk to exposed populations.

R. Lowry Dodson, a research scientist at the Lawrence Livermore National Laboratory, reported in 1974, "that chronic low levels of tritium in a range comparable to the [ICRP] Commission's then allowable limits can kill egg cells developing in the ovaries of mice. At levels commonly found in the environment, tritium beta radiation was about three times as destructive to developing egg cell as cobalt-60 gamma rays, an external radiation source widely used in human therapy." [Quigg,]

The current scientific trend is to dramatically reduce the exposure limits. The recent 1990 report by the International Commission of Radiological Protection recommends a reduction of radiation exposure by a factor of five. [Greenpeace(a),] The National Academy of Sciences also released a new report. This BEIR-5 study concludes that the risks have been underestimated. This report further states that the likelihood of getting cancer after being exposed to a low dose of radiation is three to four times higher than that given in the earlier Academy Report.

A British research team (Gardner, et al) studying England’s Sellafield nuclear plant found genetic prenatal damage which resulted in childhood diseases in succeeding generations. "Relative risks for leukemia and non-Hodgkin's lymphoma were higher in children born near Sellafield and in children of fathers employed at the plant, particularly those with high radiation dose readings before their child's conception." [British Medical Journal,vol.300,p.423] Gardner's finding suggests that fathers receiving as little as 1 rem exposure to radiation, (less than six months before conception) may be passing on a mutation to their offspring that increases the offspring's subsequent risk of cancer. Seascale, a village near Sellafield, had 12 times as many childhood cancers as expected. [Quiggley(a)] A dose-response relationship was observed, the association being strongest in the highest paternal dose group. Gardner demonstrated a case/control study that a high proportion of these cancers were linked to father's occupation at the Sellafield plant. [British Medical Journal, 2/90]

A study by Hatch and Susser of Columbia School of Public Health in New York just published in the International Journal of Epidemiology found a positive correlation between background gamma radiation and childhood cancers in census tracts within ten miles of the Three Mile Island Nuclear Facility. For childhood cancers, as a whole, incidence rates relate significantly to background radiation; the association is strongest in children ages 10-14 years. Their data indicate a 50% increase in risk of cancer of children under 15 with every 0.1 mgy increase in estimated annual background gamma ray dose rate. [Quigley(b)]

Inhalation of alpha emitting nuclides poses significant biological risk. Less than one microcurie of plutonium (the size of a grain of pollen) will cause lung cancer and death if inhaled or ingested. "Plutonium (Pu) is an alpha emitter, and no quantity inhaled has been found to be too small to induce lung cancer in animals." [Bertell,p.24] DOE-funded experiments with beagle dogs demonstrate that inhalation of less than one microcurie of Pu-239 oxide result in an incidence of lung cancer approaching 100%. [Parks]

A National Research Council report also has found that cancer risks from low level X-ray and gamma ray radiation are three to four times greater than earlier believed. [AP(b),12/26/89] As research and data are added to the collective scientific understanding of the health effects of low level radiation exposure, regulatory authorities are being asked to reevaluate their standards. Prudence would dictate a sensitivity to this trend in analyzing the impact of INL operations.

"Dr. Karl Morgan, also former head of the International Commission on Radiological Protection (ICRP) who is known as the 'father of health physics', has called the organization he used to run `reckless' for relaxing its standards. `Given that we are beginning to recognize that radiation risks are greater than we used to consider them,' Morgan says. He is now urging both the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) to reject the relaxed allowances." [Statesmen(b)] EPA and NRC adopt the standards set by the ICRP. In December, 1990 the NRC finally revised its thirty-year old standards to one-fifth the exposure level currently allowed, though the regulations will not take effect until 1993. [Tribune(b)]

According to the Nuclear Information and Resource Service, "The commission (NRC) is straining its credibility by adopting an obsolete standard. The new standards reflect recommendations made by leading scientists thirteen years ago." [Tribune(b)] Profiles of all radionuclides of concern, including tritium, must be reassessed to provide additional analyses to ensure the government protects the public health through adequate exposure standards.

Oil, Chemical, and Atomic Workers Union is proposing contract language which requests a 90% reduction of work exposure. "At the present level of 5 rem/year for a work life of forty years, the increase risk for developing cancer is estimated to range from eight times greater than that for the reference "safe industry" according to the Nuclear Regulatory Commission, to 20 times greater by the US Environmental Protection Agency. This risk estimate assumes that in the reference "safe industry" one death per 10,000 workers is acceptable. This accounts only for the cancer risk linked to radiation exposure; it does not reflect the other health and safety risks in the nuclear industry." [OCAW @ I-A] Exposure to non-radioactive carcinogens by DOE contract workers is considered by Union members to be equally as hazardous as radioactive exposures. Additionally, the synergistic (combined) effect of radiation and chemicals is a risk- area workers believe the health agencies have overlooked.

The Three Mile Public Health Fund, created and supervised by Federal District Court in Harrisburg, PA announced the results of its study of DOE workers at Hanford, Rocky Flats, and Oak Ridge. Though the court authorized the study in 1987, DOE refused to release the data until 1990 after a protracted court battle which DOE ultimately lost. Dr. Alice Stewart, an internationally recognized epidemiologist, headed up the study. The study confirmed findings reported by Dr. Stewart, George Kneale, and Thomas Mancuso in 1977 which was under contract with DOE. The 1977 Hanford study contract was terminated and all data seized when DOE became aware of the research preliminary findings. It took another 13 years and numerous court orders before the researchers could continue their work.

The research found that workers exposed to very small doses of radiation in the same order of magnitude as background exposure may be at significant increased risk of developing radiogenic cancers. Stewart and Kneale's analysis of Hanford workers showed that there were extra deaths from radiogenic cancers due to occupational exposures. The additional cancer cases were mainly older workers over 40 years at the time of exposure. When exposure reached 26 rems, researchers found an increase of 100% in cancer incidence. Older workers (60 to 65 years) exposed to the same level (26 rem) showed an increase cancer risk 20 times higher than for all workers.

Physicians for Social Responsibility *Dead Reckoning*, cites INL exposure records acknowledging 154 workers received greater than 5 rem/yr. and 562 received 4 rem to just under 5 rem between 1951 and 1989. This figure includes only prime contractors and does not include subcontractors, construction workers, security guards, or military (including Navy) personnel. [Dead Reckoning@41]

Also see Tami Thatcher's, *Radiological and Chemical Exposures at the Idaho National Laboratory that Workers May Not Have Known About —How health is harmed by uranium, plutonium and other radiological and chemical exposures and possible nutritional support strategies that states:*

"Brief Summary: Radiation workers and non-radiation workers at the Idaho National Laboratory since 1952 have been exposed to direct radiation sources, airborne radiological releases, contaminated soil, and contaminated drinking water —often without their knowledge. This report highlights historical operations at what is now called the Idaho National Laboratory and the contaminants. It discusses shortcomings in worker radiation protection standards and radiological monitoring. Former workers often have little idea of their potential exposures or health risks of the exposures. This report discusses the radiation exposure, ingestion and inhalation of radionuclides and exposure to chemical hazards that may be affecting their health —information that may be helpful as they receive care from health care providers to address their health challenges. The oxidative stress caused by ionizing radiation is described. The role of antioxidant systems, detoxification systems and nutritional support is also described which may aid a reader to seek further information to address chronic health issues." [6] [7]

See Section VIII.C for information on radiation standards.

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[6] Tami Thatcher, *Radiological and Chemical Exposures at the Idaho National Laboratory that Workers May Not Have Known About —How health is harmed by uranium, plutonium and other radiological and chemical exposures and possible nutritional support strategies,* Environmental Defense Institute Special Report April 2017; http://environmental-defense-institute.org/publications/Radchemreport.pdf

[7] Tami Thatcher, Idaho National Laboratory, Hanford, and Nevada Test Site Radiation Exposure Radiation Victim Stories Revision 26 Edited by Chuck Broscious And Tami Thatcher Updated September 2014. http://environmental-defense-institute.org/publications/Radchemreport.pdf