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Exposure pathway evaluations for sites that processed asbestos-contaminated vermiculite

Barbara A. Anderson*, Steve M. Dearwent, James T. Durant, Jill J. Dyken, Jennifer A. Freed, Susan McAfee Moore, John S. Wheeler

Agency for Toxic Substances and Disease Registry, 1600 Clifton Road, NE Mail Stop E-29, Atlanta, Georgia 30333, USA

Abstract

The Agency for Toxic Substances and Disease Registry (ATSDR) is currently evaluating the potential public health impacts associated with the processing of asbestos-contaminated vermiculite at various facilities around the country. Vermiculite ore contaminated with significant levels of asbestos was mined and milled in Libby, Montana, from the early 1920s until 1990. The majority of the Libby ore was then shipped to processing facilities for exfoliation. ATSDR initiated the National Asbestos Exposure Review (NAER) to identify and evaluate exposure pathways associated with these processing facilities. This manuscript details ATSDR's phased approach in addressing exposure potential around these sites. As this is an ongoing project, only the results from a selected set of completed site analyses are presented. Historical occupational exposures are the most significant exposure pathway for the site evaluations completed to date. Former workers also probably brought asbestos fibers home on their clothing, shoes, and hair, and their household contacts may have been exposed. Currently, most site-related worker and community exposure pathways have been eliminated. One community exposure pathway of indeterminate significance is the current exposure of individuals through direct contact with waste rock brought home for personal use as fill material, driveway surfacing, or soil amendment. Trace levels of asbestos are present in soil at many of the sites and buried waste rock has been discovered at a few sites; therefore, future worker and community exposure associated with disturbing on-site soil during construction or redevelopment at these sites is also a potential exposure pathway.
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Keywords: Asbestos; Exposure pathways; Libby asbestos; National Asbestos Exposure Review; Vermiculite

Introduction

Asbestos-contaminated vermiculite was mined in Libby, Montana, and shipped to industrial facilities across the United States during most of the 20th century. Several epidemiologic studies have documented asbestos-associated impacts to people who lived and worked in Libby (Amandus and Wheeler, 1987; Amandus et al., 1987a, b; ATSDR, 2000, 2002; McDonald et al., 1986; Peipins et al., 2003). The processing and use of significant quantities of Libby vermiculite at other facilities outside of Libby also presents a potential hazard. The Agency for Toxic Substances and Disease Registry (ATSDR) is conducting an assessment of the potential human health effects that could be associated with exposure related to the domestic processing facilities that received contaminated vermiculite from Libby. This manuscript outlines

*Corresponding author. Tel.: +1 404 498 0465; fax: +1 404 498 0071.
E-mail address: BAAnderson@cdc.gov (B.A. Anderson).

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ATSDR's ongoing assessment of the health implications for workers at the facilities and for people in communities near the facilities. ATSDR's National Asbestos Exposure Review (NAER) is identifying and evaluating past, present, and future exposure pathways at processing sites that received vermiculite from Libby. The primary goals of NAER are to identify ways people could be exposed to asbestos from these sites, determine whether these exposures represent a public health hazard, recommend appropriate public health actions, and provide information to the public to enable individuals to make informed decisions to protect their health.

Vermiculite and asbestos are naturally occurring minerals found worldwide. Vermiculite from Libby contains several types of asbestos fibers including the amphibole asbestos varieties tremolite and actinolite and the related fibrous asbestiform minerals winchite, richterite, and ferro-edenite (USGS, 2002). In this manuscript the term "Libby asbestos" is used to refer to the characteristic composition of asbestos found geologically commingled with vermiculite ore and mined in Libby. Tremolite and actinolite are amphibole minerals that can exist in a fibrous form and are potentially more toxic than other commonly encountered serpentine fibers (i.e., chrysotile) (ATSDR, 2001a; McDonald and McDonald, 1997).

The raw vermiculite ore was mined and milled in Libby to produce different sizes, or grades, of vermiculite. Before it was milled, the raw vermiculite contained up to 26% asbestos (Atkinson et al., 1982). The various grades of milled vermiculite contained asbestos at concentrations ranging from 0.3% to 7.0% (Atkinson et al., 1982). This milled vermiculite was the material shipped throughout the country.

Most of the vermiculite was shipped to facilities around the country for exfoliation, a process that is similar to popping popcorn. Intense heat is used to liberate water molecules in the vermiculite, producing an expanded, low-density material. The waste rock that remains after the vermiculite is expanded may contain a higher concentration of Libby asbestos than was in the unexpanded vermiculite. Estimates of the asbestos content of the waste rock vary from 2% to 10% (W.R. Grace, 1986; J. Kelly, Minnesota Department of Health, personal communication, 2002). Expanded vermiculite material is used as lightweight aggregate and thermal insulation in building materials, as loose-fill insulation, and as a soil conditioner and fertilizer carrier in agricultural products (Bureau of Mines, 1990).

While responding to the crisis in Libby, ATSDR and the US Environmental Protection Agency (EPA) recognized the potential consequences of processing contaminated vermiculite at hundreds of other facilities around the nation. Initially, EPA compiled a list of past or current domestic vermiculite processors and began evaluating the current operational status of these facilities. EPA also requested assistance from ATSDR to determine potential public health impacts at these sites. While EPA is focusing on identifying and mitigating current environmental contamination at the sites, ATSDR is evaluating past, present, and future exposure pathways and developing recommendations to address any public health hazards identified.

Establishing NAER is just one of ATSDRs responses to the problems originally identified in Libby. Other efforts initiated or funded by the agency, but not discussed in this report, include health statistics reviews for communities around selected sites, an in-depth community investigation for a site in Minnesota, a disease progression study in a cohort of workers from a site in Ohio, and pilot mesothelioma surveillance studies in New Jersey, New York, and Wisconsin. Although risks associated with commercial and private use of potentially contaminated vermiculite products are not evaluated within the scope of these efforts, the potential public health implications associated with decades of widespread use of commercial vermiculite products contaminated with asbestos should not be dismissed.

Methods

EPA initially identified 241 domestic vermiculite processors that may have received shipments of contaminated vermiculite from Libby. The site list encompassed a variety of industries including exfoliation facilities, gypsum board manufacturing plants, agricultural product facilities, and shipping ports. These sites were located in almost every state and situated in both urban and rural settings. Periods of operation varied for each facility, as did the volume of material received and processed. Some sites processed vermiculite from Libby during almost the entire period that the mine and processing facilities in Libby were active. ATSDR's systematic approach to the overall project, the scientific methodology employed in the site evaluations, and the data sources utilized in the evaluations are described in the following subsections.

Project approach

ATSDR adopted a phased approach for investigating the public health impacts at these numerous sites. Phase 1, which is ongoing, consists of detailed evaluations for a selected group of sites that received and processed asbestos-contaminated vermiculite from Libby. Phase 2 will utilize the site-specific findings and meta-analysis of the phase 1 effort to inform and guide evaluation of the remaining sites nationwide.