PUBLIC HEALTH CONSULTATION

Burns Air Force Range
(<u>also known as Burns Air Force Radar Station)</u>
T23S R30E Section 20 WM
Harney County, Burns, Oregon 97720
EPA Facility Number: OR0001096957

Prepared by the
Oregon Department of Human Services
Superfund Health Investigation & Education Program
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry (ATSDR)
Division of Health Assessment & Consultation
Atlanta, Georgia

Table of Contents

Purpose and Health Issues....2
Background....2
Site Description & Land Use....2
Figure 1 – (Former) Burns Air Force Radar Station....2
History....3
Discussion....3
Data Used....3
Past Site Assessment & Cleanup Activities....3
Sampling & Site Visits....4
Figure 2 – Collapsed beams and roofing....4
Figure 3 – Open hole, Radome structure, graffiti....5
Asbestos Inhalation....5
Contaminated Soil....6
Physical Hazards....7
ATSDR Child Health Initiative....7
Conclusions....7
Recommendations....7
Public Health Action Plan....7
Site Team....8
References....9
Appendix A – Asbestos Overview....11
Asbestos Health Effects....11
Inhalation of Asbestos....11
Ingestion and Dermal Exposure to Asbestos....12
Current Standards, Regulations, and Recommendations for Asbestos....12
Methods for Measuring Asbestos Content....13

Purpose and Health Issues

The Oregon Department of Environmental Quality (ODEQ) contacted the Oregon Department of Human Services (ODHS) Superfund Health Investigation & Education Program in August of 2002 for assistance in assessing the health risks from exposure to asbestos at the former Burns Air Force Radar Station[1] near the cities of Burns and Hines in Harney County. With the exception of a few communication structures, the buildings on the 18-acre property have been unoccupied since the radar station closed in 1970; they have been heavily vandalized. Trespassers and maintenance workers are exposed to friable asbestos and numerous physical hazards. A popular hangout for area teenagers, the site is easily accessed.

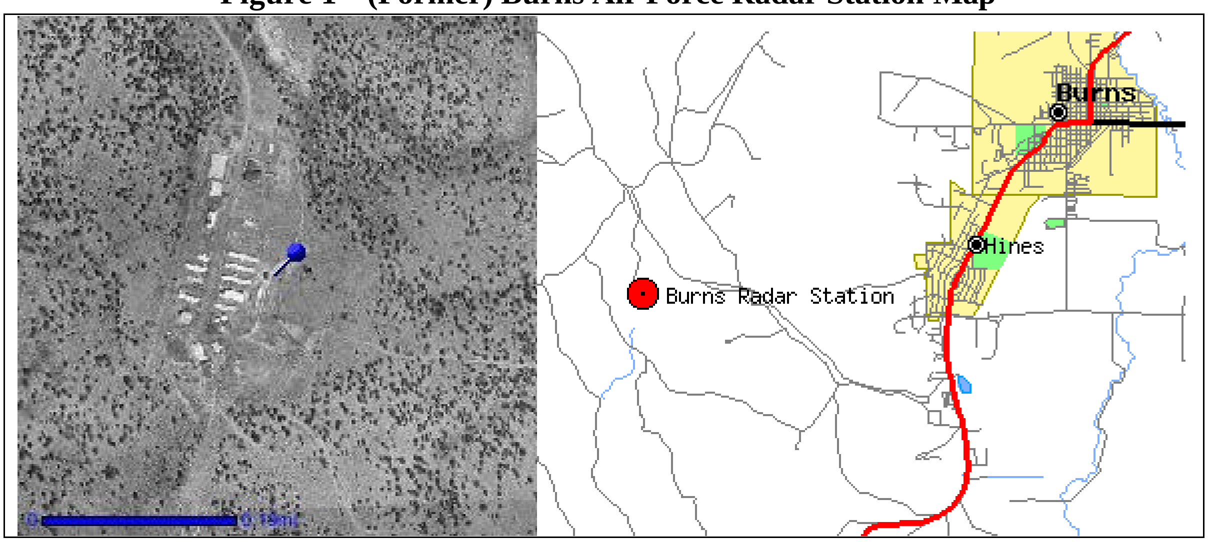
Because of the physical hazards and health risks from exposure to friable asbestos, the former Burns Air Force Radar Station is considered a **public health hazard**.

Background

Site Description & Land Use

The former Burns Air Force Radar Station is located approximately 3.5 miles southwest of the cities of Burns and Hines at the top of Burns Butte (elevation 5,100 ft., see Figure 1) The area is arid high desert, sparsely vegetated and sparsely populated. According to the 2000 US Census, the nearest residence is 1.5 miles from the former radar station, and there are 25 residents within 2 miles. The cities of Burns and Hines are adjacent to each other; together, they have a population of 4,535. There are 1,247 students in grades K-12 (360 students in high school). Harney County, in central southern Oregon, has a total population of 7,609 in a 10,228 square mile area.

Figure 1 – (Former) Burns Air Force Radar Station Map



[1] The name for this site in EPA's records system is the Burns Air Force Range, but in the Burns area it is referred to as the Burns Air Force Radar Station; the latter is the name that will be used in this document.

The area surrounding the radar station is open desert, with occasional recreation use such as hiking, motorcycling, 4WD trails, and rock hunting. Zoning in the area surrounding the former radar station allows farming and ranching but restricts residential development. The 18 acres of the former radar station were rezoned, however, two years ago to Rural Residential (RR) at the request of the current property owner. The RR zoning allows the property owner to partition the former radar station into 3 residential lots.

History

The former Burns Radar Station property was acquired in the 1950s for use by the Air Force Aerospace Defense Command as an early warning ground radar site and communications receiver. It was in use from 1954 to 1970. There were originally 38 buildings and a separate housing annex in Burns [1]; most of the buildings and structures remain at the site in various states of disrepair. In 1973, the radar station was transferred to the Burns Union High School District for educational use. It was deeded back to the federal government in 1978. The property has been in private ownership since 1979, with the exception of 1.66 acres transferred to the Federal Aviation Administration and 1.83 acres transferred to the Bonneville Power Administration. Except for two tracts of 0.35 and 0.29 acres used by cable and telephone companies, the property has remained vacant. According to a 1996 EPA Preliminary Assessment report, “The only activity at the site since Air Force operations ended in 1970 has been vandalism” [2].

Discussion

Data Used

ODHS reviewed ODEQ records, which included sampling reports, site surveys, assessments (EPA and the US Army Corps of Engineers), environmental cleanup reports, and correspondence. Site visits and interviews with staff from Harney County Planning, Health, and Sheriff departments provided additional information on the site’s condition and history.

Past Site Assessment & Cleanup Activities

At the request of the current property owner, the US Army Corps of Engineers (COE) visited the property and completed a preliminary assessment (PA) in 1991 to identify any contamination that was the result of military use of the property [3]. The US. Environmental Protection Agency (EPA) completed a second PA in 1996 [2]. The 1996 PA reported that the COE conducted activities in 1995–1997 to clean up and/or remove underground storage tanks, overhead fuel storage tanks, nine transformers, a hydraulic cylinder, and PCB-contaminated soil. A 1997 COE site cleanup report indicates that the radome structure (see Figure 3) has a 350 square feet accessible area of soil with PCB levels higher than DEQ and EPA residential cleanup levels, but lower than industrial cleanup levels [4].

The 1991 PA indicated that two abandoned disposal sites, each approximately 5,000 square feet in size, “may contain toxic materials” [3]. One of the sites had at least four 55-gallon drums that the PA indicated had been dumped onsite. The PA advised that "an investigation beyond the scope of this PA may be required to assess the potential for soil and groundwater contamination" at the disposal sites, and that "surrounding and non-productive soil indicates evidence of hazardous and toxic waste." Reports available for review indicate that a second site visit was conducted in 1995 by the COE [5], but records do not indicate that soil and groundwater at the disposal sites were sampled or tested for chemical contamination.

The 1991 PA also addressed physical hazards: "The site contains numerous buildings which are structural hazards. The buildings are in various states of disrepair due to vandalism. The site also contains several open sewer manholes and open pits which are falling and drowning hazards. The manholes and pits are over 6 feet in depth and contain several feet of water. The structural hazards are located on lands under private ownership [3]." Reports do not indicate whether the COE remediated physical hazards that were not the result of vandalism after property transfer.

There is an inactive capped well at the site that provided drinking water while the radar station was an active facility [1,2]. Reports indicate that groundwater at the site has not been evaluated, as the site was not in residential use [2].

Sampling & Site Visits

In April and October of 2002, ODEQ staff, investigating friable asbestos reported at the site, collected samples of fragmented tile, wallboard, pipe wrap, and insulation. Pipe wrap and insulation contained from 10% to 60% amosite and chrysotile asbestos; wallboard samples contained from 10% to 25% chrysotile asbestos; and tile and mastic samples contained from 5% to 8% chrysotile asbestos [6]. In November 2002, ODEQ posted "Danger Asbestos" and "Keep Out" signs and issued a press release to discourage trespassing and reduce risk of asbestos exposure [7].

Figure 2 – Collapsed beams and roofing

Janice Panichello (ODHS) and Ric Robinson (ATSDR regional office) visited the site in October 2002 with Frank Messina (ODEQ). Buildings were covered with graffiti (recent and from years past), and the buildings were extensively vandalized. (See Figure 3) Staff observed exposed asbestos insulation on indoor and outdoor piping; shattered wallboard and tile; hundreds of bullet holes in numerous walls; scattered rifle shell casings; and burst paint balls. There were ATV tracks on the inside and outside of buildings. Roofing was collapsed on some buildings, and there were collapsed beams in the fire-damaged former hospital. (See Figure 2) All windows were broken, and many buildings appeared to have been extensively salvaged for any usable wood or other materials. (See Figure 3) Salvage activities, fire, and vandalism have created numerous physical hazards inside the buildings. Outside of the buildings are open pits and formerly used water tanks. (See Figure 3)

There is no fencing around the perimeter. The few structures with communication equipment were secured, but all other buildings are easily accessed. Staff talked with two older adults who hiked through the property during the site visit. They said they often walk through the property as they enjoyed the "fresh air" and scenery. (Staff wore respirators during the site visit.) The hikers said that high school students frequent the site, particularly on weekends and nights. They also mentioned seeing motorcyclists at the property. The county sheriff, who periodically patrols the property, confirmed the trespassing at the site, particularly by area teenagers on weekends and evenings, but indicated that the remote location and large patrol area make it difficult for the sheriff to keep trespassers off the property.

Figure 3 – Open hole, Radome structure, graffiti and salvaging at former station buildings

Asbestos Inhalation

Trespassers and workers maintaining communications equipment at the site may have been exposed to asbestos fibers from disturbed and shattered asbestos-containing material (ACM). Until signs were recently posted, hikers may not have known they were "trespassing" on private property, nor that they risked exposure to asbestos fibers carried by the wind. Trespassers inside buildings would have increased exposure during asbestos-disturbing activities such as driving on fragmented tile, vandalizing walls or piping, or scavenging building materials. Teens using the site as a hangout would increase health risks as a result of prolonged exposure.

While recently posted “Danger Asbestos” and “Keep Out” signs may discourage some former “trespassers” from accessing the site, it is unrealistic to expect trespassing to stop, given the lack of fencing, limited sheriff patrols, remote location, and historic use of the site by area teens. Workers will also continue to access the site to maintain communications equipment. Without cleanup of friable ACM and prevention of continued vandalism of building materials containing asbestos, exposure to asbestos fibers will continue.

These exposures to ACM may result in adverse health effects. When asbestos fibers are inhaled, they may get trapped in the lungs. In general, health risks increase with longer exposure and greater amounts of asbestos fibers in the exposures. Short-term high-level or chronic low-level asbestos inhalation exposure has been associated with lung cancer, mesothelioma, and pleural disorders [8]. (See Appendix A for additional information on asbestos.)

Contaminated Soil

The 1991 PA reported a potential contamination of soil and groundwater at the two former disposal sites, indicating that the surrounding and non-productive soil shows evidence of hazardous and toxic waste” [3]. One of the disposal areas was described in the report as “an area in which 55-gallon barrels have been dumped.” Subsequent reports on cleanup at the radar station do not indicate what was contained in the 55-gallon barrels removed from the site and whether soil was sampled after the barrels were removed. Without soil sampling for chemical contamination, health risks from exposure by trespassers at the site cannot be determined.

Unless the property is redeveloped and the inactive well is reactivated or a new well is needed to provide potable water, groundwater is not a completed exposure pathway that poses a public health risk, unless soil sampling indicates otherwise.

Sampling of the remaining PCB-contaminated soil in the radome indicates that the soil meets DEQ and EPA industrial cleanup levels but not residential levels. The contaminated area is accessible to trespassers, but it is unknown whether trespassers access the site and if so, the frequency and length of time they are exposed.

Physical Hazards

As indicated, there are numerous physical hazards inside and outside of buildings throughout the property. An inventory of physical hazards is recommended to identify hazards that pose potentially serious physical harm and allow better planning for removal and remediation activities. Until physical hazards are removed or remediated, additional barriers to access (such as fencing) should be provided.

ATSDR Child Health Initiative

ATSDR recognizes that infants and children might be more vulnerable to exposures than 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 the site as part of the ATSDR Child Health Initiative. There is no indication that young children have accessed the site. The remote location and recent posting of warning signs at the site make it extremely unlikely that children will access the site in its current condition.

Conclusions

Because of the physical hazards and health risks from exposure to friable asbestos at the site, the Former Burns Radar Station is considered a **public health hazard**.

1. Trespassers and maintenance workers are exposed to physical hazards and friable asbestos in the abandoned, heavily vandalized buildings throughout the property.
2. Signs have been posted; however, there is no fencing, and buildings are easily accessed.
3. There may be additional contamination at two former disposal sites and in soil at the radome building.

Recommendations

1. ODHS recommends that friable asbestos and physical hazards be remediated throughout the site by ODEQ, EPA, or COE.
2. Until the site is remediated, ODHS recommends that the current property owner or the appropriate state or federal agency restrict access to the property . An inventory of physical hazards is also recommended.
3. ODHS recommends that the responsible agency (ODEQ or COE) evaluate the contamination at the two former disposal sites and the radome building.

Public Health Action Plan

The Public Health Action Plan for the site contains a description of actions that have been or will be taken by ODHS and other government agencies at the site. The purpose of the Public Health Action Plan is to ensure that this public 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 ODHS to follow up on this plan to ensure that it is implemented. The public health actions to be implemented follow:

- ODEQ is continuing to work with property owners, EPA, Harney County, and the COE to assess possible cleanup options. ODEQ will continue to oversee cleanup and efforts to control access to the site.
- Public Meeting/Availability Session–Public health agencies will participate in future public meetings to provide information and respond to questions and concerns.
- Educational materials on health effects of exposure to asbestos will be provided by ODHS, in partnership with the local health department, to the community, with particular emphasis on providing information to workers and high school age students who access the site, and to school officials and parents of students.
- ODHS and ODEQ will continue to respond to the community's concerns and questions.

Site Team

Preparer of Report
Janice Davin Panichello, MPA
Program Coordinator
Superfund Health Investigation & Education Program
Oregon Department of Human Services

Regional ATSDR Staff
Ric Robinson
Regional Representative
ATSDR Region 10
Seattle, Washington

ODHS Superfund Health Investigation & Education Program
Dave Stone, PhD
Toxicologist

Amanda Guay, MPH
Public Health Educator

ATSDR Division of Health Assessment & Consultation
John Crellin, PhD
Oregon Technical Project Officer

References

1. Department of the Air Force. Disposal report number 287. August 31, 1970.

2. URS Consultants, Inc. Preliminary assessment report for Burns Air Force Range, Burns, Oregon. Prepared for the Environmental Protection Agency, Region 10, Seattle, Washington. August 29, 1996.

3. US Army Corps of Engineers. Site investigation report for DERP-FUDS Site No. F100R016300, Burns Air Force Station, OR. July 31, 1991.

4. E.P. Johnson Construction and Environmental, Inc. Project field report—remove underground storage tanks and contaminated soil, former Burns Air Force Station, Burns, Oregon. Prepared for the US Army Corps of Engineers, Portland District Office. April 1997.

5. US Army Corps of Engineers. Memorandum CENPD-PM-MP (HAN), U.S. Army Corps of Engineers, DERP Project F10OR016302. April 24, 1995.

6. Oregon Department of Environmental Quality. Sampling reports numbers 20020454 (April 2002) and 20021144 (October 2002).

7. Oregon Department of Environmental Quality. News release of December 6, 2002, available on ODEQ website, http://www.deq.state.or.us/news/prDisplay.asp?docID=1162. Last accessed March 1, 2003.

8. Agency for Toxic Substances and Disease Registry. Asbestos toxicity—case studies in environmental medicine. Atlanta: U. Department of Health and Human Services; December 1997, Revised November 2000.

9. Agency for Toxic Substances and Disease Registry. Toxicological profile for asbestos (update). Atlanta: US Department of Health and Human Services; September 2001.

10. Churg A. Asbestos-related disease in the workplace and the environment: controversial issues. In: Churg, A and Katzenstein, AA.. The lung: current concepts (Monographs in pathology, no. 36). Philadelphia (PA): Lippincott, Williams, and Wilkins; 1993. p. 54-77.

11. Oregon Department of Environmental Quality. Administrative rules (340-248-0010) define “asbestos-containing material” as any material, including particulate material, that contains more than one-percent asbestos as determined by Polarized Light Microscopy.

12. Weis CP. (EPA0. Memorandum to P. Peronard of U.S. Environmental Protection Agency, “Amphibole mineral fibers in source materials in residential and commercial areas of Libby pose an imminent and substantial endangerment to public health”. Denver,

CO: US Environmental Protection Agency (EPA). December 20, 2001.

13. Environmental Protection Agency. Toxic Air Pollutants web site. Available at http://www.epa.gov/air/toxicair/newtoxics.html. Last accessed January 2003.

14. US Environmental Protection Agency. Integrated risk information system (for asbestos). Available at http://www.epa.gov/iris/subst/0371.htm. Last accessed January 2003.

15. National Institute of Occupational Safety and Health. Online NIOSH pocket guide to chemical hazards. Available at http://www.cdc.gov/niosh/npg/npgd0000.html. Last accessed January 2003.

16. American Conference of Government Industrial Hygienists. 2000 Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati OH; 2000.

17. Berman DW, Crump K. Methodology for conducting risk assessments at asbestos Superfund sites. Part 2: Technical background document (interim version). Prepared for the US Environmental Protection Agency Region 9. San Francisco, CA: February 15, 1999.

Appendix A – Asbestos Overview

Asbestos is a general name applied to a group of silicate minerals consisting of thin, separable fibers. Different criteria are used to identify asbestos fibers, depending on the context.

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, with a rod- or needle-like shape. Regulated amphibole minerals include amosite, tremolite, actinolite, anthophylite, and crocidolite [9]. At the former Burns Air Force Radar Station, asbestos in the fragments of wallboard and vinyl tile are the chrysotile form of asbestos. The piping insulation and wrap contain both chrysotile and amosite (an amphibole form of asbestos) asbestos.

Asbestos fibers do not have any detectable odor or taste. They do not dissolve in water or evaporate, and they are resistant to heat, fire, and chemical and biological degradation. They are generally not broken down to other compounds in the environment, and thus they will remain virtually unchanged over long periods. Asbestos fibers may break into shorter pieces or separate into a larger number of individual microscopic fibers as a result of physical processes. Small diameter fibers and fiber-containing particles may remain suspended in the air for a long time and be carried long distances by wind before settling.

Asbestos Health Effects

Inhalation of Asbestos

When asbestos fibers are breathed in, they may get trapped in the lungs. In general, health risks increase with longer exposure and greater amounts of asbestos fibers in the exposures. Short-term high-level or chronic low-level asbestos inhalation exposure has been associated with lung cancer, mesothelioma, and pleural disorders [8]. Breathing any type of asbestos increases the risk of the following health effects:

Malignant mesothelioma—Cancer of the lining of the lung (pleura) and the lining of other internal organs. This cancer can spread to tissues surrounding the lungs or other organs. Most of the mesothelioma cases are attributable to asbestos exposure [9]. Mesothelioma can occur with low asbestos exposure; however, very low background environmental exposures carry only an extremely low risk [8]. An estimated 1,500 cases of mesothelioma per year occur in the United States (compared with an average of 130,000 cases of lung cancer per year). Latency periods for mesothelioma due to asbestos exposure are generally 20 to 30 years or more.

Lung cancer—Cancer of the lung tissue. The exact mechanism relating asbestos exposure with lung cancer is not completely understood [9]. The combination of tobacco smoking and asbestos exposure greatly increases the risk of developing lung cancer. Latency periods are generally 10 to 30 years or more for lung cancer.

Noncancer effects—these include *asbestosis*, where asbestos fibers lodged in the lung cause scarring and reduce lung function; *pleural plaques*, localized or diffuse areas of thickening of the pleura (lining of the lung); *pleural thickening*, extensive thickening of the pleura which restricts 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 [9]. Either heavy exposure for a short time or lower exposure over a longer period may result in asbestosis; some cases have resulted from intense 1-day exposure [8]. No minimal risk levels (MRL) have been determined for inhalation or oral exposure to asbestos for any duration [9]. Latency periods for the development of asbestos-related nonmalignant respiratory effects are usually 15–40 years from the time of initial exposure to asbestos.

There is not enough evidence to conclude whether inhalation of asbestos increases the risk of cancers at sites other than the lungs, pleura, and abdominal cavity [9].

It has been suggested that amphibole asbestos is more toxic than chrysotile asbestos, mainly due to physical characteristics which allow chrysotile to be broken down and cleared from the lung, whereas amphibole is not removed and builds up to high levels in lung tissue [10]. Some researchers believe the resulting increased duration of exposure to amphibole asbestos is thought to significantly increase the risk of mesothelioma and, to a lesser extent, asbestosis and lung cancer.

Ingestion and Dermal Exposure to Asbestos

Ingestion of asbestos causes little or no risk of noncancer effects [9]. There is some evidence, however, 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.

Skin nodules (corns) from handling asbestos-containing materials can also occur [8].

Current Standards, Regulations, and Recommendations for Asbestos

ODEQ and other regulatory agencies commonly define “asbestos-containing materials” as any material with greater than 1% bulk concentration of asbestos [11]. 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 soils containing less than 1% amphibole asbestos can suspend fibers at levels of health concern [12].

Friable asbestos (asbestos which is crumbly and can be broken down to suspendable fibers) is listed as a Hazardous Air Pollutant on EPA’s Toxic Release Inventory [13]. EPA has determined that, if severely damaged, otherwise non-friable materials can release significant amounts of asbestos fibers.

Low levels of asbestos can be detected in almost any air sample. In rural areas, for example, there are typically 10 fibers in a cubic meter (fibers/m3) of outdoor air (or 0.00001 fibers per cubic centimeter (cc). (A cubic meter is about the amount of air someone breathes in 1 hour.)

Health professionals often report the number of fibers in cubic centimeters (f/cc); 10 fibers per cubic meter is the equivalent of 0.00001 f/cc. Typical levels found in cities are about 10 times higher. Close to an asbestos mine or factory, levels may reach 10,000 fibers/m3 (or 0.01 f/cc) or higher. Levels could also be above average near a building that contains asbestos products and is being torn down or renovated or near a waste site where asbestos is not properly covered up or stored to protect it from wind erosion [9].

Asbestos is a known human carcinogen. EPA has calculated an inhalation unit risk for cancer (cancer slope factor) of 0.23 per f/cc of asbestos [14]. The concentration resulting in an increased risk of 1 in 10,000 is 0.0004 f/cc, and the concentration resulting in an increased risk of 1 in 1,000,000 is 0.000004 f/cc. No air sampling has been conducted at the former Burns Radar Station to date.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) for workers of 0.1 f/cc for asbestos fibers greater than 5 µm in length (1 µm is about 1/25,000 of an inch) and a length-to-width ratio greater than 3:1, as determined by phase contrast microscopy (PCM) [15]. This value represents a time-weighted average (TWA) exposure level based on 8 hours a day for a 40-hour work week; at or above this level, an employer must take action to reduce employee exposure. In addition, OSHA has determined an exposure limit for workers to no more than 1 f/cc as averaged over a sampling period of 30 minutes.

The National Institute of Occupational Safety and Health (NIOSH) set a recommended exposure limit (REL) for workers of 0.1 f/cc for asbestos fibers greater than 5 µm in length [15]. This REL is a TWA for up to a 10-hour workday in a 40-hour work week. The American Conference of Government Industrial Hygienists (ACGIH) has also adopted a TWA of 0.1 f/cc as its threshold limit value [16].

Methods for Measuring Asbestos Content

Measuring asbestos content in air samples and in bulk materials that could become airborne involves both quantifying fibers and determining whether the fibers are asbestiform. For air samples, fiber quantification is traditionally done through PCM by counting fibers longer than 5 µm with a greater length-to-width ratio than 3:1. This is the standard method by which regulatory limits were developed [9]. Disadvantages of this method include the inability to detect fibers smaller than 0.25 µm in diameter and the inability to distinguish between asbestos and nonasbestos fibers.

Asbestos content in bulk samples is determined by using polarized light microscopy (PLM), a method that uses polarized light to distinguish between asbestos and nonasbestos fibers and between different types of asbestos. Fibers are first quantified through PCM. The PLM method is also limited by resolution; fibers finer than about 1 µm in diameter cannot be identified by PLM.

Scanning electron microscopy (SEM) and, more commonly, transmission electron microscopy (TEM) are more sensitive methods that can detect smaller fibers than light microscopic techniques. One disadvantage of electron microscopic methods is that it is difficult to determine bulk asbestos concentration. Generally, a combination of PCM and TEM is used to describe the fiber population in a particular sample.

Counting fibers by using the regulatory definitions does not adequately describe risk of health effects, as fiber size, shape, and composition contribute collectively to risks in ways that are still being elucidated. For example, shorter fibers appear to preferentially deposit in the deep lung, but longer fibers might disproportionately increase the risk of mesothelioma [9,17]. Fiber diameters greater than 2 μm are considered above the upper limit of respirability, and they do not contribute significantly to risk [17]. Methods are being developed to assess the risks posed by varying types of asbestos; these methods are currently awaiting peer review [17].

EPA is currently working with several contract laboratories and others to develop, refine, and test a number of methods, such as PLM, infrared (IR) and SEM, for screening bulk soil samples.