Health Consultation

ANALYSIS OF CANCER INCIDENCE NEAR THE
ZONOLITE/W.R. GRACE SITE

HAMILTON TOWNSHIP, MERCER COUNTY, NEW JERSEY

EPA FACILITY ID: NJD067387472

MARCH 14, 2005

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

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

New Jersey Department of Health and Senior Services
Public Health Protection & Emergency Preparedness
Consumer and Environmental Health Services
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Purpose

The purpose of this health consultation is to evaluate cancer incidence in a population living near the Zonolite/W.R. Grace facility in Hamilton, New Jersey. The Zonolite/W.R. Grace facility processed asbestos-contaminated vermiculite ore from Libby, Montana. Five asbestos-related and three reference (nonasbestos-related) cancer groupings were evaluated over a 22-year period (1979-2000).

Background and Statement of Issues

The Zonolite Company, purchased by W.R. Grace & Company in 1963, mined vermiculite ore from Libby, Montana, for commercial purposes from the 1920's through 1990. Vermiculite, a naturally occurring fibrous mineral, has been used in lawn, garden, agricultural, and horticultural products; thermal and sound insulation; and construction, insulation, and lightweight packing material (EPA 2000). Vermiculite from the Libby mine was contaminated with tremolite-actinolite, a particularly hazardous form of naturally occurring asbestos, up to 26% by weight (EPA 2000). It is well documented that exposure to asbestos is strongly associated with malignant and nonmalignant respiratory diseases, including asbestosis, mesothelioma, and lung cancer, and to a lesser extent, with digestive cancers (ATSDR 2001). Contaminated Libby vermiculite was shipped to processing and receiving facilities in numerous towns throughout the United States, including seven facilities in New Jersey. The Zonolite/W.R. Grace facility located in Hamilton Township, Mercer County (see Figure 1), began processing vermiculite from Libby in 1948. The facility received and processed tens of thousands of tons of Libby vermiculite over several decades (ATSDR 2004), far more than any other facility in New Jersey. In addition to the large volume of vermiculite received, the Hamilton facility also had the only vermiculite heat expansion (exfoliation) process in the state, a processing step considered to account for a large percentage of airborne asbestos released into the environment (ATSDR 2001). Consequently, the population living near the facility may have been exposed to higher levels of asbestos and may be at greater risk of developing asbestos-related cancer.

Methods

Study Area and Population

The Zonolite study area (see Figure 2) for the evaluation of cancer incidence consisted of the population residing in select census tracts (CT) or census block groups (BG) in three municipalities. The census areas (based on the 2000 U.S. Census) selected for the study include CT 28, CT 29.02, and CT 29.03 in Hamilton; CT 18 and CT 19 in Trenton; and CT 31, CT 32.01 (BG 3 and BG 4), and CT 32.02 (BG 2 and the southern portion of BG 1) in Lawrence. These tracts and block groups were selected because they are within one mile of the Zonolite/W.R. Grace facility. Table 1 presents a detailed listing of the study census areas by municipality and census year. Study area person-time was estimated by interpolation/extrapolation of the three census years (U.S. Census Bureau, 1980, 1990, 2000).

Cancer Case Ascertainment and Study Period

The New Jersey State Cancer Registry (NJSCR) was used for the ascertainment of cancer cases. The cancer registry is a population-based cancer incidence registry covering the entire state of New Jersey. By law, all cases of newly diagnosed cancer are reportable to the Registry. In addition, the registry has reporting agreements with the states of New York, Pennsylvania, Maryland, Delaware, and Florida. Information on New Jersey residents who are diagnosed in those states is supplied to the NJSCR. The Registry has been in operation since October 1, 1978.

The study period for this investigation was January 1, 1979, through December 31, 2000. A "case" was defined as an individual who was diagnosed with a new primary malignant cancer during the study period while residing in one of the study census areas. Registry cases identified only through search of death records were excluded from this evaluation because residence address at time of diagnosis is not known.

The information collected by NJSCR includes basic patient identification, demographic characteristics of the patient (date of birth, race, sex, age at diagnosis, address at diagnosis), medical information on each cancer diagnosis (including anatomical site, histologic type, and summary stage of disease), and annual follow-up status (alive/dead). Information is collected and defined in accordance with the National Cancer Institute's SEER (Surveillance, Epidemiology, and End Results) Program. Information on risk factors, such as personal lifestyle habits, are not available from the NJSCR.

Residential addresses of all persons diagnosed with cancer while living in Hamilton, Trenton, and Lawrence were inspected and assigned to the appropriate census tract/block group in the study area.

Data Analysis

Cancer types evaluated in this study were determined by an ATSDR protocol for health statistics review for communities that received asbestos-contaminated vermiculite from Libby, Montana (ATSDR 2001). Analyses were conducted for asbestos-related cancer types and reference (nonasbestos-related) cancer types. The asbestos-related cancer types include malignant neoplasms of the digestive organs; malignant neoplasms of the respiratory system and intrathoracic organs; malignant neoplasms of the lung and bronchus; malignant neoplasms of the peritoneum, retroperitoneum, and pleura; and mesothelioma. Mesothelioma is a subset of neoplasms of the peritoneum, retroperitoneum, and pleura. Reference cancer types include all malignant cancers, prostate cancer, and female breast cancer. Table 2 presents a list of the International Classification of Disease for Oncology (ICD-O-2) codes for the cancer groupings evaluated. Analyses were conducted for the total population and for males and females separately. Analyses were conducted for all races combined.

Standardized incidence ratios (SIRs) were computed for the quantitative analysis of cancer incidence in the selected study area (Kelsey, Whittemore, Evans, and Thompson 1996; Breslow and Day 1987). The SIR was calculated by dividing the observed number of cases

(from the NJSCR) by the expected number for the surveyed population over the time period reviewed. The expected number was calculated using average annual statewide age- and sex-specific incidence rates for the cancer type groupings based on NJSCR data for the period 1979 through 1999.

Evaluation of the observed and expected numbers is accomplished by interpreting the ratio (SIR) of these numbers. If the observed number of cases equals the expected number of cases, the SIR will equal one (1.0). An SIR less than one indicates that fewer cases are observed than expected. An SIR greater than one indicates that more cases than expected are observed.

The statistical test used to evaluate the difference between the observed and expected numbers was the 95% confidence interval (CI) (Breslow and Day 1987). The 95% CI is used to evaluate the probability that the SIR may be greater or less than 1.0 due to chance alone. The upper and lower limits of the CI were calculated using computational formulas that closely approximate the exact test for the Poisson distribution (Breslow and Day 1987; Checkoway, Pearce, and Crawford-Brown 1989). If the 95% CI includes 1.0, then the observed and expected numbers are not considered to be statistically significantly different from each other.

Results

Table 3 presents the study population by municipality, race, and sex for the years 1980, 1990, and 2000. The study area consisted of approximately 27,000 residents (range: 26,694 in 1980 to 27,603 in 2000). There were slightly more females (range: 51.4% in 2000 to 52.5% in 1980) than males, and substantially more whites (range: 68.6% in 2000 to 84.6% in 1980) than nonwhites in the study area. While nearly half of the study area population resided in Hamilton during each of the census periods, a larger percentage of the total Lawrence population lived within the study area boundaries. The study area person-time for the 22-year period was 284,381 males and 308,107 females.

Table 4 presents select demographic characteristics of the cancer cases in the study area. A total of 3,173 study area residents (1,625 males and 1,548 females) were diagnosed with a malignant cancer during the 22-year period. The race of the study area cases was 89.5% (2,841) white, 9.9% (313) black, and 0.6% (19) other race or unknown. The age breakdown of the cases included 0.7% (23) under 20 years of age and 74.4% (2,361) 60 years and over.

Table 5 presents the SIR results for the study area by sex, all races combined. None of the asbestos-related or reference cancer types evaluated were statistically significantly high or low. The observed and expected number of cases was virtually the same for each of the reference cancer types: all malignant cancer combined (SIR = 1.00 for total; 1.01 for males; and 0.99 for females); female breast cancer (SIR = 1.02); and prostate cancer (SIR = 0.93). For the asbestos-related cancer types, most of the observed and expected number of cases were about the same, with the exception of mesothelioma, which had few cases: digestive system cancers (SIR = 1.02 for total; 1.04 for males; and 1.00 for females); respiratory system cancers (SIR = 1.04 for total; 1.07 for males; and 0.98 for females); lung and bronchus cancers (SIR = 1.03 for total; 1.07

for males; and 0.96 for females); cancers of the peritoneum, retroperitoneum and pleura (SIR = 0.78 for total; 0.70 for males; and 0.96 for females); and mesothelioma (SIR = 0.57 for total; 0.58 for males; and 0.50 for females). Because of concerns that mesothelioma incidence is higher in New Jersey due to historical occupational exposures, SIRs were recalculated using national rates from the Surveillance, Epidemiology, and Ends Results Program of the National Cancer Institute. Using national comparison rates, mesothelioma SIRs increased slightly but remained under 1.0.

Discussion

The Zonolite/W.R. Grace facility processed asbestos-contaminated vermiculite ore from Libby, Montana, beginning in 1948 and continuing for many decades. Airborne release of asbestos during the vermiculite exfoliation process potentially contributed to ambient exposures in the nearby residential communities. The purpose of this investigation was to evaluate asbestos-related cancer incidence in a population living near the Zonolite/W.R. Grace facility. Evaluation of 22 years of cancer incidence data (1979-2000) for the study area did not indicate an excess of asbestos-related or reference cancer incidence in this population.

The approach utilized for this descriptive cancer investigation was "census" based, where the entire study population and New Jersey state cancer rates were used in order to calculate age-standardized incidence ratios by sex for the study area. While this study evaluated both asbestos-related and nonasbestos-related cancer types, it is important to note that for most cancer types evaluated, with the exception of mesothelioma, there is more than one known cause (i.e., multiple risk factors). As an example, lung cancer has a number of known risk factors with tobacco smoking considered the most important, estimated to account for more than 85% of all lung cancer cases (National Cancer Institute, 1996). Other known risk factors for lung cancer include indoor exposure to radon and environmental tobacco smoke, occupational exposure to asbestos and other cancer-causing agents in the workplace (including radioactive ores; chemicals such as arsenic, vinyl chloride, nickel, chromates, coal products, mustard gas, and chloromethyl ethers; fuels such as gasoline; and diesel exhaust), and exposure to air pollution (American Cancer Society 2004). Consequently, the multifactorial nature of cancer etiology complicates the evaluation of an asbestos-disease linkage because the degree to which other important risk factors occur in the study population is unknown. While exposure to asbestos is the only known risk factor for mesothelioma, occupational or other non-Zonolite/W.R. Grace contact with asbestos is unknown across the study population.

A limitation of cancer studies of this type is the inability to assess past exposure levels in the population. The critical piece of information required to assure a meaningful evaluation of these data is actual personal exposure to the contamination as well as other relevant risk factors over time; that is, who was exposed or not exposed and the magnitude of the exposure that did occur. Because personal exposure information does not exist, residential distance from the Zonolite/W.R. Grace site was used as a surrogate measure for potential past exposure. Although distance from the site may have been the best way to estimate past potential exposures, it is also unlikely that all of the residents in these areas were exposed to the contamination. Additionally,

the length of residence of each case is unknown, thereby potentially adding to exposure misclassification. The consequence of exposure misclassification would be to bias the results toward not finding an association (i.e., no exposure-health outcome relationship).

Another interpretation problem is that cancer is a chronic disease that takes many years after exposure to manifest as clinical disease. The information supplied by the state cancer registry provides only an address at time of diagnosis for each case. No information is available on the length of time an individual may have lived at their address before diagnosis. It is possible that some cases are new, short-term residents with little or no exposure to the site. Furthermore, former residents who moved out of the study area just prior to diagnosis are not available for analysis. Population mobility cannot be accounted for in this study. The current study assumes that in and out migration of cases will offset each other.

Conclusions and Recommendations

This analysis of cancer incidence in a population living near the Zonolite/W.R. Grace facility provides no evidence that the rate of asbestos-related cancer has been affected by the potential exposure to asbestos from vermiculite processing. While no further cancer analyses for the population living near the Zonolite/W.R. Grace facility appear to be warranted, NJDHSS and ATSDR should work with community representatives to determine the most appropriate health education and outreach strategies to inform the general population about environmental issues in the community. Additionally, the results of this health consultation will be considered along with an evaluation of the exposure pathways, community health concerns, and other pertinent information, in a future public health assessment of the site.

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Certification

This health consultation for the Zonolite/W.R. Grace site in Hamilton Township, New Jersey, was prepared by the New Jersey Department of Health and Senior Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

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

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Figures and Tables

Figure 1. Mercer County Communities

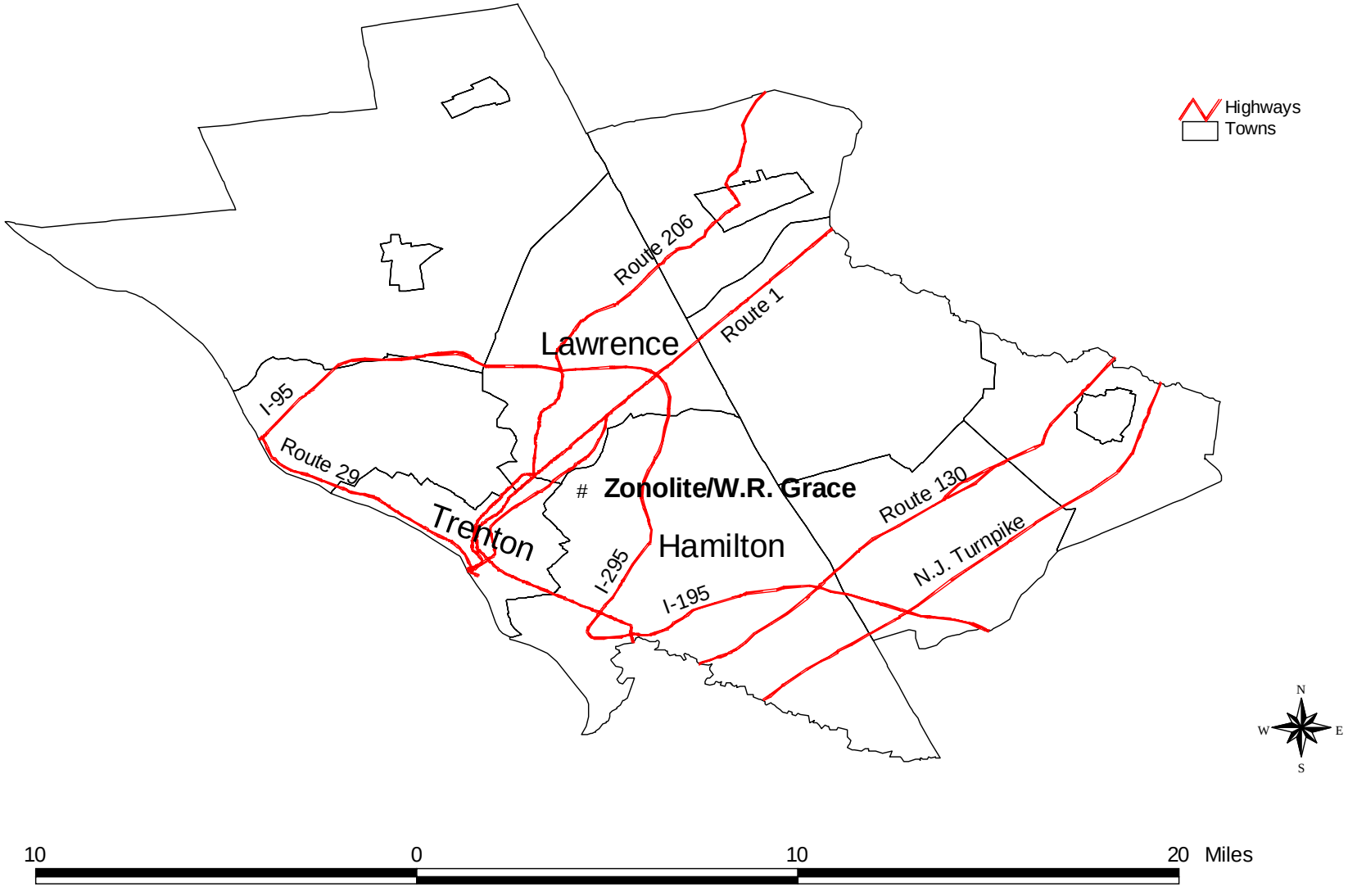

Figure 2. Zonolite/W.R. Grace Study Area

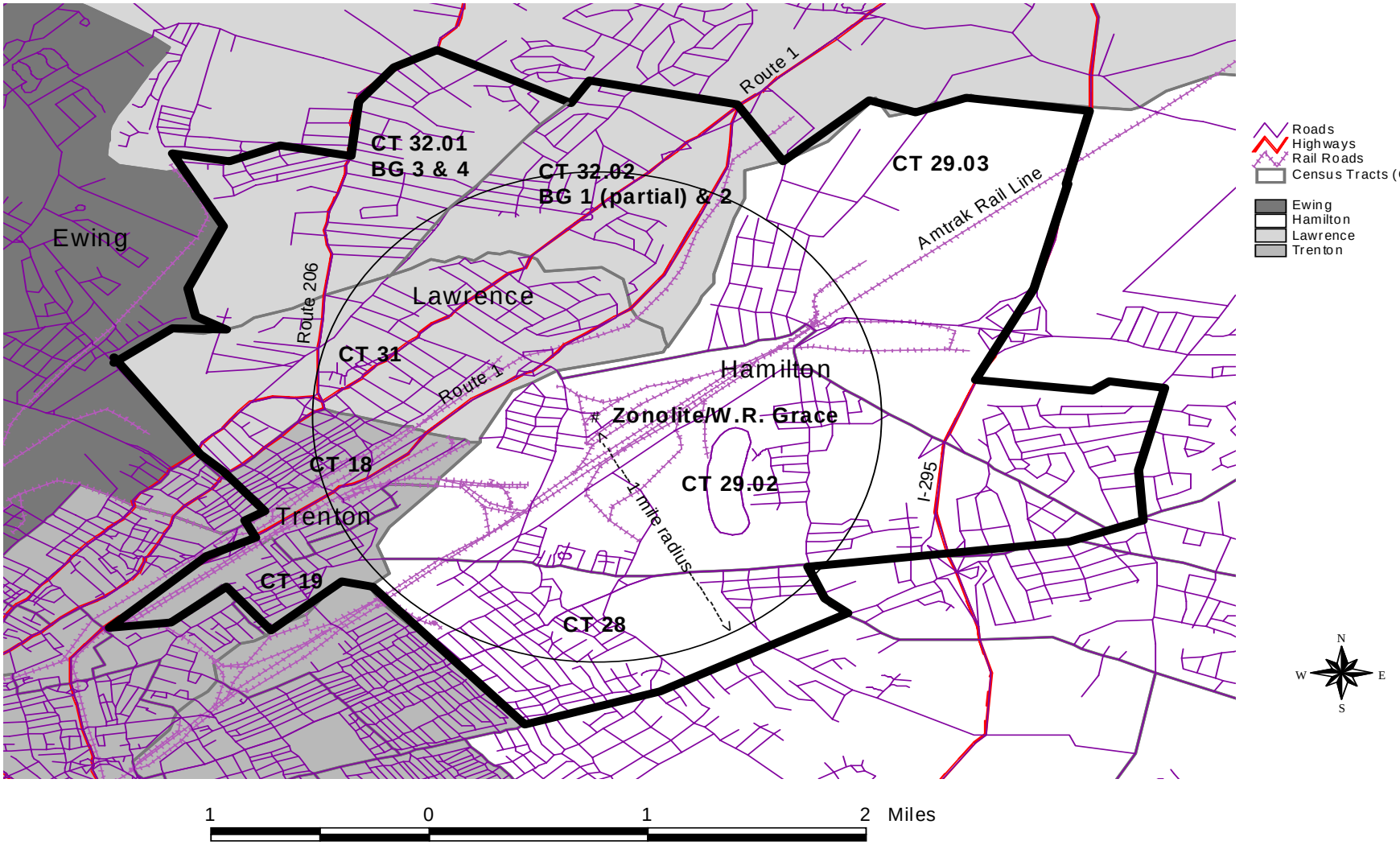

Table 1. Zonolite/W.R. Grace Study Area, Mercer County, New Jersey

	1980		1990		2000	
	Census Tract	**Census Block Groups**	**Census Tract**	**Census Block Groups**	**Census Tract**	**Census Block Groups**
Hamilton Township	28 29.02 29.01	all all 2 and 3	28 29.02 29.01	all all 2 and 3	28 29.02 29.03	all all all
Lawrence Township	31 32 32	all 3 and 4 1* and 2	31 32 32	all 3 and 4 1* and 2	31 32.01 32.02	all 3 and 4 1* and 2
Trenton	18 19	all all	18 19	all all	18 19	all all

***** Blocks 1022,1031,1032,1033,1034,1035,1036,1037,and 1038 only

Table 2. Asbestos-Related and Reference Cancer Groupings
International Classification of Diseases - Oncology Codes, Revision 2

Cancer Grouping	ICD-O-2 Site Groupings	Excluding Histology
Asbestos-related Cancer Types		
Malignant neoplasm of digestive organs	C150-C218 C260-C269	M9590-M9989
Malignant neoplasm of respiratory system and intrathoracic organs	C320-C399	M9590-M9989
Malignant neoplasm of lung and bronchus	C340-C349	M9590-M9989
Malignant neoplasm of peritoneum, retroperitoneum, and pleura	C480-C488 C384	M9590-M9989
Mesothelioma	M9050-M9053	---
Reference Cancer Types		
All malignant neoplasms	C000-C809	---
Malignant neoplasm of female breast	C500-C509	M9590-M9989
Malignant neoplasm of prostate	C619	M9590-M9989

Table 3. Zonolite/W.R. Grace Study Area, Mercer County, New Jersey
1980, 1990, and 2000 U.S. Census Bureau Populations

	1980		1990		2000	
Sex						
Male	12,670	(47.5%)	12,872	(48.1%)	13,413	(48.6%)
Female	14,024	(52.5%)	13,890	(51.9%)	14,190	(51.4%)
Total	26,694		26,762		27,603	
Race*						
White	22,583	(84.6%)	21,099	(78.8%)	18,322	(66.4%)
Black	3,407	(12.8%)	4,132	(15.4%)	6,059	(22.0%)
Other/Unknown	692	(2.6%)	1,519	(5.7%)	2,326	(8.4%)
Town of Residence (Percentage of town population in study area)						
Hamilton	13,019	(15.7%)	13,186	(15.2%)	13,647	(15.6%)
Lawrence	8,010	(40.6%)	7,908	(30.6%)	8,134	(27.8%)
Trenton	5,665	(6.1%)	5,668	(6.4%)	5,822	(6.8%)

***** Due to a change in census reporting for the 2000 population, the numbers indicated for Black and White race reflect individuals who indicated one race only.

Table 4. Zonolite/W.R. Grace Study Area Cancer Incidence (1979-2000): Number of Cases by Select Demographic Characteristics*

Demographic Characteristics	Male	Female	Total
Race			
White	1,440	1,401	2,841
Black	175	138	313
Other/Unknown	10	9	19
Total	1,625	1,548	3,173
Age at Diagnosis			
<20	15	8	23
20 - 39	57	72	129
40 - 59	297	363	660
60+	1,256	1,105	2,361

* Data from the New Jersey Department of Health and Senior Services' state cancer registry with analysis by the department's Consumer and Environmental Health Services (February 2004).

Table 5. Zonolite/W.R. Grace Study Area Cancer Incidence (1979-2000): SIR Analysis by Cancer Type and Sex, All Races Combined*

Cancer Type	Sex	Observed	Expected	SIR	95% CI Lower-Upper
Asbestos-Related Cancer Types					
Digestive System	Total Male Female	594 318 276	583.8 307.0 276.8	1.02 1.04 1.00	0.94 - 1.10 0.93 - 1.16 0.88 - 1.12
Respiratory System	Total Male Female	522 338 184	502.7 315.1 187.6	1.04 1.07 0.98	0.95 - 1.13 0.96 - 1.19 0.84 - 1.13
Lung and Bronchus	Total Male Female	465 296 169	453.4 276.4 177.0	1.03 1.07 0.96	0.93 - 1.12 0.95 - 1.20 0.82 - 1.11
Peritoneum, Retroperitoneum, and Pleura	Total Male Female	11 7 4	14.1 9.9 4.2	0.78 0.70 0.96	0.39 - 1.40 0.28 - 1.45 0.26 - 2.46
Mesothelioma	Total Male Female	6 5 1	10.6 8.6 2.0	0.57 0.58 0.50	0.21 - 1.23 0.19 - 1.36 0.01 - 2.81
Reference Cancer Types					
All Cancers	Total Male Female	3,173 1,625 1,548	3,185.0 1,616.9 1,568.1	1.00 1.01 0.99	0.96 - 1.03 0.96 - 1.06 0.94 - 1.04
Female Breast	Female	468	460.0	1.02	0.93 - 1.11
Prostate	Male	375	405.3	0.93	0.83 - 1.02

* Data from the New Jersey Department of Health and Senior Services' state cancer registry with analysis by the department's Consumer and Environmental Health Services (February 2004).