

Health Consultation

Mortality in Libby, Montana (1979 - 1998)

LIBBY ASBESTOS SITE

LIBBY, LINCOLN COUNTY, MONTANA

EPA FACILITY ID: MT0009083840

AUGUST 8, 2002

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

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Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation

Atlanta, Georgia 30333

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Prepared by:

Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Mortality in Libby, Montana, 1979-1998

Executive Summary

The Agency for Toxic Substances and Disease Registry (ATSDR), in cooperation with the Montana Department of Public Health and Human Services, has updated its previously issued Health Consultation: Mortality from Asbestosis in Libby, Montana, 1979-1998, released in December 2000. This analysis of mortality statistics for Libby, Montana during the 20-year period from 1979 to 1998 includes additional death certificates inadvertently omitted in the first study along with an assessment of the contribution from possible occupational exposures at the Libby vermiculite mine and milling facility.

ATSDR reviewed death certificate data to generate an accurate representation of mortality potentially associated with historical asbestos exposure in the Libby community. Libby rates were compared with mortality statistics for the state of Montana and the U.S. population. Underlying causes of death reviewed included nonmalignant respiratory diseases, lung cancer, mesothelioma, digestive cancers, and diseases of pulmonary circulation.

For the 20-year period reviewed in this report, mortality in Libby resulting from asbestosis was 40 to 80 times higher than expected. Mortality from lung cancer was also elevated, with a 20 to 30 percent excess over this time period. Elevations in asbestosis and lung cancer mortality were strongly associated with being male. Mesothelioma mortality was increased but difficult to quantify since statistics on this extremely rare cancer are not routinely published at the state and national levels. Overall, when compared to Montana and U.S. mortality, there was a 20 to 40 percent increase in malignant and nonmalignant respiratory deaths in this small Montana community from 1979 to 1998. Other underlying causes of mortality including digestive cancers and diseases of pulmonary circulation were not significantly elevated. There were no clear temporal trends in the underlying causes analyzed.

This mortality review included the linkage of death certificate data with employment information from a facility in Libby that mined and milled asbestos-contaminated vermiculite. This comparison of worker records with mortality data demonstrated that the majority (92%, 11/12) of asbestosis decedents and some (17%, 21/124) lung cancer decedents were prior employees at the vermiculite facility. Most mesothelioma deaths (67%, 2/3) also occurred in former workers.

The findings of this mortality review require careful interpretation. Death certificates and the facility's employment records were the primary sources of data used in this analysis. However, relevant pieces of information including smoking habits, residential and occupational histories, and exposure information were lacking. Also, death certificates are of limited value in epidemiologic studies of asbestos-related mortality. Frequent discrepancies occur between the categorization of cause of death through clinical findings compared with autopsy-based diagnoses.

Background

In December 2000, the Agency for Toxic Substances and Disease Registry (ATSDR), in cooperation with the Montana Department of Public Health and Human Services (MDPHHS), released an analysis of mortality in Libby, Montana for the twenty-year period encompassing 1979 to 1998 [1]. This review of death certificate data was performed to generate an accurate representation of mortality potentially associated with historical asbestos exposure in the Libby community. After releasing the mortality report, death certificate data inadvertently omitted from the analysis was discovered. Therefore, ATSDR and MDPHHS conducted another search for eligible decedents using the Montana Vital Statistics database.

The purpose of this health consultation is two-fold. First, mortality data omitted in the initial analysis are included in this report. This new information was combined with data gathered in the original analysis to generate adjusted standardized mortality ratios (SMRs). Secondly, decedents' potential exposure pathways were evaluated by utilizing employment records from the vermiculite mining and milling operation in Libby. The linking of employment records with the mortality database made it possible to determine if decedents had ever worked at the mining and milling operation or were potential household contacts of a worker.

Materials/Methods

This review was designed to use death certificate data to assess mortality potentially associated with asbestos exposure in Libby. The Montana Department of Public Health and Human Services (MDPHHS) provided most of the mortality data referenced in this report. The only additional information source used in this analysis was a database of historical employment records describing workers at the mining and milling facility in Libby.

Study Design

The study design used in this analysis was identical to the design from the initial assessment of mortality in Libby. The study period, study population, geographic areas of analysis, baseline population estimates and statistical methods for generating standardized mortality ratios were all similar to the first analysis and are discussed in greater detail in the Health Consultation released in December, 2000 [1]. However, some tables and maps are reproduced in this document for coherence (Tables 1 and 2, Figure 1).

Data Sources

Death Certificates

The Montana Vital Statistics database was the primary source for mortality data used in this analysis. All decedents were identified through this registry and death certificates were provided by MDPHHS for all in-state deaths. For those Libby residents dying outside of Montana, death certificates were sought from their respective states (Arizona,

Idaho, Kansas, Nebraska, New York, North Dakota, Oregon, Tennessee, Utah, Washington, and Wyoming).

As mentioned previously, some eligible deaths were omitted in the first mortality review. This omission was due to data querying methods used in the initial analysis, combined with incomplete data coding in the Montana Vital Statistics database prior to 1992. The first step of the original mortality review was to query the state's vital statistics database to identify all decedents for whom Libby was listed as their city of residence at time of death. However, prior to 1992 the Montana Vital Statistics database did not document a city of residence at time of death for some decedents in Lincoln County. Instead, the city field in the vital statistics database was left blank if a decedent didn't live in (or near) one of the incorporated municipalities in Lincoln County. Since these decedents did not have a city documented in the database and this was the primary criterion used in identifying eligible subjects, the initial database query missed some decedents from the Libby area. Beginning in 1992, all decedents in Lincoln County were assigned to one of the three largest towns (Libby, Troy, or Eureka); thus, identifying decedents from Libby was not problematic for individuals dying after 1991.

In order to locate all of the eligible decedents in the Libby area omitted in the first analysis, MDPHHS went through an extensive process of computerized and manual searching of death certificates. First, the Montana Vital Statistics database was queried to identify all deaths occurring in Lincoln County from 1979 to 1991 that had a blank field for the city of residence at time of death. Vital statistics personnel then located paper copies of these death certificates and performed a manual search to determine if they lived anywhere near Libby or central Lincoln County. Decedents with addresses in Central Lincoln County were then geographically referenced to determine if they fell within any of the geographic areas of analysis.

Employment information

Employment data for the vermiculite mining and milling facility was obtained by ATSDR from two sources and subsequently combined. The first was an employment database consisting of historical records on over 1,800 employees from the vermiculite mine and milling facility in Libby. A McGill University research group, in conjunction with W.R. Grace, compiled this data for a study of mortality in their occupational cohort [2]. The second source was information obtained during ATSDR's medical screening program conducted in Libby during the summers of 2000 and 2001. In all, data on over 1,950 previous employees were compiled through these sources. This database was compared to the mortality database to determine if decedents had ever been employed at the facility. The database was also used to determine the length of employment for any decedents that were previous workers. Potential matches between the two databases were confirmed using decedents' names and social security numbers.

Results

Death Certificates

MDPHHS provided paper copies of death certificates for most decedents documenting Libby as their place of residence at time of death and dying of one of the selected underlying causes. The majority of deaths occurred in Montana (88%, 477/542) with a few Libby residents dying outside the state (12%, 65/542). The other states where deaths occurred all--except for one certificate in New York, which was not located--provided paper copies of death certificates. Washington accounted for 83% (54/65) of the out-of-state deaths in the Libby study population.

This analysis includes 123 additional death certificates missed in the original mortality analysis. Of these additional deaths, 93% (114/123) were successfully georeferenced. Some of these georeferenced decedents did not fall within the geographic areas of analysis. These additional deaths contributed to many underlying cause categories including digestive cancers (28), lung cancers (51), and nonmalignant respiratory (44) diseases.

Demographics

The 20-year study population of 542 decedents was primarily white (99%, 537/542) with a small number of Americans Indians (1%, 5/542). There were more men (56%, 316/542) than women (44%, 237/542) and the age at time of death ranged from 2 days to 105 years with a mean of 71 years.

Georeferencing

Geographical referencing was successfully completed on 97% (527/542) of the decedents. Fifteen decedents could not be georeferenced because they had a P.O. Box or rural route address that could not be matched to a physical street address (14) or because there was no valid death certificate (1) to abstract address information. These fifteen decedents were included in a separate SMR calculation using the largest geographic area of analysis to evaluate how their inclusion may impact the results. It was reasonable to assume that these decedents may have lived in the largest area of analysis since the majority of successfully georeferenced decedents (96%, 506/527) were located within this region.

Disease-Specific SMRs

SMRs discussed below are based on specific underlying causes of mortality. SMRs were calculated for the six geographic areas of analysis and are presented in tabular form (Tables 3 and 4). Underlying causes of death that were elevated when compared to State and national rates were also stratified by gender (Tables 5 and 6). The numbers of observed cases for Central Lincoln County are reported below for each disease-specific SMR. International Classification of Disease (ICD) codes are presented in brackets next to specific underlying causes of mortality.

Pneumoconioses/Asbestosis [501]

All 12 cases of pneumoconiosis in the Libby study population resulted from asbestosis. Mortality due to asbestosis was significantly elevated over the 20-year period. SMRs for asbestosis using the Montana reference population ranged from 40 to 50 depending upon the geographic area of analysis (Table 3). SMRs for asbestosis using the U.S. reference population ranged from 64 to 80 (Table 4). All asbestosis SMRs calculated using either of the reference populations were statistically significant, regardless of the geographic area of analysis. Using either Montana or U.S. age-specific mortality as a reference, one would expect Libby to have had no more than one case over the 20-year period. However, depending upon the geographic area considered, there were between 5 and 12 observed cases.

Almost all asbestosis deaths (92%, 11/12) occurred in males. SMRs for asbestosis among males varied based on the geographic area of analysis, ranging from 38 to 55 when compared with the Montana reference population (Table 5). When compared to the U.S. reference population, SMRs ranged from 58 to 84 (Table 6). Male deaths accounted for the substantial increase in asbestosis mortality described in this report. One asbestosis death occurred in a female. This single female death was a statistically significant elevation since asbestosis is an extremely rare disease in females.

Three other decedents uncovered in this review of mortality data had asbestosis listed as an underlying cause of death or as “other significant condition” but could not be included as asbestosis deaths in this statistical review. One decedent was coded incorrectly by the nosologist. This decedent should have been designated as an asbestosis death since this was the primary underlying cause listed on the death certificate. Instead this individual was coded as a lung cancer death and treated as such in the analysis. Two deaths were included in other categories even though asbestosis was listed in the field “other significant conditions”. All three of these decedents worked at the mine and milling facility, with employment lengths of 7, 11, and 36 years.

Lung Cancer [161-165]

There were 124 identified cases of lung cancer in the Libby study population. Using Montana and U.S. mortality references, one would have expected between 95 to 108 lung cancer deaths respectively in Central Lincoln County. Lung cancer mortality was significantly elevated in most areas of analysis using the Montana reference population, with SMRs ranging from 1.2 to 1.4 (Table 3). Lung cancer mortality was also elevated when compared to U.S. rates. However, only one geographic area demonstrated a statistically significant SMR (Table 4).

The majority of lung cancer deaths occurred in males (69%, 85/124). When stratified by gender and compared to the Montana reference population, males had a 37 to 68 percent increase in lung cancer while females had no significant increase (Table 5). There were more deaths among men than expected when comparing Libby to the U.S. population but none of these increases were statistically significant (Table 6).

Mesothelioma [199]

This analysis included three mesothelioma deaths that were identified through a review of death certificates provided by Montana and Washington. Reviewing paper copies of death certificates was critical in identifying these deaths in the Libby area. The International Classification of Diseases, 9th Revision (ICD-9) does not contain a specific code for mesothelioma because this condition is defined by cell morphology and ICD-9 is an anatomically based system [3]. Because mesotheliomas are found at several sites, there are multiple codes in the ICD-9 system that can potentially describe this disease, including 158 (peritoneal malignancy), 163 (pleural malignancy), and 199 (malignancy without specification to site). The mesotheliomas in the Libby study population were classified as “malignancy without specification to site” (ICD-9 199) even though the death certificates clearly stated that the underlying cause was malignant mesothelioma. This discrepancy illustrates the difficulties in trying to assess mesothelioma mortality using death certificate data. These three deaths were not used in the calculation of SMRs because it is difficult to generate accurate disease counts at the state and national levels.

Eight other mesothelioma deaths were identified through this review of mortality data. The decedents were prior residents of Lincoln County and the majority (88%, 7/8) previously worked at the mine and milling facility. However, these eight decedents did not live in the extended Libby community at the time of their death and were therefore not eligible to be included in the analysis.

Other non-malignant respiratory diseases [490-496, 510-519]

Asbestos-related deaths may have been inadvertently misclassified to similar underlying causes. Therefore, SMRs of other nonmalignant respiratory diseases were calculated. These underlying causes of mortality include chronic obstructive pulmonary disease (COPD, ICD-9 codes 490-496) and other non-specific respiratory diagnoses (ICD-9 codes 510-519).

SMRs for COPD were elevated when compared with the U.S. reference population but this elevation was not present when compared to the Montana reference. Other non-specific respiratory diseases were significantly elevated when compared to both state and national rates.

Digestive Cancer [150-159]

There were 77 observed cases of digestive cancer in the Libby study population. There was no increase in mortality due to digestive cancer over the 20-year period. There were no temporal or gender-based trends in digestive cancer mortality.

Diseases of pulmonary circulation [415-417]

There were 14 observed cases of diseases of pulmonary circulation. There was a slight increase in mortality when compared with Montana and U.S. data. SMRs generated with the Montana and U.S. population standards were consistently above the null value of 1.0, yet only the SMR for the smallest geographic region was statistically significant.

Combined mortality for all respiratory causes

The overall impact of respiratory mortality was evaluated since there were significant increases in malignant and nonmalignant respiratory mortality in this community over the 20-year period surveyed. Deaths possibly associated with asbestos-related respiratory mortality, including those that may have been incorrectly coded to similar underlying causes of death, were combined (Table 7). This generated an estimate of the impact across all relevant respiratory causes. Combined mortality was also evaluated after removing decedents who were former employees at the facility (Table 8).

Combined underlying causes of mortality (ICD-9) included; lung cancers (161-165), mesotheliomas (199), chronic obstructive pulmonary diseases (490-496), asbestosis (501), and other, noninfectious diseases of the respiratory system (510-519). For the largest geographic area of analysis, the combined respiratory mortality included 242 observed deaths. The Montana reference population estimated 192 expected deaths and the U.S. reference population estimated 183 expected deaths for the combined underlying causes. This comparison indicated a 26 to 32 percent increase in respiratory mortality in the Libby community. When including decedents who were unable to be successfully georeferenced but were likely to fall within this area of analysis, the number of observed deaths increased to 253, indicating a 32 to 38 percent excess in respiratory mortality when compared with state and national rates.

Unknown Decedents

As previously stated, there were 15 decedents who could not be georeferenced since they had P.O. Box or rural route addresses that could not be matched to a physical street address. In order to evaluate the effects of their inclusion on mortality calculations, these decedents were added to the largest geographic area of analysis and SMRs were generated (Tables 9 and 10).

Six lung cancer decedents were included in the group of decedents that could not be georeferenced. These decedents were included in the largest geographic area of analysis, increasing the number of observed deaths to 130. This addition increased the lung cancer SMR to 1.37 when compared to the Montana reference population and 1.2 when compared to the U.S. population. Both of these elevated SMRs are statistically significant (Tables 9 and 10).

Six deaths from nonmalignant respiratory diseases also could not be successfully georeferenced. Their inclusion increased many subcategories of nonmalignant respiratory causes including COPD and other respiratory diseases.

Mortality Trends

No significant trends in mortality were detected in this analysis when grouping underlying causes of death into five-year intervals.

Exposure Analysis

In this rudimentary exposure assessment, we assumed that decedents found in the employment database were predominantly exposed through occupational routes. If

decedents were identified as relatives of previous employees, it was assumed that their primary route of exposure was through worker take home of contaminants. All other decedents (i.e., the local population) were potentially exposed through ambient environmental levels of asbestos.

Pneumoconioses/Asbestosis

Almost all deaths due to asbestosis (92%, 11/12) were linked with prior employment. The other asbestosis decedent was a household contact of a former employee who worked at the facility for 20 years. For the 11 prior employees who died of asbestosis, the average length of employment at the mining and milling operation was 24.5 years (SD = 10.7 years), ranging from a minimum of 3 years to a maximum of 38 years. Nine of these 11 asbestosis decedents worked at the facility for at least 20 years. The period from initial date of employment to death for these 11 decedents was 41.1 years (SD = 3.8 years) and from midpoint of employment to death was 28.9 years (SD = 5.2 years). All asbestosis deaths were associated with the mining and milling facility through either previous employment or as a household contact of a former worker.

Lung Cancer

Some lung cancer decedents were located in the employment database (17%, 21/124). Their periods of employment ranged from 1 month to 43 years with an average length of employment of 14 years (SD = 13 years). Additionally, two lung cancer decedents were household contacts of former workers.

Mesothelioma

Two of the three mesothelioma deaths occurred in former employees of the mine and milling facility. These former workers had employment lengths of 16 and 20 years.

Length of Employment

A query of the employment database identified eighteen individuals who had worked at the vermiculite mining and milling operation for 30 or more years. Some of these persons (22%, 4/18) were among the group of 12 asbestosis decedents acknowledged in this mortality review. This group also included some of the lung cancer deaths (17%, 3/18) documented in the mortality review.

Discussion

Health Outcomes

Excesses in lung cancer, mesothelioma, and nonmalignant respiratory mortality were clearly demonstrated in this review of death certificate data. During the 20-year period, there was a 20 to 40 percent elevation in underlying causes of respiratory mortality potentially associated with asbestos exposure.

The excesses in respiratory mortality appear to be primarily associated with occupational exposures at the mining and milling facility. Many decedents with respiratory-related underlying causes of death were former workers. Some of these former workers also had

lengthy periods of employment at the facility, particularly those diagnosed with asbestosis and mesothelioma. Extended periods of employment at the facility increased the probability of exposure to asbestos fibers released during vermiculite mining and milling.

Asbestosis is a dose-dependent response to asbestos exposure. Therefore, increased exposure potential increases the risk for disease. There is no scientific consensus on whether lung cancer and mesothelioma are dose-dependent diseases or instead require only a single, significant exposure. Regardless, it is clear that as opportunities for asbestos exposure increase, the likelihood of a person developing lung cancer or mesothelioma also increases.

Exposure Analysis

Individuals in Libby were potentially exposed to asbestos through three main routes. The primary (and most significant) route of exposure was through occupational associations with the mine and milling operation. Workers subsequently may have exposed household contacts by carrying asbestos fibers home on their clothes and/or persons. Finally, some community members were possibly exposed through ambient levels of asbestos in the environment released from the processing of contaminated vermiculite ore or through its use in insulation, gardening material and other commercial and residential applications.

Potential exposure pathways were examined in this analysis by linking death certificate data with worker rolls from the mining and milling facility. The correlations between employment and mortality databases indicated that excesses in respiratory mortality appear to be associated predominantly with working at the facility. Analysis of gender specific SMRs indicated that males have significantly increased mortality due to asbestosis, lung cancer, and other non-infectious respiratory diseases whereas females have no excesses or, in some cases, significantly decreased mortality due to these underlying causes of death. Men represented a large percentage of the work force at the facility so it is not surprising that in the Libby community, men bear an increased burden of respiratory mortality.

Limitations

Numerous limitations were discussed in detail in the first Libby mortality report from December 2000 [1]. These limitations included the effects of population migration, smoking prevalence, diagnostic bias, increased scrutiny of medical records at the Libby Care Center, and the general problems with relying on death certificate data to assess asbestos related mortality. These limitations are still applicable to this analysis. It should be emphasized that many additional malignant and nonmalignant respiratory deaths were uncovered in this review but were not included in the analysis since they did not meet the strict study parameters.

The exposure assessment component of this analysis is fairly simple as it is based on whether a decedent worked at the facility along with a measure of the length of employment. No dose estimates for community members, including workers, were

calculated. McDonald et al. and Amandus et al. assigned exposure estimates based on job titles or worker locations at the facility [2, 4]. However, this was not feasible in this study since it would be virtually impossible to assign exposure variables to all members of this study population, particularly members of the general population.

Conclusion

ATSDR reviewed death certificate data to generate an accurate representation of mortality potentially associated with historical asbestos exposure in the Libby community. For the 20-year period, mortality in Libby resulting from malignant and non-malignant respiratory disease was significantly elevated. Asbestosis mortality was 40 to 80 times higher than expected and lung cancer mortality was approximately 20 to 30 percent higher than expected. Mesothelioma mortality was elevated over this period but since statistics on this extremely rare cancer are not routinely collected, it was difficult to quantify this increase. Other non-malignant, non-infectious respiratory deaths were also significantly elevated. Overall, when compared to Montana and U.S. mortality, there was a 20 to 40 percent increase in malignant and nonmalignant respiratory deaths in this small Montana community from 1979 to 1998. There was no increase in digestive cancer mortality and no clear trends in mortality from any of the selected underlying causes.

Most of the excess in respiratory mortality can likely be attributed to occupational exposures since several decedents (12%, 64/542) were former workers at the mining and milling facility. Asbestosis and mesothelioma mortality were found almost exclusively in former workers. Increases in lung cancer mortality also could be explained by occupational association with the mine and milling facility.

Recommendations

1. Conduct periodic reviews of mortality statistics for this community to determine respiratory mortality trends
2. Initiate surveillance of former workers
3. Educate community on the benefits of smoking cessation

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Table 1 Population Estimates

Geographic Areas of Analysis	Area (in Square Miles)	Population (1990 Census)
Libby City Limits	1.1	2,532
Extended Libby Boundary	2.2	3,694
Air Modeling	16.0	4,300
Medical Screening	25.0	6,072
Libby Valley	65.0	8,617
Central Lincoln County	314.0	9,521
Montana (Reference)	145,556.0	799,065
U.S. (Reference)	3,597,693.0	248,790,925

Table 2 Libby Study Population Sizes

Number of Libby Area Decedents	
Libby Area Decedents	Number
Initial Study Population	558
After Review of Libby Care Center Records	542
After Georeferencing	527
Decedents Falling within the Following Geographic Areas of Analysis	
Central Lincoln County	506
Libby Valley	503
Medical Screening	396
Air Modeling	331
Extended Libby Boundary	303
Libby City Limits	246

Table 3 Standardized Mortality Ratios by Geographic Area of Analysis Using the Montana Population as a Reference, 1979–1998

**Malignant Neoplasm of Digestive Organs and Peritoneum
[ICD-9 150-159]**

Area of Analysis	Observed	Expected	SMR*	Lower 95% CI†	Upper 95% CI
Libby City Limits	31	34.4	0.90	0.61	1.28
Extended Libby Boundary	41	41.4	0.99	0.71	1.34
Air Modeling	46	50.0	0.92	0.67	1.23
Medical Screening	60	61.1	0.98	0.75	1.26
Libby Valley	76	78.7	0.97	0.76	1.21
Central Lincoln County	77	84.1	0.92	0.72	1.14

**Malignant Neoplasm of Esophagus, Stomach, Small Intestine, Colon, and Rectum
[ICD-9 150-154]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	21	22.6	0.93	0.58	1.42
Extended Libby Boundary	28	27.1	1.03	0.69	1.49
Air Modeling	31	32.7	0.95	0.64	1.34
Medical Screening	40	40.0	1.00	0.72	1.36
Libby Valley	53	51.5	1.03	0.77	1.35
Central Lincoln County	54	55.0	0.98	0.74	1.28

**Malignant Neoplasm of Pancreas
[ICD-9 157]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	9	7.6	1.18	0.54	2.23
Extended Libby Boundary	9	9.2	0.98	0.45	1.85
Air Modeling	11	11.2	0.98	0.49	1.76
Medical Screening	12	13.7	0.87	0.45	1.53
Libby Valley	13	17.8	0.73	0.39	1.25
Central Lincoln County	13	19.0	0.68	0.36	1.17

**Malignant Neoplasm of Respiratory and Intrathoracic Organs,
Excluding Nasal Cavities and Accessory Sinuses
[ICD-9 161-165]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	41	35.2	1.17	0.84	1.58
Extended Libby Boundary	57	43.4	1.31	0.99	1.70
Air Modeling	70	53.5	1.31¶	1.02	1.65
Medical Screening	87	67.1	1.30¶	1.04	1.60
Libby Valley	123	88.4	1.39¶	1.16	1.66
Central Lincoln County	124	95.0	1.31¶	1.09	1.56

**Malignant Neoplasm of Trachea, Bronchus, and Lung
[ICD-9 162]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	39	34.0	1.15	0.82	1.57
Extended Libby Boundary	55	41.9	1.31	0.99	1.71
Air Modeling	68	51.6	1.32¶	1.02	1.67
Medical Screening	85	64.7	1.31¶	1.05	1.62
Libby Valley	121	85.3	1.42¶	1.18	1.70
Central Lincoln County	122	91.6	1.33¶	1.11	1.59

**Diseases of Pulmonary Circulation
[ICD-9 415-417]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	9	3.9	2.31¶	1.06	4.39
Extended Libby Boundary	9	4.7	1.93	0.88	3.67
Air Modeling	10	5.6	1.79	0.86	3.29
Medical Screening	11	6.8	1.62	0.81	2.90
Libby Valley	14	8.7	1.61	0.88	2.70
Central Lincoln County	14	9.3	1.51	0.82	2.53

**Diseases of Respiratory System,
Excluding Upper Respiratory Tract Infections
[ICD-9 480-519]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	76	72.0	1.06	0.83	1.32
Extended Libby Boundary	94	83.0	1.13	0.92	1.39
Air Modeling	101	98.4	1.03	0.84	1.25
Medical Screening	124	115.1	1.08	0.90	1.28
Libby Valley	155	142.5	1.09	0.92	1.27
Central Lincoln County	156	150.8	1.03	0.88	1.21

**Chronic Obstructive Pulmonary Disease
[ICD-9 490-496]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	34	37.5	0.91	0.63	1.27
Extended Libby Boundary	49	44.3	1.11	0.82	1.46
Air Modeling	47	53.3	0.88	0.65	1.17
Medical Screening	63	64.0	0.98	0.76	1.26
Libby Valley	84	80.9	1.04	0.83	1.29
Central Lincoln County	85	86.1	0.99	0.79	1.22

**Asbestosis (Represents all Pneumoconioses)
[ICD-9 501]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	5	0.1	40.84¶	13.16	95.31
Extended Libby Boundary	7	0.1	47.30¶	18.95	97.46
Air Modeling	9	0.2	49.80¶	22.73	94.55
Medical Screening	10	0.2	45.14¶	21.61	83.03
Libby Valley	12	0.3	42.21¶	21.78	73.74
Central Lincoln County	12	0.3	39.59¶	20.43	69.16

**Other Diseases of the Respiratory System
[ICD-9 510-519]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	9	4.9	1.85	0.85	3.52
Extended Libby Boundary	10	5.7	1.75	0.84	3.21
Air Modeling	13	6.8	1.91¶	1.02	3.27
Medical Screening	16	8.1	1.97¶	1.12	3.19
Libby Valley	18	10.3	1.75¶	1.04	2.77
Central Lincoln County	18	10.9	1.65	0.98	2.60

*SMR: Standardized mortality ratio based on the Montana reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

Table 4 Standardized Mortality Ratios by Geographic Area of Analysis Using the U. S. Population as a Reference, 1979-1998

**Malignant Neoplasm of Digestive Organs and Peritoneum
[ICD-9 150-159]**

Area of Analysis	Observed	Expected	SMR*	Lower 95% CI†	Upper 95% CI
Libby City Limits	31	37.5	0.83	0.56	1.17
Extended Libby Boundary	41	45.1	0.91	0.65	1.23
Air Modeling	46	54.6	0.84	0.62	1.12
Medical Screening	60	66.8	0.90	0.69	1.16
Libby Valley	76	86.1	0.88	0.70	1.11
Central Lincoln County	77	92.0	0.84	0.66	1.05

**Malignant Neoplasm of Esophagus, Stomach, Small Intestine, Colon, and Rectum
[ICD-9 150-154]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	21	25.2	0.83	0.51	1.27
Extended Libby Boundary	28	30.3	0.92	0.61	1.33
Air Modeling	31	36.7	0.85	0.57	1.20
Medical Screening	40	44.8	0.89	0.64	1.22
Libby Valley	53	57.7	0.92	0.69	1.20
Central Lincoln County	54	61.7	0.88	0.66	1.14

**Malignant Neoplasm of Pancreas
[ICD-9 157]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	9	7.6	1.18	0.54	2.24
Extended Libby Boundary	9	9.2	0.98	0.44	1.85
Air Modeling	11	11.2	0.98	0.49	1.76
Medical Screening	12	13.8	0.87	0.45	1.52
Libby Valley	13	17.8	0.73	0.39	1.25
Central Lincoln County	13	19.0	0.68	0.36	1.17

**Malignant Neoplasms of Respiratory and Intrathoracic Organs,
Excluding Nasal Cavities and Accessory Sinuses
[ICD-9 161-165]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	41	39.7	1.03	0.74	1.40
Extended Libby Boundary	57	49.2	1.16	0.88	1.50
Air Modeling	70	60.6	1.16	0.90	1.46
Medical Screening	87	76.3	1.14	0.91	1.41
Libby Valley	123	100.8	1.22¶	1.01	1.46
Central Lincoln County	124	108.4	1.14	0.95	1.36

**Malignant Neoplasms of Trachea, Bronchus, and Lung
[ICD-9 162]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	39	38.4	1.02	0.72	1.39
Extended Libby Boundary	55	47.6	1.16	0.87	1.51
Air Modeling	68	58.6	1.16	0.90	1.47
Medical Screening	85	73.8	1.15	0.92	1.42
Libby Valley	121	97.4	1.24¶	1.03	1.48
Central Lincoln County	122	104.8	1.16	0.97	1.39

**Diseases of Pulmonary Circulation
[ICD-9 415-417]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	9	3.7	2.41¶	1.10	4.57
Extended Libby Boundary	9	4.5	1.99	0.91	3.78
Air Modeling	10	5.4	1.84	0.88	3.39
Medical Screening	11	6.7	1.65	0.82	2.96
Libby Valley	14	8.6	1.63	0.89	2.73
Central Lincoln County	14	9.2	1.52	0.83	2.55

**Diseases of Respiratory System,
Excluding Upper Respiratory Tract Infections
[ICD-9 480-519]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	76	62.2	1.22	0.96	1.53
Extended Libby Boundary	94	72.0	1.31¶	1.06	1.60
Air Modeling	101	85.2	1.19	0.97	1.44
Medical Screening	124	99.9	1.24¶	1.03	1.48
Libby Valley	155	124.0	1.25¶	1.06	1.46
Central Lincoln County	156	131.2	1.19¶	1.01	1.39

**Chronic Obstructive Pulmonary Disease
[ICD-9 490-496]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	34	27.5	1.23	0.85	1.72
Extended Libby Boundary	49	32.6	1.51¶	1.11	1.99
Air Modeling	47	39.1	1.20	0.88	1.60
Medical Screening	63	46.9	1.34¶	1.03	1.72
Libby Valley	84	59.4	1.42¶	1.13	1.75
Central Lincoln County	85	63.2	1.35¶	1.08	1.66

**Asbestosis (Represents all Pneumoconioses)
[ICD-9 501]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	5	0.1	63.55¶	20.48	148.30
Extended Libby Boundary	7	0.1	74.95¶	30.03	154.40
Air Modeling	9	0.1	79.86¶	36.44	151.60
Medical Screening	10	0.1	73.47¶	35.17	135.10
Libby Valley	12	0.2	69.48¶	35.86	121.40
Central Lincoln County	12	0.2	65.24¶	33.67	114.00

**Other Diseases of the Respiratory System
[ICD-9 510-519]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	9	5.0	1.80	0.82	3.42
Extended Libby Boundary	10	5.9	1.68	0.80	3.09
Air Modeling	13	7.1	1.83	0.98	3.14
Medical Screening	16	8.6	1.87¶	1.07	3.04
Libby Valley	18	10.9	1.65	0.98	2.61
Central Lincoln County	18	11.6	1.55	0.92	2.45

*SMR: Standardized mortality ratio based on the U.S. reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

Table 5 Gender Specific Standardized Mortality Ratios by Geographic Area of Analysis Using the Montana Population as a Reference, 1979-1998

**Malignant Neoplasms of Respiratory and Intrathoracic Organs,
Excluding Nasal Cavities and Accessory Sinuses — Male
[ICD-9 161-165]**

Area of Analysis	Observed	Expected	SMR*	Lower 95% CI†	Upper 95% CI
Libby City Limits	30	19.4	1.55¶	1.04	2.21
Extended Libby Boundary	43	25.6	1.68¶	1.22	2.26
Air Modeling	51	32.8	1.55¶	1.16	2.04
Medical Screening	63	42.7	1.48¶	1.13	1.89
Libby Valley	85	57.7	1.47¶	1.18	1.82
Central Lincoln County	85	62.1	1.37¶	1.09	1.69

**Malignant Neoplasms of Respiratory and Intrathoracic Organs,
Excluding Nasal Cavities and Accessory Sinuses — Female
[ICD-9 161-165]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	11	13.6	0.81	0.40	1.44
Extended Libby Boundary	14	16.3	0.86	0.47	1.44
Air Modeling	19	19.5	0.97	0.59	1.52
Medical Screening	24	23.9	1.00	0.64	1.49
Libby Valley	38	30.9	1.23	0.87	1.69
Central Lincoln County	39	33.2	1.17	0.83	1.61

**Asbestosis (Represents all Pneumoconioses) — Male
[ICD-9 501]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	5	0.1	52.00¶	16.76	121.40
Extended Libby Boundary	7	0.1	55.45¶	22.21	114.20
Air Modeling	9	0.2	55.49¶	25.32	105.30
Medical Screening	9	0.2	43.49¶	19.84	82.56
Libby Valley	11	0.3	40.09¶	19.98	71.73
Central Lincoln County	11	0.3	37.53¶	18.71	67.15

Asbestosis (Represents all Pneumoconioses) — Female
[ICD-9 501]

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	0	0.0	0	-	-
Extended Libby Boundary	0	0.0	0	-	-
Air Modeling	0	0.0	0	-	-
Medical Screening	1	0.0	101.60¶	1.33	565.50
Libby Valley	1	0.0	86.63¶	1.13	482.00
Central Lincoln County	1	0.0	83.40¶	1.09	464.00

Other Diseases of the Respiratory System – Male
[ICD-9 510-519]

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	6	2.2	2.75¶	1.01	5.98
Extended Libby Boundary	6	2.9	2.10	0.77	4.58
Air Modeling	9	3.6	2.51¶	1.15	4.77
Medical Screening	12	4.5	2.68¶	1.39	4.69
Libby Valley	14	5.8	2.41¶	1.32	4.05
Central Lincoln County	14	6.2	2.26¶	1.23	3.79

Other Diseases of the Respiratory System – Female
[ICD-9 510-519]

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	3	2.5	1.22	0.24	3.55
Extended Libby Boundary	4	2.7	1.46	0.39	3.74
Air Modeling	4	3.2	1.27	0.34	3.24
Medical Screening	4	3.6	1.10	0.29	2.81
Libby Valley	4	4.5	0.89	0.24	2.28
Central Lincoln County	4	4.8	0.84	0.23	2.15

*SMR: Standardized mortality ratio based on the Montana reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

Table 6 Gender Specific Standardized Mortality Ratios by Geographic Area of Analysis Using the U.S. Population as a Reference, 1979-1998

**Malignant Neoplasms of Respiratory and Intrathoracic Organs,
Excluding Nasal Cavities and Accessory Sinuses — Male
[ICD-9 161-165]**

Area of Analysis	Observed	Expected	SMR*	Lower 95% CI†	Upper 95% CI
Libby City Limits	30	23.6	1.27	0.86	1.82
Extended Libby Boundary	43	31.2	1.38	1.00	1.86
Air Modeling	51	40.1	1.27	0.95	1.67
Medical Screening	63	52.4	1.20	0.92	1.54
Libby Valley	85	71.1	1.20	0.96	1.48
Central Lincoln County	85	76.6	1.11	0.89	1.37

**Malignant Neoplasms of Respiratory and Intrathoracic Organs,
Excluding Nasal Cavities and Accessory Sinuses — Female
[ICD-9 161-165]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	11	14.5	0.76	0.38	1.35
Extended Libby Boundary	14	17.3	0.81	0.44	1.36
Air Modeling	19	20.7	0.92	0.55	1.44
Medical Screening	24	25.3	0.95	0.61	1.41
Libby Valley	38	32.6	1.17	0.82	1.60
Central Lincoln County	39	35.0	1.12	0.79	1.52

**Asbestosis (Represents all Pneumoconioses) — Male
[ICD-9 501]**

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	5	0.1	76.49¶	24.65	178.50
Extended Libby Boundary	7	0.1	82.66¶	33.12	170.30
Air Modeling	9	0.1	84.00¶	38.33	159.50
Medical Screening	9	0.1	66.78¶	30.47	126.80
Libby Valley	11	0.2	62.41¶	31.11	111.70
Central Lincoln County	11	0.2	58.44¶	29.14	104.60

Asbestosis (Represents all Pneumoconioses) — Female
[ICD-9 501]

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	0	0.0	0.0	-	-
Extended Libby Boundary	0	0.0	0.0	-	-
Air Modeling	0	0.0	0.0	-	-
Medical Screening	1	0.0	161.20¶	2.11	897.00
Libby Valley	1	0.0	131.70¶	1.72	732.70
Central Lincoln County	1	0.0	124.20¶	1.62	691.30

Other Diseases of the Respiratory System – Male
[ICD-9 510-519]

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	6	2.2	2.67	0.97	5.81
Extended Libby Boundary	6	3.0	2.03	0.74	4.41
Air Modeling	9	3.7	2.43¶	1.11	4.62
Medical Screening	12	4.7	2.56¶	1.32	4.47
Libby Valley	14	6.2	2.28¶	1.24	3.82
Central Lincoln County	14	6.6	2.13¶	1.16	3.57

Other Diseases of the Respiratory System – Female
[ICD-9 510-519]

Area of Analysis	Observed	Expected	SMR	Lower 95% CI	Upper 95% CI
Libby City Limits	3	2.6	1.14	0.23	3.34
Extended Libby Boundary	4	2.9	1.36	0.37	3.48
Air Modeling	4	3.4	1.18	0.32	3.02
Medical Screening	4	3.9	1.01	0.27	2.59
Libby Valley	4	4.9	0.82	0.22	2.09
Central Lincoln County	4	5.2	0.77	0.21	1.97

*SMR: Standardized mortality ratio based on the U.S. reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

Table 7 Combined Respiratory Mortality in Central Lincoln County Using the Montana and U.S. Population References, 1979–1998

Underlying Cause (ICD-9)	Observed	Montana Expected	SMR* (95% CIs†)	U.S. Expected	SMR* (95% CIs)
Lung Cancers (161-165)	124	95.0	1.31¶ (1.09 - 1.56)	108.4	1.14 (0.95 – 1.36)
Mesotheliomas (199)	3	-	- -	-	- -
COPD (490-496)	85	86.1	0.99 (0.79 - 1.22)	63.2	1.35¶ (1.08 – 1.66)
Asbestosis (501)	12	0.3	39.59¶ (20.43 - 69.16)	0.2	65.24¶ (33.67 – 114.00)
Other respiratory (510-519)	18	10.9	1.65 (0.98 – 2.60)	11.6	1.55 (0.92 – 2.45)
Combined causes (161-165, 199, 490-496, 501, 510-519)	242	192.3	1.26¶ (1.10 – 1.43)	183.4	1.32¶ (1.16 – 1.50)
Combined causes including non-georeferenced deaths	253	192.3	1.32¶ (1.16 – 1.49)	183.4	1.38¶ (1.21 – 1.56)

*SMR: Standardized mortality ratio based on the Montana or U.S. reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

-Expected death estimates and SMRs for mesothelioma are insignificant in this example.

Table 8 Combined Respiratory Mortality Excluding Former Workers in Central Lincoln County Using the Montana and U.S. Population References, 1979–1998

Underlying Cause (ICD-9)	Observed	Montana Expected	SMR* (95% CIs†)	U.S. Expected	SMR* (95% CIs)
Lung Cancers (161-165)	103	95.0	1.08 (0.88 - 1.31)	108.4	0.95 (0.78 – 1.15)
Mesotheliomas (199)	1	-	- -	-	- -
COPD (490-496)	73	86.1	0.85 (0.66 - 1.07)	63.2	1.16 (0.91 – 1.45)
Asbestosis (501)	1	0.3	3.33 (0.04 – 18.55)	0.2	5.00 (0.07 – 27.82)
Other respiratory (510-519)	17	10.9	1.56 (0.91 – 2.50)	11.6	1.47 (0.85 – 2.35)
Combined causes (161-165, 199, 490-496, 501, 510-519)	195	192.3	1.01 (0.88 – 1.17)	183.4	1.06 (0.92 – 1.22)

*SMR: Standardized mortality ratio based on the Montana or U.S. reference population.

†CI: Confidence interval.

Table 9 Standardized Mortality Ratios Including Fifteen Unknown Decedents in Central Lincoln County Using the Montana Population as a Reference, 1979–1998

Underlying Cause (ICD-9)	Observed	Expected	SMR*	Lower 95% CI†	Upper 95% CI
Digestive Cancers (150-159)	80	84.1	0.95	0.75	1.18
Lung Cancers (161-165)	130	95.0	1.37¶	1.14	1.63
All non-malignant respiratory (480-519)	162	150.8	1.07	0.92	1.25
COPD (490-496)	88	86.1	1.02	0.82	1.26
Asbestosis (501)	12	0.3	39.59¶	20.43	69.16
Other respiratory (510-519)	20	10.9	1.83¶	1.12	2.83

*SMR: Standardized mortality ratio based on the Montana reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

Table 10 Standardized Mortality Ratios Including Fifteen Unknown Decedents in Central Lincoln County Using the U.S. Population as a Reference, 1979–1998

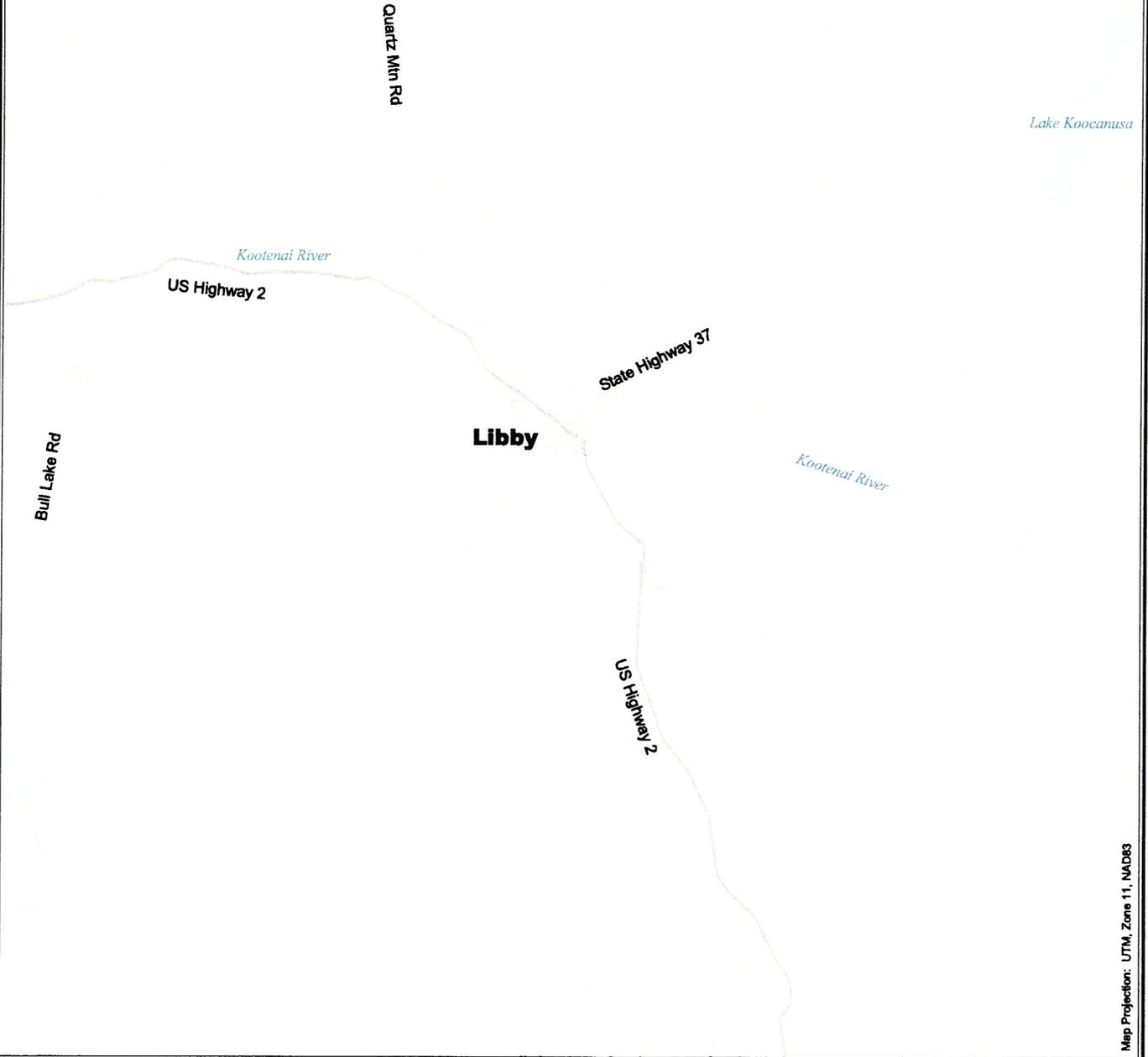
Underlying Cause (ICD-9)	Observed	Expected	SMR*	Lower 95% CI†	Upper 95% CI
Digestive Cancers (150-159)	80	92.0	0.87	0.69	1.08
Lung Cancers (161-165)	130	108.4	1.20¶	1.01	1.42
All non-malignant respiratory (480-519)	162	131.2	1.23¶	1.05	1.44
COPD (490-496)	88	63.2	1.39¶	1.12	1.72
Asbestosis (501)	12	0.2	65.24¶	33.67	114.00
Other respiratory (510-519)	20	11.6	1.72¶	1.05	2.66

*SMR: Standardized mortality ratio based on the U.S. reference population.

†CI: Confidence interval.

¶Statistically significant elevated SMRs.

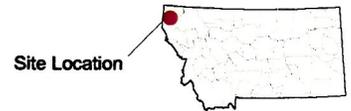
Figure 1 Geographic Areas of Analysis



Map Projection: UTM, Zone 11, NAD83

General Vicinity

Libby, Montana



Lincoln County, Montana

VICINITY MAP

Data Source: 1997 TIGER/Line Files (U.S. Census)





Quartz Mtn Rd

Kootenai River

US Highway 2

State Highway 37

Libby

Kootenai River

US Highway 2

Legend

 Central Lincoln County

 Road

 Water Body

1 0 1 2 Miles

Map Projection: UTM, Zone 11, NAD83

Central Lincoln County

Libby, Montana



Site Location

VICINITY MAP

Lincoln County, Montana

Central Lincoln County - This catchment area of 314 square miles describes a concentric region with a 10-mile radius. It is centered in downtown Libby at the intersection of California Ave. and Highway 2.



ALD 010197



Quartz Mtn Rd

Kootenai River

US Highway 2

State Highway 37

Libby

Kootenai River

US Highway 2

Legend

-  Libby Valley
-  Road
-  Water Body
-  Central Lincoln County

1 0 1 2 Miles

Map Projector: UTM, Zone 11, NAD83

Libby Valley

Libby, Montana



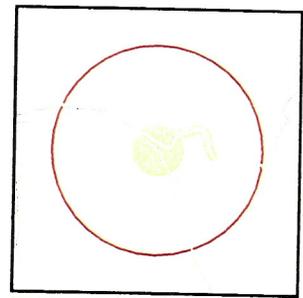
VICINITY MAP

Lincoln County, Montana

Libby Valley - The 65 square mile area includes the extended Libby community living within the valley up to an elevation of 800 ft. It was derived from a digital elevation model for Lincoln County obtained from the U.S.G.S.



ALD 06062000



Central Lincoln County

Bobtail Rd

Pipe Creek Rd

State Highway 37

US Highway 2

Kootenai River

Kootenai River

State Highway 37

Libby

US Highway 2

Legend

-  Medical Screening
-  Water Body
-  Road
-  Central Lincoln County (INSET ONLY)

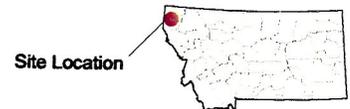
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Map Projection: UTM, Zone 11, NAD83

Medical Screening

Libby, Montana



Site Location

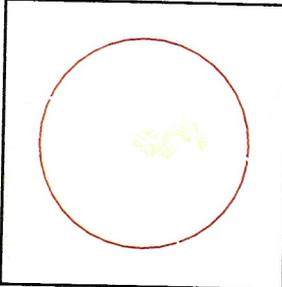
VICINITY MAP

Medical Screening - ATSDR's Division of Health Studies established this 25 square mile region for the purpose of prompting individuals who were most likely impacted by the contamination to enter the medical screening program.

ALD 08082000

Lincoln County, Montana





Central Lincoln County

Bobtail Rd

Pipe Creek Rd

US Highway 2

Kootenai River

State Highway 37

Libby

Kootenai River

State Highway 37

US Highway 2

Legend

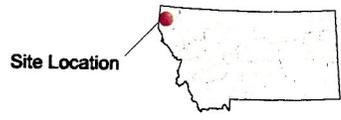
- Air Modeling
- Road
- Water Body
- Central Lincoln County (INSET ONLY)

0.4 0 0.4 0.8 Miles

Map Projection: UTM, Zone 11, NAD83

Air Modeling

Libby, Montana



Site Location

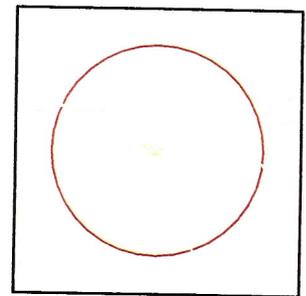
VICINITY MAP

Lincoln County, Montana

Air modeling -- This 16 square mile area describes the region where computer modeling has indicated the highest probability for asbestos fiber distribution associated with exfoliation, mining, and milling processes.



ALD 08082000



Central Lincoln County

Bobtail Rd

Pipe Creek Rd

State Highway 37

US Highway 2

Kootenai River

Libby

Kootenai River

State Highway 37

US Highway 2

Legend

- Extended Libby Boundary
- Water Body
- Road
- Central Lincoln County (INSET ONLY)

0.4 0 0.4 0.8 Miles



Map Projection: UTM, Zone 11, NAD83

Extended Libby Boundary

Libby, Montana



Site Location

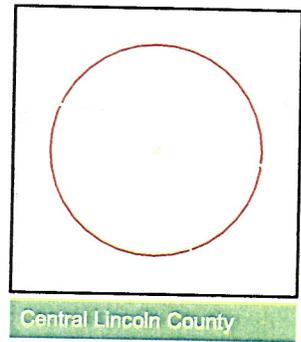
VICINITY MAP

Extended Libby Boundary - This region is approximately 2.2 square miles and includes downtown Libby as well as most of the major subdivisions surrounding the downtown area.

Lincoln County, Montana



ALD 08082000



Bobtail Rd

Pipe Creek Rd

State Highway 37

Kootenai River

US Highway 2

Kootenai River

State Highway 37

US Highway 2



Libby

Legend

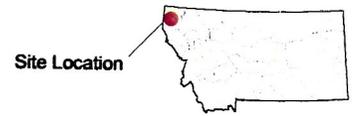
- Libby City Limits
- Water Body
- Road
- Central Lincoln County (INSET ONLY)

0.5 0 0.5 1 Miles

Map Projection: UTM, Zone 11, NAD83

Libby City Limits

Libby, Montana



Site Location

VICINITY MAP

Lincoln County, Montana

Libby City Limits - This region is approximately 1.1 square miles and encompasses downtown Libby. The boundary files was obtained from the U.S. Census Bureau's TIGER/Line files.



ALD 08072000