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DuPont Epidemiology Surveillance Report

MORTALITY AND CANCER INCIDENCE SURVEILLANCE AT WASHINGTON WORKS

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**MORTALITY AND CANCER INCIDENCE SURVEILLANCE
AT WASHINGTON WORKS**

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SUMMARY

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INTERPRETATION OF EPIDEMIOLOGIC SURVEILLANCE DATA

Enclosed are tables for Washington Works showing (1) cancer incidence surveillance from 1956 through 1992 among active employees and (2) mortality surveillance from 1957 through 1993 among active employees and pensioners. For each specific cause, the number of observed cases/deaths (OBS) is compared to the number expected (EXP) based on the experience of the entire Company. Comparison is made by the ratio of the observed to the expected numbers of cases/deaths (OBS/EXP). Accompanying each table is descriptive text which summarizes the major findings.

Sources of Surveillance Data

Since 1956, cancer cases that occur among active employees in the U.S. are recorded in the DuPont Cancer Registry. Through 1988, cases have been reported to the Registry primarily by diagnoses entered on Accident and Health Insurance (A&H) claims and by death certificates that accompany life insurance claims filed by beneficiaries of deceased employees. Since 1988, insurance claims data are being used to ascertain diagnoses of cancer among active employees. Beginning in 1977, registry data sources were supplemented by Cancer Registry Report forms submitted by Company physicians. The Cancer Registry does not include cases diagnosed among employees whose cancer was first diagnosed after retirement or after employment termination due to reasons other than pension.

Deaths that occur among active and pensioned employees in the U.S. are recorded in the DuPont Mortality Registry that was initiated in 1957. Deaths are identified through life insurance claims filed by beneficiaries of deceased employees. Deaths that occur among employees terminated without pension are not included since there is no uniform mechanism for identification of these deaths.

Methods

To determine expected numbers of cases/deaths for the standardized analysis, cancer incidence and mortality rates for DuPont employees (and pensioners for mortality), specific for 5-year age categories, gender and payroll class (i.e., wage or salary roll), are computed for each cause category shown in the enclosed tables. Then, the Company-wide incidence/mortality rates are multiplied by the cumulative mid-year population of employees (and pensioners, where applicable) from each location, specific for age, gender and payroll class, over the entire study period. The sum of the products over all age groups is the expected number of cases or deaths.

Standardized analyses are preferred because they provide age-adjusted expected numbers and are based on actual plant populations. In isolated cases where accurate population data are not available, proportionate incidence or mortality analyses are presented. In these analyses, the observed distribution of cases/deaths by cause is compared with that expected derived from proportions which occur throughout the entire Company. Proportions can be misleading, however, as it is possible to have an unusual

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distribution of cases/deaths without there being any excess rate for any specific cause. For example, if a plant has a lower death rate from heart disease than the rate in the Company as a whole, the proportion of deaths from other causes would be inflated (compared to that of the entire Company) in order that proportions for all causes add up to 100 percent.

Tests of Statistical Significance

To test whether the observed to expected ratios (OBS/EXP) given in the tables differ significantly from 1.00, we determine the probability that the difference between the observed and expected numbers occurred by chance alone. This probability value is obtained from the Poisson probability distribution. The difference is considered statistically significant if the probability value is less than 0.10 using the two-tailed test. In the two-tailed test, statistically significant deficits as well as excesses are denoted. Statistical significance is tested only if either the observed or expected number of cases or deaths is four or more.

Interpretation of Statistically Significant Results

The designation of a statistically significant excess often suggests the need for further investigation to determine whether the excess may have occurred because of some agent at the plant. However, an excess may also occur because of environmental and other factors associated with increased risks, such as smoking, diet, alcohol, ethnic origin, socioeconomic status or genetic factors.

Chance alone may account for a statistically significant difference. When the level of statistical significance is set at 0.10, one should expect to find a statistically significant difference in about 10 out of every 100 comparisons due to chance alone, even when no specific causative factor is responsible.

The magnitude of the difference, expressed as the ratio of observed to expected numbers (OBS/EXP), must also be considered in data interpretation. The OBS/EXP ratio and its corresponding probability value should be considered together in assessment of the difference between an observed and expected number.

It may be that the observed number for a particular cause is greater than the expected number, but the difference is not statistically significant. In this instance, it does not necessarily follow that a particular agent at the plant may not be associated with the moderate excess. If the number of persons at the plant exposed to the agent is small, excess morbidity or mortality in that group would be difficult to detect because of dilution by data from the rest of the plant. Also, it may be too soon for effects of an agent to be manifested by excess morbidity or mortality.

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CANCER INCIDENCE SURVEILLANCE - 1956-1992

Male Employees (Table 1)

Among male employees at Washington Works from 1956-1992, 149 cancer cases are reported and 132 expected. The total observed/expected case ratio is 1.25 for male salary and 1.07 for male wage employees.

Buccal cavity and pharynx

Cancers of the buccal, or oral, cavity and pharynx are statistically significantly elevated among male wage (9 cases and 3.1 expected) and all male employees (10 cases versus 4.6 expected). One case has been reported since the last surveillance update through 1989 and 0.3 would have been expected. Anatomic sites are lip (4 cases), other parts of mouth (1 case), oropharynx (1 case), pharynx (2 cases) tongue (1 case) and salivary gland (1 case).

Primary risk factors for oral cancers are use of smokeless tobacco, alcohol usage and tobacco smoking. Although several occupational groups have been reported to have an excess of this cancer (e.g. those employed as metal, textile or steel workers and plumbers and asbestos workers), occupational exposures are not suspected to play a major role in the etiology of this disease. An exception is that persons employed in occupations with prolonged exposure to sunlight have a greater risk of lip cancer.

Recommendations (and Results):

Determine smoking histories, with particular attention to information on use of smokeless tobacco, if available.

'Out of 10 cases, 7 smoked cigarettes for a number of years before diagnosis, 2 were nonsmokers and 1 case could not be determined. Information on the use of smokeless tobacco was not available.'

Consider use of educational materials: on the adverse health effects from use of smokeless tobacco and importance of regular dental hygiene visits in screening oral cancers.

'As part of our Wellness program, it is our current practice to distribute American Cancer Society literature on smokeless tobacco usage to anyone who is at risk according to their wellness appraisal. The site has also run several clinics for people who are attempting to quit smoking. The policy of only allowing smoking outdoors has also focused attention on its dangers.'

Add work history of one additional case to previous work history review of 9 cases. 'The 10 cases show no commonality of exposure. Also, for 2 cases the date of diagnosis is less than one year after they were hired, and for 2 others the diagnosis was within 5 years of hiring. This would make it unlikely that exposure at the site was the cause of the disease. Of the remaining 6 cases, 4 were cigarette smokers and 2 were nonsmokers.'

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Kidney and other urinary cancers

The category of kidney cancer and other urinary cancers is no longer statistically significant in male employees. No kidney cancer cases have been reported since 1989. At that time, examination of work histories of the 9 cases identified no commonality that would suggest a workplace causality.

Multiple myeloma

A three fold excess of multiple myeloma is seen among male employees (5 cases are observed versus 1.6 expected). An additional case was reported in 1990, which results in statistical significance. Among female employees, 2 cases were observed and less than .1 expected. Statistical significance, however, is only tested on four or more cases.

Suspected risk factors for multiple myeloma are familial history, exposure to ionizing radiation and increased age. Occupational groups that have been reported to have an increased risk of mortality from multiple myeloma are farmers, copper smelter workers exposed to arsenic, rubber workers, petroleum refinery workers and workers exposed to asbestos, plastics, cutting oil, wood dust and leather.

Recommendation (and Result)

Work histories of all 7 cases were examined in late 1992, shortly after the last surveillance results on cancer incidence were issued. No unusual patterns were observed which would be indicative of a common workplace exposure. This work history review should be expanded and reassessed after inclusion of the one additional case.

'The additional case does not change the previous conclusion of no commonality of exposure.'

Other lymphoma

A statistically significant excess of 'other lymphoma' continues among all male employees (8 cases versus 3.8 expected). One additional case has been reported since 1989 whereas 0.8 would have been expected. Seven cases are reported to be malignant lymphoma, not otherwise specified, and one is nodular lymphoma.

Occupational risk factors are difficult to determine from the literature since most studies report only on mortality and in mortality studies, deaths from all lymphatic cancers and leukemia are generally grouped together. Mortality from lymphomas has been reported to be elevated among chemists, rubber workers, petroleum refinery workers, and less consistently in several other occupational groups.

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Recommendation (and Result)

Work histories of the 7 cases reported through 1989 had been examined and no job or work area clusters were noted. The work history of the one additional case should be determined and compared with those of the previously examined 7 work histories.

'The additional case does not change the previous conclusion of no commonality of exposure. Also, one case was diagnosed less than half a year after to transfer to the site.'

Leukemia

The elevation in leukemia previously reported among male wage and all male employees is no longer statistically significant (9 cases are reported and 5.1 would be expected). A 1991 case-control study of leukemia at Washington Works found no association between work in any area at the plant and development of leukemia. We will continue to monitor for any additional cases.

Malignant melanoma

Incidence of malignant melanoma is elevated among men in the salary roll, with 8 cases reported and 3.8 expected. This finding was not present in the most recent surveillance report through 1989. Since then, 1 case has been reported and .55 would have been expected. Incidence is somewhat lower than expected in the wage roll, with 5 cases observed and 7.3 expected. This pattern follows reports in the general population, where non-manual workers are at greater risk than manual workers of developing malignant melanoma. The effect, however, does not appear to be related to occupational factors.

In the general population, the incidence of malignant melanoma has been rising rapidly. The major risk factor is believed to be excessive sunlight exposure, particularly in the first 20 years of life. Although an excess of malignant melanoma has been reported in several occupational epidemiology studies, no consistent patterns have been seen and no chemical etiologic agent is suspected.

Recommendations (and Results)

Since malignant melanoma is the most deadly form of skin cancer, early diagnosis is a crucial factor for a favorable prognosis. We recommend distribution of literature available through the local branch of your American Cancer Society which describes characteristics of moles which may indicate the presence of malignant melanoma and the need for urgent professional medical consultation.

'Our Wellness Consultant has prepared an employee training package on the dangers of skin cancer which will be used in the near future.'

As a precautionary measure, we recommend examination of the work histories of the 8 salary roll cases to ensure that no jobs or work areas are more in common than would be expected.

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'These 8 cases do not appear to have any commonality of exposure. One individual worked for 5 years at Savannah River and another worked for 10 years at Sabine River. Both locations provide ample opportunity for exposure to strong sunlight. Two other cases were diagnosed 4-6 years after transfer to the site, which is shorter than the 10-20 year latency period typical for melanoma.'

Female Employees (Table 2)

There are no statistically significant excesses or deficits in the cancer experience of female employees at Washington Works during 1956-1989. Overall, 20 cancer cases were reported and 14.9 expected; 7 of these cases were breast cancer, compared with 5.2 expected. In the wage roll, 10 cases were observed versus 5.8 expected, and in the salary roll, 10 cases versus 9.0 expected.

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TABLE 1 - Observed/Expected Cancer Incidence Results for Male Employees

TYPE OF CANCER	OBSERVED AND EXPECTED CANCER INCIDENCE USING POPULATION BASED RATES - 07FE896									
	WASHINGTON WORKS - 1956 - 1992, MALES					(LOCATION CODE = 013)				
	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED
SALARY ROLL										
	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED
BUCCAL CAVITY & PHARYNX	1	1.57	0.63	9	3.07	2.93	4.64	2.15	10	4.64
ESOPHAGUS	0	0.54	0.00	0	1.37	0.00	1.92	0.00	0	1.92
STOMACH	0	0.87	0.00	0	1.71	0.00	2.57	0.00	0	2.57
SMALL AND LARGE INTESTINE	9	5.86	1.54	8	8.49	0.94	14.34	1.19	17	14.34
RECTUM AND BILIARY PASSAGES	3	2.03	1.48	3	3.70	0.81	5.73	1.05	6	5.73
LIVER AND BILIARY PASSAGES	0	0.57	0.00	2	1.04	1.93	1.61	0.65	2	1.61
PANCREAS	1	1.26	0.79	2	2.29	0.88	3.55	3.42	3	3.55
PERITONEUM	0	0.12	0.00	1	0.17	5.72	0.29	0.00	1	0.29
UNSPEC. DIGESTIVE ORGANS	0	0.03	0.00	0	0.01	0.00	0.03	0.00	0	0.03
NOSE, NASAL CAVITIES, ETC.	1	0.15	6.76	0	0.63	0.00	0.78	1.29	1	0.78
LARYNX	1	0.75	1.34	0	0.34	1.28	3.08	1.30	4	3.08
LUNG, BRONCHUS, & TRACHEA	8	7.86	1.02	13	17.70	0.73	25.57	0.82	21	25.57
MEDIASTINUM & UNSPEC.	0	0.12	0.00	0	0.17	0.00	0.29	3.58	0	0.29
PLEURA	0	0.14	0.00	2	0.42	4.79	0.56	0.00	2	0.56
BREAST	0	0.11	0.00	0	0.10	0.00	0.21	0.00	0	0.21
PROSTATE	2	3.25	0.62	3	5.58	0.54	8.83	0.57	5	8.83
TESTIS	1	1.17	0.86	0	0.23	0.94	0.25	0.00	3	0.25
OTHER MALE GENITAL ORGANS	1	0.02	0.00	0	2.78	1.44	4.96	1.82	0	4.96
KIDNEY & OTHER URINARY	5	2.17	2.30	9	5.06	1.78	7.31	1.37	10	7.31
BLADDER	1	2.24	0.45	5	7.34	0.68	11.09	1.17	13	11.09
MALIGNANT MELANOMA	8	3.75	2.14	0	0.23	0.00	0.35	0.00	0	0.35
EYE	0	0.12	0.00	0	1.52	0.91	4.90	0.82	4	4.90
BRAIN & OTHER NERVOUS SYSTEM	1	1.60	0.62	3	3.29	0.66	2.09	0.48	1	2.09
THYROID	0	0.57	0.00	1	0.26	7.67	0.66	1.52	3	0.66
OTHER ENDOCRINE GLANDS	1	0.22	4.60	2	0.44	1.55	2.74	0.73	2	2.74
BONE	0	0.76	0.00	1	1.29	0.00	2.05	0.00	2	2.05
CONNECTIVE TISSUE	0	1.33	1.50	0	1.40	0.00	3.39	1.18	4	3.39
LYMPHOSARCOMA & RETICULOSARCOMA	2	0.99	2.01	2	2.77	0.83	3.78	3.11	4	3.78
HODGKIN'S DISEASE	2	1.01	1.98	6	1.10	2.17	1.61	1.78	8	1.61
OTHER LYMPHOMA	2	0.51	3.91	3	3.38	2.73	5.06	2.47	5	5.06
MULTIPLE MYELOMA	2	1.68	1.79	6	0.00	1.77	0.40	0.00	9	0.40
LEUKEMIA	3	0.12	0.00	0	0.00	0.00	0.12	0.00	0	0.12
MYCOSIS FUNGOIDES	0	0.18	5.57	0	2.46	0.41	3.49	0.57	1	3.49
OTHER HEMATOPOIETIC SYSTEM	1	1.03	0.97	1	87.09	1.07	132.00	1.13	2	132.00
OTHER & UNKNOWN	56	44.91	1.25	93	87.09	1.07	132.00	1.13	149	132.00
TOTAL ALL CAUSES	56	44.91	1.25	93	87.09	1.07	132.00	1.13	149	132.00

STAT SIGNIFICANT EXCESS (*) / DEFICIT (#) AT 2-TAILED 0.10 LEVEL (CALCULATED ONLY WHERE EITHER OBS OR EXP GE 4)

NOTE: OTHER SKIN CANCER NOT INCLUDED IN THIS REPORT

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TABLE 2 - Observed/Expected Cancer Incidence Results for Female Employees

TYPE OF CANCER	OBSERVED AND EXPECTED CANCER INCIDENCE USING POPULATION BASED RATES - 07FEB96				WASHINGTON WORKS - 1992 FEMALES				WAGE + SALARY			
	1956 - 1992 FEMALES				WAGE ROLL				WAGE ROLL			
	OBSERVED	EXPECTED	OBS/EXP		OBSERVED	EXPECTED	OBS/EXP		OBSERVED	EXPECTED	OBS/EXP	
BUCCAL CAVITY & PHARYNX	0	0.06	0.00		0	0.17	0.00		0	0.23	0.00	
ESOPHAGUS	0	0.00	0.00		0	0.00	-		0	0.00	0.00	
STOMACH	0	0.09	0.00		0	0.00	-		0	0.09	0.00	
SMALL AND LARGE INTESTINE	0	0.42	0.00		0	0.20	0.00		0	0.62	0.00	
RECTUM	0	0.13	0.00		0	0.14	0.00		0	0.27	0.00	
LIVER AND BILIARY PASSAGES	0	0.02	0.00		0	0.12	0.00		0	0.14	0.00	
PANCREAS	0	0.05	0.00		0	0.02	0.00		0	0.07	0.00	
PERITONEUM	0	0.00	0.00		0	0.00	0.00		0	0.00	0.00	
NOSE, NASAL CAVITIES, ETC.	0	0.01	0.00		0	0.00	-		0	0.01	0.00	
LARYNX	0	0.04	0.00		0	0.01	0.00		0	0.05	0.00	
LUNG, BRONCHUS, & TRACHEA	0	0.49	0.00		1	0.14	0.00		1	0.63	1.59	
BREAST	4	3.23	1.24		3	1.99	1.51		7	5.22	1.34	
CERVIX	0	1.53	0.00		4	1.53	2.62		4	3.06	1.31	
OTHER FEMALE GENITAL ORGANS	0	1.03	0.00		0	0.46	0.00		0	1.49	0.00	
KIDNEY & OTHER URINARY	0	0.07	0.00		0	0.17	0.00		0	0.19	0.00	
BLADDER	0	0.44	0.00		0	0.02	0.00		0	0.09	0.00	
MALIGNANT MELANOMA	0	0.13	0.00		0	0.22	0.00		3	0.66	4.55	
EYE	0	0.31	3.23		1	0.00	0.00		0	0.01	0.00	
BRAIN & OTHER NERVOUS SYSTEM	1	0.00	0.00		0	0.06	0.00		0	0.13	0.00	
THYROID	0	0.08	0.00		0	0.06	0.00		1	0.37	2.74	
OTHER ENDOCRINE GLANDS	0	0.09	0.00		0	0.06	0.00		0	0.06	0.00	
BONE	0	0.14	0.00		0	0.07	0.00		0	0.08	0.00	
CONNECTIVE TISSUE	0	0.19	0.00		0	0.06	0.00		1	0.16	6.22	
LYMPHOSARCOMA & RETICULOSARCOMA	0	0.14	0.00		0	0.07	13.39		0	0.20	0.00	
HODGKIN'S DISEASE	0	0.19	0.00		0	0.03	0.00		0	0.21	0.00	
OTHER LYMPHOMA	0	0.14	0.00		0	0.19	0.00		0	0.32	0.00	
MULTIPLE MYELOMA	2	0.09	22.81		0	0.00	0.00		2	0.09	22.81	
LEUKEMIA	1	0.09	7.22		0	0.09	0.00		1	0.23	4.32	
MYCOSIS FUNGOIDES	0	0.00	0.00		0	0.00	0.00		0	0.00	0.00	
OTHER & UNKNOWN	0	0.10	0.00		0	0.06	0.00		0	0.17	0.00	
TOTAL ALL CAUSES	10	9.03	1.11		10	5.82	1.72		20	14.85	1.35	

STAT SIGNIFICANT EXCESS (*) / DEFICIT (#) AT 2-TAILED 0.10 LEVEL (CALCULATED ONLY WHERE EITHER OBS OR EXP GE 4)

NOTE: OTHER SKIN CANCER NOT INCLUDED IN THIS REPORT

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MORTALITY SURVEILLANCE - 1957-1993

Male Employees and Pensioners (Table 3)

The overall mortality experience of male wage and all male employees at Washington Works continues to be statistically significantly lower than expected. For the time period 1957-1993, a total of 444 deaths are observed among all male employees and pensioners at the site and 494 would have been expected based on DuPont mortality rates (Table 3).

All malignant neoplasms

A statistically significant deficit of deaths is seen for all cancers combined among male wage (72 deaths versus 88.6 expected) and all male employees and pensioners (115 deaths versus 141.3 expected). None of the individual cancer cause of death categories show a statistically significant deficit in mortality.

Mortality from lymphatic and hematopoietic neoplasms, a category which is elevated in the incidence surveillance results, is close to expected.

Other heart disease

Mortality from "other heart disease" is elevated, with 17 deaths reported and 10.7 expected. This category has shown an excess in previous reports, but the ratio of observed to expected deaths has not been not statistically significant until now. This residual grouping comprises non-specific 'heart failure' and other ill-defined descriptions and complications of heart disease; i.e. acute and chronic pulmonary disease, acute pericarditis, acute and subacute endocarditis, acute myocarditis, other disease of pericardium and endocardium, cardiomyopathy, conduction disorders and cardiac dysrhythmias. No occupational risk factors are suspected.

Arteriosclerosis

There is a statistically significant excess of deaths from arteriosclerosis among all male employees (4 deaths versus 1.3 expected). Arteriosclerosis, a condition characterized by thickening and loss of elasticity of arterial walls, has no known occupational risk factors. Years of death are 1977, 1978, 1992 and 1993, and ages at death are 50 and 78 (three).

Motor vehicle accidents

Motor vehicle accidental deaths were higher than expected in the male salary roll, with 8 deaths observed and 3.7 expected. Four of these deaths were recent, 2 in 1990 and 2 in 1993. There is a marked deficit of deaths from "other accidents" in the male wage roll.

Suicide

There is a marked deficit of suicide among male wage and all male employees.

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Female Employees and Pensioners (Table 4)

Among female employees and pensioners, 16 deaths are observed and 11.9 expected.
No unusual patterns are seen with respect to individual cause of death categories.

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TABLE 3 - Observed/Expected Mortality Results for Male Employees

CAUSE OF DEATH	OBSERVED AND EXPECTED DEATHS USING POPULATION-BASED RATES - 14FEB96									
	WASHINGTON WORKS - 1957 - 1993, MALES					(LOCATION CODE = 013)				
	SALARY ROLL					WAGE ROLL				
	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED
MALIGNANT NEOPLASMS	1	0.88	1.13	3	1.79	1.67	2.68	1.49	4	2.68
BUCCAL CAVITY & PHARYNX	10	14.05	0.71	16	21.57	0.74	35.82	0.73	26	35.82
DIGESTIVE ORGANS	16	16.76	0.95	24	32.92	0.73	49.68	0.81	40	49.68
RESPIRATORY SYSTEM	0	0.10	0.00	0	0.09	0.00	0.19	0.00	0	0.19
BREAST	4	4.24	0.94	3	6.50	0.66	10.74	0.65	7	10.74
GENITAL ORGANS	1	3.07	0.33	5	4.21	1.19	7.28	0.82	6	7.28
URINARY ORGANS	5	6.14	0.81	10	9.59	1.04	15.73	0.95	15	15.73
LYMPHATIC, ETC.	6	7.47	0.80	11	11.94	0.92	19.40	0.88	17	19.40
OTHER & UNSPECIFIED	43	52.70	0.82	72	88.62	0.81	141.32	0.81	115	141.32
TOTAL MALIGNANT NEOPLASMS	6	8.08	0.74	10	15.57	0.64	23.65	0.68	16	23.65
CEREBROVASCULAR DISEASE	2	0.73	2.74	2	0.80	2.50	1.53	2.61	4	1.53
DISEASES OF THE HEART	62	55.29	1.12	91	98.91	0.92	154.20	0.99	153	154.20
CHRONIC RHEUMATIC HEART DISEASE	1	0.32	3.15	0	0.60	0.00	0.91	1.09	1	0.91
ARTERIOSCLEROTIC HEART DISEASE	0	1.46	0.00	1	1.97	0.51	3.43	0.29	1	3.43
CHRONIC ENDOCARDITIS	17	10.67	1.59	20	19.38	1.03	30.06	1.23	37	30.06
HYPERTENSIVE HEART DISEASE	0	0.02	0.00	0	0.02	0.00	0.04	0.00	0	0.04
OTHER HEART DISEASE	2	0.52	3.84	1	0.74	1.35	1.26	2.38	3	1.26
OTHER CARDIOVASCULAR DISEASE	2	0.49	4.07	2	0.79	2.52	1.28	3.12	4	1.28
RHEUMATIC FEVER	7	3.74	1.87	5	5.65	0.88	9.39	1.28	12	9.39
HYPERTENSION WITHOUT MENTION OF HEART	0	0.02	0.00	0	0.02	0.00	0.04	0.00	0	0.04
GENERALIZED ARTERIOSCLEROSIS	0	0.52	3.84	1	0.74	1.35	1.26	2.38	3	1.26
OTHER	2	0.49	4.07	2	0.79	2.52	1.28	3.12	4	1.28
EXTERNAL CAUSES OF DEATH	8	3.74	2.14	10	15.58	0.64	19.32	0.93	18	19.32
MOTOR VEHICLE ACCIDENTS	1	3.68	0.27	4	9.29	0.43	12.97	0.39	5	12.97
SUICIDE	0	0.48	0.00	1	2.78	0.36	3.25	0.31	1	3.25
HOMICIDE	4	3.69	1.08	4	10.59	0.38	14.28	0.56	8	14.28
OTHER ACCIDENTS	0	0.04	0.00	0	0.11	0.00	0.15	0.00	0	0.15
OTHER CAUSES	5	2.72	1.84	4	5.53	0.72	8.24	1.09	9	8.24
INFLUENZA	0	0.96	0.00	1	2.15	0.47	3.10	0.32	1	3.10
PNEUMONIA	0	0.05	0.00	0	0.22	0.00	0.27	0.00	0	0.27
NEPHRITIS & NEPHROSIS	0	1.34	0.75	4	3.53	1.13	4.87	1.03	5	4.87
TUBERCULOSIS OF RESPIRATORY SYSTEM	1	0.46	0.00	0	0.71	0.00	1.17	0.00	0	1.17
DIABETES MELLITUS	0	0.06	0.00	0	0.03	0.00	0.09	0.00	0	0.09
PEPTIC ULCER	0	0.28	0.00	1	0.36	2.81	5.80	1.57	1	5.80
APPENDICITIS	3	2.07	1.45	2	3.73	0.54	3.83	1.31	5	3.83
HERNIA & INTESTINAL OBSTRUCTION	1	1.26	0.79	4	3.56	1.56	4.93	0.61	3	4.93
CIRRHOSIS OF THE LIVER	1	1.66	0.60	2	3.27	0.61	4.60	0.87	3	4.60
EMPHYSEMA	13	15.75	0.83	24	26.84	0.89	42.60	0.87	37	42.60
SYMPTOMS & ILL-DEFINED CONDITIONS	0	0.09	0.00	0	0.89	0.00	0.98	0.00	0	0.98
RESIDUAL	179	172.34	1.04	265	321.21	0.83	493.55	0.90	444	493.55
UNSPECIFIED	0	0.00	0.00	0	0.11	0.00	0.15	0.00	0	0.15
TOTAL ALL CAUSES	179	172.34	1.04	265	321.21	0.83	493.55	0.90	444	493.55

STAT SIG EXCESS (*) / DEFICIT (#) AT 2-TAILED 0.10 LEVEL (CALCULATED ONLY WHERE EITHER OBS OR EXP GE 4)

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TABLE 4 - Observed/Expected Mortality Results for Female Employees

CAUSE OF DEATH	OBSERVED AND EXPECTED DEATHS USING POPULATION-BASED RATES - 14FEB896									
	WASHINGTON WORKS - 1957 - 1993, FEMALES					(LOCATION CODE = 013)				
	SALARY ROLL					WAGE ROLL				
	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED	OBSERVED	EXPECTED	OBS/EXP	OBSERVED	EXPECTED
MALIGNANT NEOPLASMS	0	0.04	0.00	0	0.00	0	0.00	0.00	0	0.04
BUCCAL CAVITY & PHARYNX	0	0.52	0.00	0	0.27	0	0.27	0.00	0	0.79
DIGESTIVE ORGANS	0	0.56	0.00	0	0.16	0	0.16	0.00	0	0.72
RESPIRATORY SYSTEM	0	1.14	0.00	1	0.87	1	0.87	1.14	1	2.02
BREAST	0	0.48	0.00	0	0.09	0	0.09	0.00	0	0.57
GENITAL ORGANS	0	0.07	0.00	0	0.18	0	0.18	0.00	0	0.25
URINARY ORGANS	1	0.47	2.14	0	0.23	0	0.23	0.00	1	0.70
LYMPHATIC, ETC.	1	0.49	2.04	1	0.15	1	0.15	6.58	2	0.64
OTHER & UNSPECIFIED	2	3.77	0.53	2	1.96	2	1.96	1.02	4	5.74
TOTAL MALIGNANT NEOPLASMS	0	0.47	0.00	1	0.29	1	0.29	3.47	1	0.76
CEREBROVASCULAR DISEASE	0	0.10	0.00	0	0.00	0	0.00	0.00	0	0.10
DISEASES OF THE HEART	2	0.82	2.44	0	0.35	0	0.35	0.00	2	1.17
CHRONIC RHEUMATIC HEART DISEASE	0	0.01	0.00	0	0.00	0	0.00	0.00	0	0.01
ARTERIOSCLEROTIC HEART DISEASE	0	0.04	0.00	0	0.00	0	0.00	0.00	0	0.05
CHRONIC ENDOCARDITIS	1	0.27	3.66	0	0.20	0	0.20	0.00	1	0.47
HYPERTENSIVE HEART DISEASE	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
OTHER HEART DISEASE	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
OTHER CARDIOVASCULAR DISEASE	0	0.02	0.00	0	0.00	0	0.00	0.00	0	0.02
RHEUMATIC FEVER	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
HYPERTENSION WITHOUT MENTION OF HEART	0	0.10	0.00	0	0.03	0	0.03	0.00	0	0.13
GENERALIZED ARTERIOSCLEROSIS	0	0.59	1.69	1	0.38	1	0.38	2.64	2	0.97
OTHER	0	0.25	0.00	0	0.15	0	0.15	0.00	0	0.40
EXTERNAL CAUSES OF DEATH	0	0.13	0.00	0	0.05	0	0.05	0.00	0	0.18
MOTOR VEHICLE ACCIDENTS	1	0.01	0.00	0	0.00	0	0.00	0.00	0	0.01
SUICIDE	0	0.11	0.00	0	0.01	0	0.01	0.00	0	0.12
HOMICIDE	0	0.01	0.00	0	0.03	0	0.03	0.00	0	0.03
OTHER ACCIDENTS	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
OTHER CAUSES	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
INFLUENZA	0	0.05	19.50	0	0.01	0	0.01	0.00	0	0.06
PNEUMONIA	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
NEPHRITIS & NEPHROSIS	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
TUBERCULOSIS OF RESPIRATORY SYSTEM	1	0.00	0.00	0	0.00	0	0.00	0.00	1	17.29
DIABETES MELLITUS	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
PEPTIC ULCER	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
APPENDICITIS	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
HEPATOMA & INTESTINAL OBSTRUCTION	0	0.06	0.00	0	0.01	0	0.01	0.00	0	0.07
CIRRHOSIS OF THE LIVER	0	0.05	0.00	1	0.00	1	0.00	0.00	1	0.05
EMPHYSEMA	1	0.11	8.98	0	0.03	0	0.03	0.00	1	0.15
SYMPTOMS & ILL-DEFINED CONDITIONS	2	0.79	2.54	1	0.17	1	0.17	6.05	3	0.95
RESIDUAL	0	0.01	0.00	0	0.06	0	0.06	0.00	0	0.06
UNSPECIFIED	10	7.92	1.26	6	3.94	6	3.94	1.52	16	11.86
TOTAL ALL CAUSES	0	0.47	0.00	1	0.29	1	0.29	3.47	1	0.76
	0	0.10	0.00	0	0.00	0	0.00	0.00	0	0.10
	2	0.82	2.44	0	0.35	0	0.35	0.00	2	1.17
	0	0.01	0.00	0	0.00	0	0.00	0.00	0	0.01
	0	0.04	0.00	0	0.00	0	0.00	0.00	0	0.05
	1	0.27	3.66	0	0.20	0	0.20	0.00	1	0.47
	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
	0	0.02	0.00	0	0.00	0	0.00	0.00	0	0.02
	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
	0	0.10	0.00	0	0.03	0	0.03	0.00	0	0.13
	1	0.59	1.69	1	0.38	1	0.38	2.64	2	0.97
	0	0.25	0.00	0	0.15	0	0.15	0.00	0	0.40
	0	0.13	0.00	0	0.05	0	0.05	0.00	0	0.18
	0	0.01	0.00	0	0.00	0	0.00	0.00	0	0.01
	0	0.11	0.00	0	0.01	0	0.01	0.00	0	0.12
	0	0.01	0.00	0	0.03	0	0.03	0.00	0	0.03
	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
	1	0.05	19.50	0	0.01	0	0.01	0.00	1	17.29
	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
	0	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00
	0	0.06	0.00	0	0.01	0	0.01	0.00	0	0.07
	0	0.05	0.00	1	0.00	1	0.00	0.00	1	0.05
	1	0.11	8.98	0	0.03	0	0.03	0.00	1	0.15
	2	0.79	2.54	1	0.17	1	0.17	6.05	3	0.95
	0	0.01	0.00	0	0.06	0	0.06	0.00	0	0.06
	10	7.92	1.26	6	3.94	6	3.94	1.52	16	11.86
	0	0.47	0.00	1	0.29	1	0.29	3.47	1	0.76

CONFIDENTIAL

SUMMARY

The first draft of this document contained recommendations for consideration by your site to follow-up on positive surveillance findings. The final surveillance report includes results of recommendations and follow-up actions taken by the site.

Results of these surveillance data were communicated to employees at the plant site.

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