Health Consultation

CELOTEX CORPORATION

EDGEWATER, BERGEN COUNTY, NEW JERSEY

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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.

HEALTH CONSULTATION

CELOTEX CORPORATION

EDGEWATER, BERGEN COUNTY, NEW JERSEY

Prepared By:

New Jersey Department of Health and Senior Services
Public Health Services Branch
Consumer and Environmental Health Services
Hazardous Site Health Evaluation Program

Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Foreword: ATSDR's National Asbestos Exposure Review

Vermiculite was mined and processed in Libby, Montana, from the early 1920s until 1990. This vermiculite, which was shipped to many locations around the United States for processing, is now known to have contained asbestos.

The National Asbestos Exposure Review (NAER) is a project of the Agency for Toxic Substances and Disease Registry (ATSDR). The project goal is to work with other federal, state, and local environmental and public health agencies to evaluate public health impacts at sites that processed Libby vermiculite.

The evaluations focus on the processing sites and on the human health effects that might be associated with possible past or current exposures. Commercial or consumer use of the products from these facilities is not considered.

The sites that processed Libby vermiculite will be evaluated by (1) identifying ways people could have been exposed to asbestos in the past and ways that people could be exposed now and (2) determining whether the exposures represent a public health hazard. ATSDR will use the information gained from the site-specific investigations to recommend further public health actions as needed. Site evaluations are progressing in two phases:

Phase 1: ATSDR has selected 28 sites for the first phase of reviews on the basis of the following criteria:

- The U.S. Environmental Protection Agency (EPA) mandated further action at the site based upon contamination in place

- or -

- The site was an exfoliation facility that processed more than 100,000 tons of vermiculite ore from the Libby mine. Exfoliation, a processing method in which ore is heated and "popped," is expected to have released more asbestos than other processing methods.

The following document is one of the site-specific health consultations that ATSDR and its state health partners are developing for each of the 28 Phase 1 sites. A future report will summarize findings at the Phase 1 sites and will include recommendations for evaluating the more than 200 remaining sites nationwide that received Libby vermiculite.

Phase 2: ATSDR will continue to evaluate former Libby vermiculite processing sites in accordance with the findings and recommendations contained in the summary report. ATSDR will also identify further actions when necessary to protect public health.

Statement of Issues

Vermiculite is a naturally occurring fibrous mineral mined in Libby, Montana, from the 1920s until 1990. The vermiculite mined in Libby contained naturally occurring asbestos fibers, including the amphibole varieties tremolite and actinolite, as well as the related asbestiform minerals winchite, richterite, and ferro-edenite [U.S. Geological Survey 2002]. Libby vermiculite ore collected by EPA in 1980 contained up to 26% tremolite-actinolite by mass [EPA 1982]. Samples of the various grades of unexpanded Libby vermiculite typically shipped to processing sites across the nation contained 0.3%–7% fibrous tremolite-actinolite by mass [EPA 1982]. The characteristic composition of asbestos contained in the vermiculite mined in Libby is referred to in this document as Libby asbestos.

Asbestos exposure has been associated with the incidence of asbestosis, lung cancer, mesothelioma, and pleural plaques. Asbestosis is a chronic, degenerative lung disease caused by the scarring of lung tissue. Mesothelioma, a rare disease, is a cancer of the membranes that line the chest (pleural) or abdominal (peritoneal) cavities. Asbestos exposure has also been associated with lung cancer and, to a lesser extent, gastrointestinal cancers (esophageal, stomach, colon, and rectal). Asbestos exposure may also result in other non-cancerous conditions of the respiratory system such as pleural plaques, which are a thickening of the lining of the lungs (see Appendix A).

EPA has identified seven New Jersey facilities that received vermiculite ore from the Libby mine. This health consultation addresses one of these facilities, the former Celotex Corporation located in Edgewater, Bergen County. Vermiculite was used to manufacture gypsum wallboard at the facility. The process for producing gypsum wallboard at this site used vermiculite in its unexpanded state and likely released less asbestos than other processes such as exfoliation [EPA 1985].

The New Jersey Department of Health and Senior Services (NJDHSS), in cooperation with ATSDR, prepared a health consultation for the Edgewater site. The main goal of this consultation is to evaluate the potential health impact of exposure to Libby asbestos and to propose appropriate actions at the Celotex Corporation site. This health consultation includes: 1) a review of available information on environmental contamination; 2) identification of past, current, and future human exposure pathways of Libby asbestos; 3) characterization of the degree of public health hazard associated with exposure pathways; and 4) recommendations for health-related follow-up activities.

Background

Vermiculite

Vermiculite is the common name given to hydrated laminar magnesium-aluminum-iron-silicate, a mineral that resembles mica in appearance. All vermiculite ores contain other minerals, and some sources of the ores have been found to contain asbestos fibers. Vermiculite mining is a surface operation where ore is separated from other minerals and then screened or classified into several particle sizes. Although vermiculite is found in various parts of the world, the current predominant commercial mines are in Australia, Brazil, China, Kenya, South Africa, United States, and Zimbabwe.

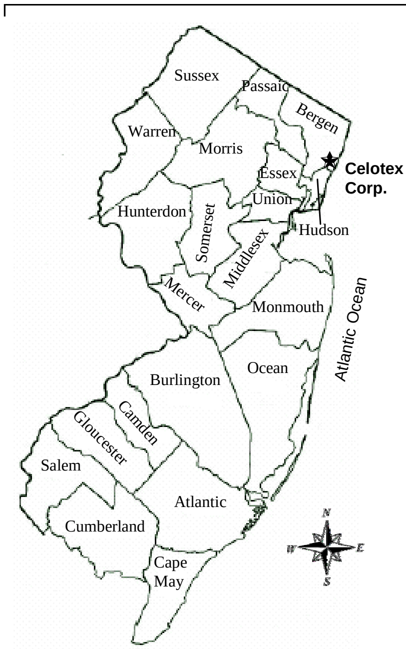

Figure 1: Location of Celotex Corporation Site

In the 1920s, the Zonolite Company was formed and began mining vermiculite ore in Libby, Montana. The mine was later sold to W.R. Grace & Company and was finally closed in 1990. While in operation, the vermiculite mine in Libby may have produced 80% of the world's supply of vermiculite [EPA 2005]. Because all vermiculite does not contain asbestos, it has been used as loose fill insulation, fertilizer carrier, and aggregate for concrete. Raw vermiculite ore is used in gypsum wallboard, joint compound, and cinder block, as well as in many other building products.

EPA requested that ATSDR provide technical assistance in evaluating the potential public health impacts from Libby asbestos. In New Jersey, the former Celotex Corporation in Edgewater, Bergen County, used vermiculite mined in Libby, Montana, to produce gypsum wallboard (see Figure 1). Although the site was the location of numerous industrial operations throughout the years, this health consultation focuses exclusively on the gypsum wallboard manufacturing activities and on an on-site landfill used primarily for gypsum wallboard waste disposal.

Available records indicate that the Celotex Corporation received and processed approximately 300 tons of vermiculite from the Libby, Montana, mine during 1967 through 1969 and did not perform exfoliation as part of their operation [ATSDR 2002a]. ATSDR selected the Celotex Corporation as one of the 28 Phase 1 sites because it had been designated by EPA as a “Further Action Site” [A. Gonzalez, ATSDR, personal communication, 2003].

Site Description

The Celotex Corporation site, hereafter referred to as the "Celotex site", is located at 1 River Road, Edgewater, Bergen County, New Jersey (see Figure 2). The 29.5 acre site is in a mixed industrial-, commercial-, and residential-zoned area. The site is bordered on the west by "new" River Road. Beyond River Road is residential housing that overlooks the site from atop the New Jersey Palisades cliffs at a distance of approximately 500 yards. The site is bordered on the northwest by Multiplex Cinemas; to the north by Independence Harbor, a residential waterfront development of approximately 500 units; on the east by the Hudson River; and on the south by the Quanta Resources Corporation site [ATSDR 2002b]. The Quanta Resources Corporation site, a former coal tar distillation operation, was added to the National Priorities List on September 4, 2002. An aerial view of the Celotex site is presented in Figure 3.

In the 1990s, the eastern portion of the Celotex site was redeveloped for residential use and The Promenade (see Photograph 1) was constructed. The Promenade consists of 162 units of condominiums and apartments and is located on an 800 foot pier extending into the Hudson River. Recently, a multi-story residential and commercial development named "City Place" was built on the western portion of the Celotex site. City Place spans five square blocks along the Hudson River waterfront and contains 331 apartments and street-level retail businesses.

ATSDR, using U.S. Census 2000 data, estimates that approximately 37,000 individuals reside within a 1-mile radius of the Celotex site (see Figure 4); in the decade prior, nearly 30,000 individuals resided within a 1-mile radius of the site.

Site History

In spite of an extensive review of available the NJDEP files on the Celotex site (i.e., site remediation, air enforcement, and solid and hazardous waste files), no specific information or documentation could be found on employee records or on the gypsum wallboard manufacturing operation.

The Celotex Corporation acquired several facilities from Allied Chemical Corporation around 1970 (+/- 5 years) that included the gypsum wallboard manufacturing operation located in Edgewater (L. Colburn, Celotex Corporation, personal communication, 2002). Allied Chemical Corporation[1] manufactured gypsum wallboard for a number of years before the Celotex purchase. "Off-spec" gypsum wallboard products produced at the Celotex site were dumped in an on-site landfill. In the late 1970s, the Celotex Corporation transferred its gypsum

[1] Allied Chemical Corporation changed its name to Allied Corporation in 1981 and merged with the Signal Companies to form AlliedSignal in 1985. In 1999, AlliedSignal and Honeywell, Inc. announced a merger agreement to form Honeywell. Information concerning the AlliedSignal gypsum wallboard manufacturing operation, vermiculite transport, employee records, off-site use of vermiculite, and disposal practices is unavailable (M. Kamilow, Honeywell, personal communication, 2002).

wallboard manufacturing operation to another location and began leasing the Edgewater property to other industries (R. Hayton, NJDEP, personal communication, 2002). During this time, the area along the Hudson River in Edgewater was heavily industrialized, and, according to the NJDEP, it was common practice for companies to exchange waste products and soil for use as fill material.

Vermiculite at the Celotex site was used as purchased, i.e., no exfoliation occurred at the Edgewater facility (L. Colburn, Celotex Corporation, personal communication, 2002). Exfoliation is the rapid heating of vermiculite at temperatures above 1,000 degrees Fahrenheit (^{o}F). An oven process was used at the site to cure the vermiculite at a low temperature (around 200^{o}F). Typically, vermiculite is added to gypsum wallboard to improve its structural integrity during a fire [Georgia-Pacific 2005]. Vermiculite has several properties that make it important for fire protection when it is used in sheetrock (J. Wheeler, ATSDR, personal communication, 2006). It has very low heat conductivity, and expands and fills voids thus preventing burn through. The water contained in it becomes steam and absorbs heat. Fire retardant sheetrock made when Celotex was in operation, used asbestos as a structural component and flame retardant (vermiculite was added as a second agent). This addition of vermiculite to the gypsum wallboard is probably the major source of on-site chrysotile asbestos. The gypsum wallboard manufacturing process was described as a not especially dusty operation since the raw material (gypsum) was fairly moist. Dust was generated, however, when the gypsum wallboard was cut and sized. The number of individuals employed by the Celotex gypsum wallboard manufacturing operation is not now known. In 2000, BPB America, Incorporated, purchased the Celotex gypsum wallboard and ceiling tile businesses. Celotex is still in operation, although it does not have a plant facility.

Soil Contamination

On-Site Landfill. As part of the waterfront development permit for City Place, a storm water detention basin was required for the collection of on-site surface water runoff (see Photograph 2). Construction of this basin required the reconfiguration of the 2.8 acre on-site gypsum wallboard landfill, and a Major Landfill Disruption Permit application was submitted to the NJDEP. Borings installed in the landfill identified the presence of contaminants (e.g., lead, arsenic, and polychlorinated biphenyls [PCBs] at subsurface depths; boring samples were not analyzed for asbestos. Samples collected from the surface of the landfill indicated "no actionable asbestos present" [EWMA 2001]. Based on the analytical data collected, the use of institutional (deed notice) and engineering controls (surface cap to restrict exposure of the waste material) were deemed to be the appropriate and recommended remedial approach for the landfill [EWMA 2000]. The permit application was approved by the NJDEP in September 1999.

In reshaping the landfill to accommodate the construction of the storm water detention basin, the volume of excavated waste material generated exceeded the expected volume by nearly sixfold. The waste was bulldozed westward toward River Road and was pushed into an approximately 20-foot high pile. Workers began grading the top of this pile, but it was too high. The landfill was then expanded to the west and onto the City Place construction site. This waste was covered with soil and remained in this state for several years. Plans to bulldoze the soil from the west side eastward to meet and complete a 15-foot high pile of waste from the original landfill were not approved by the NJDEP. Ultimately, nearly 6,000 tons of waste from the westernmost portion of the landfill was excavated and transported to the Linden solid waste landfill pursuant to the NJDEP requirements [EWMA 2002; Monteclavo 2001]. Results of air monitoring conducted at four locations along the perimeter of the landfill throughout the October and November 2001 excavation period were negative for arsenic, cadmium, chromium, and lead; no monitoring or analysis was conducted for asbestos [Turner 2001]. In anticipation of potential odor problems, the residents of The Promenade were notified about the excavation a week before the work began [Heller 2001].

In a letter from the NJDEP to the developer (Edgewater Enterprises LLC), the following problems concerning the landfill were outlined: 1) the landfill was expanded beyond the original boundaries as described in the landfill disruption permit application; 2) the landfill was not uniformly covered with the required 24 inches of clay (coverage ranged from no cover to 24 inches), with some landscape plantings placed directly in waste material; 3) paver blocks used in the construction of the river walkway were laid directly on waste material; and 4) a pile of waste material was left uncovered on the western portion of the landfill [Hayton 2000]. Site visits conducted by the NJDEP in early 2001 determined that the majority of the public river walkway was constructed with insufficient underlying cap (i.e., paver blocks resting on six inches or less of dense-graded aggregate and two inches of leveling sand); some paver blocks were laid directly onto waste. This situation was further substantiated by field investigations conducted in December 2001 and January 2002, in which portions of the remaining landfill, particularly areas near a sidewalk and public walkway, did not have the required cap thickness [EWMA 2002]. A portion of the public walkway along the Hudson River has been completed and may be continued as part of future area redevelopment activities designed to establish a continuous 18-mile public waterfront extending from the George Washington Bridge to the Bayonne Bridge [Fund for a Better Waterfront, Inc. 1999].

On April 4, 2000, EPA representatives collected 12 discrete grab surface soil samples of exposed material and surface soil from the landfill (see Photograph 3). The samples were analyzed for asbestos content using polarized light microscopy (PLM) and transmission electron microscopy (TEM) (see Appendix B)[2]. The PLM results indicated that the asbestos concentration in samples 1 through 11 were below detection level. Sample 12, which contained 25% chrysotile asbestos, was collected from a pile of demolished building debris on the abandoned pier (see Figure 5). The material appeared to be crumbled pieces of transite siding board [ATSDR 2002a]; the asbestos content of this sample was not considered representative of the waste material in the landfill.

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[2]PLM does not distinguish between asbestos and other types of fibers and counts only fibers longer than five micrometers. It is typically used for determining the asbestos content of bulk samples such as soil or pipe insulation; results are reported in percent (%). TEM can distinguish asbestos from other fibers and is also able to detect very thin fibers less than 0.01 μm in diameter. The analytical technique known as energy dispersive X-ray spectrometry (EDXA) is used with TEM to confirm the identity of fibers.

The TEM results indicated that only one sample (sample 11) of the surface soil samples contained actinolite asbestos structures (see Table 3). Although actinolite was widely reported [USGS 2002] as one of the asbestos fibers found in the Libby asbestos, recent data [Leake et al. 1997; Meeker 2003] indicated that actinolite fibers are not one of the amphibole asbestos fiber types characteristic of Libby asbestos. On the basis of these results, the EPA required no further on-site activities.

Site Visit

On September 25, 2002, a site visit was conducted at the Celotex site, Edgewater, Bergen County. Present during the site visit were James Pasqualo, Steven Miller, and Julie Petix of the NJDHSS and Kathryn Lynch, Susan Metcalf, and Amanda Gonzalez of the ATSDR. The NJDEP Case Manager for the site was present and provided a tour and overview of site conditions.

The gypsum wallboard landfill, located south of The Promenade pier was covered with paver blocks. A staffed guardhouse for The Promenade was centrally located on the landfill (Photograph 4). Heavy construction activity (i.e., pouring concrete) was occurring directly west of the landfill as part of City Place development activities. According to the NJDEP, workers were required to wet the site at least three times a day for dust suppression. Perimeter air monitoring for non-asbestos-related contaminants was continuing at that time.

On April 28, 2005, a second site visit of the former Celotex Industrial Park site was conducted. Present were Steve Miller, Tariq Ahmed, and Somia Aluwalia of the NJDHSS; Leah Escobar of the ATSDR; and a representative from the NJDEP. The NJDEP representative stated that the developer of the site planned to construct seven buildings, six of which were already built. At the time of the site visit, construction on Building 7 was underway.

The former gypsum wallboard landfill area was inspected during this site visit. According to the NJDEP representative, the cap thickness on the landfill was compromised in a few places and was evident by the stressed vegetation and the settlement of some pavement blocks. When asked about the dust levels reported by The Promenade residents during remediation of the landfill, the NJDEP representative stated that Environmental Waste Management Associates (EWMA) had used water spraying as a dust suppression measure and was unaware of any excessive dust issues.

Past ATSDR Involvement

As part of the Public Health Assessment for the Quanta Resources Corporation site, the NJDHSS, in conjunction with the ATSDR, reviewed and analyzed environmental data collected from the Quanta site and from neighboring properties, including the Celotex site [ATSDR 2002b].

Community Concerns

According to the NJDEP, a common community concern regarding the Celotex site involves rotten egg odors that result from gypsum wallboard debris coming in contact with river water.

In October 2002, the NJDHSS received a telephone call from a former Cliffside resident who was concerned about a variety of cancers, including lung cancer, experienced by this individual and several of his family members. This individual stated that during the years of its operation, the Celotex plant constantly emitted dust that had an odor comparable to rotten eggs.

Also in October 2002, the NJDHSS received a telephone call from an individual on behalf of her spouse. In the mid-1980s, the spouse was employed as a security guard and was stationed in a “telephone booth-type” structure located outdoors near the entrance to the Celotex site. The spouse, who was in his mid 50s and who had never smoked, was reportedly diagnosed in August 2001 with “asbestos pleural disease which may develop into mesothelioma”.

In December 2003, a former resident of The Promenade petitioned the ATSDR about the redevelopment of the Celotex site. Her concerns included exposure to dust from on-site construction activities during the time of her and her spouse’s residency (2000–2003) and the potential impact of this exposure on their health. The petition was accepted, and a separate health consultation is being prepared to address these concerns.

Worker Interviews

In an effort to identify and contact former employees, the NJDHSS requested the assistance of an Edgewater Borough Health Department public health nurse who was able to provide the name of one of the former employees. The individual was employed as a line foreman from the time the Celotex Corporation purchased the gypsum wallboard operation from Allied Chemical Corporation until the Edgewater plant closure in 1978 or 1979. Through a telephone interview, the former employee provided the following description of the gypsum wallboard manufacturing process:

- the gypsum came in as rock on ships from Nova Scotia and was ground to powder on-site (this process was described as “dusty”);
- the vermiculite was shipped to Celotex in bags loaded on skids on flatbed trucks, and the bags were stored uncovered on-site;
- (non-exfoliated) vermiculite was added to a slurry of gypsum powder, water, and “flour”;
- the bags of vermiculite were cut open, and, as needed, the vermiculite was added to hoppers that contained slurry;

- the slurry was de-watered and processed by papering it on 500-foot long belts;
- the product was then heated in a kiln at 550^{o}F, then at 350 ^{o}F, and was followed by cooling at 250^{o}F; and
- air scrubbers were used to minimize dust emissions.

According to this former employee, disposal practices consisted of dumping waste behind the plant along the Hudson River, which eventually modified the original shoreline. The air scrubbers sometimes broke down, leading to complaints from neighboring residents as their homes became coated with fine dust. This dust was "only gypsum powder" because the vermiculite had not yet been added to the process. Showers were provided on-site and employees did not wear their work clothes home, or, at least, this former employee did not.

Discussion

During the period 1967 through 1969, vermiculite processed at the Celotex site originated from the mine in Libby, Montana, known to be contaminated with asbestos. Studies conducted in the Libby community indicate health impacts that are associated with asbestos exposure [ATSDR 2002c; Peipins et al. 2003]. The findings at Libby provided the impetus for investigating sites across the nation that received asbestos-contaminated vermiculite from the Libby mine. Asbestos exposure conditions documented in the Libby community, however, are in many ways unique and not necessarily present at other sites that processed or handled Libby vermiculite. The health consultation prepared for the Celotex site is part of a national effort to identify and evaluate potential asbestos exposures that may be expected at the sites that processed or handled Libby vermiculite.

Exposure Assessment and Toxicologic Evaluation

An evaluation of the health effects of exposure to Libby asbestos requires extensive knowledge of both exposure pathways and toxicity data. The toxicologic information currently available is limited, and, therefore, the exact level of health concern based on the different sizes and mineral types of asbestos remains controversial (see Appendix A). Site-specific information on exposure pathways is also limited or unavailable. The limitations include the following:

- No information could be obtained about past levels of asbestos in the air in and around the site. This lack of information hinders our ability to estimate the levels of Libby asbestos that individuals may have been exposed to.

- No information is known about the frequency of people's contact with Libby asbestos from the site. This information is necessary to accurately calculate exposure doses.

- Insufficient information is available on the handling and disposal of wastes containing vermiculite. This lack of information makes identifying and assessing past and present potential exposures difficult.

Given these limitations, the public health implications of past operations at this site were evaluated qualitatively. Current health implications were likewise evaluated qualitatively.

The following sections describe the various types of evidence used to evaluate exposure pathways and reach conclusions about the site. In the health consultation, ATSDR considers a set of relevant pathways (see Appendix C) and evaluates those pertaining to the Celotex site and to Libby asbestos (see Table 1). Not every pathway identified in Appendix C was considered to be a significant source of exposure at the site. The exposures associated with the chrysotile asbestos detected at the site will be addressed in a separate health consultation.

Exposure Pathways

Compared with other Phase 1 sites that received vermiculite shipments from W.R. Grace, a relatively small amount (300 tons) of vermiculite from Libby, Montana, was shipped to and used at the Celotex site. Because exfoliation did not occur at the site, workers' occupational exposures to Libby vermiculite were reduced, as were community members' potential environmental exposures. Those exposed to asbestos were the former Celotex site workers who handled Libby vermiculite (1967–1969) in the course of their work duties, and they may have brought dust containing asbestos home on their clothing, shoes, and hair and in their automobiles. One former employee stated that on-site showers were available, which, if used, would have reduced the amount of Libby vermiculite dust brought home.

The area of the former Celotex site has been redeveloped for commercial and residential use. Construction activities associated with The Promenade and City Place disturbed site soils, including the on-site landfill that contained gypsum wallboard waste, and created dust. The sampling results indicated that although half of the samples contained chrysotile asbestos (see Appendix B), the amphibole asbestos fiber types characteristic of Libby asbestos were not present.

Table 1: Libby Asbestos Inhalation Pathways Considered for the Celotex Corporation Site

Pathway Name	Exposure Scenario(s)	Past Pathway Status	Present Pathway Status	Future Pathway Status
Occupational	Former Celotex Corp. workers exposed to airborne Libby asbestos during handling and manufacturing of gypsum wallboard	Complete	Not applicable	Not applicable
Household Contact	Household members exposed to airborne Libby asbestos brought home on Celotex Corp. workers' body or clothing	Potential	Not applicable	Not applicable
Waste Piles	Community members disturbing on-site waste piles	Potential	Eliminated	Eliminated
On-site Soils	Current on-site workers, contractors, or community members disturbing contaminated on-site soils (residual contamination, buried gypsum wallboard manufacturing waste)	Not applicable	Not applicable	Not applicable
Ambient Air	Community members and nearby workers exposed to Libby asbestos fibers from facility emissions during gypsum wallboard manufacturing process	Potential	Not applicable	Not applicable
	Community members and workers exposed to Libby asbestos fibers from contaminated on-site soils	Not applicable	Not applicable	Not applicable

Occupational Exposure Pathway (Past, Present and Future)

The gypsum wallboard manufacturing process was described as not being an especially dusty operation; dust was generated, however, when the wallboards were cut and sized (L. Colburn, Celotex Corporation, personal communication, 2002). The amount of vermiculite in each wallboard is assumed to be relatively low. The NJDHSS also interviewed a former Celotex Corporation employee who worked as a line foreman at the plant. This individual provided a description of the gypsum wallboard manufacturing process, which included the on-site storing of uncovered bags of vermiculite, the cutting open of the bags and mixing the vermiculite with gypsum slurry, the disposal of waste materials, and the neighborhood dust complaints. On the basis of this information, past occupational exposures to Libby asbestos at the Celotex site is a completed pathway of concern during the period 1967 through 1969.

Samples representative of the landfill material indicated mostly chrysotile asbestos contamination, which means that the workers redeveloping the site were not exposed to Libby asbestos (see Appendix B). Therefore, past, current, and future exposures of Libby asbestos to redevelopment workers at the Celotex site are not a pathway of concern.

Household Contact Exposure Pathway (Past, Present, and Future)

In the past, Celotex Corporation workers (1967 through 1969) may have brought dust containing Libby asbestos home on clothing, shoes, and hair and in automobiles. One former employee, however, stated that on-site showers were available, which if used, would have reduced the amount of dust brought home. Quantitative evaluation of exposures to household contacts is difficult because data on Libby asbestos concentrations associated with take-home contamination and behavior-specific factors (e.g., worker practices, household laundering practices) are unavailable. Nevertheless, exposure to asbestos dust that results in asbestos-related disease among household contacts of asbestos industry workers has been well-documented [Anderson et al. 1976; Kilburn et al. 1985]. In Libby, Montana, a high prevalence of pleural abnormalities was observed in household contacts of W. R. Grace mine and vermiculite processing facility workers [ATSDR 2001]. On the basis of this information, past exposures of household contacts of former Celotex Corporation workers are a potential pathway of concern.

Waste Piles Exposure Pathway (Past, Present, and Future)

Waste generated from the gypsum wallboard manufacturing process was disposed of in an on-site landfill. Currently, no waste piles are at the site. Thus, current and future exposures to waste piles are eliminated exposure pathway.

No information is available on the past existence of on-site waste piles and on community access to the site and landfill area. Therefore, past exposures to waste piles are considered a potential pathway of concern.

On-Site Soil Exposure Pathway (Present and Future)

Sampling conducted at the Celotex site indicated the presence of mostly chrysotile asbestos (see Appendix B). Therefore, on-site workers, contractors, or community members disturbing on-site soils were not exposed to Libby asbestos. Current and future exposures from on-site soils are not considered a pathway of concern.

Activities that disturbed gypsum wallboard waste materials, such as the reconfiguration of the detention basin and the excavation activities associated with City Place construction, may have released chrysotile asbestos fibers into the air. Dust containing chrysotile asbestos may have contaminated on-site buildings and automobiles. An evaluation of exposures associated with this pathway will be addressed in a separate health consultation.

Ambient Air Exposure Pathway (Past, Present and Future)

Community members in the area surrounding the Celotex Corporation gypsum wallboard manufacturing process may have been exposed to Libby asbestos from facility emissions such as from the plant's ventilation system. Other possible exposure sources include fugitive emissions from materials handling, such as opening bags containing Libby vermiculite; disturbing on-site soils contaminated with Libby asbestos; and waste disposal practices. Although dust was generated during the cutting and sizing of the wallboard, the majority of dust generated during the gypsum wallboard manufacturing operation was associated with the crushing and grinding of gypsum rock and the mechanical failures of the air scrubbers. The NJDHSS could not locate any plant emissions data or other data concerning ambient asbestos concentrations for the period when gypsum wallboard was being manufactured at the site. Therefore, past ambient air exposures associated with the Celotex facility emissions are considered a potential pathway of concern.

Health Outcome Data Evaluation

The NJDHSS, in cooperation with ATSDR, conducted a health statistics review for seven New Jersey municipalities, including Edgewater, that have facilities that may have received asbestos-contaminated vermiculite from Libby, Montana. NJDHSS reviewed select disease incidence and mortality data for these seven communities using an ATSDR protocol for evaluating asbestos-related and non-asbestos-related health outcomes (ATSDR 2001). Asbestos-related cancer groups were mesothelioma; malignant cancers of the lung and bronchus; malignant cancers of the digestive organs; malignant cancers of the respiratory system and intrathoracic organs; malignant cancers of the peritoneum, retroperitoneum, and pleura (including mesothelioma); and malignant cancers without specification of site. Asbestos-related non-cancer respiratory causes of death were asbestosis, pneumoconiosis, chronic obstructive pulmonary disease, other diseases of the respiratory system, and diseases of pulmonary circulation. Non-asbestos-related cancer groups were "all malignant cancers combined", "malignant breast cancer in females", and "malignant prostate cancer". The health outcomes with the greatest medical evidence for an asbestos-disease link include asbestosis and mesothelioma, and, to a lesser extent, lung cancer (ACS 2004, ALA 2004).

Standardized incidence ratios (SIR), standardized mortality ratios (SMR) and corresponding 95% confidence intervals were calculated for each community. For these analyses, SIRs and SMRs were used to compare the observed occurrence of disease or death with the expected occurrence of disease or death in the community. National rates of disease or death were used to calculate the expected occurrence for the communities. SIRs were computed for the period January 1, 1986, through December 31, 1995, using Surveillance, Epidemiology and End Results (SEER) reference rates for the five asbestos-related cancer groups and the three non-asbestos-related cancer groups. SMRs were computed for the period January 1, 1979, through December 31, 1998, using National Center for Health Statistics (NCHS) reference rates for the five asbestos-related cancer death groups, the five asbestos-related non-cancer respiratory causes of death, and the three non-asbestos-related cancer death groups.

The results for Edgewater indicated that the incidence of asbestos-related malignant cancers of the digestive organs for “males” and for “males and females combined” was statistically significantly higher than would be expected. Of the three non-asbestos-related cancer incidence groups, the group found to be statistically significantly higher was “all malignant cancers for females” and for “males and females combined”. Mortality from both the asbestos-related and the non-asbestos related causes of death groups was not statistically significantly different from the expected occurrence. Health outcomes with the strongest exposure-disease link were found to be close to the expected occurrence for Edgewater. Those exposure-disease links were “death due to asbestosis”, “mesothelioma incidence”, and “lung cancer incidence and mortality”. One death due to asbestosis and one incident case of mesothelioma occurred during the study periods. These results, however, do not indicate that asbestos-related outcomes have been affected by potential asbestos exposures from the Celotex gypsum wallboard manufacturing operation in Edgewater (NJDHSS 2005).

Child Health Considerations

ATSDR recognizes that infants and children are more vulnerable to exposures than are adults in communities faced with environmental contamination. Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at a site.

The effects of asbestos on children are thought to be similar to the effects on adults. Children, however, can be especially vulnerable to asbestos exposures because they are more likely to disturb fiber-laden soils or indoor dust while playing. Because children breathe air that is closer to the ground, they may be more likely to inhale airborne fibers from contaminated soils or dust. Children exposed to asbestos could be more at risk of developing asbestos-related disease than are adults exposed later in life because of the long latency period between exposure and onset of asbestos-related diseases.

For the Celotex site, the most at-risk children are likely to be those who were household contacts of former workers during the period 1967 through 1969. Because sampling results did not indicate the presence of Libby asbestos, household contacts, including children, of workers at The Promenade/City Place redevelopment site and children residing in the immediate vicinity during redevelopment activities were not exposed to Libby asbestos.

Conclusions

1. Asbestos fiber types characteristic of Libby asbestos were not detected in the landfill waste at the Celotex site.

2. Available records indicate that the Celotex Corporation received and processed approximately 300 tons of unexfoliated vermiculite from the Libby, Montana, mine during 1967 through 1969. Dust was generated during the handling of the Libby vermiculite and when the wallboards were cut and sized. Therefore, the past occupational exposure pathway represents a public health hazard for workers who had direct contact with Libby vermiculite.

3. During the period 1967 through 1969, household contacts of former Celotex Corporation workers may have been exposed to Libby asbestos when workers brought contaminated dust home on clothing, hair, and shoes and in automobiles. One former employee interviewed stated that on-site showers were available, which, if used, would have reduced the amount of dust brought home. Concentrations of Libby asbestos associated with take-home contamination and with behavior-specific factors (e.g., worker practices, household laundering practices) are unavailable. Therefore, past exposures to household contacts of former Celotex Corporation workers is an indeterminate public health hazard.

4. Currently, there are no waste piles at the site. As such, there are no apparent public health hazards associated with Libby asbestos to current community members. There is no information available on the past existence of on-site waste pile. As such, this represents an indeterminate public health hazard to community members.

5. The results of surface soil sampling conducted in 2000 indicated the presence of mostly chrysotile asbestos. No apparent public health hazards associated with Libby asbestos exists for current residents, contractors, or community members disturbing buried gypsum wallboard manufacturing waste.

6. Although dust contaminated with Libby asbestos released during gypsum wallboard manufacturing operations (1967 through 1969) was likely to have been minimal, no data is available to assess this potential exposure pathway. As such, this represents an indeterminate public health hazard to community members and nearby workers.

A summary of ATSDR conclusion categories are provided in Appendix D.

Recommendations

Although Libby asbestos was not detected in the landfill material, the landfill waste is contaminated with chrysotile asbestos. Therefore, the NJDEP should take appropriate measures to ensure adequate cap thickness on the landfill.

Public Health Action Plan

The Public Health Action Plan (PHAP) for the Celotex site under the NAER contains a description of the actions to be taken by the NJDHSS and/or ATSDR at or in the vicinity of the site subsequent to the completion of this health consultation. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of the NJDHSS and ATSDR to ensure that this plan is implemented and followed. The public health actions to be implemented by NJDHSS and ATSDR are as follows:

Public Health Actions Taken

1. Available data for the Celotex site have been reviewed and evaluated to determine human exposure pathways and public health issues related to Libby asbestos.

Public Health Actions Planned

1. If former workers or their household contacts are identified, NJDHSS will provide health information on Libby asbestos to the individuals and their physicians upon request.

2. The NJDHSS will prepare a Citizen's Guide for the Celotex site that will be made available to the Bergen County Department of Health Services and to other interested parties.

3. In cooperation with the ATSDR and EPA, the NJDHSS will schedule public availability sessions to present the findings of the health consultation for the Celotex site and will gather information on individual health concerns regarding the site.

4. The ATSDR will develop a comprehensive report outlining overall conclusions and strategies for addressing public health implications at the 28 Phase 1 sites that received vermiculite from the Libby, Montana mine.

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Certification

The health consultation for the Celotex Corporation site, Edgewater, 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 were initiated.

Gregory V. Ulirsch, MS, PhD
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Agency for Toxic Substances and Disease Registry

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

Alan Yarbrough
Team Leader, CAT, CAPEB, DHAC
Agency for Toxic Substances and Disease Registry

Figures 2-4

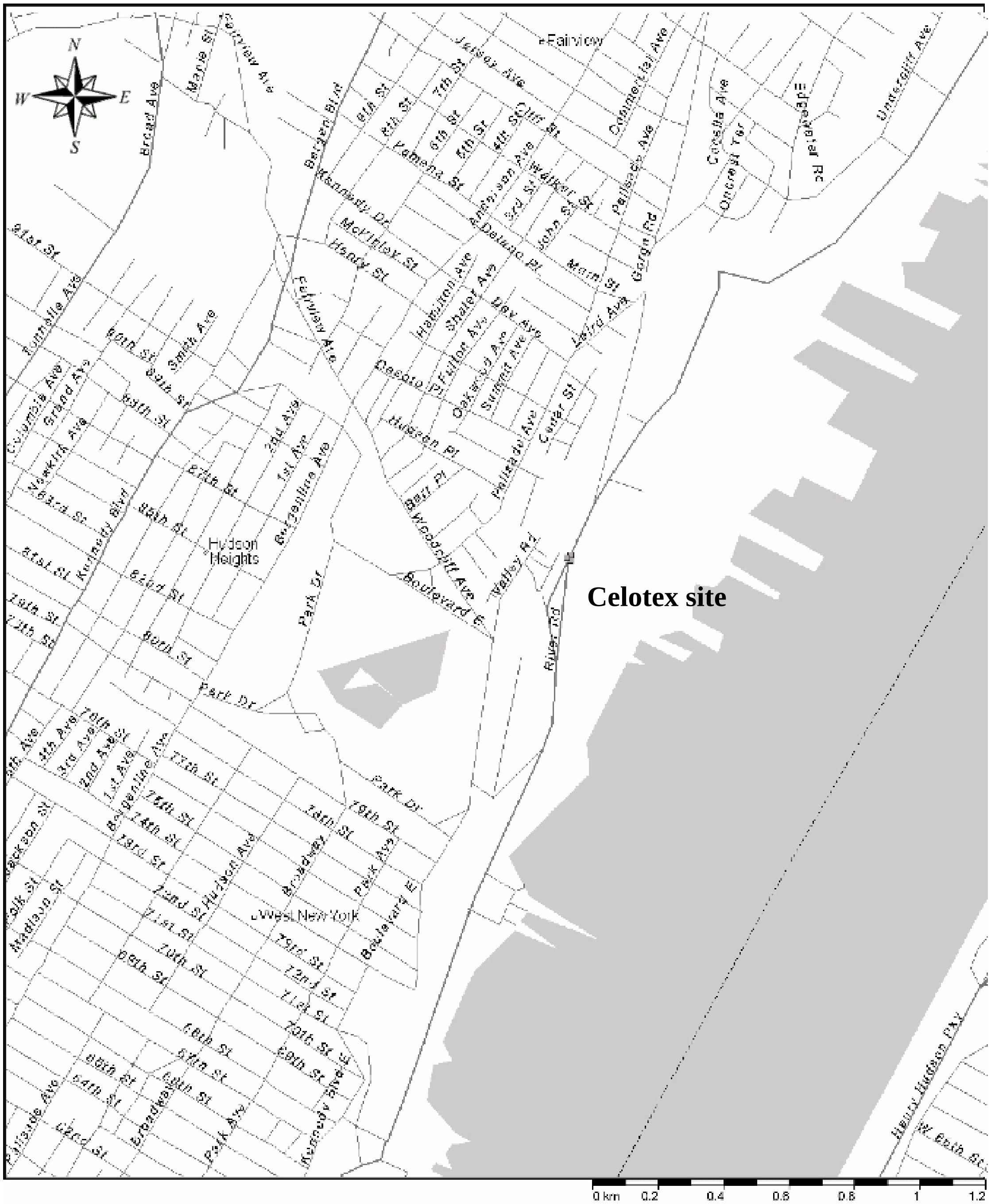

Figure 2. Street map of Celotex Corporation site

Figure 3. Aerial photograph of the Celotex Corporation site

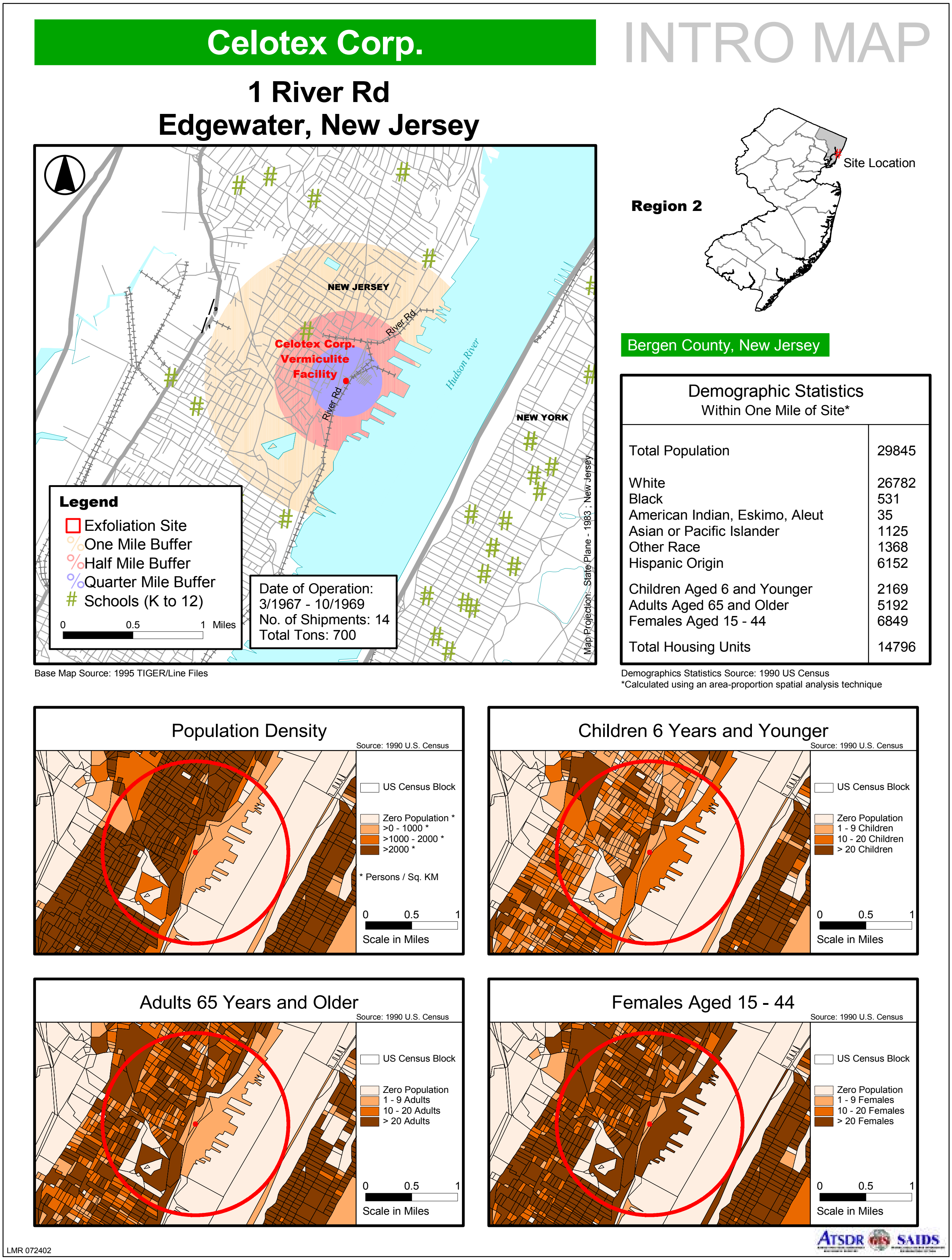

Figure 4. Demographic information of Celotex Corporation site based on 2000 U.S. Census data

Photographs 1-4

Photograph 1. The Promenade on the Hudson River

Photograph 2. The detention basin at the Celotex Corporation site

Photograph 3. Suspect asbestos contaminated soil

Photograph 4. The guard house situated on the landfill

Appendix A

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 Occupational Safety and Health Administration (OSHA) includes five classes: fibrous tremolite, actinolite, anthophyllite, crocidolite, and amosite. However, other amphibole minerals, including winchite, richterite, and others, can exhibit fibrous asbestiform properties [1].

Asbestos fibers do not have any detectable odor or taste. They do not dissolve in water or evaporate and are resistant to heat, fire, and chemical and biological degradation.

The vermiculite mined at Libby 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 byproduct 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 current regulations concerning asbestos in the environment. A more detailed discussion of these topics will 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 >5 µm and with an aspect ratio (length: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 <0.25 µm in diameter and the inability to distinguish between asbestos and non-asbestos fibers [1].

Asbestos content in soil and bulk material samples is commonly determined using polarized light microscopy (PLM), a method that uses polarized light to compare refractive indices of minerals and that can distinguish between asbestos and non-asbestos fibers and between different types of asbestos. The PLM method can detect fibers with lengths greater than ~1 µm, widths greater than ~0.25 µm, and aspect ratios (length to width ratios) of 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 soils and other bulk materials 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 ($\mu g/m^3$)/(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 ($\mu g/m^3$)/(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.

EPA is currently working with several contract laboratories and other organizations to develop, refine, and test a number of methods for screening bulk soil samples. The methods under investigation include PLM, infrared (IR), and SEM (personal communication, Jim Christiansen, U.S. Environmental Protection Agency, November 2002).

Asbestos Health Effects and Toxicity

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

> *Malignant mesothelioma*—Cancer of the lining of the lung (pleura) and other internal organs. 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 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 (lining of the lung); pleural thickening, extensive thickening of the pleura that 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 cancers at sites other than the lungs, pleura, and abdominal cavity [1].

Ingestion of asbestos causes little or no risk of non-cancer 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 Libby vermiculite. 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 with fiber mineralogy. Fiber length may play an important role in clearance and mineralogy may affect both biopersistence and surface chemistry.

In December 2002, 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 [4]. The panel concluded that fiber length plays an important role in toxicity. Fibers with lengths <5 µm are essentially non-toxic in terms of association with mesothelioma or lung cancer promotion. However, fibers <5 µm in length 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, amphibole asbestos has been suggested to be more toxic than chrysotile asbestos, mainly because physical differences allow chrysotile to break down and be cleared from the lung. Amphibole asbestos, however, is not removed, and it 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 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 risks 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 2–5 µm are considered above the upper limit of respirability (that is, too large to inhale) and thus do not contribute significantly to risk. Methods are being developed to assess the risks posed by varying types of asbestos 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]. Although 1% is not a health-based level, it represents the practical detection limit in the 1970s when OSHA regulations were created. Studies have shown that disturbing soils containing <1% amphibole asbestos, however, can suspend fibers at levels of health concern [9].

Friable asbestos (asbestos that is crumbly and can be broken down to suspendable 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 eight 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 basic of qualitative 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 former workers. ATSDR does not, however, support using PEL for evaluating community member exposure, as the PEL is based on an unacceptable health risk level.

In response to the World Trade Center disaster in 2001 and to 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 of 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 0.0009 f/cc after cleanup [11]. Continued monitoring was recommended to limit long-term exposure at this level [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 (ACGIH) has 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, because of an increased risk of developing benign intestinal polyps [15]. 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 has 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.

The 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 above this concentration the slope factor 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 its asbestos quantitative risk methodology given the limitations of the current assessment and the knowledge gained since the methodology was implemented in 1986.

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Appendix B

LOCKHEED MARTIN

DATE: June 2, 2000

TO: David B. Mickunas, U.S. EPA/ERTC Work Assignment Manager

THROUGH: Dennis A. Miller, REAC Section Leader

FROM: Michael Metz, REAC Task Leader M. Metz

SUBJECT: Soil Sampling for Asbestos Analysis
Work Assignment - #0132 - Trip Report

BACKGROUND

The objective of this work assignment was for the Response Engineering and Analytical Contract (REAC) to provide technical support to the United States Environmental Protection Agency/ Environmental Response Team Center (U.S. EPA/ERTC) by conducting soil sampling at the Edgewater Soil Sampling Site in Edgewater, NJ. The samples were analyzed by polarized light microscopy (PLM) and transmission electron microscepy (TEM) for asbestos content.

OBSERVATIONS AND ACTIVITIES

The project scope required REAC to support the U.S. EPA/ERTC by providing sampling and analysis of the soil at the Edgewater Soil Sampling Site in Edgewater, NJ. On April 4, 2000, REAC, along with an On-Scene Coordinator (OSC) from the U.S. EPA Region II, obtained 12 soil samples from the site. The sample locations are presented in Figure 1. Detailed descriptions of the each sample type and location are indicated in Table 1. Samples were shipped to a subcontracted laboratory, EMSL Analytical, Inc. in Westmont, NJ, for asbestos analysis using U.S.EPA Methods EPA600-R-93-116 (PLM) and EPA540-R-97-028 (TEM).

Samples analyzed using Method EPA540-R-97-028 (TEM) are prepared using a dust generator, and analyzed by TEM. This method allows for the determination of the mineralogical type(s) of asbestos that is present in the sample and for distinguishing asbestos structures from non-asbestos structures..

RESULTS

Results from the PLM and TEM analysis are summarized in Table 2. The detailed analytical reports are in Appendix A.

PLM RESULTS

No asbestos was detected in 11 of the 12 soil samples analyzed using PLM. Sample number 25061 contained 25% Chrysotile.

TEM RESULTS

No asbestos was detected in six of the 12 samples, sample numbers 25050, 25051, 25052, 25054. 25055, and 25056.

In sample number 25053, 3 chrysotile structures were detected at lengths ranging betweeen 0.5 and 5 microns.

In sample number 25057, 1 chrysotile structure was detected at a length ranging betweeen 0.5 and 5 microns. .

In sample number 25058, 3 chrysotile structures were detected at a lengths ranging betweeen 0.5 and 5 microns and 1 chrysotile structure at a length ranging between 5 and 10 microns.

In sample number 25059, 1 chrysotile structure was detected at a length ranging betweeen 0.5 and 5 microns and.1 chrysotile structure at a length ranging between 5 and 10 microns. Also, 1 amphibole structure was excluded with a diameter greater than 0.5 microns. The amphibole was identified as actinolite.

In sample number 25060, 2 chrysotile structures were detected at lengths ranging betweeen 5 and 10 microns. Also, 2 amphibole structures were detected at lengths ranging between 5 and 10 microns. One amphibole was identified as actinolite. One amphibole was identified as amosite.

In sample number 25061, 1 amphibole structure was detected at a length ranging between 0.5 and 5 microns. The amphibole was identified as amosite.

FUTURE ACTIVITIES

There are no future site activities scheduled at this time.

cc: Central File WA 0-0132

TABLE 1

Soil Sampling Descriptions and Locations
Edgewater Soil Sampling Site
Edgewater, NJ
June 2000

Sample Location	Sample Number	Sample Description and Location
1	25050	Exposed white material, surface level, between rip rap and top soil.
2	25051	Exposed white material, surface level, between freshly planted pine trees.
3	25052	Exposed white material, surface level, between rip rap and path.
4	25053	Exposed white material, 1 foot below path level in hole of fallen tree.
5	25054	Exposed white material, surface level at base of 20 foot tree.
6	25055	Exposed white material, surface level between soil cap and red clay.
7	25056	Exposed white material in retention basin three feet below path level in erosion vein.
8	25057	Exposed white material, surface level in unlandscaped area.
9	25058	Exposed white material, surface level next to unfinished path.
10	25059	Exposed white material, surface level in unfinished path.
11	25060	Exposed white material, approx. 8 feet below level of path on pier.
12	25061	Exposed white material, approx. 8 feet below level of path on pier.

TABLE 2

Soil Sampling Analytical Results for Asbestos
Edgewater Soil Sampling Site
Edgewater, NJ
June 2000

Sample Location	Sample Number	PLM Results	TEM Results
1	25050	None Detected	None Detected
2	25051	None Detected	None Detected
3	25052	None Detected	None Detected
4	25053	None Detected	**3 Chrysotile Structures (0.5-5μ)**
5	25054	None Detected	None Detected
6	25055	None Detected	None Detected
7	25056	None Detected	None Detected
8	25057	None Detected	**1 Chrysotile Structure (0.5-5μ)**
9	25058	None Detected	**3 Chrysotile Structures (0.5-5μ)** **1 Chrysotile Structure (5-10μ)**
10	25059	None Detected	**1 Chrysotile Structure (0.5-5μ)** **1 Chrysotile Structure (5-10μ)**
11	25060	None Detected	**2 Chrysotile Structures (5-10μ)** **1 Actinolite Structure (5-10μ)** **1 Amosite Structure (5-10μ)**
12	25061	**25% Chrysotile**	**1 Amosite Structure (0.5-5μ)**

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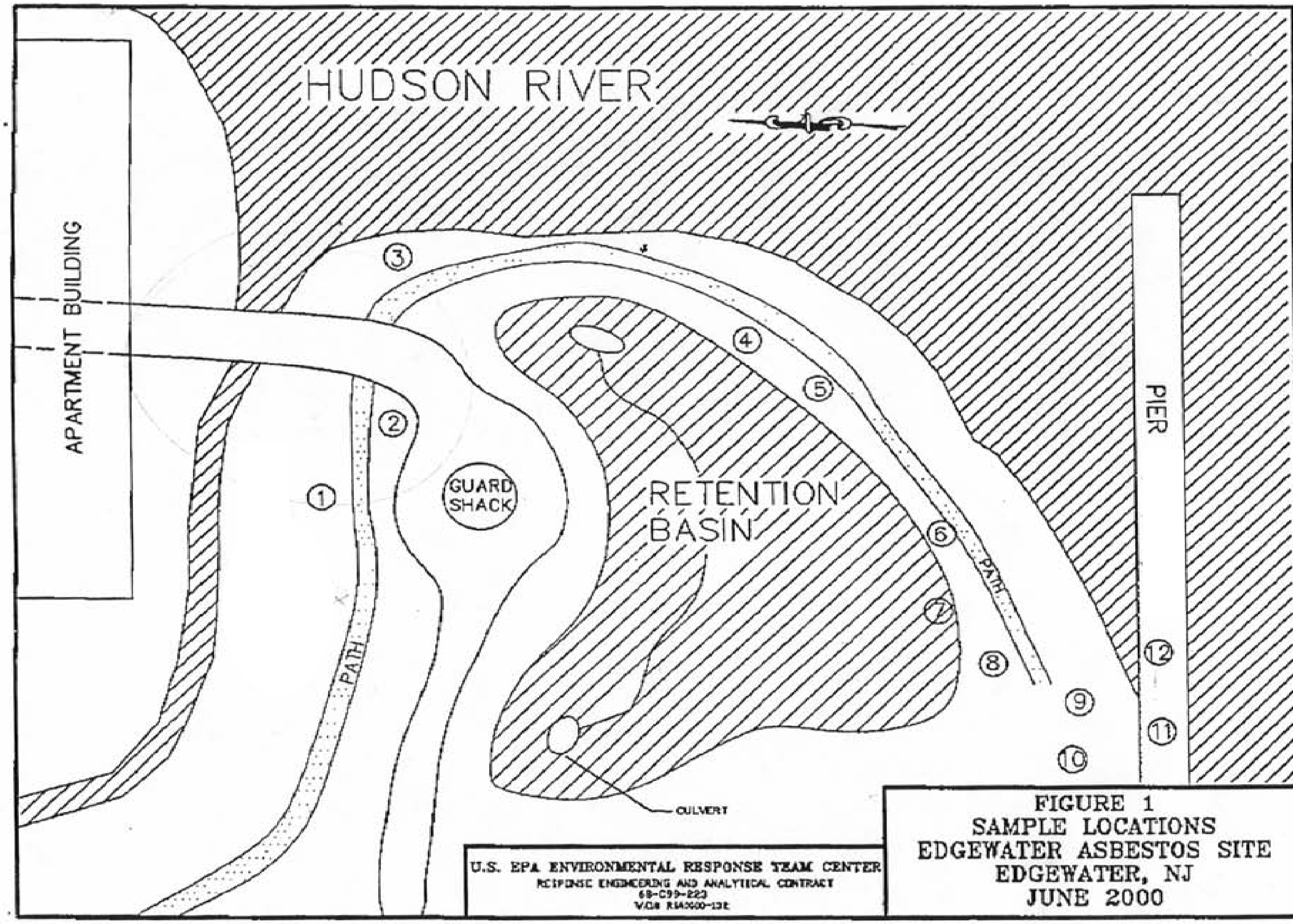

FIGURE 1
SAMPLE LOCATIONS
EDGEWATER ASBESTOS SITE
EDGEWATER, NJ
JUNE 2000

Sample Results of Superfund Method

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040005518

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	John Johnson Lockheed Martin Technologies Service Center 2890 Woodbridge Building 209 Annex Edison, NJ 08837-3679	Customer ID: Customer PO: Received: Report Date:	LOCK55 4/12/00 2:04P 5/31/00
Fax:	732-494-4021	EMSL Order:	040005518
Project:	RIA-00132 Metuchen Asbestos Site	EMSL Project ID:	

Client Sample# 25058
EMSL Sample# 040005518-009

Chrysotile Asbestos Analysis Results	Low Magnification	High Magnification
No. of Total Chrysotile Asbestos Structures	N/A	4
No. of Long (>5 µm) Chrysotile Asbestos Structures	N/A	1
No. of Total Chrysotile Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Fibers/Bundles	N/A	0
Amphibole Asbestos Analysis Results		
No. of Total Amphibole Asbestos Structures	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Structures	N/A	0
No. of Total Amphibole Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Fibers/Bundles	N/A	0
Amphibole Mineral Type-	N/A	

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN SAMPLE

	Conc.	95% UCL
Total Chrysotile Structures per g Sample	425.15	833.29
Total Amphibole Structures per g Sample	<106.29	<208.32
Total Asbestos Structures per g Sample	425.15	833.29
Long Chrysotile Structures per g Sample	106.29	208.32
Long Amphibole Structures per g Sample	<106.29	<208.32
Long Asbestos Structures per g Sample	106.29	208.32
Estimated Analytical Sensitivity: (structures/g)	<106.29	<208.32

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN RESPIRABLE DUST OF SAMPLE

	Conc.	95% UCL
Total Chrysotile Structures per g Dust	6.01E+10	1.18E+11
Total Amphibole Structures per g Dust	<1.50E+10	<2.95E+10
Total Asbestos Structures per g Dust	6.01E+10	1.18E+11
Long Chrysotile Structures per g Dust	1.50E+10	2.95E+10
Long Amphibole Structures per g Dust	<1.50E+10	<2.95E+10
Long Asbestos Structures per g Dust	1.50E+10	2.95E+10
Estimated Analytical Sensitivity: (structures/g dust)	<1.50E+10	<2.95E+10

A.V. Samudra, Ph,D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

Appendix C

EXPOSURE PATHWAYS—VERMICULITE PROCESSING FACILITIES					
Source for all pathways: 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 when materials were transported, handed, or processed	Onsite	Inhalation	Former and/or current workers	Past, present, future
Household Contact	Suspension of Libby asbestos fibers into air from dusty clothing workers wore home	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	Onsite waste piles	Inhalation	Community members, particularly children	Past, present, future
Onsite Soils	Suspension of Libby asbestos fibers into air from disturbing contaminated on-site soils (residual soil contamination and/or buried waste)	Areas with remaining contamination at or around the site	Inhalation	Current on-site workers, contractors, community members	Present, future
Ambient Air	Stack emissions and fugitive plant-related dust moving off-site	Area around site	Inhalation	Community members, nearby workers	Past
Residential Outdoor	Suspension of Libby asbestos fibers into air by disturbing contaminated vermiculite taken offsite for personal uses (e.g., gardening, paving driveways, traction, fill)	Residential yards or driveways	Inhalation	Community members	Past, present, future
Residential Indoor	Suspension of household dust containing Libby asbestos fibers from plant emissions or residential outdoor waste	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 repair personnel	Past, present, future

Appendix D

Summary of ATSDR Conclusion Categories

Category	Definition
1. Urgent Public Health Hazard	Applies to sites that have certain physical hazards or evidence of short-term (less than 1 year), site-related exposure to hazardous substances that could result in adverse health effects and that require quick intervention to prevent people from being exposed.
2. Public Health Hazard	Applies to sites that have certain physical hazards or evidence of chronic, site-related exposure to hazardous substances that could result in adverse health effects.
3. Indeterminate Public Health Hazard	Applies to sites where critical information is lacking (missing or has not yet been collected) to support a judgment on the level of public health hazard.
4. No Apparent Public Health Hazard	Applies to sites where exposure to site-related chemicals might have occurred in the past or is still occurring, but the exposures are not at levels expected to cause adverse health effects.
5. No Public Health Hazard	Applies to sites where no exposure to site-related hazardous substances exists.