

Mortality Study at the 3M Chemolite Plant

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**Exhibit
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Introduction

A retrospective cohort mortality study of the 3M Chemolite Plant in Cottage Grove, Minnesota was completed in 1980. The purpose of the study was to determine if the mortality experience of employees at this plant was significantly different from that expected in a comparable population. The results from that study, summarized in a report issued in February of 1980, found no cause of death among employees which was significantly greater than expected.

On February 16, 1984, a contract was instituted to update the initial study by evaluating the mortality experience through 1983. Specifically, it was agreed that the vital status of all former employees would be ascertained and a statistical analysis conducted to determine if there was any significantly different cause of death among Chemolite Plant employees when compared to the general population. This paper presents the methods and results of the followup study.

Methods

The methods employed were essentially the same as those utilized in the initial study. The goal of the study was to determine the vital status of all inactive employees, obtain a copy of the death certificate for those who are deceased, and analyze the mortality data to determine whether there were any significant excesses or deficiencies among Chemolite Plant employees compared to the general population.

The study population was defined as all hourly employees who were employed at least six months at the Chemolite plant. The roster of employees from the initial study (n=3,688) was updated to include:

1. new employees hired since the first study was conducted;
2. terminated (deceased, retired, laid-off, disabled, on leave, transferred) employees since 1978, the closing date of the initial study.

Vital status was determined for all inactive employees through Social Security Administration (SSA), the National Death Index (NDI) and tracing of individuals whose status could not be resolved by SSA or NDI.

On August 15, 1984, a request was sent to SSA requesting a formal agreement for the ascertainment of vital status. Approval was received on October 15, 1984, and a computer tape containing 2,668 records was shipped to SSA on November 1, 1984. The results were returned on March 19, 1985.

In August of 1984, a request for similar services was sent to NDI. Approval was received on October 16, 1984 and a computer tape was shipped October 29, 1984. The results were received November 20, 1984.

Following receipt of the results of the SSA and NDI searches, death certificates were requested from state health departments for all former employees known or presumed to be dead. Death certificates were coded by a professional nosologist according to the Eighth Revision of the International Classification of Diseases.

Employees for whom no vital status information was available were individually traced using a number of resources such as telephone information, reverse street directories to identify former neighbors, motor vehicle registration, former employers, church affiliations and unions.

All data were coded and keyed for computer-assisted analysis. The method of analysis was based on a comparison of the observed to expected number of deaths by cause, adjusted for age, time, sex and race (Monson, 1974).

Expected deaths were obtained from U.S. death rates.

Nested Case-Control Study

For any significantly elevated standardized mortality ratio, a nested case-control study was conducted. Cases were all deaths from the cause which was elevated and controls were four employees individually matched to the case on sex, race, birthyear (± 3 years), year first employed at 3M (± 2 years) and vital status (alive at least until year of death of the case). The work histories of the cases and controls were examined to determine if there were any job titles or department codes associated with the disease.

Results

A total of 4,085 employees (3,204 male and 881 female) were eligible for the study. These employees represented 87,684 person-years at risk (68,833 males and 18,851 for females). Vital status was determined for 100 percent of the cohort. Two hundred and eighty (7%) were deceased and death certificates were obtained for 278. Two died overseas; one in Korea and one in South America. Information on cause of death for those two deaths was obtained from the military for the Korean death and a family member for the death which occurred in South America.

It took from 20 to 341 days to obtain the death certificates from the state health departments. Six states took over three months to respond.

Table 1 presents the observed and expected number of male deaths, the ratio of observed to expected (standardized mortality ratios), the lower and upper 95% confidence limits and the chi-square value by cause of death. The SMR for all causes of death was 0.61 (95% C.L. = 0.54, 0.70), indicating a significantly lower than expected death rate among the Chemolite employees. A major contributor to this favorable mortality experience was the low rate of cardiovascular disease mortality, most probably reflecting a healthy worker effect. The SMR for all cancers was 0.76 (95% C.L. = 0.58, 0.97), a ratio significantly less than 1.0. No cause of death has an SMR significantly greater than 1.0.

Table 2 presents the results for all male (100) deaths among employees in the Chemical Division. The SMR's were 0.64 (95% C.L. = 0.52, 0.78) for deaths from all causes, 0.54, (95% C.L. = 0.37, 0.76) for deaths due to diseases of the circulatory system and 0.73 (95% C.L. = 0.46, 1.10) for cancer deaths. The only statistically significantly elevated SMR was for prostatic cancer deaths where the observed number of deaths (4) was four times greater than expected (SMR = 3.94, 95% C.L. = 1.06, 10.08).

Tables 3 and 4 present the results for all females and females in the Chemical Division, respectively. Based on a total of 35 deaths there were no statistically significant increased standardized mortality ratios.

A nested case-control study was conducted for what were initially five prostatic cancer deaths in the entire study population. For each death

four matched controls were selected. Individual job histories were reviewed to determine if any job titles or department codes occurred more frequently among cases than controls. On reviewing the entire job history, it was apparent that one prostatic cancer death was duplicated. This occurred because the employee had been assigned two different identification numbers and the records contained different dates of entry into the workforce. Thus, the case-control comparison was limited to four cases and 16 controls. The cases were employed in 16 different departments and had 11 different jobs, controls were in 25 different departments and had 27 different jobs. There were no significant differences in department codes or job titles between cases and controls.

Discussion

Employees at the Chemolite Plant were found to have an overall lower than expected death rate than the general population. This occurred for both males and females and for both the whole Plant population and those employed in the Chemical Division. The only exception was for deaths from prostatic cancer among males employed in the Chemical Division where four deaths were observed and 1.02 were expected. Despite efforts to identify duplicate records, one pair was not discovered until job histories were reviewed in the nested case-control study. Removing the duplicate death reduced the SMR from 3.94 to 2.94. Even though this was no longer a statistically significant SMR, the case-control study was still conducted. No specific job title or department code was found to occur more often among cases than controls. Two possible explanations for the larger than expected number of prostatic cancer deaths are: (1) prostatic cancer is

more prevalent in Minnesota than the U.S. and thus a higher rate would be expected and (2) a chance finding due to the large number of comparisons that were conducted.

The conclusion based on this study is that no statistically significant excess mortality was evident among employees at Chemolite.

TABLE 1. OBSERVED AND EXPECTED DEATHS BY CAUSE, STANDARDIZED MORTALITY RATIO (SMR), 95 PERCENT CONFIDENCE LIMITS AND CHI-SQUARE VALUE, MALES, CHEMOLITE PLANT.

	OBSERVED	EXPECTED	OBS/EXP	LL	UL	CHISQ
0 ALL CAUSES OF DEATH	245	399.47	0.61	0.54	0.70	59.35
1 ALL MALIGNANT NEOPLASMS	63	83.23	0.76	0.58	0.97	4.60
2 ALL INFECTIVE AND PARASITIC DISEASE	1	3.97	0.25	0.00	1.40	1.54
9 ALL TUBERCULOSIS	1	1.59	0.63	0.01	3.49	0.01
140 CANCER OF BUCCAL CAVITY AND PHARYNX	1	2.63	0.38	0.00	2.12	0.48
149 CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	21	20.10	1.04	0.65	1.60	0.01
150 CANCER OF ESOPHAGUS (1925- APPROXIMATE)	3	1.93	1.55	0.31	4.54	0.17
151 CANCER OF STOMACH	4	3.19	1.25	0.34	3.21	0.03
153 CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	7	6.77	1.03	0.41	2.13	0.01
154 CANCER OF RECTUM (1925- APPROXIMATE)	1	1.95	0.51	0.01	2.05	0.10
155 ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	1	1.65	0.69	0.01	3.05	0.00
157 CANCER OF PANCREAS (1925- APPROXIMATE)	4	4.19	0.95	0.26	2.44	0.02
160 CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	10	30.72	0.33	0.16	0.60	13.31
161 CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	1	1.16	0.06	0.01	4.79	0.10
162 ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-, 1930- APPROXIMATE)	9	29.22	0.31	0.14	0.58	13.31
170 CANCER OF BOVIE (1925-, 1930-, 1945- APPROXIMATE)	0	0.42	0.00	0.00	8.66	0.01
172 CANCER OF SKIN	1	2.22	0.45	0.01	2.51	0.23
185 CANCER OF PROSTATE (1925- APPROXIMATE)	5*	3.12	1.60	0.52	3.74	0.61
186 CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-49) (1925-, 1930- APPROXIMATE)	1	0.00	1.14	0.01	6.35	0.16
188 CANCER OF BLADDER (1925- APPROXIMATE)	1	1.64	0.61	0.01	3.39	0.01
189 CANCER OF KIDNEY (1925- APPROXIMATE)	1	2.22	0.45	0.01	2.50	0.24
190 CANCER OF EYE (1950-1969 ONLY)	0	0.07	0.00	0.00	55.76	2.87
191 CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMATE)	3	3.49	0.86	0.17	2.51	0.00
193 CANCER OF THYROID (1950-1969 ONLY)	0	0.17	0.00	0.00	21.93	0.66
200 LYMPHOSARCOMA AND RETICULOSARCOMA (1950-1969 ONLY)	1	1.05	0.54	0.01	3.01	0.06
201 HODGKIN'S DISEASE (1940-, 1945- APPROXIMATE)	2	1.45	1.38	0.15	4.97	0.00

*includes duplicate

208 CANCER OF OTHER LYMPHATIC TISSUE (1950-1969 ONLY)	0	3.35	0.00	0.00	1.10	2.42
209 ALL LYMPHOPOIETIC CANCER	3	2.38	1.26	0.25	3.69	0.01
210 BENIGN NEOPLASMS	6	9.38	0.64	0.23	1.39	0.88
240 ALLERGIC, ENDOCRINE, METABOLIC, NUTRITIONAL DISEASES (1950-1969 ONLY)	0	1.26	0.00	0.00	2.91	0.46
250 DIABETES MELLITUS	4	6.68	0.60	0.16	1.53	0.71
280 ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-, 1930- APPROXIM)	3	5.34	0.56	0.11	1.64	0.64
319 MENTAL, PSYCHONEUROTIC, AND PERSONALITY DISORDERS (1950-1969 ONLY)	1	0.86	1.16	0.02	6.47	0.15
320 ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	1	3.47	0.29	0.00	1.60	1.12
390 ALL DISEASES OF CIRCULATORY SYSTEM	3	4.37	0.69	0.14	2.00	0.17
393 CHRONIC RHEUMATIC HEART DISEASE (1925- APPROXIMATE)	104	168.25	0.62	0.51	0.75	24.16
410 ARTERIOSCLEROTIC HEART DISEASE, INCLUDING CHD (1925- APPROXIMATE)	3	3.51	0.85	0.17	2.49	0.00
430 ALL VASCULAR LESIONS OF CHS	84	120.48	0.70	0.56	0.86	10.74
460 ALL RESPIRATORY DISEASES (1925-, 1930- APPROXIMATE)	7	16.53	0.42	0.17	0.87	4.94
480 ALL PNEUMONIA (1925-, 1930- APPROXIMATE)	7	19.18	0.36	0.15	0.75	7.11
492 EMPHYSEMA (1950-, 1955 APPROXIMATE)	3	6.30	0.48	0.10	1.39	1.25
493 ASTHMA (1925-, 1930- APPROXIMATE)	1	3.74	0.27	0.00	1.49	1.34
520 ALL DISEASES OF DIGESTIVE SYSTEM	1	0.59	1.68	0.02	9.37	0.01
531 ALL GASTRIC AND DUODENAL ULCER	12	22.78	0.53	0.27	0.92	4.64
571 CIRRHOSIS OF LIVER	2	1.95	1.03	0.12	3.70	0.10
580 ALL DISEASES OF GENITO-URINARY SYSTEM	3	14.16	0.21	0.04	0.62	8.02
582 CHRONIC NEPHRITIS	0	4.03	0.00	0.00	0.91	3.10
709 ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	1.43	0.00	0.00	2.57	0.60
739 ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	0	0.26	0.00	0.00	14.07	0.22
799 SYMPTOMS, SEVERITY, AND ILL DEFINED CONDITIONS	1	0.76	1.31	0.02	7.32	0.09
800 ALL EXTERNAL CAUSES OF DEATH	1	5.30	0.19	0.00	1.05	2.72
801 ALL ACCIDENTS	46	73.73	0.62	0.46	0.83	10.06
810 MOTOR VEHICLE ACCIDENTS	34	48.67	0.70	0.48	0.98	4.12
959 SUICIDE	27	26.27	1.03	0.68	1.50	0.00
TOTAL RESIDUAL	9	16.10	0.56	0.26	1.06	2.71
	1	-104.94	-0.01			

TABLE 2. OBSERVED AND EXPECTED DEATHS BY CAUSE, STANDARDIZED MORTALITY RATIO (SMR),
95 PERCENT CONFIDENCE LIMITS AND CHI-SQUARE VALUE, MALES, CHEMICAL DIVISION.

	OBSERVED	EXPECTED	OBS/EXP	LL	UL	CHISQ
0 ALL CAUSES OF DEATH	100	156.32	0.64	0.52	0.78	19.93
1 ALL MALIGNANT NEOPLASMS	23	31.36	0.73	0.46	1.10	1.97
2 ALL INFECTIVE AND PARASITIC DISEASE	0	1.53	0.00	0.00	2.60	0.69
9 ALL TUBERCULOSIS	0	0.50	0.00	0.00	6.30	0.01
140 CANCER OF BUCCAL CAVITY AND PHARYNX	0	0.90	0.00	0.00	3.74	0.23
149 CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	6	7.37	0.01	0.30	1.77	0.10
150 CANCER OF ESOPHAGUS (1925- APPROXIMATE)	1	0.71	1.41	0.02	7.05	0.06
151 CANCER OF STOMACH	0	1.16	0.00	0.00	3.17	0.37
153 CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	3	2.49	1.20	0.24	3.51	0.00
154 CANCER OF RECTUM (1925- APPROXIMATE)	0	0.70	0.00	0.00	5.21	0.06
155 ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	0	0.53	0.00	0.00	6.09	0.00
157 CANCER OF PANCREAS (1925- APPROXIMATE)	2	1.54	1.30	0.15	4.69	0.00
160 CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	5	11.40	0.44	0.14	1.02	3.05
161 CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	1	0.42	2.36	0.03	13.15	0.01
162 ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-, 1930- APPROXIMATE)	4	10.04	0.37	0.10	0.94	3.71
170 CANCER OF DOSE (1925-, 1930-, 1945- APPROXIMATE)	0	0.30	0.00	0.00	20.28	0.56
172 CANCER OF SKIN	1	0.93	1.08	0.01	5.99	0.20
185 CANCER OF PROSTATE (1925- APPROXIMATE)	4*	1.02	3.94	1.06	10.00	6.08
186 CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-69) (1925-, 1930- APPROXIMATE)	1	0.41	2.42	0.03	13.44	0.02
188 CANCER OF BLADDER (1925- APPROXIMATE)	0	0.56	0.00	0.00	6.52	0.01
189 CANCER OF KIDNEY (1925- APPROXIMATE)	0	0.04	0.00	0.00	4.37	0.14
190 CANCER OF EYE (1950-1969 ONLY)	0	0.02	0.00	0.00	148.15	9.12
191 CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMATE)	1	1.43	0.70	0.01	3.89	0.00
193 CANCER OF THYROID (1950-1969 ONLY)	0	0.06	0.00	0.00	56.77	2.93
200 LYMPHOSARCOMA AND RETICULOSARCOMA (1950-1969 ONLY)	0	0.73	0.00	0.00	5.00	0.07
201 HODGKIN'S DISEASE (1940-, 1945- APPROXIMATE)	0	0.65	0.00	0.00	5.60	0.03

*includes duplicate

204 LEUKEMIA AND ALEUKEMIA	0	1.36	0.00	0.00	2.70	0.54
208 CANCER OF OTHER LYMPHATIC TISSUE (1950-1969 ONLY)	1	0.91	1.10	0.01	6.11	0.19
209 ALL LYMPHOPOIETIC CANCER	1	3.79	0.26	0.00	1.47	1.38
210 BENIGN NEOPLASMS	0	0.50	0.00	0.00	7.29	0.00
240 ALLERGIC, ENDOCRINE, METABOLIC, NUTRITIONAL DISEASES (1950-1969 ONLY)	2	2.59	0.77	0.09	2.79	0.00
250 DIABETES MELLITUS	1	2.05	0.49	0.01	2.72	0.15
280 ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-, 1930- APPROXIMATE)	0	0.33	0.00	0.00	10.96	0.08
319 MENTAL, PSYCHONEUROTIC, AND PERSONALITY DISORDERS (1950-1969 ONLY)	0	1.47	0.00	0.00	2.50	0.64
320 ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	1	1.81	0.55	0.01	3.08	0.05
330 ALL DISEASES OF CIRCULATORY SYSTEM	33	61.17	0.54	0.37	0.76	12.52
333 CHRONIC RHEUMATIC HEART DISEASE (1925- APPROXIMATE)	1	1.35	0.74	0.01	4.12	0.02
410 ARTERIOSCLEROTIC HEART DISEASE, INCLUDING CHD (1925- APPROXIMATE)	28	43.76	0.64	0.43	0.92	5.32
430 ALL VASCULAR LESIONS OF CNS	2	5.83	0.34	0.04	1.24	1.90
460 ALL RESPIRATORY DISEASES (1925-, 1930- APPROXIMATE)	4	6.93	0.58	0.16	1.48	0.85
480 ALL PNEUMONIA (1925-, 1930- APPROXIMATE)	2	2.34	0.86	0.10	3.09	0.01
492 EMPHYSEMA (1950-, 1955 APPROXIMATE)	0	1.27	0.00	0.00	2.88	0.47
493 ASTHMA (1925-, 1930- APPROXIMATE)	1	0.22	4.47	0.06	24.88	0.34
520 ALL DISEASES OF DIGESTIVE SYSTEM	9	8.96	1.00	0.46	1.91	0.02
531 ALL GASTRIC AND DUODENAL ULCER	2	0.71	2.81	0.32	10.16	0.88
571 CIRRHOSIS OF LIVER	2	5.66	0.35	0.04	1.28	1.76
580 ALL DISEASES OF GENITO-URINARY SYSTEM	0	1.53	0.00	0.00	2.40	0.69
592 CHRONIC NEPHRITIS	0	0.57	0.00	0.00	6.47	0.01
709 ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	0.10	0.00	0.00	36.99	1.62
739 ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	0	0.30	0.00	0.00	12.11	0.13
799 SYMPTOMS, SENILITY, AND ILL DEFINED CONDITIONS	1	2.17	0.46	0.01	2.56	0.21
800 ALL EXTERNAL CAUSES OF DEATH	27	34.97	0.77	0.51	1.12	1.60
801 ALL ACCIDENTS	10	23.15	0.78	0.46	1.23	0.93
810 MOTOR VEHICLE ACCIDENTS	13	12.94	1.00	0.53	1.72	0.01
959 SUICIDE	7	7.39	0.95	0.38	1.95	0.00
TOTAL RESIDUAL	0	-38.02	0.00			

1.69

2.36

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CANCER RESIDUAL

TABLE 3. OBSERVED AND EXPECTED DEATHS BY CAUSE, STANDARDIZED MORTALITY RATIO (SMR),
95 PERCENT CONFIDENCE LIMITS AND CHI-SQUARE VALUE, FEMALES, CHEMOLITE PLANT.

	OBSERVED	EXPECTED	OBS/EXP	LL	UL	CHISQ
0 ALL CAUSES OF DEATH	35	54.47	0.64	0.45	0.89	6.61
1 ALL MALIGNANT NEOPLASMS	11	19.26	0.57	0.28	1.02	3.12
2 ALL INFECTIVE AND PARASITIC DISEASE	1	0.64	1.56	0.02	8.68	0.03
9 ALL TUBERCULOSIS	0	0.17	0.00	0.00	21.29	0.62
140 CANCER OF BUCCAL CAVITY AND PHARYNX	0	0.27	0.00	0.00	13.70	0.20
149 CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	1	3.60	0.28	0.00	1.55	1.22
150 CANCER OF ESOPHAGUS (1925- APPROXIMATE)	0	0.14	0.00	0.00	26.48	0.94
151 CANCER OF STOMACH	0	0.41	0.00	0.00	8.84	0.02
153 CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	1	1.59	0.63	0.01	3.49	0.01
154 CANCER OF RECTUM (1925- APPROXIMATE)	0	0.33	0.00	0.00	11.01	0.08
155 ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	0	0.32	0.00	0.00	11.44	0.10
157 CANCER OF PANCREAS (1925- APPROXIMATE)	0	0.60	0.00	0.00	5.43	0.05
160 CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	2	2.89	0.69	0.00	2.49	0.05
161 CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	0	0.06	0.00	0.00	61.08	3.22
162 ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-,1930- APPROXIMATE)	2	2.79	0.72	0.08	2.59	0.03
170 CANCER OF BOWEL (1925-,1930-,1945- APPROXIMATE)	0	0.07	0.00	0.00	54.94	2.81
172 CANCER OF SKIN	1	0.36	2.79	0.04	15.51	0.06
174 CANCER OF BREAST	4	4.97	0.80	0.22	2.06	0.04
180 CANCER OF CERVIX UTERI (1950-1969 ONLY)	0	0.99	0.00	0.00	3.69	0.24
181 CANCER OF CORPUS UTERI (1950-1969 ONLY)	0	0.51	0.00	0.00	7.20	0.00
182 CANCER OF ALL UTERUS (1930-1969 ONLY)	0	1.52	0.00	0.00	2.42	0.68
183 CANCER OF OTHER GENITAL ORGANS (1930-1969 ONLY)	1	1.51	0.66	0.01	3.67	0.00
184 CANCER OF ALL GENITAL ORGANS	1	3.04	0.33	0.00	1.83	0.78
188 CANCER OF BLADDER (1925- APPROXIMATE)	0	0.13	0.00	0.00	27.36	1.00
189 CANCER OF KIDNEY (1925- APPROXIMATE)	0	0.27	0.00	0.00	13.52	0.19
190 CANCER OF EYE (1950-1969 ONLY)	0	0.01	0.00	0.00	271.28	17.50

191 CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMATE)	1	0.63	1.60	0.02	8.88	0.03
193 CANCER OF THYROID (1950-1969 ONLY)	0	0.05	0.00	0.00	77.62	4.34
200 LYMPHOSARCOMA AND RETICULOSARCOMA (1950-1969 ONLY)	0	0.33	0.00	0.00	11.28	0.09
201 HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	0	0.23	0.00	0.00	16.13	0.33
204 LEUKEMIA AND ALEUKEMIA	0	0.61	0.00	0.00	6.04	0.02
208 CANCER OF OTHER LYMPHATIC TISSUE (1950-1969 ONLY)	0	0.44	0.00	0.00	8.38	0.01
209 ALL LYMPHOPOIETIC CANCER	0	1.68	0.00	0.00	2.18	0.83
210 BENIGN NEOPLASMS	1	0.33	3.00	0.04	16.68	0.08
240 ALLERGIC,ENDOCRINE,METABOLIC,NUTRITIONAL DISEASES (1950-1969 ONLY)	0	1.53	0.00	0.00	2.40	0.69
250 DIABETES MELLITUS	0	1.18	0.00	0.00	3.10	0.39
280 ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-,1930- APPROXIMATE)	0	0.21	0.00	0.00	17.39	0.40
319 MENTAL,PSYCHONEUROTIC,AND PERSONALITY DISORDERS (1950-1969 ONLY)	0	0.31	0.00	0.00	11.78	0.11
320 ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	1	0.90	1.11	0.01	6.17	0.18
390 ALL DISEASES OF CIRCULATORY SYSTEM	11	16.76	0.66	0.33	1.17	1.65
393 CHRONIC RHEUMATIC HEART DISEASE(1925- APPROXIMATE)	0	0.95	0.00	0.00	3.85	0.22
410 ARTERIOSCLEROTIC HEART DISEASE,INCLUDING CHD (1925- APPROXIMATE)	6	8.76	0.68	0.25	1.49	0.58
430 ALL VASCULAR LESIONS OF CNS	1	3.35	0.30	0.00	1.66	1.03
460 ALL RESPIRATORY DISEASES (1925-,1930- APPROXIMATE)	2	2.49	0.80	0.09	2.90	0.00
480 ALL PNEUMONIA (1925-,1930- APPROXIMATE)	0	0.89	0.00	0.00	4.10	0.17
492 EMPHYSEMA (1950-,1955 APPROXIMATE)	0	0.32	0.00	0.00	11.53	0.10
493 ASTHMA (1925-,1930- APPROXIMATE)	1	0.19	5.25	0.07	29.21	0.50
520 ALL DISEASES OF DIGESTIVE SYSTEM	2	3.26	0.61	0.07	2.22	0.18
531 ALL GASTRIC AND DUODENAL ULCER	0	0.19	0.00	0.00	19.31	0.51
571 CIRRHOSIS OF LIVER	0	1.92	0.00	0.00	1.91	1.05
580 ALL DISEASES OF GENITO-URINARY SYSTEM	0	0.79	0.00	0.00	4.62	0.11
582 CHRONIC NEPHRITIS	0	0.22	0.00	0.00	16.54	0.35
709 ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	0.09	0.00	0.00	39.36	1.78
739 ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	0	0.31	0.00	0.00	11.71	0.11
799 SYMPTOMS,SENILITY,AND ILL DEFINED CONDITIONS	1	0.71	1.40	0.02	7.80	0.06
800 ALL EXTERNAL CAUSES OF DEATH	4	6.25	0.64	0.17	1.64	0.49

TABLE 4. OBSERVED AND EXPECTED DEATHS BY CAUSE, STANDARDIZED MORTALITY RATIO (SMR)
95 PERCENT CONFIDENCE LIMITS AND CHI-SQUARE VALUE, FEMALES, CHEMICAL DIVISION.

	OBSERVED	EXPECTED	OBS/EXP	LL	UL	CHISQ
0 ALL CAUSES OF DEATH						
1 ALL MALIGNANT NEOPLASMS	35	54.47	0.64	0.45	0.89	6.61
2 ALL INFECTIVE AND PARASITIC DISEASE	11	19.26	0.57	0.28	1.02	3.12
9 ALL TUBERCULOSIS	1	0.64	1.56	0.02	8.68	0.03
140 CANCER OF BUCCAL CAVITY AND PHARYNX	0	0.17	0.00	0.00	21.29	0.62
149 CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	0	0.27	0.00	0.00	13.70	0.20
150 CANCER OF ESOPHAGUS (1925- APPROXIMATE)	1	3.60	0.28	0.00	1.55	1.22
151 CANCER OF STOMACH	0	0.14	0.00	0.00	26.48	0.94
153 CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	0	0.41	0.00	0.00	8.84	0.02
154 CANCER OF RECTUM (1925- APPROXIMATE)	1	1.59	0.63	0.01	3.49	0.01
155 ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	0	0.33	0.00	0.00	11.01	0.08
157 CANCER OF PANCREAS (1925- APPROXIMATE)	0	0.32	0.00	0.00	11.44	0.10
160 CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	0	0.68	0.00	0.00	5.43	0.05
161 CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	2	2.89	0.69	0.08	2.49	0.05
162 ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-, 1930- APPROXIMATE)	0	0.06	0.00	0.00	61.08	3.22
170 CANCER OF BONE (1925-, 1930-, 1945- APPROXIMATE)	2	2.79	0.72	0.08	2.59	0.03
172 CANCER OF SKIN	0	0.07	0.00	0.00	54.94	2.81
174 CANCER OF BREAST	1	0.36	2.79	0.04	15.51	0.06
180 CANCER OF CERVIX UTERI (1950-1969 ONLY)	4	4.97	0.80	0.22	2.06	0.04
181 CANCER OF CORPUS UTERI (1950-1969 ONLY)	0	0.99	0.00	0.00	3.69	0.24
182 CANCER OF ALL UTERUS (1930-1969 ONLY)	0	0.51	0.00	0.00	7.20	0.00
183 CANCER OF OTHER GENITAL ORGANS (1930-1969 ONLY)	0	1.52	0.00	0.00	2.42	0.68
184 CANCER OF ALL GENITAL ORGANS	1	1.51	0.66	0.01	3.67	0.00
188 CANCER OF BLADDER (1925- APPROXIMATE)	1	3.04	0.33	0.00	1.83	0.78
189 CANCER OF KIDNEY (1925- APPROXIMATE)	0	0.13	0.00	0.00	27.36	1.00
190 CANCER OF EYE (1950-1969 ONLY)	0	0.27	0.00	0.00	13.52	0.19
	0	0.01	0.00	0.00	271.28	17.50

193 CANCER OF THYROID	0	0.22	4.47	0.06	24.85	0.34
200 LYMPHOSARCOMA AND RETICULOSARCOMA (1950-1969 ONLY)	0	0.02	0.00	0.00	205.74	13.04
201 HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	0	0.12	0.00	0.00	30.54	1.20
204 LEUKEMIA AND ALEUKEMIA	0	0.07	0.00	0.00	49.59	2.45
208 CANCER OF OTHER LYMPHATIC TISSUE (1950-1969 ONLY)	0	0.21	0.00	0.00	17.14	0.38
209 ALL LYMPHOPOIETIC CANCER	0	0.17	0.00	0.00	21.86	0.66
210 BENIGN NEOPLASMS	0	0.61	0.00	0.00	6.05	0.02
240 ALLERGIC,ENDOCRINE,METABOLIC,NUTRITIONAL DISEASES (1950-1969 ONLY)	0	0.12	0.00	0.00	30.97	1.23
250 DIABETES MELLITUS	0	0.57	0.00	0.00	6.43	0.01
280 ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-,1930- APPROXIM	0	0.44	0.00	0.00	8.24	0.01
319 MENTAL,PSYCHONEUROTIC,AND PERSONALITY DISORDERS (1950-1969 ONLY)	0	0.08	0.00	0.00	48.55	2.38
320 ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	0	0.11	0.00	0.00	33.45	1.39
390 ALL DISEASES OF CIRCULATORY SYSTEM	0	0.32	0.00	0.00	11.48	0.10
393 CHRONIC RHEUMATIC HEART DISEASE(1925- APPROXIMATE)	5	6.50	0.77	0.25	1.79	0.16
410 ARTERIOSCLEROTIC HEART DISEASE,INCLUDING CHD (1925- APPROXIMATE)	0	0.35	0.00	0.00	10.51	0.07
430 ALL VASCULAR LESIONS OF CNS	3	3.48	0.86	0.17	2.52	0.00
460 ALL RESPIRATORY DISEASES (1925-,1930- APPROXIMATE)	1	1.27	0.79	0.01	4.37	0.04
480 ALL PNEUMONIA (1925-,1930- APPROXIMATE)	0	0.93	0.00	0.00	3.92	0.20
492 EMPHYSEMA (1950-,1955 APPROXIMATE)	0	0.33	0.00	0.00	11.24	0.09
493 ASTHMA (1925-,1930- APPROXIMATE)	0	0.13	0.00	0.00	29.22	1.12
520 ALL DISEASES OF DIGESTIVE SYSTEM	0	0.07	0.00	0.00	54.27	2.77
531 ALL GASTRIC AND DUODENAL ULCER	0	1.18	0.00	0.00	3.10	0.39
571 CIRRHOSIS OF LIVER	0	0.07	0.00	0.00	51.06	2.55
580 ALL DISEASES OF GENITO-URINARY SYSTEM	0	0.69	0.00	0.00	5.29	0.05
582 CHRONIC NEPHRITIS	0	0.29	0.00	0.00	12.86	0.16
709 ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	0.08	0.00	0.00	48.07	2.35
739 ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	0	0.03	0.00	0.00	111.19	6.61
799 SYMPTOMS,SENILITY,AND ILL DEFINED CONDITIONS	0	0.11	0.00	0.00	32.34	1.32
800 ALL EXTERNAL CAUSES OF DEATH	0	0.25	0.00	0.00	14.69	0.25
	1	2.03	0.49	0.01	2.74	0.14