

# Construction Considerations in Naturally Occurring Asbestos Areas: A Case Study

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A geotechnical investigation conducted to support construction of an office building in Fairfax County, Virginia revealed naturally occurring asbestos (actinolite and tremolite) at the project site. An asbestos-bearing rock, known as a greenstone/shist, occurs in the county. The six-story, 26 940-m<sup>2</sup> office building required blasting of rock and excavation. To protect public health, the Fairfax County Air Pollution Control Board became interested in monitoring the work site for asbestos emissions. In hopes of maximizing health protection and minimizing liability, the developer chose to develop an asbestos hazard abatement program. The Virginia Occupational Safety and Health Administration advised that regulations oriented toward the asbestos abatement industry should be applied on the site. SCS Engineers adapted requirements from the indoor abatement regulations for use at the outdoor construction site. A respiratory protection program was developed for the construction workers. Hazards were communicated, and workers were trained to use personal protective equipment and were fit-tested with respirators. Decontamination presented special challenges during the early stages of the effort due to lack of water, electricity, and heat. Medical examinations were performed to obtain information on worker health and fitness for respirator use. Where possible, engineered controls, consisting of dust control measures, were used. Air sampling was done to monitor airborne concentrations of asbestos in worker breathing zones and along site boundaries (to protect public health). Detailed records of site activities and air monitoring results were prepared and submitted to the Air Pollution Control Board on a weekly basis.

In 1988 SCS Engineers designed and implemented an asbestos hazard abatement program for construction of a six-story, 26 940 m<sup>2</sup> (290,000 ft<sup>2</sup>) office building and three-level garage on a 5.7-acre site in Fairfax County, Virginia, that is underlain by asbestos-bearing rocks. Approximately 2710 hectares (6,700 acres) of Fairfax County are potentially underlain by asbestos-bearing rock. Although hundreds of construction projects have been successfully completed in portions of Fairfax County underlain by naturally occurring asbestos, this project was among the first to address fully the health and safety considerations involved for workers and the public (1).

A preliminary site assessment and geotechnical investigation revealed the presence of naturally occurring asbestos in portions of this particular site, including areas scheduled for extensive excavation. The potential for a "dust hazard" during construction was identified at this phase of the project development. The Fairfax County Air Pollution Control Board became interested in monitoring the potential for off-site releases of airborne asbestos during construction in the mapped asbestos-bearing rock areas. In hopes of maximizing health protection and minimizing potential liability, the property owner

wanted to meet and exceed existing applicable regulations for mitigation of asbestos-related concerns on the site.

Geotechnical studies indicated the presence of naturally occurring asbestos in the decomposed rock at the site, commonly described as weathered greenstone, which occurred at depths from 0.6 to 4.3 m (2 to 14 ft). Solid rock was encountered in two rock core borings at depths of 3.0 and 5.8 m (10 and 19 ft). The preliminary site plans indicated that excavation for portions of the building, the garage, and the site utilities would involve some blasting of the solid rock and significant excavation in the decomposed asbestos-bearing rock.

In addition to excavation activities, the stockpiling of contaminated site soil materials formed a secondary potential for asbestos exposure by means of fugitive dust emissions. Excess soil stockpiles remained on site until the project approached completion, at which point the materials were hauled to an approved sanitary landfill. Because of the small size of the site, the materials frequently were transported and stockpiled on various portions of the site.

Several subcontracting firms were involved in the project; 13 subcontractors were directly involved in ground excavation activities. These trades were subject to the highest risk for potential asbestos exposure on the site. Additional secondary exposure risks for subcontractors not involved in excavation activities were posed by the site roads, which dried quickly and formed a source of fugitive dust emissions. The primary and secondary possibilities of exposure present on the site were considered in the development of the asbestos hazard abatement program.

## PROGRAM DEVELOPMENT

Design of the health and safety program began with an extensive regulatory review. A variety of agencies were contacted to determine their jurisdiction with respect to naturally occurring asbestos. Agencies contacted included the Washington Occupational Health Association, the Virginia Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration, the Environmental Protection Agency, the Virginia State Asbestos Coordinator, and the Virginia Department of Labor and Industry. Virginia OSHA advised that many of the health and safety policies contained in the regulations developed for the asbestos abatement industry should be applied on the site.

SCS was faced with meeting the intent of regulations designed for indoor asbestos abatement at an outdoor construction site. These existing regulations were not directly applicable for a variety of reasons. Strict application of the asbestos

policies conflicted with OSHA's safety standards for the construction industry. Maintenance of a regulated zone was difficult because of shifting wind patterns and the need for workers and equipment to traverse the site. The work was not conducted by experienced asbestos workers, thereby making the program execution a substantial challenge. From the perspective of the workers, construction was the primary focus and potential on-site asbestos risks were secondary.

Combining these constraints with regulatory considerations, SCS developed a three-pronged approach to the health and safety program, allowing room for continued review and improvements: to (a) protect worker and public health and safety, (b) meet applicable regulatory standards and guidelines, and (c) provide sufficient documentation and reporting to protect owner liability. SCS began the project with stringent personal protective equipment and other health and safety requirements, which were relaxed when deemed appropriate through continuing review of the air monitoring results. The program needed to apply during all phases of construction, accommodate a variety of trades, and manage between 1 and 70 site personnel at any given time.

The key elements and aspects of the SCS program included the following:

- A respiratory protection program was developed to establish a set of guidelines for respirator selection and use. The program was customized to address the needs of varied types of construction work.

- Worker training involved instructing workers on the hazards of asbestos and the need for protection. Worker training also included the fit of assigned respirators.

- Air sampling was done to monitor airborne concentrations of asbestos in worker breathing zones and along site boundaries (to protect public health).

- Engineering controls consisted of dust control measures. Wet methods were used during drilling, excavation, and transportation operations to limit the potential for generating airborne asbestos fibers. However, when the addition of water would interfere with the construction process (e.g., compaction), wet methods could not be employed.

- Personal protective equipment (PPE) also was used to limit worker exposure. PPE consisted of a half-face negative pressure respirator with high-efficiency particulate air filters, Tyvek or polypropylene coverall suits with hoods, and washable rubber boots, when appropriate.

- Decontamination was difficult initially because of lack of water, heat, and electricity on the site during project start-up. At that time, a series of wash basins were used outdoors. Eventually, a decontamination trailer with running water was established.

- Medical examinations were performed to obtain baseline information on worker health and to test worker fitness for respirator use.

- Detailed records were maintained on site conditions and activities through daily logs. Weekly project summaries were submitted to the Fairfax County Air Pollution Control Board.

## AIR MONITORING RESULTS

On-site asbestos readings obtained usually were below the OSHA action level for personal breathing zones of 0.1 fibers

per cubic centimeter (f/cc) and below Fairfax County limit of 0.02 f/cc for off-site asbestos migration. However, certain activities and site conditions produced higher-than-average asbestos fiber releases.

Air monitoring results obtained during initial rock drilling and blasting operations indicated that potentially hazardous airborne asbestos concentrations could be released on the job site, warranting the continuation of the hazard abatement program. Breathing zone readings as high as 0.3 f/cc were obtained during dry drilling, which occurred on occasions when the water in the drill rig froze. When the operator was required to stand directly over the drill rig for an extended period of time, OSHA's action level of 0.1 f/cc frequently was exceeded. These results mandated the continuation of safe work practices, engineering controls, protective equipment, and monitoring on the job site.

Similarly, higher-than-average readings were obtained in other situations where engineering controls on dust generation could not be implemented. The OSHA action level was exceeded during final grading of the garage pad, where equipment operators obtained 8-hr time-weighted averages as high as 0.14 f/cc. The pad could not be kept wet, as the optimum moisture content for compaction would have been exceeded.

Work in semiconfined spaces, such as deep-site utility ditches and excavated building footings, also showed increased asbestos concentrations. Personal breathing zone readings approached the OSHA action level more frequently for workers in these portions of the site. The highest individual reading obtained in a semiconfined area was 0.54 f/cc. Backfilling operations using tampers to compact the soil also exceeded the OSHA action level occasionally. Once again, these asbestos dust levels were most likely due to construction restrictions on adding water to the backfill soils.

Ambient air readings at the site perimeter usually remained below the Fairfax County limit of 0.02 f/cc, even when site readings were elevated. Wind dispersal and the distance from site activities to the perimeter probably aided in keeping these readings low. Boundary readings that exceeded the 0.02 f/cc limit often could be attributed to other non-asbestos materials in use on the site. Similarly, high ambient air readings inside the building were found to contain no asbestos fibers, when analyzed using the more precise transmission electron microscope (TEM) methods.

## RECOMMENDATIONS

Review of the procedures used on this project provides general recommendations concerning improved hazard mitigation during construction in naturally occurring asbestos:

1. A qualified asbestos consultant should be brought into the site-planning process as soon as the potential for an asbestos hazard is identified. Changes in the standard operating procedures can be made before the arrival of subcontractors to reduce the interference of the health and safety program with project progress. The contractor also can be informed of other site needs specific to the program, such as the requirements for on-site running water, heat, and electricity to provide for decontamination facilities.

2. All subcontractors and other employers on the site should be informed of the on-site asbestos hazard before or during

contracting procedures. In this way, compliance issues and awareness of the site requirements are made clear to all personnel who agree to work on the site. This procedure also will produce bid prices and work schedules that accurately reflect the additional site considerations, possibly serving to reduce contract conflicts.

3. The on-site chain of authority must be clear in order to provide adequate compliance with health and safety procedures. Enforcement and documentation form an integral part of a well-functioning hazard abatement program.

4. Personnel in charge of the site health and safety program should be actively involved in tracking project planning. When included in progress meetings at the site, the site safety personnel are able to predict adjustments that may become necessary to provide adequate worker and public health and safety.

## CONCLUSION

The hazard abatement program focused on reducing worker and public asbestos exposure, meeting regulatory standards, and providing documentation of all aspects of the health and safety procedures. The project also created an opportunity to analyze the levels of exposure produced during construction in naturally occurring asbestos. This information is useful in analyzing the effectiveness of the site program, designing future programs, and aiding regulatory agencies in the development of effective and practical requirements to ensure a safe workplace.

Work at this particular site provided the Fairfax County Air Pollution Control Board with practical methods for reporting and documentation, allowing the development of regulations and guidelines that are now in effect throughout the county. Many of the procedures used at this job site have been recommended to other contractors working in naturally occurring asbestos as practical methods for reducing job hazards. Virginia OSHA currently is considering developing guidelines or regulations to address methods of providing a safe work environment during construction in naturally occurring asbestos. As regulatory interest in this type of job site continues to grow, it becomes increasingly important that accurate records are maintained to provide practical input to the regulatory guideline development process.

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## REFERENCE

1. *Bridging to the 21st Century. Proc., 84th Annual Meeting and Exhibition*, Air and Waste Management Association, Vancouver, British Columbia, Canada, June 1991.

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