

Health Consultation

CANCER STATISTICS REVIEW
FOR LOUISIANA COMMUNITIES that RECEIVED ASBESTOS
CONTAINING VERMICULITE from LIBBY, MONTANA
1988-2002

DECEMBER 10, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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Prepared By:

Louisiana Department of Health and Hospitals
Office of Public Health
Section of Environmental Epidemiology and Toxicology
Under a Cooperative Agreement With the
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ABSTRACT

Six Louisiana facilities received vermiculite containing asbestos fibers originating from the W.R. Grace mine in Libby, Montana. Through a cooperative agreement, with the Agency for Toxic Substances and Disease Registry, the Louisiana Department of Health and Hospitals (LDHH) conducted a health statistics review to evaluate cancer incidence in four of the six zip codes in which these facilities are located.

Cancer incidence data (1988-2002) was obtained from the Louisiana Tumor Registry, a state-wide population based cancer registry. Standardized Incidence Ratios (SIR) and Standardized Rate Ratios (SRR) for 5 asbestos-related health outcomes and 3 reference outcomes were computed to compare incidence in 70084 (St. John the Baptist Parish), 70117 and 70126 (Orleans Parish), and 70121 (Jefferson Parish) with the state of Louisiana.

Incidence of pleural, peritoneal, and retroperitoneal cancers, including mesothelioma, in the 4-zip code study area was comparable to incidence measured in the comparison population. The LDHH observed excess respiratory cancers among white males and digestive organ cancers among whites in the combined study area, but cannot attribute these excesses to possible vermiculite exposure.

A review of mortality data revealed the occupations for 15 of the 17 mesothelioma cases in the 4-zip code study area. Sixty percent (9 of 15) reported an occupation that is historically associated with asbestos exposure, however, a complete exposure and occupational history was not available.

INTRODUCTION

The Louisiana Department of Health and Hospitals (LDHH) received funding from the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct a health statistics review for select communities that received asbestos-contaminated vermiculite from Libby, Montana.

The United States Environmental Protection Agency (EPA) identified six facilities in Louisiana which received asbestos-contaminated vermiculite ore from the Libby, Montana mine. These facilities include three in Orleans Parish, one in Jefferson Parish, one in St. John the Baptist Parish, and one in Caddo Parish. Three of the six Louisiana facilities that received the Libby vermiculite operated as exfoliation plants.

Filter Media Company is located in Reserve, Louisiana (zip code 70084), a small, rural community situated on the Mississippi River in St. John the Baptist Parish. Filter Media, one of the 3 exfoliation sites, is located in a mostly industrial area. However, there is a trailer park approximately 200 feet to the south and a residential area 1 mile southeast of the facility (Figure 1).

Southern Mineralite, also an exfoliation plant, was located about ¼ mile from the Mississippi River in the Bywater neighborhood (zip code 70117) of the city of New Orleans (Orleans Parish). The neighborhood is mixed with small businesses and approximately 100-year old homes. Southern Mineralite operated from the 1930's until 1964, when the operation relocated to River Road in Jefferson Parish. Today, only the slab from the original facility remains (Figure 2).

The W.R. Grace facility located on River Road (zip code 70121) just outside the New Orleans city limits in Jefferson Parish operated as a vermiculite exfoliation facility from 1965 to 1990. According to EPA documents, this facility received 148,000 tons of contaminated vermiculite from the Libby mine. A residential area lies several hundred feet to the northeast of the 2-acre site (Figure 3).

Of the three non-exfoliation facilities, only one, Best Wall Gypsum in Orleans Parish, was included in this review. Best Wall Gypsum was located on Almonaster Boulevard in zip code 70126 and manufactured gypsum lath and plaster products. Although the area immediately around the site is industrial, there are residential areas a ½ mile to the north and 1 mile to the west of the facility (Figure 4).

The facility in Caddo Parish, American Perlite, was located in a very rural area of the state surrounded by farmland and produced spray-on vermiculite for roofing. C.Gartenmann & Company was located in the business district of lower Canal Street in New Orleans. The site of this facility is now a shopping mall. The communities near these facilities were not part of the review.

BACKGROUND

Vermiculite is a mineral ore that is composed of hydrated laminar magnesium-aluminum-iron silicate (1). Vermiculite ores may also contain a range of other minerals including asbestos (1). All vermiculite does not necessarily contain asbestos, however, much of the vermiculite from Libby Montana was contaminated with a toxic form of naturally-occurring asbestos fibers (tremolite-actinolite asbestiform minerals) (1,2). Because vermiculite may contain asbestos, there is concern for populations living near receiving and processing facilities.

Asbestos may be released from vermiculite during mining, milling, and exfoliation. During the exfoliation process, vermiculite is heated to high temperatures. Water within the layers is converted to steam which mechanically separates layers and expands vermiculite into worm-like pieces (1). This increases its bulk volume and makes vermiculite a commercially valuable product. However, the exfoliation process also releases asbestos and increases the likelihood of human exposure (2).

Vermiculite ore was mined in Libby, Montana from the early 1920's until the mine closed in 1990. It was distributed, mostly for commercial purposes, around the United States and abroad. During the time the Libby, Montana mine was in operation, it produced over 70% of the vermiculite sold in the United States (4). From the 1950s to the 1980s, vermiculite ore from the Libby, Montana mine was shipped throughout the United States to processing and receiving facilities (3). The EPA has identified facilities in the country that received vermiculite ore from Libby, Montana (3). Some of these facilities were involved in the manufacturing of construction materials and agricultural products (1,3). Vermiculite is commonly used in building insulation and as an additive for potting soil (1).

Inhalation is the primary route of human exposure to asbestos-containing materials, including vermiculite (2). Workers from a variety of occupational settings (e.g. mines, mills, shipyards) are at greatest risk for developing an asbestos-related illness (3,5). Family members may also be exposed if workers carry home asbestos fibers on their clothes (5). Non-occupational exposures to the general public may result from the use of asbestos-containing products or living in the proximity of facilities that process asbestos-containing materials (3). In fact, some studies suggest that populations who live near asbestos mines and mills have experienced excess asbestos-related diseases, specifically mesothelioma (3).

The primary asbestos-related health effects that may result from vermiculite exposure include asbestosis, lung cancer, and mesothelioma (2). Asbestosis, a fibrotic lung disease resulting from chronic scarring of the lung, is associated with long term exposure to very high levels of asbestos, usually in occupational settings (5). A strong association between asbestos exposure and some malignant respiratory diseases such as mesothelioma and lung cancer has been well documented (3).

Mesothelioma is a rare cancer of the thin membranes that line the chest and abdomen (5).

Mesothelioma is uniquely related with asbestos exposure. This type of cancer may not be detected for 30 years, or more, after the initial exposure (5).

Lung cancer is a malignant tumor that usually develops in the bronchial lining and obstructs air passages (5). The time between exposure to asbestos and the occurrence of lung cancer can range from 10 to 40 years (6). Smokers have an increased risk of developing lung cancer after exposure to asbestos due to the synergistic effect between tobacco smoke and asbestos fibers (5,6).

There is a well-established link between the inhalation of asbestos fibers and the development of lung cancer and mesothelioma (5,6). Dozens of cohort studies on occupationally-exposed workers provide evidence of this link (6). A few epidemiological studies suggest an association between gastrointestinal and colorectal cancers and workplace exposures to asbestos (5). However, study results are inconsistent and do not clearly establish a causal relationship between occupational asbestos exposure and the development of gastrointestinal cancers (5,6).

METHODS

LDHH conducted a Cancer Statistics Review in accordance with the 2001 ATSDR protocol, *Health Statistics Review Protocol for US Communities that Received Asbestos-Contaminated Vermiculite from Libby, Montana*. The objective was to determine if there was an increase in asbestos-related cancer incidence in four zip codes in which vermiculite exfoliation/receiving facilities were located. This review will provide information on the incidence rate of cancer within the study area, but cannot ascertain the cause of any cancer increase or determine if a relationship between the increase and vermiculite (or asbestos exposure) exists.

Data Collection

Cancer incidence was obtained for each of the four zip codes. LDHH combined cancers within all four zip codes (exfoliation and receiving plants) because this provided more statistical stability in analyzing the cancer incidence data. The state of Louisiana was selected as the comparison population for this analysis. The period of time selected for evaluation of cancer incidence data was 1988-2002.

Cancer incidence was chosen for this review because cancer mortality rates are affected by multiple factors: how advanced the cancer is at the time of diagnosis, access to health care, and other factors not related to exposure. An incident case was defined as an individual residing within one of the selected zip codes at the time they were diagnosed with a new primary malignant cancer of a specific type during the evaluation period.

Analyses were conducted for potential asbestos-related cancer types. The asbestos related cancer types include mesothelioma, malignant neoplasm of the peritoneum, retroperitoneum, and pleura, malignant neoplasm of the lung and bronchus, malignant neoplasm of the respiratory system and intrathoracic organs, and malignant neoplasm of the digestive organs. Mesothelioma is a subset of neoplasms of the peritoneum, retroperitoneum and pleura. Reference outcomes, which include all cancers, female breast and prostate cancer, were included in this review to evaluate reporting/coding anomalies in the study areas. Table 1 presents a list of the International Classification of Disease Oncology (ICD-O-2) codes for the cancer groupings evaluated.

The Louisiana Tumor Registry (LTR) provided data on incident cancer cases for the years 1988-2002. The LTR, operated by the Louisiana State University Health Sciences Center, is a population-based Surveillance, Epidemiology, and End Results (SEER) cancer registry covering the entire state of Louisiana. The registry has been in operation in the New Orleans metropolitan area since 1974, in South Louisiana since 1983 and in the rest of the state since 1988. By law, every health care provider is required to report newly diagnosed cancers.

Total population for the years 1988-2002 was calculated using intercensal projections based on the 1990 and 2000 reported census data.

Data Analysis

The objectives for this study are to:

1. determine whether the standardized incidence ratios (SIRs) for communities with facilities that received Libby vermiculite are significantly elevated, and
2. compare the standardized rate ratios (SRRs) between communities that received Libby vermiculite.

SIRs were calculated for specific age groups, genders, and races. The SIR compares the actual occurrence of cancer in the study population, in this case, zip codes 70084, 70117, 70121 and 70126, to what might be expected if the zip code had the same cancer incidence rate as the comparison population, in this case, Louisiana.

A SIR is represented as the ratio of the observed number of cases to the expected number of cases during the same time period. If the observed number of cases equals the expected number of cases, the SIR will equal one. If there are more observed cases than are expected, then the SIR will be greater than one. If there are fewer observed cases than one would expect, then the SIR will be less than one. For example, if 10 cases are observed in the study population, but 5 cases were expected, then the $SIR = 10/5 = 2$ and the area has twice as many cancer cases than expected. But if 20 cases were expected, then the $SIR = 10/20 = 0.5$ and the area has half as many cancer cases than expected.

Caution should be exercised, however, when interpreting the SIR. The interpretation must take into account the actual number of cases observed and expected, not just the ratio. Two SIRs can have the same number, but represent very different scenarios. For example, a SIR of 1.5 could mean 3 cases were observed and 2 were expected ($3/2 = 1.5$) or it could mean 300 cases were observed and 200 were expected ($300/200 = 1.5$). In the first instance, only one excess cancer case occurred, which could easily have been due to chance. But, in the second instance, 100 excess cancers occurred and it would be less likely that this would occur by chance alone.

SRRs were calculated for specific age groups, genders, and races. The SRR is the ratio of the number of expected cases in the comparison population (Louisiana), based on incidence rates in the study area, to the number of observed cases in the comparison population. If the incidence rate of cancer in the study area is the same as the incidence rate in the comparison population, then the SRR will equal 1. If the incidence rate in the study area is greater than the incidence rate in the comparison population, then the SRR will be greater than 1. If the incidence rate in the study area is less than the incidence rate in the comparison population, then the SRR will be less than 1.

Since each SRR is weighted by the population distribution of a common comparison population, in this case Louisiana, the SRRs for the individual zip codes may be compared with one another. Comparing SIRs for individual zip codes is not valid due to differences in age-sex distributions between the study areas.

Ninety-five percent confidence intervals (95% CIs) were calculated to assess statistical significance. A confidence interval is a range of possible values for the SIR and SRR that is considered consistent with the normal variation in disease over time in a geographic area. The confidence interval consists of two numbers -- the lower bound and the upper bound of the range of normal SIR and SRR values.

If both the lower and upper bound numbers of the confidence interval are less than 1, then the conclusion of the statistical test is that a disease is occurring less frequently in the specific zip code than it is in the Louisiana population. This is called a "statistically significant decrease" or a "statistically significant deficit." If the lower bound number is less than 1 and the upper bound number is greater than 1, then the conclusion of the statistical test is that a disease is occurring in the specific zip code at the same frequency as in the Louisiana population (or cannot be distinguished from normal fluctuations using this statistical technique). This is called "not statistically significantly different." Lastly, if both of the numbers in the confidence interval are higher than 1, then the conclusion of the statistical test is that a disease is occurring more frequently in the zip code than it is in the rest of the state. This is called a "statistically significant increase" or a "statistically significant excess."

Because mesothelioma is highly associated with occupational asbestos exposure, the LDHH determined the occupations of the identified mesothelioma cases in the 4-zip code area by extracting the information from the Louisiana Tumor Registry and examining the corresponding death certificates provided by the LDHH's Vital Records Registry.

RESULTS

In order to characterize the populations living in zip codes 70084, 70117, 70121, and 70126, 2000 U.S. census data were evaluated (Table 2). The racial distribution of residents living within these zip codes differs considerably. Zip codes 70117 and 70126 are predominantly black and more densely populated urban areas. Zip code 70121 is also in an urban area, although not as densely populated, and is predominantly white. Zip code 70084 is in a rural area and is racially balanced. The population labeled "other" was not evaluated because the numbers were too small to accurately represent the population.

Mesothelioma (Table 3a)

Incidence of mesothelioma from 1988-2002 in the combined study area is comparable to Louisiana. Nine cases were observed in the black population while 8 were expected (SIR=1.11, CI = 0.5-2.1). There were 8 cases among whites when 9 were expected (SIR = 0.86, CI = 0.37-1.69). Because mesothelioma is such a rare cancer, a comparison of incidence between individual zip codes is not possible.

A review of cancer incidence data from 1988-2002 produced 17 mesothelioma cases living in zip codes 70084, 70117, 70121, or 70126 at the time of diagnosis. Cases are predominantly male (13/17, 76%) and evenly distributed among race with 53% (9/17) of cases being black and 47% (8/17) white. The median age at diagnosis is 71 years of age (range 45-89). The greatest number of cases were from Orleans Parish, with 8 (47%) from 70117 and 2 from 70126. Forty-one percent

(7/17) of the mesothelioma cases were from zip code 70121. There were no cases of malignant mesothelioma diagnosed in zip code 70084 (St. John the Baptist Parish) between 1988 and 2002.

Occupational information was available for 15 of the 17 mesothelioma cases in the 4-zip code area. Of the 15, 9 (60%), all males, reported occupations/industries that are associated with asbestos exposure. The industries in which the cases reported working include shipping, construction, and mining (oil and gas). Four of the 6 individuals whose reported occupations were not associated asbestos exposure were female. Occupational information on the spouses of these individuals is unknown.

Malignant Neoplasm of Peritoneum, Retroperitoneum, and Pleura (Table 3b)

Incidence rates for pleural, peritoneal and retroperitoneal cancers in the study area were not statistically significantly different than those in Louisiana. Fourteen cases were observed in the black population while 12 were expected (SIR=1.15, CI = 0.63 – 1.93). There were 10 cases among whites when 11 were expected (SIR = 0.89, CI = 0.43-1.63).

Malignant Neoplasm of the Lung and Bronchus (Table 3c)

For the combined study area, incidence rates for black males, black females and white females were not statistically significantly different from the comparison population. There is, however, a statistically significant increase in lung and bronchus cancer among white males in the combined study area (SIR = 1.21, CI = 1.09 – 1.34). Twenty-one percent more cases were observed than expected in the lung and bronchus subgroup. The incidence rate is 44% higher in zip code 70117 and 25% higher in 70126 for lung and bronchus cancers among white males.

Although there were fewer lung and bronchus cancers observed than expected for blacks in the combined study area, black males in 70121 have a 47% higher incidence rate than the comparison population, whereas black males in zip 70126 have a nearly 30% statistically significant decrease in lung and bronchus cancer.

Malignant Neoplasm of the Respiratory System and Intrathoracic Organs (Table 3d)

In addition to cancer of the lung and bronchus, this group includes cancer of the larynx, pleura, trachea and other respiratory organs.

There is a statistically significant increase in respiratory system cancer among white males in the combined study area. As with lung and bronchus cancers, 21% more cases were observed than expected. The incidence rate is 48% higher in zip code 70117 and 27% higher in 70126 for this group.

Similar to the results of the evaluation of lung and bronchus cancer incidence, blacks in 70121 have a 44% higher incidence rate than the comparison population, and black males in zip 70126 have a nearly 30% statistically significant decrease in respiratory system and intrathoracic organ cancer.

Malignant Neoplasm of the Digestive Organs (Table 3e)

Incidence of digestive organ cancer is statistically significantly higher among whites in the combined study area. Cancer incidence is 46% higher among white males, driven by a statistically

significant increase in cancer diagnoses in zip codes 70117, 70121 and 70126. Cancer incidence is 16% higher among white females, which is driven by a statistically significant increase in cancer diagnoses in zip code 70126.

Reference Outcomes (Tables 3f-3h)

Incidence rates for all malignant neoplasms among whites in the combined study area are statistically significantly higher than the comparison population. Cancer incidence is 25% higher among white males and 9% higher among white females. Three of the 4 zip codes (70084, 70117 and 70126) had statistically significant increases in cancer diagnoses which contributed to the overall increase for whites in the combined study area. Cancer incidence rates for the zip codes evaluated separately were 21% - 59% higher in males and 13% - 26% higher among females.

In zip code 70084, the incidence rate for all malignant neoplasms among black males was 76% higher than the comparison population; however, this only represents 20 excess cancers. Whereas in 70126, there were 90 fewer cancers than expected for black males resulting in an incidence rate 7% lower than the comparison population.

Incidence rates for malignant neoplasms of the prostate and female breast in the study area were comparable to the state of Louisiana with a couple of exceptions in individual zip codes. White females in 70084 had a 44% higher rate of breast cancer and black females in zip code 70126 had a 13% higher rate of breast cancer. There is a higher incidence of prostate cancer in 70084 for both black and white males and a higher incidence of prostate cancer for whites only in 70117.

LIMITATIONS

There are many risk factors that may increase one's chance of developing cancer (e.g., genetics, diet, and smoking). LDHH did not have access to this information for this evaluation of cancer incidence, and could not control for other risk factors.

Residential proximity to the vermiculite containing asbestos site was selected as an environmental indicator of exposure. This provided a clear geographically defined environmental parameter. There are obvious limitations to the use of residence at diagnosis as the primary environmental indicator. The approach assumes that proximity equals exposure and ignores the latency period of cancer and residential and occupational history. Limited data exist to determine completed routes of exposure. It is possible that portions of the groups are exposed while others are not.

Another limitation of this report is the small number of observed cases for some of the more rare cancers examined in this review. Small numbers of cases within a limited geographical area may make the results very unstable and difficult to interpret (3).

Since mesothelioma is strongly associated with occupational exposure to asbestos, the LDHH identified the occupations of the 17 mesothelioma cases who lived in the 4-zip code area at the time of diagnosis. However, only limited occupational information was available to the LDHH. Death certificates report "usual occupation", defined as the occupation in which the individual spent most of his/her working life. Due to the absence of a complete occupational history, occupational exposure to asbestos can not be ruled out for the 17 mesothelioma cases, making it impossible to attribute any increase in asbestos exposure-related health outcomes to residential proximity to vermiculite exfoliation/receiving plants alone. In addition, the occupations of the cases' spouses were unknown, preventing "take home" exposures from being ruled out as well.

CONCLUSIONS

This cancer statistics review produced no evidence that cancer incidence has been effected by residential proximity to vermiculite processing facilities. The analysis revealed no excess of pleural, peritoneal or retroperitoneal tumors, including mesothelioma, a cancer almost exclusively associated with asbestos exposure.

Excess lung and bronchus cancers in white males were noted for the combined study area, with incidence rates in the individual zip codes ranging from 15% - 44% higher than the comparison population. And, despite the weak association between asbestos exposure and non-respiratory cancer, this analysis included a review of digestive organ cancer incidence and revealed excess cases among whites in the combined study area. White males in zip codes 70117 and 70126 have digestive organ cancer incidence rates 60% and 84% higher than the comparison population respectively. In addition, the digestive organ cancer incidence rate for white females in zip code 70126 was 44% higher than that of the comparison population.

In order to account for differences in risk factors between genders and races, males and females and blacks and whites were evaluated separately. No consistent patterns of asbestos-related health outcomes were observed among the demographic subgroups. An evaluation of reference outcomes did not reveal any reporting anomalies.

The cause(s) of the increased incidences of some asbestos-related cancers among whites in the study area are not known. There are many risk factors that were not considered for this health consultation. There is no evidence to support a linkage of excess asbestos-related cancers in the study area to residential proximity to vermiculite-receiving facilities.

LDHH further analyzed the 17 cases of mesothelioma diagnosed in the 4-zip code area between 1988 and 2002 by confirming the incidence data with the LTR and evaluating the corresponding death records provided by LDHH's Vital Records Registry. The occupation and industry data from the death certificates indicates that, for at least some of the 17 cases in the 4-zip code study area, asbestos exposure may have occurred in an occupational setting.

PUBLIC HEALTH ACTION PLAN

1. ATSDR will combine the findings from this health consultation with findings from other health statistics reviews on sites that processed vermiculite from Libby and develop a national summary report of the overall conclusions and strategies for addressing the public health implications.
2. LDHH's Occupational Health Surveillance Program will continue to track incidence of mesothelioma. Data will be reported to the National Institute for Occupational Safety and Health.

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CERTIFICATION

This Health Statistics Review was prepared by the Louisiana Department of Health and Hospitals

under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures at the time the health consultation was begun. The editorial review was conducted by the Cooperative Agreement Partner.

Jeffrey Kellam

Technical Project Officer, Division of Health Assessment and Consultation (DHAC)

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Alan W. Yarbrough

Cooperative Agreement Team Leader, DHAC, ATSDR

Appendix A: Tables 1-3h

Table 1. Cancer Incidence Data: Asbestos Related Health Outcomes and Reference Outcomes

Asbestos Related Health Outcome:	ICD-0-2* Groupings	Excluding Type
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Malignant neoplasm of mesothelioma	M-9050:M9053	-----
Malignant neoplasm of peritoneum, retroperitoneum, and pleura	C480:C488, C384	M-9590:9989
Malignant neoplasm of lung and bronchus	C340:C349	M-9590:9989
Malignant neoplasm of respiratory system and intrathoracic organs	C320:C399	M-9590:9989
Malignant neoplasm of digestive organs	C150:C218, C260:C269	M-9590:9989
Reference Outcome:	ICD-0-2* Groupings	Excluding Type
All malignant neoplasms	C000:C809	-----
Malignant neoplasm of female breast	C500:C509	M-9590:9989
Malignant neoplasm of prostate	C619	M-9590:9989

*From the International Classification of Diseases-Oncology codes, Revision Two.

Table 2: Demographic information for zip codes: 70084, 70117, 70121, 70126 and Louisiana (7)

	70084 n (%)	70117 n (%)	70121 n (%)	70126 n (%)	Louisiana n (%)
Total Population	7,416 (100)	51,252 (100)	12,998 (100)	40,677 (100)	4,468,976 (100)
White	3,451 (47)	4,806 (9)	9,630 (74)	4,195 (10)	2,856,161 (64)
Black	3,849 (52)	45,536 (89)	2,789 (22)	35,441 (87)	1,451,944 (32)
Other	116 (1)	910 (2)	579 (4)	1,041 (3)	160,871 (4)
Gender					
Female	3,854 (52)	27,387 (53)	6,755 (52)	22,134 (54)	2,306,073 (52)
Male	3,562 (48)	23,865 (47)	6,243 (48)	18,543 (46)	2,162,903 (48)
No. of Households	2,541	18,804	5,930	14,487	1,656,053
1999 Annual Income (dollars)					
Household (median)	\$34,529	\$19,567	\$32,441	\$30,627	\$32,566
Per capita	\$14,237	\$10,595	\$19,855	\$14,146	\$16,912
1999 Poverty Level					
Individuals below	1,740 (23)	19,298 (38)	1,744 (13)	9,157 (22)	851,113 (19)
Households below	561 (22)	6,492 (35)	701 (12)	2,928 (20)	316,991 (19)

Table 3a. Mesothelioma

Zip Code	Gender	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Female	Black	0	0.08	0.00	-	-	0.00	-	-
		White	0	0.18	0.00	-	-	0.00	-	-
	Male	Black	0	0.21	0.00	-	-	0.00	-	-
		White	0	0.67	0.00	-	-	0.00	-	-
	Total	Black	0	0.30	0.00	-	-	0.00	-	-
		White	0	0.83	0.00	-	-	0.00	-	-
70117	Female	Black	1	1.17	0.85	0.01	4.75	1.00	0.14	7.37
		White	0	0.52	0.00	-	-	0.00	-	-
	Male	Black	6	3.29	1.82	0.67	3.97	1.68	0.73	3.86
		White	1	1.66	0.60	0.01	3.35	0.54	0.08	3.87
	Total	Black	7	4.49	1.56	0.62	3.21	1.50	0.70	3.24
		White	1	2.36	0.42	0.01	2.36	0.39	0.05	2.74
70121	Female	Black	0	0.06	0.00	-	-	0.00	-	-
		White	3	0.79	3.80	0.76	11.11	3.05	0.95	9.81
	Male	Black	0	0.21	0.00	-	-	0.00	-	-
		White	4	2.57	1.56	0.42	3.99	1.17	0.43	3.19
	Total	Black	0	0.25	0.00	-	-	0.00	-	-
		White	7	3.51	2.00	0.80	4.12	1.63	0.76	3.47
70126	Female	Black	0	0.83	0.00	-	-	0.00	-	-
		White	0	0.57	0.00	-	-	0.00	-	-
	Male	Black	2	2.27	0.88	0.10	3.19	0.91	0.22	3.70
		White	0	2.02	0.00	-	-	0.00	-	-
	Total	Black	2	3.10	0.65	0.07	2.33	0.63	0.16	2.57
		White	0	2.65	0.00	-	-	0.00	-	-
ALL Zips Combined	Female	Black	1	2.14	0.47	0.01	2.61	0.49	0.07	3.60
		White	3	2.07	1.45	0.29	4.24	1.15	0.36	3.64
	Male	Black	8	5.97	1.34	0.58	2.64	1.25	0.60	2.58
		White	5	6.91	0.72	0.23	1.69	0.60	0.25	1.45
	Total	Black	9	8.14	1.11	0.50	2.10	1.06	0.54	2.09
		White	8	9.34	0.86	0.37	1.69	0.72	0.36	1.45

Table 3b. Malignant Neoplasm of Peritoneum, Retroperitoneum, and Pleura

Zip Code	Gender	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Female	Black	0	0.19	0.00	-	-	0.00	-	-
		White	0	0.29	0.00	-	-	0.00	-	-
	Male	Black	1	0.24	4.09	0.05	22.75	3.54	0.49	25.41
		White	0	0.74	0.00	-	-	0.00	-	-
	Total	Black	1	0.45	2.23	0.03	12.41	2.02	0.28	14.41
		White	0	1.01	0.00	-	-	0.00	-	-
70117	Female	Black	2	2.80	0.71	0.08	2.58	0.79	0.19	3.21
		White	0	0.82	0.00	-	-	0.00	-	-
	Male	Black	7	3.88	1.80	0.72	3.71	1.70	0.78	3.68
		White	1	1.85	0.54	0.01	3.01	0.48	0.07	3.45
	Total	Black	9	6.72	1.34	0.61	2.54	1.30	0.66	2.55
		White	1	2.83	0.35	0.00	1.96	0.31	0.04	2.23
70121	Female	Black	0	0.14	0.00	-	-	0.00	-	-
		White	3	1.24	2.42	0.49	7.08	1.92	0.60	6.13
	Male	Black	0	0.24	0.00	-	-	0.00	-	-
		White	5	2.84	1.76	0.57	4.11	1.45	0.58	3.62
	Total	Black	0	0.37	0.00	-	-	0.00	-	-
		White	8	4.22	1.90	0.82	3.74	1.63	0.79	3.33
70126	Female	Black	2	1.93	1.04	0.12	3.74	1.03	0.25	4.21
		White	0	0.91	0.00	-	-	0.00	-	-
	Male	Black	2	2.67	0.75	0.08	2.70	0.77	0.19	3.11
		White	1	2.22	0.45	0.01	2.51	0.42	0.06	3.00
	Total	Black	4	4.61	0.87	0.23	2.22	0.85	0.32	2.30
		White	1	3.18	0.31	0.00	1.75	0.28	0.04	2.00
ALL Zips Combined	Female	Black	4	5.06	0.79	0.21	2.02	0.81	0.30	2.23
		White	4	3.26	1.23	0.33	3.14	0.94	0.35	2.54
	Male	Black	10	7.04	1.42	0.68	2.61	1.39	0.72	2.67
		White	6	7.64	0.79	0.29	1.71	0.70	0.31	1.59
	Total	Black	14	12.14	1.15	0.63	1.93	1.13	0.66	1.96
		White	10	11.25	0.89	0.43	1.63	0.78	0.41	1.48

Table 3c. Malignant Neoplasm of the Lung and Bronchus

Zip Code	Gender	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Female	Black	17	10.89	1.56	0.91	2.50	1.50	0.92	2.42
		White	14	17.35	0.81	0.44	1.35	0.81	0.47	1.38
	Male	Black	26	22.28	1.17	0.76	1.71	1.70	0.97	2.95
		White	36	29.42	1.22	0.86	1.69	1.22	0.88	1.70
	Total	Black	43	33.77	1.27	0.92	1.72	1.29	0.95	1.76
		White	50	46.37	1.08	0.80	1.42	1.06	0.80	1.41
70117	Female	Black	167	165.42	1.01	0.86	1.17	1.02	0.87	1.19
		White	60	52.04	1.15	0.88	1.48	1.24	0.94	1.64
	Male	Black	363	351.59	1.03	0.93	1.14	1.05	0.94	1.17
		White	99	71.32	1.39	1.13	1.69	1.44	1.18	1.76
	Total	Black	530	521.19	1.02	0.93	1.11	1.03	0.94	1.12
		White	159	128.01	1.24	1.06	1.45	1.32	1.12	1.55
70121	Female	Black	9	8.32	1.08	0.49	2.05	1.24	0.64	2.40
		White	84	76.69	1.10	0.87	1.36	1.10	0.88	1.38
	Male	Black	29	22.10	1.31	0.88	1.88	1.47	1.01	2.13
		White	123	109.72	1.12	0.93	1.34	1.15	0.96	1.38
	Total	Black	38	28.64	1.33	0.94	1.82	1.46	1.05	2.01
		White	207	190.68	1.09	0.94	1.24	1.10	0.96	1.27
70126	Female	Black	100	107.98	0.93	0.75	1.13	0.94	0.77	1.15
		White	54	57.59	0.94	0.70	1.22	0.95	0.72	1.26
	Male	Black	163	232.97	0.70	0.60	0.82	0.72	0.61	0.84
		White	104	89.45	1.16	0.95	1.41	1.25	1.02	1.53
	Total	Black	263	341.65	0.77	0.68	0.87	0.78	0.69	0.88
		White	158	148.57	1.06	0.90	1.24	1.12	0.95	1.32
ALL Zips Combined	Female	Black	293	292.61	1.00	0.89	1.12	1.00	0.89	1.13
		White	212	203.66	1.04	0.91	1.19	1.06	0.92	1.22
	Male	Black	581	628.94	0.92	0.85	1.00	0.93	0.85	1.01
		White	362	299.91	1.21	1.09	1.34	1.24	1.11	1.37
	Total	Black	874	925.26	0.94	0.88	1.01	0.95	0.88	1.01
		White	574	513.64	1.12	1.03	1.21	1.15	1.05	1.25

Table 3d. Malignant Neoplasm of the Respiratory System and Intrathoracic Organs

Zip Code	Gender	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Female	Black	18	11.64	1.55	0.92	2.44	1.48	0.93	2.36
		White	16	18.42	0.87	0.50	1.41	0.88	0.53	1.44
	Male	Black	31	25.31	1.22	0.83	1.74	1.71	1.04	2.81
		White	39	33.04	1.18	0.84	1.61	1.18	0.86	1.62
	Total	Black	49	37.68	1.30	0.96	1.72	1.31	0.99	1.75
		White	55	50.99	1.08	0.81	1.40	1.07	0.82	1.40
70117	Female	Black	175	176.48	0.99	0.85	1.15	1.00	0.86	1.17
		White	65	54.81	1.19	0.92	1.51	1.28	0.98	1.67
	Male	Black	423	397.94	1.06	0.96	1.17	1.08	0.97	1.19
		White	114	79.96	1.43	1.18	1.71	1.48	1.22	1.78
	Total	Black	598	579.44	1.03	0.95	1.12	1.04	0.96	1.13
		White	179	139.95	1.28	1.10	1.48	1.36	1.17	1.59
70121	Female	Black	10	8.86	1.13	0.54	2.08	1.28	0.69	2.40
		White	89	80.94	1.10	0.88	1.35	1.09	0.88	1.36
	Male	Black	32	24.95	1.28	0.88	1.81	1.43	1.00	2.04
		White	134	122.65	1.09	0.92	1.29	1.10	0.93	1.32
	Total	Black	42	31.78	1.32	0.95	1.79	1.44	1.06	1.97
		White	223	208.52	1.07	0.93	1.22	1.07	0.94	1.23
70126	Female	Black	109	115.65	0.94	0.77	1.14	0.95	0.79	1.16
		White	57	60.83	0.94	0.71	1.21	0.94	0.72	1.23
	Male	Black	191	264.80	0.72	0.62	0.83	0.73	0.64	0.85
		White	120	99.98	1.20	1.00	1.44	1.27	1.05	1.54
	Total	Black	300	381.38	0.79	0.70	0.88	0.80	0.71	0.89
		White	177	162.58	1.09	0.93	1.26	1.13	0.97	1.32
ALL Zips Combined	Female	Black	312	312.62	1.00	0.89	1.12	1.00	0.89	1.12
		White	227	214.99	1.06	0.92	1.20	1.07	0.93	1.22
	Male	Black	677	713.01	0.95	0.88	1.02	0.96	0.88	1.03
		White	407	335.63	1.21	1.10	1.34	1.24	1.12	1.36
	Total	Black	989	1030.29	0.96	0.90	1.02	0.96	0.90	1.03
		White	634	562.04	1.13	1.04	1.22	1.15	1.06	1.25

Table 3e. Malignant Neoplasm of the Digestive Organs

Zip Code	Gender	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Female	Black	21	16.95	1.24	0.77	1.89	1.27	0.82	1.97
		White	24	18.69	1.28	0.82	1.91	1.50	0.99	2.26
	Male	Black	22	17.97	1.22	0.77	1.85	2.15	1.15	4.04
		White	25	22.93	1.09	0.71	1.61	1.09	0.73	1.63
	Total	Black	43	35.26	1.22	0.88	1.64	1.32	0.96	1.79
		White	49	41.36	1.18	0.88	1.57	1.21	0.91	1.60
70117	Female	Black	247	255.32	0.97	0.85	1.10	0.97	0.85	1.10
		White	69	62.56	1.10	0.86	1.40	1.10	0.85	1.42
	Male	Black	285	269.99	1.06	0.94	1.19	1.08	0.96	1.22
		White	93	57.97	1.60	1.29	1.97	1.60	1.30	1.97
	Total	Black	532	526.96	1.01	0.93	1.10	1.02	0.93	1.11
		White	162	122.79	1.32	1.12	1.54	1.34	1.14	1.58
70121	Female	Black	19	13.96	1.36	0.82	2.13	1.34	0.85	2.12
		White	90	88.96	1.01	0.81	1.24	1.00	0.81	1.24
	Male	Black	15	18.24	0.82	0.46	1.36	0.92	0.54	1.56
		White	108	87.91	1.23	1.01	1.48	1.21	0.99	1.47
	Total	Black	34	31.50	1.08	0.75	1.51	1.09	0.77	1.54
		White	198	179.16	1.11	0.96	1.27	1.09	0.94	1.26
70126	Female	Black	177	169.16	1.05	0.90	1.21	1.06	0.91	1.23
		White	92	63.52	1.45	1.17	1.78	1.44	1.16	1.78
	Male	Black	169	179.95	0.94	0.80	1.09	0.97	0.83	1.13
		White	119	68.44	1.74	1.44	2.08	1.84	1.52	2.22
	Total	Black	346	349.43	0.99	0.89	1.10	1.00	0.90	1.12
		White	211	132.87	1.59	1.38	1.82	1.62	1.41	1.87
ALL Zips Combined	Female	Black	464	455.39	1.02	0.93	1.12	1.02	0.93	1.12
		White	275	233.73	1.18	1.04	1.32	1.16	1.02	1.31
	Male	Black	491	486.15	1.01	0.92	1.10	1.02	0.93	1.12
		White	345	237.25	1.45	1.30	1.62	1.46	1.31	1.63
	Total	Black	955	943.15	1.01	0.95	1.08	1.02	0.95	1.09
		White	620	476.18	1.30	1.20	1.41	1.30	1.20	1.41

Table 3f. All Malignant Neoplasms

Zip Code	Gender	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Female	Black	110	97.70	1.13	0.93	1.36	1.10	0.91	1.33
		White	153	130.02	1.18	1.00	1.38	1.26	1.07	1.48
	Male	Black	123	103.95	1.18	0.98	1.41	1.76	1.36	2.27
		White	173	147.94	1.17	1.00	1.36	1.21	1.04	1.40
	Total	Black	233	202.63	1.15	1.01	1.31	1.18	1.04	1.35
		White	326	276.73	1.18	1.05	1.31	1.20	1.08	1.34
70117	Female	Black	1427	1426.26	1.00	0.95	1.05	1.01	0.96	1.07
		White	384	368.44	1.04	0.94	1.15	1.13	1.01	1.27
	Male	Black	1616	1580.91	1.02	0.97	1.07	1.05	1.00	1.10
		White	571	365.31	1.56	1.44	1.70	1.59	1.46	1.73
	Total	Black	3043	3011.67	1.01	0.97	1.05	1.02	0.99	1.06
		White	955	760.98	1.25	1.18	1.34	1.36	1.27	1.45
70121	Female	Black	88	75.83	1.16	0.93	1.43	1.19	0.96	1.47
		White	570	555.62	1.03	0.94	1.11	1.01	0.93	1.11
	Male	Black	107	104.93	1.02	0.84	1.23	1.15	0.94	1.40
		White	573	557.60	1.03	0.95	1.12	1.05	0.97	1.15
	Total	Black	195	174.67	1.12	0.97	1.28	1.18	1.02	1.36
		White	1143	1129.03	1.01	0.95	1.07	1.02	0.96	1.08
70126	Female	Black	996	981.81	1.01	0.95	1.08	1.02	0.96	1.09
		White	459	402.71	1.14	1.04	1.25	1.18	1.07	1.30
	Male	Black	959	1048.97	0.91	0.86	0.97	0.93	0.87	0.99
		White	524	439.86	1.19	1.09	1.30	1.24	1.13	1.35
	Total	Black	1955	2022.95	0.97	0.92	1.01	0.97	0.93	1.01
		White	983	849.16	1.16	1.09	1.23	1.19	1.11	1.27
ALL Zips Combined	Female	Black	2621	2581.61	1.02	0.98	1.05	1.02	0.98	1.06
		White	1566	1456.79	1.07	1.02	1.13	1.09	1.04	1.15
	Male	Black	2805	2838.75	0.99	0.95	1.03	1.00	0.96	1.04
		White	1841	1510.70	1.22	1.16	1.28	1.25	1.19	1.31
	Total	Black	5426	5411.92	1.00	0.98	1.03	1.01	0.98	1.03
		White	3407	3015.91	1.13	1.09	1.17	1.16	1.12	1.20

Table 3g. Malignant Neoplasms of the Female Breast

Zip Code	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Black	26	29.81	0.87	0.57	1.28	0.86	0.58	1.26
	White	55	40.15	1.37	1.03	1.78	1.44	1.10	1.89
70117	Black	418	426.37	0.98	0.89	1.08	0.99	0.89	1.09
	White	102	106.75	0.96	0.78	1.16	1.04	0.84	1.29
70121	Black	20	22.42	0.89	0.54	1.38	0.90	0.57	1.39
	White	166	163.75	1.01	0.87	1.18	1.04	0.89	1.22
70126	Black	345	304.69	1.13	1.02	1.26	1.13	1.01	1.26
	White	138	121.07	1.14	0.96	1.35	1.16	0.97	1.38
ALL Zips Combined	Black	809	783.28	1.03	0.96	1.11	1.04	0.96	1.11
	White	461	431.71	1.07	0.97	1.17	1.10	1.00	1.21

Table 3h. Malignant Neoplasms of the Prostate

Zip Code	Race	Observed	Expected	SIR	CI Lower	CI Upper	SRR	CI Lower	CI Upper
70084	Black	39	31.84	1.22	0.87	1.67	1.98	1.25	3.13
	White	50	38.87	1.29	0.95	1.70	1.36	1.03	1.80
70117	Black	461	500.29	0.92	0.84	1.01	0.93	0.84	1.02
	White	122	97.23	1.25	1.04	1.50	1.24	1.03	1.49
70121	Black	24	34.06	0.70	0.45	1.05	0.77	0.51	1.18
	White	146	152.33	0.96	0.81	1.13	1.01	0.85	1.20
70126	Black	318	321.10	0.99	0.88	1.11	0.99	0.88	1.10
	White	120	122.65	0.98	0.81	1.17	1.03	0.86	1.24
ALL Zips Combined	Black	842	887.30	0.95	0.89	1.02	0.95	0.88	1.01
	White	438	411.08	1.07	0.97	1.17	1.09	0.99	1.20

Appendix B: Figures 1-4



Date December 10, 2008

From Division of Health Assessment and Consultation, ATSDR

Subject Health Consultation
Vermiculite related to Libby, MT

To George Pettigrew
Senior Regional Representative, ATSDR, Region VI

Enclosed please find 3 hard copies and 3 CDs of the December 10, 2008 Health Consultation on the following site prepared by the Louisiana Department of Health and Hospitals under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

CANCER STATISTICS REVIEW
FOR LOUISIANA COMMUNITIES that RECEIVED ASBESTOS
CONTAINING VERMICULITE from LIBBY, MONTANA
1988-2002

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Freda Dumas
Manager, ATSDR Records Center

Enclosures

cc: W. Cibulas, Jr. R. Gillig J. Kellam L. Luker L. Daniel

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