Appendix B

Excerpts from reports and complaint cards from the Wayne County Air Quality Management Division, 1983–1990. [Note: Excerpts are printed as received.]

Complaint cards

July 22, 1983: Recd. call from Dearborn Police who said they recd. complaints of foul odors from [Zonolite] company.

July 25, 1983: Smoke and ashes flying over the area. Fine ash being created. Wind scattering ash.

June 27, 1988: Ongoing since Spring. West wind blows residuals of mfg. process. Smells terrible. Coming in the house. Has unbagged material lying all over the facility.

Inspection reports

June 27, 1988: Fugitive dust from co. manufactured materials as well as odors in area....Upon completion of touring the facility...it was determined that the somewhat lax housekeeping (vermiculite materials on floor) was conducive to allowing fugitive materials to be blown off the plant premises. Material build-up on floor is being tracked to outside by foot and forklift traffic and wind blowing through the building via open doorways. This material as well as spillage on pallets left outside is likely to be picked up by winds and deposited off the plant site.

July 5, 1988, follow-up visit: Plant interior in better condition but still unacceptable regarding fugitive materials. Also fresh spillages in outdoor forklift trafficking areas and other build-up outdoor plant areas.

July 29, 1988, follow-up visit: Facility inside and out (out of doors w/ potential to be carried offsite) was found to be much cleaner than on previous visits. [The plant manager] showed [the inspector] receipts for repairs to the sweeper (motorized) which is used for this clean up. He also assured [the inspector] that continued efforts will be made to keep the fugitives cleaned up as required. Will remonitor in a couple months.

October 4, 1988, follow up visit: The inspection revealed that the co. is performing housekeeping at a much higher level than has been the case in the past. Only very minor accumulations of vermiculite were found both inside and outside the plant which would be expected from normal material handling practices. Contact assured [the inspector] these accumulations are handled on a daily basis with any more significant spill handled more promptly when and if they occur.

June 19, 1990: Somebody also shut off the rotary air lock causing a back pressure which blew the product and dust into the ambient.

Appendix C. EPA Preliminary Inspection Report

March 8, 2000

PRELIMINARY INSPECTION REPORT

FORMER: ZONOLITE COMPANY/W.R. GRACE
14300 HENN STREET
DEARBORN, MICHIGAN

CURRENTLY: N-FORCER
DIE, MOLD & AUTOMATION COMPONENTS, INC.
PLANT #1 14300 HENN STREET
DEARBORN, MICHIGAN

Attendees:

U.S. EPA On-Scene Coordinator (OSC) Kurt Grunert
N-Forcer Company, President, Paul Martin

Purpose:

The purpose of this inspection was to determine the current operating status of Former *Zonolite Company/W.R. Grace*, located in Dearborn, Michigan and if the company had utilized raw ore vermiculite from the W.R. Grace mine located in Libby, Montana in its exfoliation process. The former *Zonolite Company/W.R. Grace* has now been out of operation since 1990. OSC Grunert conducted a plant tour with the current owner of the 14300 Henn Street property. U.S. EPA also performed photodocumentation during the tour of the facility.

Discussions with the N-Forcer (current owner/operator) President:

On February 25, 2000, a site visit and an interview was conducted with the company president, Mr. Paul Martin. According to Mr. Martin, *Zonolite Company/W.R. Grace* stopped plant operations at the 14300 Henn Street property in 1990. In 1992, Mr. Martin purchased the property at 14300 Henn Street property from *Zonolite Company/W.R. Grace*. Mr. Martin stated that following cleanup by *Zonolite Company/W.R. Grace* a Phase I Environmental Audit was conducted at the property prior to purchase by Mr. Martin.

During the tour of the facility, Mr. Martin explained that all of the original buildings had been remodeled to suit the needs of company's operation. No evidence of vermiculite was observed in any of the structures on site. The property is adjacent to a set of railroad tracks from which a railroad spur enters the property from the east. The spur is not used at this time with N-Forcer. Mr. Martin stated during the interview that nearby residents during the operation of Zonolilte Company/W.R. Grace used to complain about the materials being emitted from the plant.

On March 7, 2000, OSC Grunert had to re-photograph the facility due to problems with the film. Mr. Martin was asked by the OSC to provide the U.S. EPA with a copy of the environmental audit conducted between 1990-1992. Mr. Martin told U.S. EPA that he would look through his files to provide us with a copy. Will have to follow up in the next two to three weeks.

Conclusion:

Based on the interview with Mr. Martin, and tour of the property, no visual evidence of vermiculite from the Libby, Montana mine was observed anywhere on the property.

Current Facility Contact Information:

N-Forcer (Nitrogen Gas Springs)
Die, Mold & Automation Components, Inc.
Plant #1- 14300 Henn Street
Dearborn, Michigan 48126

(313) 581-3444 ext. 12

President: Mr. Paul Martin

Memo

To: Jim Augustyn
From: Kurt Grunert *K— 3/7/00*
Date: March 7, 2000
Subject: Vermiculite Property Inspections- Dearborn Facility

The property is now a company called N-Forcer-Die, Mold and Automation Components, Inc. and occupies the former W.R. Grace Property- Zonolite Company. On February 25, 2000, OSC Grunert inspected the property and interviewed the current owner of the property. Mr. Paul Martin, N-Forcer, purchased the property from W.R.Grace in 1992. Since the transaction, Mr. Martin has remodeled the facility. No evidence of any vermiculite was observed anywhere on the property. Mr. Martin did mention that a Phase I Environmental Audit was conducted on the property following cleanup by W.R. Grace. A walk-thru of the property showed no evidence of the exfoliation process anywhere on the property. Mr. Martin did mention that during the last couple of years of operation by W.R. Grace, residences across the street did compliant of operation (burning of the materials). Something we may want to look into. Photographs were taken of the outside and inside of the property.

N-FORCER® — Nitrogen Gas Springs
DIE, MOLD & AUTOMATION COMPONENTS, INC
Plant #1 - 14300 Henn St.
Dearborn, MI 48126
(313)581-6510 Fax (313)945-0485

D.D.C., Inc — Wear Plates
DEARBORN DIE COMPONENTS, INC
Plant #2 - 13105 Prospect St.
Dearborn, MI 48126
(313)846-1330 Fax (313)846-9448

PAUL MARTIN
(313)581-3444 EXT. 12
(313)793-5326 PAGER

FIELD INSPECTION CHECKLIST

Vermiculite Processing Sites

CURRENTLY: N-FORCER COMPANY

PHASE I - Initial Site Visit

FORMER: ZONOLITE Co. / W.R. GRACE

Facility Name / Address: 14300 HENN ST. DEARBORN, MI

Property Recently Redeveloped / Original Exfoliation Building

Site Access - Contact owner or local Police/Fire if necesssary (Have written access agreement)
* MET W/CURRENT OWNER: MR. PAUL MARTIN

List of Attendees: KURT GRUNERT - OSC

Primary Contact Name / Phone: MR. PAUL MARTIN - 313-581-3444 EXT. 12

Company Owner / Address / Phone (if operating facility): SAME AS ABOVE

Property Owner / Address / Phone: SAME AS ABOVE

Is state background information available? YES / NO

Are environmental assessment reports available? (YES) / NO TALK TO OWNER ABOUT GETTING A COPY OF PHASE I AUDIT.

Any historical use of vermiculite on site? ~~YES~~ (NO) JUST BUILDING - HOWEVER PRODUCT?/ GROUNDS? HAS BEEN REMODELED SINCE W/R GRACE.

Are there any additional facilities associated with this site? YES / (NO)

Presence of vermiculite on site? If NO, then photograph property If YES, photograph and procede to Phase II.

PHASE II - Site Assessment

Is vermiculite present?: YES / NO

What was the source of the vermiculite? Libby Mine?

Describe storage practices:

Describe current operation on site:

Describe dust control / worker safety precautions of current operation:

Was vermiculite landfilled on site? YES / NO ____________________

GPS Location: Lat________ Long________

Bulk Sampling of suspected ACM
Composite or Grab
Location of samples:____________________

Laboratory Name / Address:____________________
Analytical Method: PLM or TEM

Photographs
Document photo locations on site sketch.
Photograph current operation and vermiculite storage, handling, and processing if applicable

Describe potential threats pose by the vermiculite if determined to be ACM:

Appendix D: Asbestos Overview

Asbestos is a general name applied to a group of silicate minerals consisting of thin, separable fibers in a parallel arrangement. Asbestos minerals fall into two classes, serpentine and amphibole. Serpentine asbestos has relatively long and flexible crystalline fibers; this class includes chrysotile, the predominant type of asbestos used commercially. Amphibole asbestos minerals are brittle and have a rod- or needle-like shape. Amphibole minerals regulated as asbestos by OSHA include five classes: crocidolite, amosite, and the fibrous forms of tremolite, actinolite, and anthophyllite. Other unregulated amphibole minerals, including winchite, richterite, and others, can also exhibit fibrous asbestiform properties [1].

Asbestos fibers do not have any detectable odor or taste. They do not dissolve in water or evaporate into the air, although individual asbestos fibers can easily be suspended in the air. Asbestos fibers do not move through soil. They are resistant to heat, fire, and chemical and biological degradation. As such, they can remain virtually unchanged in the environment over long periods of time.

Vermiculite that was mined in Libby, Montana, contains amphibole asbestos, with a characteristic composition including tremolite, actinolite, richterite, and winchite; this material will be referred to as Libby asbestos. The raw vermiculite ore was estimated to contain up to 26% Libby asbestos as it was mined [2]. For most of the mine's operation, Libby asbestos was considered a by-product of little value and was not used commercially. The mined vermiculite ore was processed to remove unwanted materials and then sorted into various grades or sizes of vermiculite that were then shipped to sites across the nation for expansion (exfoliation) or use as a raw material in manufactured products. Samples of the various grades of unexpanded vermiculite shipped from the Libby mine contained 0.3%–7% fibrous tremolite-actinolite (by mass) [2].

The following sections provide an overview of several concepts relevant to the evaluation of asbestos exposure, including analytical techniques, toxicity and health effects, and the current regulations concerning asbestos in the environment. A more detailed discussion of these topics will also be provided in ATSDR's upcoming summary report for the national review of vermiculite sites.

Methods for Measuring Asbestos Content

A number of different analytical methods are used to evaluate asbestos content in air, soil, and other bulk materials. Each method varies in its ability to measure fiber characteristics such as length, width, and mineral type. For air samples, fiber quantification is traditionally done through phase contrast microscopy (PCM) by counting fibers with lengths greater than 5 micrometers (>5 µm) and with an aspect ratio (length to width) greater than 3:1. This is the standard method by which regulatory limits were developed. Disadvantages of this method include the inability to detect fibers less than 0.25 (<0.25) µm in diameter and the inability to distinguish between asbestos and nonasbestos fibers [1].

Asbestos content in soil and bulk material samples is commonly determined using polarized light microscopy (PLM), a method which uses polarized light to compare refractive indices of minerals and can distinguish between asbestos and nonasbestos fibers and between different types of asbestos. The PLM method can detect fibers with lengths greater than approximately 1 µm (~1 µm), widths greater than ~0.25 µm, and aspect ratios (length-to-width ratios) greater than 3. Detection limits for PLM methods are typically 0.25%–1% asbestos.

Scanning electron microscopy (SEM) and, more commonly, transmission electron microscopy (TEM) are more sensitive methods that can detect smaller fibers than light microscopic techniques. TEM allows the use of electron diffraction and energy-dispersive x-ray methods, which give information on crystal structure and elemental composition, respectively. This information can be used to determine the elemental composition of the visualized fibers. SEM does not allow measurement of electron diffraction patterns. One disadvantage of electron microscopic methods is that determining asbestos concentration in soil and other bulk material is difficult [1].

For risk assessment purposes, TEM measurements are sometimes multiplied by conversion factors to give PCM equivalent fiber concentrations. The correlation between PCM fiber counts and TEM mass measurements is very poor. A conversion between TEM mass and PCM fiber count of 30 micrograms per cubic meter per fiber per cubic centimeter (µg/m^3)/(f/cc) was adopted as a conversion factor, but this value is highly uncertain because it represents an average of conversions ranging from 5 to 150 (µg/m$^{3)}$/(f/cc) [3]. The correlation between PCM fiber counts and TEM fiber counts is also very uncertain, and no generally applicable conversion factor exists for these two measurements [3]. Generally, a combination of PCM and TEM is used to describe the fiber population in a particular air sample.

Asbestos Health Effects and Toxicity

Breathing any type of asbestos increases the risk of the following health effects:

Malignant mesothelioma—cancer of the membrane (pleura) that encases the lungs and lines the chest cavity. This cancer can spread to tissues surrounding the lungs or other organs. The great majority of mesothelioma cases are attributable to asbestos exposure [1].

Lung cancer—cancer of the lung tissue, also known as bronchogenic carcinoma. The exact mechanism relating asbestos exposure with lung cancer is not completely understood. The combination of tobacco smoking and asbestos exposure greatly increases the risk of developing lung cancer [1].

Noncancer health effects—these include asbestosis, scarring, and reduced lung function caused by asbestos fibers lodged in the lung; pleural plaques, localized or diffuse areas of thickening of the pleura; pleural thickening, extensive thickening of the pleura which may restrict breathing; pleural calcification, calcium deposition on pleural areas thickened from chronic inflammation and scarring; and pleural effusions, fluid buildup in the pleural space between the lungs and the chest cavity [1].

Not enough evidence is available to determine whether inhalation of asbestos increases the risk of cancer at sites other than the lungs, pleura, and abdominal cavity [1].

Ingestion of asbestos causes little or no risk of noncancer effects. However, some evidence indicates that acute oral exposure might induce precursor lesions of colon cancer and that chronic oral exposure might lead to an increased risk of gastrointestinal tumors [1].

ATSDR considers the inhalation route of exposure to be the most significant in the current evaluation of sites that received vermiculite from Libby. Exposure scenarios that are protective of the inhalation route of exposure should be protective of dermal and oral exposures.

The scientific community generally accepts the correlations of asbestos toxicity with fiber length as well as fiber mineralogy. Fiber length may play an important role in clearing the materials from the body, and mineralogy may affect both biopersistence and surface chemistry.

ATSDR, responding to concerns about asbestos fiber toxicity from the World Trade Center disaster, held an expert panel meeting to review fiber size and its role in fiber toxicity in December 2002 [4]. The panel concluded that fiber length plays an important role in toxicity. Fibers with lengths <5 μm are essentially nontoxic in terms of association with mesothelioma or lung cancer promotion. However, fibers with lengths <5 μm may play a role in asbestosis when exposure duration is long and fiber concentrations are high. More information is needed to definitively reach this conclusion.

In accordance with these concepts, it has been suggested that amphibole asbestos is more toxic than chrysotile asbestos, mainly because physical differences allow chrysotile to break down and to be cleared from the lung, whereas amphibole is not removed and builds up to high levels in lung tissue [5]. Some researchers believe the resulting increased duration of exposure to amphibole asbestos significantly increases the risk of mesothelioma and, to a lesser extent, asbestosis and lung cancer [5]. However, OSHA continues to regulate chrysotile and amphibole asbestos as one substance, as both types increase the risk of disease [6]. EPA's Integrated Risk Information System (IRIS) assessment of asbestos also currently treats mineralogy (and fiber length) as equipotent.

Evidence suggesting that the different types of asbestos fibers vary in carcinogenic potency and site specificity is limited by the lack of information on fiber exposure by mineral type. Other data indicate that differences in fiber size distribution and other process differences can contribute at least as much as fiber type to the observed variation in risk [7].

Counting fibers using the regulatory definitions (see below) does not adequately describe risk of health effects. Fiber size, shape, and composition contribute collectively to risk in ways that are still being elucidated. For example, shorter fibers appear to deposit preferentially in the deep lung, but longer fibers may disproportionately increase the risk of mesothelioma [1,7]. Some of the unregulated amphibole minerals, such as the winchite present in Libby asbestos, can exhibit asbestiform characteristics and contribute to risk. Fiber diameters greater than 2 μm–5 μm are considered above the upper limit of respirability (that is, too large to inhale), and thus do not contribute significantly to risk. Methods to assess the risk posed by varying types of asbestos are being developed and are currently awaiting peer review [7].

Current Standards, Regulations, and Recommendations for Asbestos

In industrial applications, asbestos-containing materials are defined as any material with >1% bulk concentration of asbestos [8]. It is important to note that 1% is not a health-based level, but instead represents the practical detection limit in the 1970s when OSHA regulations were created. Studies have shown that disturbing soil containing <1% amphibole asbestos, however, can suspend fibers at levels of health concern [9].

Friable asbestos (asbestos which is crumbly and can be broken down to suspendible fibers) is listed as a hazardous air pollutant on EPA's Toxic Release Inventory [10]. This classification requires companies that release friable asbestos at concentrations >0.1% to report the release under Section 313 of the Emergency Planning and Community Right-to-Know Act.

OSHA's permissible exposure limit (PEL) is 0.1 f/cc for asbestos fibers with lengths >5 µm and with an aspect ratio (length:width) >3:1, as determined by PCM [6]. This value represents a time-weighted average (TWA) exposure level based on 8 hours per day for a 40-hour work week. In addition, OSHA has defined an "excursion limit," which stipulates that no worker should be exposed in excess of 1 f/cc as averaged over a sampling period of 30 minutes [6]. Historically, the OSHA PEL has steadily decreased from an initial standard of 12 f/cc established in 1971. The PEL levels prior to 1983 were determined on the basis of empirical worker health observations, while the levels set from 1983 forward employed some form of quantitative risk assessment. ATSDR has used the current OSHA PEL of 0.1 f/cc as a reference point for evaluating asbestos inhalation exposure for past workers. ATSDR does not, however, support using the PEL for evaluating exposure for community members, because the PEL was developed as an occupational exposure for adult workers.

In response to the World Trade Center disaster in 2001 and an immediate concern about asbestos levels in buildings in the area, the Department of Health and Human Services, EPA, and the Department of Labor formed the Environmental Assessment Working Group. This work group was made up of ATSDR, EPA, CDC's National Center for Environmental Health, the National Institute for Occupational Safety and Health (NIOSH), the New York City Department of Health and Mental Hygiene, the New York State Department of Health, OSHA, and other state, local, and private entities. The work group set a re-occupation level of 0.01 f/cc after cleanup. Continued monitoring was also recommended to limit long-term exposure at this level [11]. In 2002, a multiagency task force headed by EPA was formed specifically to evaluate indoor environments for the presence of contaminants that might pose long-term health risks to residents in Lower Manhattan. The task force, which included staff from ATSDR, developed a health-based benchmark of 0.0009 f/cc for indoor air. This benchmark was developed to be protective under long-term exposure scenarios, and it is based on risk-based criteria that include conservative exposure assumptions and the current EPA cancer slope factor. The 0.0009 f/cc benchmark for indoor air was formulated on the basis of chrysotile fibers and is therefore most appropriately applied to airborne chrysotile fibers [12].

NIOSH set a recommended exposure limit of 0.1 f/cc for asbestos fibers longer than 5 µm. This limit is a TWA for up to a 10-hour workday in a 40-hour work week [13]. The American Conference of Government Industrial Hygienists has also adopted a TWA of 0.1 f/cc as its threshold limit value [14].

EPA has set a maximum contaminant level (MCL) for asbestos fibers in water of 7,000,000 fibers longer than 10 µm per liter, on the basis of an increased risk of developing benign intestinal polyps [16]. Many states use the same value as a human health water quality standard for surface water and groundwater.

Asbestos is a known human carcinogen. Historically, EPA's IRIS model calculated an inhalation unit risk for cancer (cancer slope factor) of 0.23 per f/cc of asbestos [3]. This value estimates additive risk of lung cancer and mesothelioma using a relative risk model for lung cancer and an absolute risk model for mesothelioma.

This quantitative risk model has significant limitations. First, the unit risks were based on measurements with phase contrast microscopy and therefore cannot be applied directly to measurements made with other analytical techniques. Second, the unit risk should not be used if the air concentration exceeds 0.04 f/cc because the slope factor above this concentration might differ from that stated [3]. Perhaps the most significant limitation is that the model does not consider mineralogy, fiber-size distribution, or other physical aspects of asbestos toxicity. EPA is in the process of updating their asbestos quantitative risk methodology given the limitations of the IRIS model currently used and the knowledge gained since this model was implemented in 1986.

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Appendix E. Exposure Pathways for Vermiculite Processing Facilities

Source for all pathways: Libby asbestos (asbestos-contaminated vermiculite from Libby, Montana)

Pathway Name	Environmental Media and Transport Mechanisms	Point of Exposure	Route of Exposure	Exposure Population	Time
Occupational	Suspension of Libby asbestos fibers or contaminated dust into air during materials transport and handling operations or during processing operations	On site	Inhalation	Former workers	Past
	Suspension of Libby asbestos fibers into air from residual contamination inside former processing buildings	Inside former processing buildings	Inhalation	Current workers	Present, future
Household Contact	Suspension of Libby asbestos fibers into air from dirty clothing of workers after work	Workers' homes	Inhalation	Former and/or current workers' families and other household contacts	Past, present, future
Waste Piles	Suspension of Libby asbestos fibers into air by playing in or otherwise disturbing piles of vermiculite or waste rock	On site, at waste piles	Inhalation	Community members, particularly children	Past, present, future
On-Site Soil	Suspension of Libby asbestos fibers into air from disturbing contaminated material remaining in on-site soil (residual soil contamination, buried waste)	At areas of remaining contamination at the site or around the site	Inhalation	Current on-site workers, contractors, community members	Past, present, future
Ambient Air	Stack emissions and fugitive dust from plant operations into neighborhood air	Neighborhood around site	Inhalation	Community members, nearby workers	Past
Residential: Outdoor	Suspension of Libby asbestos fibers into air by disturbing contaminated vermiculite brought off the site for personal use (gardening, paving driveways, traction, fill)	Residential yards or driveways	Inhalation	Community members	Past, present, future
Residential: Indoor	Suspension of household dust containing Libby asbestos from plant emissions or waste rock brought home for personal use	Residences	Inhalation	Community members	Past, present, future
Consumer Products	Suspension of Libby asbestos fibers into air from using or disturbing insulation or other consumer products containing Libby vermiculite.	At homes where Libby asbestos-contaminated products were/are present	Inhalation	Community members, contractors, and repairmen	Past, present, future

Appendix F. Health Statistics Review for Populations Near the W.R. Grace Dearborn Plant in Dearborn, Michigan

Background

Through an analysis of mortality records, ATSDR and the Montana Department of Public Health and Human Services detected a statistically significant excess of asbestos-related disease (asbestosis) among residents of Libby, Montana [1]. Rates of asbestosis were 60 times higher than the national rates, and this difference was highly unlikely due to natural fluctuations in the occurrence of this disease. This discovery led to several follow-up activities in Libby to address the health impacts on the community [2, 3]. Another follow-up activity is a nationwide effort to screen for a similar impact on the health of communities near facilities that processed or received vermiculite ore from the mine in Libby. As part of this activity, ATSDR is currently working with 25 state health departments (including the Michigan Department of Community Health [MDCH]) to conduct health statistics reviews (HSR) on sites that may have received the asbestos-contaminated Libby ore. HSRs are statistical analyses of existing health outcome data (e.g., cancer registry data and/or death certificate data) that help provide information on whether people living in a particular community have gotten selected diseases more often than a comparison population (i.e., people living in the rest of the country). Finding an excess of asbestos-related diseases in a community through an HSR analysis would inform ATSDR and MDCH to the possibility that workers and/or community members might have been exposed to Libby asbestos from the vermiculite ore. Participating state health departments are conducting HSRs for communities near vermiculite facilities in their states, regardless of whether it is known that the community was exposed to Libby asbestos through the processing or handling of vermiculite from the Libby mine. The methodology of the HSR used for the Zonolite Company/W.R. Grace site in Dearborn, Michigan, and other vermiculite sites across the United States was developed by ATSDR [4].

Methods

Both cancer registry data and mortality data were used for this analysis. For both analyses, the same target area was used. The target area consisted of people who died and/or were diagnosed with potential asbestos-related diseases while residing within the city limits of Dearborn (population 89,015 according to 1990 U.S. Census data). The city of Dearborn was chosen because it contains the Zonolite Company/W.R. Grace site located at 14300 Henn Street. In addition, the city of Dearborn was chosen because it represents the smallest geographic area surrounding the site that is electronically coded on Michigan cancer registry records and death certificates.

Cancer Registry Data

The analysis period used was from 1986 to 1995. This period was used by MDCH because (1) it is consistent with ATSDR's standardized nationwide protocol; (2) it corresponds to an approximate latency period in which initial exposure occurred and onset of disease would be expected; and (3) it allows for enough years worth of data for meaningful analyses. There were eight disease groupings used for this cancer incidence analysis (Table A). Of these eight groupings, the three of greatest interest to ATSDR were the ones that have a known association with asbestos exposure. These three include malignant neoplasm of peritoneum, retroperitoneum, and pleura [ICD-0-2 C480:C488, C384, excluding type M-9590:9989], mesothelioma [ICD-0-2 M-9050:9053], and malignant neoplasm of lung and bronchus [ICD-0-2 C340:C349, excluding type M-9590:9989]. The other five disease groupings analyzed were reported in the literature as having weaker associations with asbestos exposure or were ones that were included to evaluate reporting/coding anomalies in the target area.

Sex-specific, age-standardized incidence ratios (SIRs) were calculated for cases of asbestos-related cancer. These SIRs are measures of whether the number of people who got cancer in the city of Dearborn is the same as, lower, or higher than the number of people we would expect to find if the occurrence of cancer in Dearborn were the same as the occurrence of cancer in a comparison population. The comparison population used in this analysis was the population registered in the National Cancer Institute’s Surveillance, Epidemiology, and End Results Program [5]. If the number of people getting cancer in Dearborn is the same as the number we would expect to find, the SIR will equal 1. If the number of Dearborn citizens getting cancer is less than one would expect, the SIR will be between 0 and 1. If the number of Dearborn citizens getting cancer is more than one would expect, the SIR will be greater than 1. Chance variation can cause a study area’s rates to be higher or lower. The 95% confidence interval (CI) was used to evaluate the probability that the SIR may have been less than or greater than 1 due to chance alone. A confidence interval with a lower bound greater than 1 is possible evidence of an elevated rate. The 95% CIs were calculated to assess statistical significance using Byar’s approximation [6].

Mortality Data

The mortality analysis period was from 1979–1998. This period was chosen because (1) it covered the most recent 20 years of mortality data available at the time the analysis began; (2) it corresponded to an approximate latency period in which initial exposure occurred and death would be expected; and (3) no overlapping of ICD revisions occur. There were 12 disease groupings used for this mortality analysis (Table B). Of the 12 groupings, the 3 of greatest interest to ATSDR were the ones that have a known association with asbestos exposure. These three include asbestosis (ICD9 501); malignant neoplasm of peritoneum, retroperitoneum, and pleura (ICD9 158, 163, which includes mesothelioma); and malignant neoplasm of lung and bronchus (ICD9 162.2–162.9). The other nine disease groupings analyzed were reported in the literature as having weaker associations with asbestos exposure or were ones that were included to evaluate reporting/coding anomalies in the analysis areas.

Sex-specific, age-standardized mortality ratios (SMRs) were calculated for asbestos-related deaths. An SMR is a measure of whether the number of people who died from a selected diseases in a specific area is the same as, lower, or higher than the number of people we would expect to find in a comparison population. The comparison population data came from national death certificate data received from the National Center of Health Statistics [7]. If the number of persons who died from selected diseases in Dearborn is the same as the number we would expect to find, the SMR will equal 1. If the number of Dearborn citizens who died from selected diseases is less than one would expect, the SMR will be between 0 and 1. If the number of

Dearborn citizens who died from selected diseases is more than one would expect, the SMR will be greater than 1. Again, 95% CIs were calculated to assess statistical significance using Byar's approximation [6].

Results

Tables A and B show, for each disease group analyzed (1) whether past studies have shown a link between asbestos exposure and that type of disease; (2) the number of people in the Dearborn target area who developed or died from the specified disease; (3) the number of people we would expect to develop the specified disease if the community had the same occurrence of disease (or death rate) as the rest of the country; (4) the SIR/SMR; and (5) the 95% confidence interval for the SIR/SMR.

Cancer Registry Data Findings

For the time period 1986–1995, four of the eight disease groupings for the Dearborn target area had SIRs greater than one. These four groupings included *malignant neoplasm of digestive organs*, *all malignant neoplasms*, *malignant neoplasm of female breast*, and *malignant neoplasm of prostate*.

Of these four disease groupings, three were within the normal range of what would be expected (Table A). The disease grouping that had a statistically significant excess was for *all malignant neoplasms* (Table A).

Mortality Data Findings

For the time period 1979–1998, two of the 12 disease groupings for the Dearborn target area had SMRs greater than one: *malignant neoplasm of digestive organs* and *malignant neoplasm of female breast*, However, these two disease groupings were both within the normal range of what would be expected (Table B).

Discussion and Limitations

The main goal of conducting these HSRs is to help determine whether communities near facilities that received Libby vermiculite have higher than expected occurrences of asbestos-related diseases. The SIR and SMR analyses suggest that the occurrence of known asbestos-related diseases (i.e., mesothelioma, asbestosis, lung cancer) in the Dearborn population does not appear to be higher than expected compared to the rest of the country. While the disease grouping *all malignant neoplasms* was significantly higher than expected, this grouping was mainly used in this analysis to evaluate reporting/coding anomalies in the study area. Because cancer is made up of hundreds of different diseases, each cancer type has different risk factors. For this reason, it is better to focus on a specific cancer site of concern (i.e., leukemia) when calculating rates.

There are many limitations to using existing data sources to examine the relationship between environmental exposures and chronic diseases (a chronic disease is one that develops over a long period of time). Some of the major limitations in this analysis include, but are not limited to exposure misclassification, population migration, lack of control for confounding factors (i.e., smoking status data), overstated numerators/under-estimated denominators, large study areas, small numbers of cases/deaths, and under-reporting of cancer cases to the state registry. Most of these limitations would make it less likely (as opposed to more likely) that this type of analysis would identify a higher than expected occurrence of asbestos-related cancers/deaths among people who lived near the Zonolite Company/W.R. Grace site in Dearborn, Michigan, during its years of operation.

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Table A. Cancer registry data findings for selected cancer cases diagnosed in close proximity to the Zonolite Company/W.R. Grace in Dearborn, Michigan

Selected Cancer	Past studies have shown a link to asbestos exposure?	Number of persons diagnosed	Expected number of cases[*]	SIR[†]	95% Confidence Interval (CI)[‡]	
					Lower	Upper
nant neoplasm of digestive organs (ICD-0-2 C150:C218, C260:C269, excluding type M – 9590:9989)	Weak link	899	843.2	1.07	1.00	1.14
Malignant neoplasm of respiratory system and intrathoracic organs (ICD-0-2 C320:C399, excluding type M –9590:9989)	No	831	832.7	1.00	0.93	1.07
Malignant neoplasm of lung and bronchus[§] (ICD-0-2 C340:C349, excluding type M – 9590:9989)	Yes	757	764.4	0.99	0.92	1.06
Malignant neoplasm of peritoneum, retroperitoneum, and pleura[§] (ICD-0-2 C480:C488, C384, excluding type M – 9590:9989)	Yes	16	19.1	0.84	0.48	1.36
Mesothelioma[§] (ICD-0-2 M – 9590:9989)	Yes	8	12.3	0.65	0.28	1.28
All malignant neoplasms (ICD-0-2 C000:C809)	No	5,653	5,191.9	1.09	1.06	1.12
Malignant neoplasm of female breast (ICD-0-2 C500:C509, excluding type M – 9590:9989)	No	764	736.1	1.04	0.97	1.11
Malignant neoplasm of prostate (ICD-0-2 C619, excluding type M – 9590:9989)	No	899	810.3	1.11	1.04	1.18

* Calculated using national cancer registry data received from the Surveillance, Epidemiology, and End Results Program [5].
† The standardized incidence ratio (SIR) equals the number of people who got the disease divided by the expected number of cases.
‡ The 95% CIs were calculated to assess statistical significance using Byar's approximation [6].
§ Have known associations with asbestos exposure. The other disease groupings analyzed were reported in the literature as having weaker associations with asbestos exposure or were ones that were included to evaluate reporting/coding anomalies in the target area.

Table B. Mortality data findings for residents who died from selected diseases in close proximity to the Zonolite Company/W.R. Grace facility in Dearborn, Michigan

Selected Disease	Past studies have shown a link to asbestos exposure?	Number of persons who died	Expected number of deaths*	SMR†	95% Confidence Interval‡	
					Lower	Upper
Malignant neoplasm of selective digestive organs (ICD-9 150-154, 159)	Weak link	819	785.1	1.04	0.97	1.12
Malignant neoplasm of respiratory system and intrathoracic organs (ICD-9 161-165)	Weak link	1,173	1,305.1	0.90	0.85	0.95
Malignant neoplasm of lung and bronchus§ (ICD-9 162.2-162.9)	Yes	1,133	1,261.3	0.90	0.85	0.95
Malignant neoplasm of peritoneum, retroperitoneum, and pleura (includes mesothelioma)§ (ICD-9 158, 163)	Yes	9	9.6	0.93	0.43	1.77
Malignant neoplasm without specification of site (ICD-9 199)	No	255	297.3	0.86	0.76	0.97
Diseases of pulmonary circulation (ICD-9 415-417)	No	84	112.8	0.74	0.59	0.92
Chronic obstructive pulmonary disease (ICD-9 490-496)	No	589	826.3	0.71	0.66	0.77
Asbestosis§ (ICD-9 501)	Yes	1	2.4	0.41	0.01	2.29
Other diseases of respiratory system (ICD-9 510-519)	No	112	146.7	0.76	0.63	0.92
All malignant neoplasms (ICD-9 140-208)	No	4,508	4,606.8	0.98	0.95	1.01
Malignant neoplasm of female breast (ICD-9 174)	No	401	370.8	1.08	0.98	1.19
Malignant neoplasm of prostate (ICD-9 185)	No	266	292.9	0.91	0.80	1.02

* Calculated using mortality data received from the National Center of Health Statistics (unpublished data) [7].

† The standardized mortality ratio (SMR) equals the number of people who died divided by the expected number of deaths.

‡ The 95% CIs were calculated to assess statistical significance using Byar's approximation [6].

§ Have known associations with asbestos exposure. The other disease groupings analyzed were reported in the literature as having weaker associations with asbestos exposure or were ones that were included to evaluate reporting/coding anomalies in the target area.

Appendix G: Responses to Public Comments

Comment (C) received regarding the MDCH/ATSDR Health Consultation "W.R. Grace Dearborn Plant (a/k/a Zonolite Company/WR Grace)," and response (R) to comment:

Comment Directed to MDCH

C: The only comment I have are [sic] that it would be good if it were modified slightly to reflect the American Thoracic Society's medical effects criteria that were published in September [2004]. They're considered to be exhaustive and authorative [sic].

R: The document to which the commenter refers is the American Thoracic Society (ATS) "Diagnosis and initial management of nonmalignant disease related to asbestos" official statement, adopted on December 12, 2003, by the ATS Board of Directors. It is available for free online in Adobe Portable Document Format (PDF) at the ATS Web site (see http://www.thoracic.org/adobe/statements/asbestos.pdf).

MDCH proposes the following actions in response to this comment:

1) MDCH will place this PDF document on the agency's Internet Web page devoted to the former W.R. Grace facility in Dearborn, Wayne County, Michigan. This can be accessed at http://www.michigan.gov/vai.
2) MDCH will provide printed copies of this document to any healthcare provider who contacts us, should they be unable to access the document through other channels. MDCH can be contacted via our toll-free "Toxics & Health Hotline" at 1-800-MI-TOXIC (648-6942).

Appendix H: Definitions of exposure pathways and health hazard categories.

Exposure pathways

An exposure pathway is the way in which an individual comes into contact with a contaminant. An exposure pathway consists of the following five elements: (1) a *source* of contamination; (2) a *medium* such as air or soil through which the contaminant is transported; (3) a *point of exposure* where people can contact the contaminant; (4) a *route of exposure* by which the contaminant enters or contacts the body; and (5) a *receptor population*. A pathway is considered **complete** if all five elements are present and connected. A **potential** exposure pathway indicates that exposure to a contaminant could have occurred in the past, could be occurring currently, or could occur in the future. A potential exposure exists when information about one or more of the five elements of an exposure pathway is missing or uncertain. An **incomplete** pathway is missing one or more of the pathway elements and it is likely that the elements were never present and are not likely to be present at a later point in time. An **eliminated** pathway was a potential or completed pathway in the past, but has had one or more of the pathway elements removed to prevent present and future exposure.

Public health hazard categories

ATSDR uses public health hazard categories to describe whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are defined as follows.

No public health hazard

A category used in ATSDR's assessments for sites where people have never been and will never be exposed to harmful amounts of site-related substances.

No apparent public health hazard

A category used in ATSDR's assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

Indeterminate public health hazard

The category used in ATSDR's assessments documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Public health hazard

A category used in ATSDR's assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances that could result in harmful health effects.

Urgent public health hazard

A category used in ATSDR's assessments for sites where short-term exposure (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.